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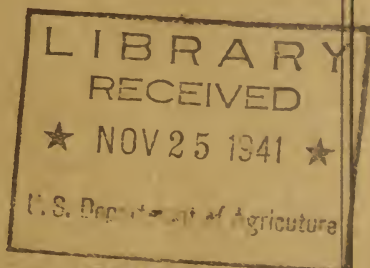
NOVEMBER 1941

# A Classification of the Scale Insect Genus *Asterolecanium*

By

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INSECT GENUS *ASTEROLECANIUM*<sup>1</sup>By LOUISE M. RUSSELL<sup>2</sup>*Assistant entomologist, Division of Insect Identification, Bureau of Entomology  
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## INTRODUCTION

This revisionary study of the genus *Asterolecanium*<sup>3</sup> has evolved from unsuccessful attempts to identify accurately an injurious member of the genus which evidently was introduced into the United States, and from difficulty experienced in satisfying numerous requests for correct identifications of other economically important species. Consideration of literature and specimens in these efforts disclosed a degree of confusion regarding many of the especially destructive species which could be clarified only through a critical classificatory review of the kind here presented. In this publication the writer has attempted to

<sup>1</sup> Submitted for publication September 9, 1940.

<sup>2</sup> The preparation of this publication has been greatly facilitated by the aid rendered by several individuals and institutions. The writer is particularly indebted to each of the following individuals who have been extremely generous in the gift or loan of specimens, and without whose cooperation many problems could not have been solved: A. Balachowsky, Station Centrale de Zoologie Agricole, Versailles; M. Beier, Naturhistorische Museum, Vienna; G. Brittin, Motueka, New Zealand; G. P. Ferris, Stanford University, Calif.; E. E. Green, Camberley, Surrey, England; A. Hempel, Instituto Biologico de Defensa Agricola e Animal, Sao Paulo, Brazil; F. Laing, British Museum; H. K. Munro, Collection Entomologist, Pretoria, South Africa; F. Silvestri, Laboratorio di Entomologia Agraria, Portici; R. Takahashi, Department of Agriculture, Taihoku, Taiwan (Formosa); P. Vayssière, Museum National d'Histoire Naturelle, Paris; R. S. Woglum, Entomologist, California Fruit Growers Exchange, Los Angeles, Calif. The writer is also grateful to H. Morrison for his efforts in obtaining material and for discussion of problems and constructive criticism.

Others who have assisted in the preparation of this paper are Mary Foley Benson and Sara Hoke DeBord, of the Bureau of Entomology and Plant Quarantine, who prepared the drawings, and M. Foubert, of the Illustrations Section, Division of Publications, Office of Information, U. S. Department of Agriculture, who made the photographic illustrations.

Several botanists also have rendered assistance. W. R. Maxon, Curator of the U. S. National Herbarium, and E. D. Merrill, during his directorship of the New York Botanic Garden, extended to the writer the privilege of removing scale insects from plants in the herbaria of those institutions. Further, F. A. McClure, of Lingnan University, Canton, China, kindly granted the writer permission to examine a considerable amount of bamboo material which he had accumulated in connection with his study of the Bambuseae. Finally, the writer expresses her sincere thanks to all who have assisted in any way.

<sup>3</sup> Superfamily Coccoidea, family Asterolecaniidae.

provide descriptions and illustrations adequate for the identification of the included species and a classification of these species based primarily on a critical study of their morphology.

Most of the previous taxonomic work on the genus has consisted of individual descriptions or redescrptions of species, the nearest approach to a comprehensive work being that of Green, in that part of *The Coccidae of Ceylon* (42)<sup>4</sup> published in 1909, where 16 species and 2 varieties were discussed and illustrated. Some of the minute anatomical structures that have proved useful were first described by Morrison and Morrison (73) in 1927, in a paper which included redescrptions of the Maskell species of the genus. Of the 92 specific or varietal names definitely assignable to *Asterolecanium* prior to the preparation of this publication, 26 were proposed by Green, 8 by Cockrell, 5 by Kuwana, 5 by Brain, 5 by Takahashi, and the remainder by a number of other authors. In the present study 19 of the 92 names have been suppressed, 4 varietal names have been retained, and the remaining names have been accepted as representing valid species. Eighty-three new species have been recognized, and their descriptions are included in the paper. Other new species doubtless await discovery and description, and it is hoped that the present study will have established a sound working basis for their proper placement in the genus.

### ECONOMIC IMPORTANCE

Some species of *Asterolecanium* are well known as destructive insects, and others are potential enemies of economic plants. In the descriptions of *bambusae* and *miliaris* published in 1869 (9, pp. 261-262), Boisduval warned that bamboos might suffer seriously from severe infestations of these species, and his prediction has been fully realized in the present-day abundance and destructiveness of *bambusae* and *miliaris* in many of the bamboo-growing areas of the world. Since 1836, when Audouin (1, pp. xxxv-xxxv) wrote of the damaged condition of oak trees in the Bois de Boulogne, caused by a scale insect unquestionably belonging to *Asterolecanium*, species going under the names of *quercicola* or *variolosum* have been recognized as serious pests of oaks in Europe, Africa, New Zealand, and the United States. With reference to *coffcae* in Kenya, James made the following statement in 1933 (53, p. 421):

Heavy infestations of *A. coffcae* not only destroy the crop of the current season but so warp and distort the crop-bearing wood as seriously to lower the future reproductive power of the trees. In fact there is no known scale pest of coffee in the Colony which produces such deleterious after-effects.

*Asterolecanium pustulans*, which infests many different plants, and is widely distributed in tropical and semitropical areas, is recognized as one of the most destructive species of the genus. Judging from the intensity of infestation and the unhealthy condition of their host plants, several of the new species described in this paper are, or may prove to be, detrimental to agriculture. Although the seriousness of the damage done by certain species is recognized, the economic loss caused by the group as a whole is probably greatly underestimated, because of the inconspicuousness of the insects.

<sup>4</sup> Italic numbers in parentheses refer to Literature Cited, p. 232.



## GEOGRAPHICAL DISTRIBUTION

Representatives of the genus have been collected in each of the 6 major zoogeographical regions of the world, and from 22 of the 24 subregions, no species having been reported as yet from the Siberian Subregion of the Palearctic Region, or the Celebesian Subregion of the Oriental Region.

## HOST ASSOCIATIONS

Although species of *Asterolecanium* have been found on at least 37 plant families ranging from the Gramineae to the Compositae, they are most numerous on the Gramineae, Palmae, and Fagaceae. The species occurring on bamboos, palms, and oaks are, so far as known, limited to their respective host groups, but others may be found on members of several plant families, and still others appear to have a marked preference for a single host family and rarely occur on other, unrelated, hosts. Some members of the genus seem to be restricted in their feeding to one part of a plant, such as the leaves, stems, or bark, while others live indiscriminately on leaves, stems, twigs, fruit, and trunk. Some species apparently never produce pits, while others cause pits in some plants but not in others; thus the habit seems partially dependent upon the susceptibility of the host to pit formation.

## RELATIONSHIPS

*Asterolecanium* belongs in the family Asterolecaniidae, subfamily Asterolecaniinae. The subfamily is poorly defined, and the total number of genera correctly assignable to it is debatable. The subfamily, as treated in this paper, is characterized in the adult females by the presence of comparatively sessile 8-shaped pores and asymmetrical tubular ducts and by the absence of characters which might indicate a closer relationship with some other group. The following genera (on the basis of their genotypes) are here included: *Amelococcus* Marchal, *Amorphococcus* Green, *Anomalococcus* Green, *Asterolecanium* Targioni-Tozzetti, *Birchippia* Green, *Callococcus* Ferris, *Cerococcus* Comstock, *Frenchia* Maskell, *Lecaniodiaspis* Targioni-Tozzetti, *Olliffia* Fuller, *Polea* Green, and *Solenococcus* Cockerell.

The family Asterolecaniidae is more closely related to the Coccidae and Dactylopiidae than to other families. This affinity is evinced by the presence, in some representatives of Asterolecaniinae, of loculate pores associated with the spiracles, by the presence of spiracular setae and modified anal plates, and by the outline of the posterior margin of the body, which may be cleft or strongly lobed. All these characters are found in the families Coccidae and Dactylopiidae.

Within the subfamily, *Asterolecanium* is most closely related to *Amorphococcus*, *Frenchia*, and *Polea*. Adult females of these genera have a tubular duct which is thickened on one side near the inner end, usually bends slightly entad of the thickening, and is of practically the same diameter each side of the thickening. They do not have spiracular spines or cribriform plates, and the posterior margin of the body is not cleft or strongly lobed. Larvae of these genera usually have 28 marginal 8-shaped pores, a ventral submarginal row of minute

8-shaped pores, and an antenna of distinctive shape, in which the third segment does not have setae, but does have a narrow, membranous band encircling it. Within this group *Asterolecanium* and *Polea* are most alike, the morphological structures and their arrangement being similar except that adult females and third-stage males of *Polea* lack the marginal row of 8-shaped pores characteristic of these stages of *Asterolecanium*, and adult males of *Polea* differ somewhat from those of *Asterolecanium*. Adult females of *Asterolecanium* may be separated from other genera of Asterolecaniinae by the following key:

*Key to Genera of the Subfamily Asterolecaniinae*

1. Apex of abdomen protruding; anal lobes strongly developed; with a cauda-----*Amelococcus*, *Cerococcus*, *Solenococcus*, *Olliffia*.  
Apex of abdomen protruding or not; anal lobes not so strongly developed; without a cauda----- 2
2. Posterior margin of body with a narrow, fairly deep median cleft; cribriform plates present-----*Anomalococcus*, *Birchippia*, *Lecaniodiaspis*.  
Posterior margin of body without such a cleft; cribriform plates absent----- 3
3. Dorsal surface with a median longitudinal band of quinquelocular and minute 8-shaped pores extending from anterior margin to anal opening-----*Callococcus*.  
Dorsal surface without such a band of pores----- 4
4. Margin of body without a well defined row of comparatively large 8-shaped pores-----*Amorphococcus*, *Frenchia*, *Polea*.  
Margin of body with a well defined row of comparatively large 8-shaped pores-----*Asterolecanium*.

### GENERIC SYNONYMY

The genus *Asterolecanium* was established by Targioni-Tozzetti in 1869 (96, p. 734), and its type designated as *Coccus aureus* Boisduval. The correct name for the type of the genus now appears to be *epidendri* (Bouché), because *aureus* is here considered a synonym of *epidendri* (see discussion, p. 84).

*Planchonia*, proposed by Signoret in 1870 (88, pp. 282-283) for *Coccus fimbriatus* Fonscolombe, has long been considered a synonym of *Asterolecanium*, and is so regarded in this paper.

In 1876 Signoret erected *Asterodiaspis* (89, pp. 606-607) (90, pp. ccviii-ccix) for specimens which he believed were *Coccus quercicola* Bouché. The name has long stood as a synonym of *Asterolecanium*, and the writer's study of Signoret's description and specimens shows that *Asterodiaspis* has no generic validity, and that the insects on which Signoret based the genus were misidentified (see p. 109).

The name *Bambusaspis* was suggested by Cockerell in 1902 (23, p. 114) as a new section of *Asterolecanium*, and in 1906 (83, p. 3) Sanders designated *Chermes miliaris* Boisduval as its type. Cockerell included *miliaris*, *bambusae*, *delicatum*, *solenophoroïdes*, *palmae*, and *wichi* in the subgenus, and characterized it as follows: "scale elongated, often very narrow; living on bamboos and palms in the tropics." Because the writer does not think the shape of these species, or morphological differences between them and related forms, warrants their segregation in a subgenus, *Bambusaspis* is suppressed.

This study of the classification of the genus *Asterolecanium* has not, in the writer's opinion, produced any clear basis for segregating the included species into formal groups, such as subgenera. The most striking group characteristic that has been observed is the pair of dorsal tubes, present with and apparently restricted to the

adult females of the bamboo-infesting species of the genus.<sup>5</sup> In all other respects, however, these bamboo-inhabiting species show intimate relationships with the other members of the genus, and it is the present opinion that their segregation in a formally designated subgroup would give an unbalanced picture of the species classification within the genus.

## GENERIC DESCRIPTION

*Adult female*.—Enclosed in a rather glassy test; body saclike, without segmentation; posterior margin of body not deeply cleft or strongly lobed; derm mostly or entirely membranous; 8-shaped pores in a marginal row; minute 8-shaped pores present ventrally; loculate pores associated with spiracles; tubular ducts present dorsally; antenna a flat disk or short unsegmented stub, usually with 2 minute setae and with several larger setae; beak 1-segmented; thoracic spiracles present; genital opening transverse; setae usually in a submarginal row ventrally and in pairs or groups near genital opening; apex of abdomen with at least 1 pair of setae; anal opening present.

*Second stage* (same for both sexes).—Without tubular ducts, dorsal tubes, genital opening, or multilocular pores; exhibiting other structures found in adult females.

*Larva* (same for both sexes).—Body longer than wide; derm mostly membranous; minute 8-shaped pores in a submarginal row ventrally; 2 eyespots on anterior margin; antenna slightly sclerotized, either 5- or 6-segmented; first segment with setae, second with 2 long and 1 minute seta, third without setae but with a narrow, membranous, encircling band; sixth usually with long setae with expanded tips, stout setae, fairly stout setae, slender setae, and 2 minute setae; beak 1-segmented; leg slightly sclerotized, 5-segmented, slender; anterior coxa with a minute seta on outer surface near point of attachment of leg and 1 halfway between inner and outer margins on inner and outer surfaces, latter seta lacking on middle and posterior coxae, all coxae also with long setae; trochanter with 2 minute setae and 4 pores; tibia without setae, shorter than tarsus; tarsus with 1 minute seta on outer margin near base and usually with 2 on inner margin near claw, also with longer setae near center, and with 2 digitules with expanded tips exceeding apex of claw; claw elongate, slender, slightly curved, with 2 digitules with expanded tips exceeding apex of claw; thoracic spiracles present; setae usually present on anterior margin of body, between antennae and mouth parts, and in a submarginal row ventrally; apex of abdomen with at least 1 pair of setae, anal opening usually apparent.

*Adult male*.—Before emergence covered by test formed by third-stage male; elongate; head membranous except for sclerotized lines, widest at posterior third, vertex somewhat rounded; antennae on anterior margin, fairly close together at bases, either 9- or 10-segmented; first and second segments short, others longer, all segments with fairly long setae, second also with 1 minute seta, and terminal segment with 2-4 very long setae and 2 minute setae; 2 eyespots on dorsal margin and 2 in ventral submedian area; setae anterior to and between eyespots ventrally; a sclerotized linear bar on median line ventrally, extending to anterior margin, and forked at anterior end; 2 sclerotized bars dorsally near base of head, their inner ends nearly contiguous, usually with other curved sclerotized lines apparently forming framework of head; thorax membranous except for attachment plate of legs, wings (when present), and internal framework; a sclerotized bar between wing bases; wings usually present, with vestiges of 1 or 2 longitudinal and 1 diagonal vein, covered with minute setae; legs elongate, slender, apparently with minute setae and pores as in the larva and with many larger setae; tibia nearly same length as tarsus; 2 tarsal digitules; claw slender, curved, with 2 digitules exceeding apex of claw; abdomen mostly membranous, partially reticulate; with submarginal dorsal setae and submedian ventral setae; posterior lateral margin of apical segment with at least 1 pair of setae; penis sheath rather elongate, broadest at base, tapering to an acute tip, curved downward, sclerotized, a longitudinal opening in ventral surface; penis sclerotized, elongate, flat, slender.

<sup>5</sup> Comparable dorsal tubes are also present in adult females of undescribed bamboo-infesting species of *Polca*; they have not been found by the writer in pseudococcine, eriococcine, lecaniine, or diaspine genera.



*Male nymph.*—Enclosed in test formed by third-stage male; elongate; derm mostly membranous; antenna either 9- or 10-segmented; wing pads usually apparent; legs 5-segmented; abdominal setae as in adult male; penis sheath short, somewhat triangular; penis small, tongue-shaped.

*Third-stage male.*—Enclosed in a rather glassy test; somewhat elliptical; without dorsal tubes, genital opening, or multilocular pores; legs represented by 3 pairs of raised sclerotized areas; exhibiting other morphological characters found in adult females.

## CHARACTERS USED IN THE CLASSIFICATION AND THEIR TERMINOLOGY

Structural characters of diagnostic value are fairly numerous in *Asterolecanium*, and the majority of these structures are illustrated in diagrammatic form in figure 1. All structures of primary taxonomic importance, which are actually present in a species, are discussed in the individual descriptions, and characters of secondary importance, if not noted in the text, are shown in the illustrations. On this account no attempt is made to discuss these characters in detail at this point. Users of the publication will find it to their advantage, however, to study figure 1 carefully and acquaint themselves with the structures there depicted and the terms applied to them.

In general the terms used in this publication are in current use in coccid literature. One previously unnoted structure is named, however, a few terms are restricted in their usage, and some descriptive words are added to known terms in order to assist in the location or differentiation of certain structures. A pair of tubelike structures found dorsally, near the posterior end of the body of some adult females, is here designated as *dorsal tubes*. *Disk pores* refer only to minute, clear, nonloculate pores. *Submarginal 8-shaped pores* are minute, are located ventrally, and extend around the body in a definite row. There are other minute 8-shaped pores on the ventral surface of the body, and these are called *dark-rimmed 8-shaped pores*. The latter are usually readily distinguishable from the submarginal 8-shaped pores by their structure and position. They are slightly invaginated, and the rims appear very dark after staining. Moreover, these pores are usually situated in a group each side of the beak, and may be scattered elsewhere or arranged in fairly definite rows. The term "interrupted" indicates a break in a row of pores or setae, and the term "complete" denotes that a row of pores or setae is not interrupted.

Although characters of diagnostic value are treated rather fully in the species descriptions, there are some omissions which should be kept in mind. First, the discussion usually is limited to the characters that are present, the absence of structures being noted only in particular cases; since the marginal disk pores of adults and the dorsal disk pores of the larvae usually are in single rows, their singleness is not mentioned, though their presence is noted, and certain characteristics of some structures, although significant, are not discussed because they are shown satisfactorily in the illustrations. Included in the last category are the position of the antennae, the shape of the apical notch (when present), and the shape and position of the anal tube and anal opening in species having 6 setae on the anal ring.

Quantitative data concerning structures which vary in size or number within a species, such as the size of specimens, pores, and setae and the number of spiracular and multilocular pores of adults, are pre-



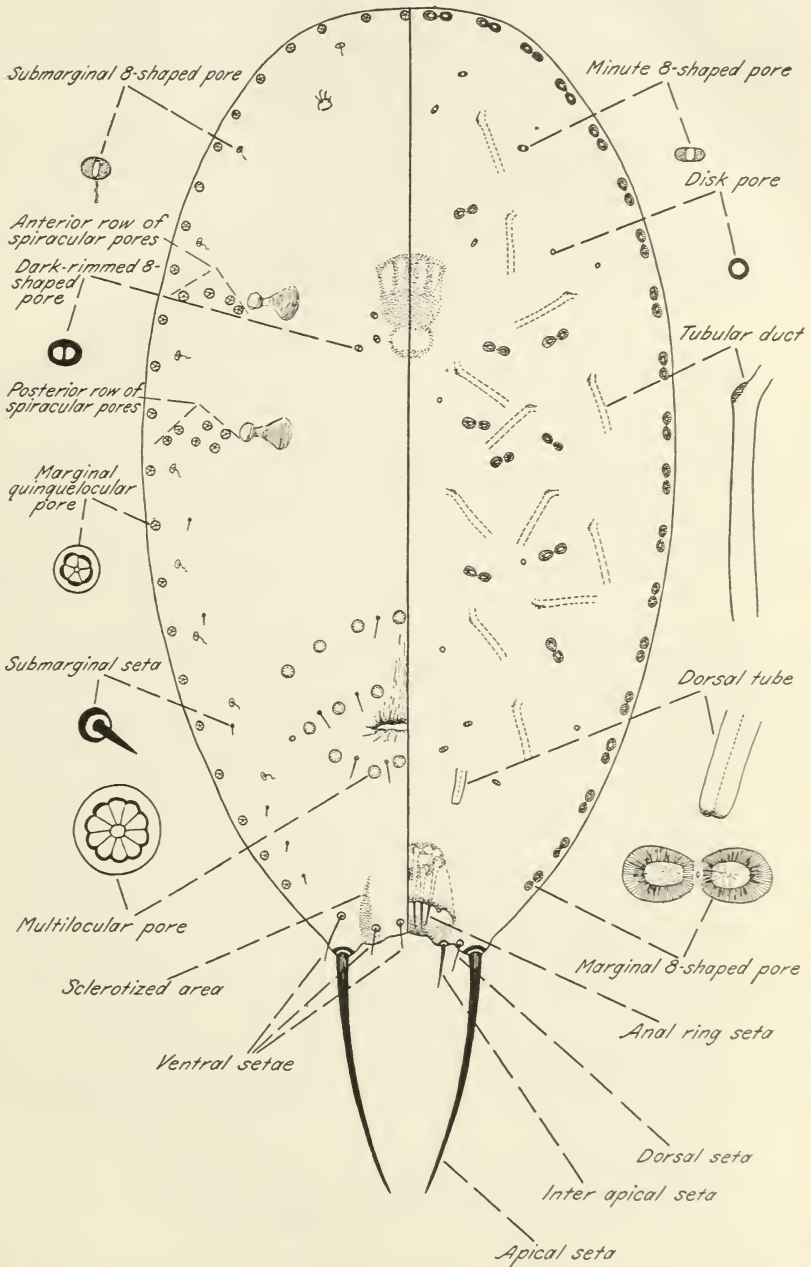


FIGURE 1.—Diagrammatic drawing representing an adult female of *Asterolecanium* having 6 setae on the anal ring.

sented so as to show the limits observed in the material examined. When many examples of a species have been studied, the limits recorded should cover satisfactorily the range of variation expected in that species. On the other hand, where only a few specimens have been studied, it may be expected that the quantitative limits here presented will be widened as additional material is examined.

The drawings used in this paper present structural details of use for the recognition of species. Divided drawings show the dorsal surface on the right, and the ventral on the left. Minute pores, submarginal setae, and tubular ducts usually are omitted from the outline figures. Where the enlargement of a structure is not given in the explanation of figures, it lies within the range of 1,100 to 1,500 times. The photographs are enlarged approximately 10 times.

### SPECIES GROUPS

The genus *Asterolecanium* comprises an extremely homogeneous array of species. Nevertheless, some species fall into definite groups, and others stand alone. Structures of the nymphal and adult males do not appear suggestive of grouping within the genus, and those of the second-stage insects and third-stage males seem indicative only of broad specific relationships. Therefore, species segregation is based on structures of the adult females and larvae. In some cases groups definable on the basis of morphological characters are also set apart by indicated host preferences or geographical distribution. Since a natural grouping usually is not followed in the keys, and since only the most closely related species are discussed and contrasted in the descriptions, it seems desirable to define these groups, and to point out the zoogeographical regions inhabited by them. Claim is not made for complete accuracy in these assignments because additional collecting and study are necessary before the relationships and the native habitats of some species can be known with even approximate certainty. The order in which the groups are given is arbitrary. Only species studied by the writer are included and, with two exceptions, the distribution shown is based only on records listed in this paper.

*Group I* (*abiectum*, *acutulum*, *amboinae*, *bambusae*, *bambusicola*, *brunetae*, *captiosum*, *caudatum*, *ceriferum*, *ceriferum*, *chinae*, *circulare*, *coronatum*, *delicatum*, *disiunctum*, *elongatum*, *exiguum*, *florum*, *fusum*, *gemmae*, *hemisphaericum*, *largum*, *longulum*, *longum*, *masuii*, *miliaris*, *miliaris*, *miliaris robustum*, *mimicum*, *minusculum*, *minutum*, *notabile*, *oblongum*, *ordinarium*, *parvum*, *penicillatum*, *proboscidis*, *pseudolanceolatum*, *pseudomiliaris*, *pusillum*, *radiatum*, *rubrocomatum*, *sasae*, *scirrosis*, *simplex*, *solenophoroides*, *sparus*, *subdolum*, *udagamae*, *vulgare*).—Known to occur only on Bambuseae. The natural distribution of some of these species must be inferred since some of them are now established in each of the six major zoogeographical regions. Regardless of their present-day distribution, however, all of them probably are indigenous to the Oriental Region.

Adult female characterized by the presence of dorsal tubes (restricted to this group), an interrupted row of submarginal setae, and a beak without setae. Larva (with one exception) characterized by absence of a minute seta close to each of the posterior 2 or 3 pairs of marginal 8-shaped pores; sixth antennal segment having 2 long, 2 stout, and 2 or 3 fairly stout setae; coxa usually with 4 setae, femur usually with 3, and tarsus usually with 3.

*Group II (boliviae, bondari, degeneratum, difficile, distinctum, gilvum, hilli, inlabefactum, inusitatum, oraniae, pallidum, palmae, phoenicis, pinnangae, sabalis, simile, singulare, spectabile, truncatum, unicum, urichi).*—Known to occur only on Palmae. Representatives of the group are found in the Neotropical, Ethiopian, Palearctic, Oriental, and Australian Regions. Although the majority of species appear indigenous to the Neotropical Region, several are probably native to the Oriental, and one may be indigenous to the Australian Region. The native homes of the species known from the Ethiopian and Palearctic Regions are uncertain.

Adult female characterized by body being longer than wide, usually with marginal row of 8-shaped pores interrupted, or terminating at a considerable distance from bases of apical setae; anal opening simple, circular, without anal ring or setae, or anal opening circular or elliptical with anal ring modified into a plate or into 2 collars, without any setae or with 2 or 4; spiracular atrium usually enlarged and containing pores. Larva usually characterized by presence of a minute seta near each pore of the posterior 3 pairs of marginal 8-shaped pores, terminal antennal segment with 3 long setae, femur with 1 seta, and tarsus with 2 setae.

*Group III (adjunctum, bellum, castaneae, horishae, ilicicola, japonicum, luteolum, minus, nitidum, pasaniae, perplexum, quercicola, repugnans, roboris, semiseptum, skaniana, suishae, variabile, variolosum, viennae).*—Known to occur only on Fagaceae. Some of these species are now found in each of the six major zoogeographical regions. Originally they were probably restricted to the Palearctic Region, or to this and the Oriental Region.

Adult female characterized by body usually being somewhat circular; 3 or fewer pairs of setae on apex of abdomen; anal opening ventral, fairly close to body margin; presence of multilocular pores; margin of anal opening with 2 setae or with none. Larva with anterior margin of body provided with 2 pairs of setae; first and fourth antennal segments each with 1 seta, fifth with none, sixth with 2 long, 2 stout, usually 2 fairly stout, and 2 slender setae; coxa with 3, femur with 1, tarsus with 2 setae; 3 or fewer pairs of setae on apex of abdomen, margin of anal opening or anal ring without any or with 2 setae.

*Group IV (algeriense, arabidis, fimbriatum, launeae, nevadense, stentae, zanthenes).*—All these species are probably indigenous to the Palearctic Region, although *arabidis* apparently has been introduced into and is now established in the Nearctic Region, and *stentae* is known to occur only in the Ethiopian Region.

Adult female characterized by a double or triple row of marginal 8-shaped pores; submarginal 8-shaped pores in a row 2 to 4 or 6 pores wide; a marginal row of disk pores dorsad and ventrad of 8-shaped pores; 6 pairs of setae on apex of abdomen, absence of elongate sclerotized areas from ventral surface of apex of abdomen. Larva with first antennal segment provided with 2 setae, fourth with 1, fifth with 1, sixth with 2 long, 2 stout, and 3 fairly stout setae; coxa with 4, femur with 3, and tarsus with 3 setae; less than 9 pairs of submarginal 8-shaped pores.

*Group V (brachylenae, thespesiae).*—Although *brachylenae* is known to occur only in the Ethiopian and *thespesiae* in the Oriental Region, they are so similar structurally that their natural distribution may include only one region. On the basis of their relationship to other members of the genus, they appear indigenous to the Oriental Region.

Adult female characterized by a double row of marginal and submarginal 8-shaped pores, a marginal row of disk pores dorsad and ventrad of 8-shaped pores, 6 pairs of setae on apex of abdomen, and 2 elongate sclerotized areas



placed ventrally on apex of abdomen. Larva having first antennal segment with 2 setae, fourth with 1, fifth with 1, sixth with 2 long, 2 stout, 3 fairly stout, and 2 slender setae; coxa with 4, femur with 3, tarsus with 3 setae; 9 pairs of submarginal 8-shaped pores.

*Group VI (agavis, cristatum, grandiculum, puteanum, sanbermar-dense, townsendi, viridulum).*—Species of this group are found in the Nearctic and Neotropical Regions. Although they appear indigenous to both regions, they may be native only to the Neotropical, because certain members of the group appear only in, or appear to be spreading from, the lower limits of the Nearctic Region, thus suggesting a gradual extension of an original Neotropical distribution.

Adult female characterized by row of marginal quinquelocular pores usually being interrupted, or terminating at a considerable distance from posterior marginal 8-shaped pores; by the presence usually of a marginal row of disk pores dorsad of 8-shaped pores; by the occurrence of 5 pairs of setae on apex of abdomen; and by the absence of a rectangular sclerotized area or 2 elongate sclerotized areas from ventral surface of apex of abdomen. Larva with first antennal segment provided with 2 setae, fourth with 1, fifth with none, sixth with 2 long, 2 stout, 3 fairly stout, and 2 slender setae; coxa with 4, femur with 3, tarsus with 3 setae.

*Group VII (hakeae, quadrisetosum, subventruosum, ventruosum).*—All species of this group are found in, and doubtless are indigenous to, the Australian Region.

Adult female characterized by a double row of marginal 8-shaped pores, a marginal row of disk pores usually dorsad and ventrad of 8-shaped pores, a complete row of marginal quinquelocular pores terminating less than 7 8-shaped pores from posterior marginal 8-shaped pores, 4 pairs of setae on apex of abdomen, absence of a rectangular or 2 elongate sclerotized areas from ventral surface of apex of abdomen. Larva characterized by coxa with 3 setae, femur with 2, and tarsus with 2 setae.

*Group VIII (epacridis, inconspicuum, lacrimula, multiporum, stypheliae, transversum).*—All species of this group are found in, and appear native to, the Australian Region.

Adult female usually characterized by a single row of marginal 8-shaped pores, a complete row of marginal quinquelocular pores terminating at or near posterior marginal 8-shaped pores, absence of a well defined marginal or ventral sub-marginal row of disk pores; a rectangular or 2 elongate sclerotized areas, or gradations between the two, placed ventrally on apex of abdomen; an anal ring with 6 setae and usually with pores. Larva usually characterized by first antennal segment with 2 setae, fourth with 1, fifth with 1, sixth with 2 long, 2 stout, 3 fairly stout, and 2 slender setae; coxa with 4 setae, femur with 2, tarsus with 2 setae.

*Group IX (victoriae, vitreum).*—Both these species are found in, and appear indigenous to, the Australian Region.

Adult female characterized by a single row of marginal 8-shaped pores, a complete row of marginal quinquelocular pores terminating near posterior marginal 8-shaped pores, a cylindrical anal tube, a circular anal ring without pores but with 2 or 4 setae about  $2\mu$  long. Larva having first antennal segment with 1 seta, fourth with 1, fifth with 1, sixth with 2 long, 2 stout, 3 fairly stout, and 2 slender setae; coxa with 4 setae, femur with 2, and tarsus with 2 setae.

*Group X (corallinum, javae, litseae, machili, psychotriae, striatum).*—These species occur within, and appear indigenous to, the Oriental Region, though *litseae* has also been reported from the lower part of the Manchurian Subregion of the Palearctic Region.

Adult female characterized by a single row of marginal 8-shaped pores, a complete row of quinquelocular pores terminating at or posterior to posterior

marginal 8-shaped pores, a submarginal row of disk pores (usually), and a rectangular sclerotized area or 2 elongated sclerotized areas on ventral surface of apex of abdomen. Larva (only those of *javae* and *striatum* available) having first antennal segment with 1 seta, fifth with 1, sixth with 2 stout and 3 fairly stout setae; coxa with 4 setae, femur with 2, and tarsus with 3 setae.

*Group XI (coffaeae, conspicuum, pustulans).*—The species *coffaeae* and *conspicuum* are known only from the Ethiopian Region, but *pustulans* is well disseminated, being found in each of the six major zoogeographical regions. These insects are so similar morphologically to various other species believed to be native to the Oriental Region that there is definite question as to their distributional origin. The relationship of these species to those included in group X is evident, and additional species and further study may show that these two groups should be consolidated.

Adult female characterized by a single row of marginal 8-shaped pores, a row of marginal quinquelocular pores terminating at or near posterior marginal 8-shaped pores, a ventral marginal row of disk pores, a rectangular sclerotized area or 2 elongate sclerotized areas on ventral surface of apex of abdomen. Larva having first antennal segment with 2 setae, fifth with 1, sixth with 2 long and 2 stout setae; coxa usually with 4 setae, femur with 3, and tarsus with 3 setae.

*Group XII (gutta).*—This species is found in, and may be indigenous to, the Oriental Region.

Adult female and larva characterized by unusual shape of 8-shaped pores, which are as wide as long, with the halves closely appressed; by apex of abdomen being simply invaginated with anal ring at base of invagination, anal opening and anal tube not differentiated from surrounding derm.

Certain species do not fit properly in any of the groups defined above, although a few do resemble the species included in one or another of the outlined groups. The species involved are the following: *acaciae*, found in and indigenous to the Australian Region; *borboniae*, found in the Ethiopian Region, native habitat uncertain; *borneense*, *garciniae*, *sumatrae*, found in the Oriental Region, indigenous to the Palearctic or Oriental region, possibly belonging in one group; *brevispinum*, found in and indigenous to the Ethiopian Region; *epidendri*, found in the Palearctic and Nearctic Regions (in greenhouses), and in the Oriental and Neotropical Regions, probably indigenous to the Neotropical Region, resembling species of Group VI; *euphorbiae*, found in the Ethiopian Region, native habitat uncertain, resembling species of Group VI; *curyopsis*, occurring in and indigenous to the Ethiopian Region; *flagellariae*, found in the Oriental Region, native habitat uncertain; *ingae*, known from and probably indigenous to the Neotropical Region, resembling species of Group VI; *medium*, found in and indigenous to the Australian Region, resembling species of Group IX; *petrophilae*, occurring in and probably native to the Australian Region; *quaesitum*, found in and probably indigenous to the Neotropical Region, resembling species of Group VI; *tokyonis*, found in the Oriental and Palearctic Regions, probably indigenous to the Palearctic Region; *ungulatum*, found in the Oriental Region and indigenous to it or to the Australian Region, resembling species of Group VIII.

Type material of the new species described in this paper is included in the National Collection of Coccidae and, in some cases, in the collection of the individual or institution furnishing specimens.

## KEY TO ADULT FEMALES

- |     |   |    |
|-----|---|----|
| 1.  | Anal ring or margin of anal opening without setae or with 1 or 2 setae-----   | 2  |
|     | Anal ring with 4 or 6 setae-----  | 50 |
| 2.  | Marginal 8-shaped pores in a double row-----  | 3  |
|     | Marginal 8-shaped pores in a single row-----  | 4  |
| 3.  | Marginal quinquelocular pores numerous; multilocular pores, totaling 35-40, in 4 complete rows and 1 or 2 interrupted rows; margin of anal opening without setae; mounted specimens usually at least 1.25 mm. in diameter<br><i>acaciae</i> Morrison and Morrison, p. 37. |    |
|     | Marginal quinquelocular pores sparse; multilocular pores, totaling 2-6, in 2 indefinite rows; margin of anal opening with setae; mounted specimens usually less than 1 mm. in diameter-----   |    |
| 4.  | (2) Tubular ducts around 7.2 $\mu$ long-----  | 5  |
|     | Tubular ducts 16-48 $\mu$ long-----   | 6  |
| 5.  | Multilocular pores approximately 250 in number, arranged in groups within rows; dark-rimmed 8-shaped pores unusually numerous and arranged in conspicuous groups; 2 sclerotized contiguous collars sunken in derm at apex of abdomen-----                                 |    |
|     | Multilocular pores 36-46 in number, not arranged as above; dark-rimmed 8-shaped pores not particularly numerous or conspicuous; no such sclerotized collars<br><i>distinctum</i> , new species, p. 80.  |    |
|     | <i>spectabile</i> Newstead, p. 194.   |    |
| 6.  | (4) Entire apex of abdomen heavily sclerotized; marginal 8-shaped pores present only on lateral margins, with 7-11 on each side of body-----  |    |
|     | Apex of abdomen not as above; marginal 8-shaped pores present elsewhere than on lateral margins, more numerous than above-----  | 7  |
|     | <i>scirrosis</i> , new species, p. 184.   |    |
| 7.  | Apical setae not more than 12 $\mu$ long, shorter or very slightly longer than a posterior marginal 8-shaped pore-----  | 8  |
|     | Apical setae at least 20 $\mu$ long, much longer than a posterior marginal 8-shaped pore-----   | 14 |
| 8.  | Apical setae approximately 9 $\mu$ long, approximately the same length as a posterior marginal 8-shaped pore, about one-half the length of a tubular duct-----  | 9  |
|     | Apical setae not more than 5.5 $\mu$ long, distinctly shorter than a posterior marginal 8-shaped pore, one-fifth to one-ninth the length of a tubular duct-----   | 11 |
| 9.  | With a sclerotized, heart-shaped area associated with anal ring setae; anal ring setae around 16 $\mu$ long, about twice the length of apical setae-----  |    |
|     | Without a heart-shaped area as above; anal ring setae 7-10 $\mu$ long, of practically the same length as apical setae-----  | 10 |
| 10. | With 4-6 multilocular pores; marginal 8-shaped pores continuous between apical setae; marginal trilocular pores absent between apical setae; mounted specimens measuring 0.85-1 mm. long and 0.6 wide-----  |    |
|     | With 20-28 multilocular pores; marginal 8-shaped pores usually absent between apical setae; marginal trilocular pores usually present between apical setae; mounted specimens measuring 1-1.75 mm. long and 0.5-0.9 wide<br><i>degeneratum</i> , new species, p. 75.      |    |
|     | <i>simile</i> , new species, p. 187.  |    |
| 11. | (8) With 8-shaped pores in median area of ventral surface approximating marginal 8-shaped pores in size; with quinquelocular pores dorsad as well as ventrad of marginal 8-shaped pores-----  |    |
|     | With 8-shaped pores on ventral surface, but none approximating marginal 8-shaped pores in size; without quinquelocular pores dorsad of marginal 8-shaped pores-----   | 12 |
| 12. | With a rectangular, sclerotized plate containing multilocular pores, on ventral surface posterior to anal opening-----  |    |
|     | Without such a plate-----   | 13 |
|     | <i>singulare</i> , new species, p. 190.   |    |



## Key to Adult Females—Continued

13. Elongate and slender, 2.25–2.85 mm. long and 0.45 wide; with median dorsal 8-shaped pores; anal tube fairly large, rather long; anal opening ventral—*elongatum*, new species, p. 81.  
Not elongate and slender, approximately 0.95 mm. in diameter; without dorsal 8-shaped pores; anal tube small, bulbous; anal opening apical—*proboscidis*, new species, p. 157.
14. (7) With setae on anal ring or on margin of anal opening well defined, 7–28  $\mu$  long, at least as long as a posterior marginal 8-shaped pore----- 15  
Setae absent from anal ring and margin of anal opening, or, if present, then minute or small, not more than 5  $\mu$  long and shorter than a posterior marginal 8-shaped pore----- 20
15. Apical setae around 22  $\mu$  long; anal ring setae either about 9 or 16–24  $\mu$  long----- 16  
Apical setae 36–56  $\mu$  long; anal ring setae 16–28  $\mu$  long----- 18
16. Multilocular pores absent; anal ring setae 8–9  $\mu$  long  
*urichi* Cockerell, p. 215.
17. Multilocular pores present; anal ring setae 16–24  $\mu$  long----- 17  
Dorsal 8-shaped pores usually numerous along median line; marginal trilocular pores in a complete row, usually terminating near the posterior marginal 8-shaped pores  
*palmae* Cockerell, p. 146.
18. (15) Dorsal 8-shaped pores sparse; marginal trilocular pores starting slightly anterior to anterior spiracular pore bands and ending about halfway between posterior spiracular pore bands and the posterior marginal 8-shaped pores  
*oraniae*, new species, p. 143.  
Anal ring setae about 16  $\mu$  long; apical setae 36–44  $\mu$  long; interapical setae about 2.7  $\mu$  long; dorsal 8-shaped pores absent----- *pinangae*, new species, p. 156.  
Anal ring setae 20–28  $\mu$  long; apical setae 46–56  $\mu$  long; interapical setae about 10  $\mu$  long; dorsal 8-shaped pores absent or present----- 19
19. With dorsal 8-shaped pores, with marginal trilocular pores, and with approximately 22 multilocular pores  
*boliviae*, new species, p. 52.  
Without dorsal 8-shaped pores, with marginal quinquelocular pores, and without multilocular pores  
*pectrophilae* (Fuller), p. 153.
20. (14) Marginal row of 8-shaped pores rather poorly defined; dorsum with numerous, scattered 8-shaped pores, the majority measuring 18–20  $\mu$  long and 14 wide; mounted insect slightly longer than wide, approximately 1.5 mm. wide; tubular ducts 48  $\mu$  long----- *brevispinum* Brain, p. 56.  
Marginal row of 8-shaped pores well defined; dorsum with or without numerous, scattered 8-shaped pores, but if any pores approximate the above in size, then the mounted insects are conspicuously longer than wide, and are approximately 0.5 mm. wide; tubular ducts not more than 40  $\mu$  long----- 21
21. Marginal 8-shaped pores with a sclerotized projection on dorsal edge; certain species on Fagaceae from Asia----- 22  
Marginal 8-shaped pores without such a sclerotized projection----- 28
22. Dorsal 8-shaped pores distributed over much of surface, not arranged in groups; atrium of spiracle slightly enlarged and containing 2–4 quinquelocular pores; 9 or 10 quinquelocular pores in each spiracular band; margin of anal opening with 2 minute setae—*adjunctum*, new species, p. 39.  
Dorsal 8-shaped pores not distributed over surface, arranged in groups when present; atrium of spiracle neither enlarged nor containing pores; usually with less than 9 or more than 10 quinquelocular pores in each spiracular band; margin of anal opening normally without setae (rarely with 1 minute seta)----- 23

Key to Adult Females—Continued

23.	Multilocular pores, totaling 30-42, arranged in 4 complete and 4 interrupted rows-----	24
	Multilocular pores, totaling 20-36, arranged either in 3 or in 4 complete rows-----	25
24.	Marginal quinquelocular pores in a single row where spiracular pore bands meet body margin, approximately 18 at anterior and 30 at posterior spiracular pore band; apical setae approximately 48 $\mu$ long----- <i>nitidum</i> , new species, p. 139.	
	Marginal quinquelocular pores much more numerous than above, in a complete row terminating at or near the posterior 8-shaped pores; apical setae approximately 56 $\mu$ long <i>pasaniac</i> Kuwana and Cockerell, p. 149.	
25. (23)	Marginal quinquelocular pores in a complete row, numerous-----	26
	Marginal quinquelocular pores either absent or present only where spiracular pore bands meet body margin-----	27
26.	Marginal quinquelocular pores in a complete row, terminating at or before the posterior 8-shaped pores; multilocular pores in 4 rows----- <i>castanacae</i> , new species, p. 59.	
	Marginal quinquelocular pores in a complete row, continuous between apical setae; multilocular pores in 3 rows <i>skanianac</i> , new species, p. 191.	
27. (25)	Marginal row of 8-shaped pores terminating about the length of an apical seta from setal bases; marginal quinquelocular pores absent; apical setae about 40 $\mu$ long <i>semiscpultum</i> , new species, p. 186.	
	Marginal row of 8-shaped pores terminating twice a pore's length from bases of apical setae; marginal quinquelocular pores usually present where spiracular pore bands meet body margin; apical setae about 48 $\mu$ long <i>horishac</i> , new species, p. 106.	
28. (21)	Dorsum thickly strewn with 8-shaped pores measuring 12-13 $\mu$ long and 8-9 wide; 40-99 quinquelocular pores in each spiracular band-----	29
	Dorsum with or without 8-shaped pores, but not thickly strewn with pores measuring 12-13 $\mu$ long and 8-9 wide; if some dorsal 8-shaped pores approximate this size, then there are less than 40 quinquelocular pores in each spiracular band-----	30
29.	Marginal quinquelocular pores starting a short distance anterior to anterior spiracular pore bands and ending slightly posterior to posterior spiracular pore bands; 71-99 quinquelocular pores in each spiracular band <i>roboris</i> , new species, p. 177.	
	Marginal quinquelocular pores absent; 40-76 quinquelocular pores in each spiracular band <i>repugnans</i> , new species, p. 176.	
30. (28)	Margin of anal opening with setae-----	31
	Margin of anal opening without setae (ring with minute setae in <i>vitreum</i> )-----	39
31.	Dorsal 8-shaped pores present-----	32
	Dorsal 8-shaped pores absent-----	33
32.	Dorsal 8-shaped pores much smaller than marginal, present in lateral and submarginal areas; marginal quinquelocular pores present around most of margin; multilocular pores, totaling 26-33, in 4 complete and 2 or 3 interrupted rows <i>luteolum</i> , new species, p. 124.	
	Dorsal 8-shaped pores practically as large as marginal, scattered over entire surface; marginal quinquelocular pores absent; multilocular pores, totaling 4-9, in 2 or 3 indefinite rows----- <i>bellum</i> , new species, p. 50	
33. (31)	Marginal quinquelocular pores mostly in a double row but in a single row near posterior end of body and continuous between apical setae----- <i>japonicum</i> Cockerell, p. 114.	
	Marginal quinquelocular pores not so numerous, normally absent between apical setae-----	34



## Key to Adult Females—Continued

34. Marginal quinquelocular pores 10-30 in number where each spiracular pore band meets body margin, not present near apical setae, and interrupted between anterior and posterior spiracular pore bands; apical setae 64-72  $\mu$  long  
*ilicicola* Targioni-Tozzetti, p. 107.  
Marginal quinquelocular pores more numerous than above, present nearer anterior and posterior ends of body, and not interrupted between anterior and posterior spiracular pore bands; apical setae not more than 50  $\mu$  long except in *perplexum*----- 35
35. Multilocular pores in 3 rows, usually totaling 6-8, but very rarely up to 13; apical setae 28-32  $\mu$  long  
*minus* Lindinger, p. 132.  
Multilocular pores in more than 3 rows and totaling at least 23; apical setae 32-64  $\mu$  long----- 36
36. Multilocular pores in 4 or 5 complete and 2-5 interrupted rows; 13-30 quinquelocular pores in each spiracular band----- 37
37. Multilocular pores in 4 complete rows; 35-100 quinquelocular pores in each spiracular band----- 38
37. Multilocular pores in 4 or 5 complete and 2-4 interrupted rows; apical setae approximately 48  $\mu$  long; largest marginal 8-shaped pores about 9  $\mu$  long and 6 wide  
*variabile*, new species, p. 217.  
Multilocular pores in 4 complete and 5 interrupted rows; apical setae approximately 64  $\mu$  long; largest marginal 8-shaped pores about 12  $\mu$  long and 8 wide, smallest about 10  $\mu$  long and 6 wide----- *perplexum*, new species, p. 151.
38. (36) Usually with 23-33 multilocular pores, but very rarely with as many as 38; mounted specimens averaging 1.25 mm. in diameter; apical setae averaging 34  $\mu$  long  
*quercicola* (Bouché), p. 173.  
Usually with 50-62 multilocular pores, but very rarely with as few as 40, and occasionally with as many as 71; mounted specimens averaging around 1.95 mm. long and 1.5 wide; apical setae averaging 38  $\mu$  long  
*variosum* (Ratzeburg), p. 218.
39. (30) Multilocular pores absent----- 40  
Multilocular pores present----- 42
40. Dorsal 8-shaped pores deeply invaginated, actually tubular; marginal 8-shaped pores nearly as wide as long, and about 9  $\mu$  long and 8 wide; with a characteristic group of 5-7 pairs of setae posterior to genital opening  
*phoenicis* Ramachandra Rao, p. 154.  
Dorsal 8-shaped pores absent; marginal 8-shaped pores not nearly so wide as long; without such a group of setae----- 41
41. With marginal trilocular pores; spiracle with a bar; mounted specimens approximately 0.6 mm. long and 0.5 wide; dorsal tubes absent----- *gilvum*, new species, p. 99.  
With marginal quinquelocular pores; spiracle apparently without a bar; mounted specimens approximately 1.8 mm. long and 0.9 wide; dorsal tubes present  
*simplex*, new species, p. 189.
42. (39) Dorsal 8-shaped pores present----- 43  
Dorsal 8-shaped pores absent----- 45
43. Anal tube present, clearly differentiating anal opening from anal ring; anal opening apical----- *borboniae* Brain, p. 53.  
Anal tube absent; anal opening ventral, close to margin----- 44
44. Apex of abdomen with 5 pairs of setae; with marginal quinquelocular pores; some dorsal 8-shaped pores twice size of marginal----- *inuitatum*, new species, p. 113.  
Apex of abdomen with 2 pairs of setae; with marginal trilocular pores; no dorsal 8-shaped pores twice size of marginal  
*inlabefactum*, new species, p. 112.
45. (42) With marginal quinquelocular pores----- 46  
With marginal trilocular pores----- 47

## Key to Adult Females—Continued

46. Tubular ducts about 18  $\mu$  long; anal ring differentiated from anal opening, the ring bearing minute setae  
*vitreum*, new species, p. 225.
- Tubular ducts about 24  $\mu$  long; anal ring not differentiated from anal opening, margin of anal opening without setae  
*suishac*, new species, p. 203.
47. (45) Atrium of spiracle not enlarged, not containing pores  
*sabalis*, new species, p. 180.
- Atrium of spiracle slightly or greatly enlarged, containing pores. 48
48. Atrium of spiracle slightly enlarged and containing 2 trilobular or quinquelocular pores; multilocular pores, totaling approximately 60, in 3 complete rows-----*hilli* Green, p. 105.
- Atrium of spiracle greatly enlarged and containing 5-11 quinquelocular pores; multilocular pores, totaling fewer than 40, in 3 complete and 1 or 2 interrupted rows----- 49
49. Anal tube and anal ring distinct; marginal row of 8-shaped pores interrupted near posterior end of body, but continued and terminating around twice a pore's length from bases of apical setae; atrium of spiracle containing 5-8 quinquelocular pores; 8-15 trilobular pores in each spiracular band  
*flagellariae*, new species, p. 93.
- Anal tube and anal ring not apparent; marginal row of 8-shaped pores not interrupted, terminating about one and a half times the length of an apical seta from setal bases; atrium of spiracle containing 8-11 quinquelocular pores; apparently without pores in spiracular bands  
*unicum*, new species, p. 214.
50. (1) Anal ring with 4 setae----- 51
- Anal ring with 6 setae----- 56
51. Marginal 8-shaped pores in a double row; anal ring a sclerotized band with pores--*quadrisetosum*, new species, p. 170.
- Marginal 8-shaped pores in a single row; anal ring a sclerotized band or not, but if so, without pores----- 52
52. Anal ring a circular, sclerotized band, with setae around 2  $\mu$  long----- 53
- Anal ring consisting of 2 elliptical plates, with setae at least 20  $\mu$  long----- 54
53. Multilocular pores, totaling 10-14, arranged in a longitudinal row at each end of genital opening; 55-65 quinquelocular pores in each spiracular band--*medium*, new species, p. 127.
- Multilocular pores, totaling 71-81, arranged in 8 transverse rows; 6-10 quinquelocular pores in each spiracular band  
*victoriae*, new species, p. 221.
54. (52) Marginal row of 8-shaped pores terminating around one-half length of an apical seta from setal bases; multilocular pores, totaling 37-50, arranged in 3 complete and 5 interrupted rows-----*truncatum*, new species, p. 211.
- Marginal row of 8-shaped pores terminating at least the length of an apical seta from setal bases; multilocular pores, totaling fewer than 30, arranged in 2 or 3 rows----- 55
55. Marginal row of 8-shaped pores terminating around the length of an apical seta from setal bases; 23-26 multilocular pores; apex of abdomen with 4 pairs of setae  
*pallidum*, new species, p. 145.
- Marginal row of 8-shaped pores terminating two or three times the length of an apical seta from setal bases; 9-14 multilocular pores; apex of abdomen with 3 pairs of setae  
*bondari* Lepage, p. 210.
56. (50) Marginal 8-shaped pores in a double or triple row----- 57
- Marginal 8-shaped pores in a single row----- 74
57. Tubular ducts about 16  $\mu$  long; dorsal tubes present; 125-140 quinquelocular pores in each spiracular band. Found only on Bambuseae-----*hemisphaericum* Kuwana, p. 104.
- Tubular ducts at least 26  $\mu$  long; dorsal tubes absent; less than 100 quinquelocular pores in each spiracular band. Not found on Bambuseae----- 58

## Key to Adult Females—Continued

58. Marginal 8-shaped pores of unusual shape, the 2 halves closely appressed, individual pores measuring 12 or 13  $\mu$  long and wide; anal opening and anal tube not differentiated from adjacent derm; approximately 368 multilocular pores  
*gutta* Green, p. 101.
- Marginal 8-shaped pores not as above, if 12 or 13  $\mu$  long then 8 or 9 wide; anal opening and anal tube differentiated from adjacent derm; less than 200 multilocular pores----- 59
59. Apex of abdomen with 4 pairs of setae----- 60
- Apex of abdomen with more than 4 pairs of setae----- 62
60. Dorsal 8-shaped pores scattered; antenna apparently with 3 setae; anal ring setae approximately 25  $\mu$  long  
*subcentruosum*, new species, p. 202.
- Dorsal 8-shaped pores absent; antenna apparently with 1 or 2 setae; anal ring setae about 30  $\mu$  long----- 61
61. Marginal row of 8-shaped pores irregularly double, single at points other than at posterior end, terminating around the length of an apical seta from setal bases; 10-16 quinquelocular pores in each spiracular band; apical setae approximately 47  $\mu$  long----- *hakeae* Fuller, p. 103.
- Marginal row of 8-shaped pores double except near posterior end, terminating one-half the length of an apical seta from setal bases; 18-25 quinquelocular pores in each spiracular band; apical setae approximately 65  $\mu$  long  
*ventruosum* (Maskell), p. 220.
62. (59) Ventral submarginal 8-shaped pores 7-8  $\mu$  long and 5 wide, nearly as large as posterior marginal 8-shaped pores; dorsal 8-shaped pores 8-9  $\mu$  long and 5 wide  
*quacsitum*, new species, p. 171.
- Ventral submarginal 8-shaped pores either smaller than above or, if that size, conspicuously smaller than posterior marginal 8-shaped pores; dorsal 8-shaped pores smaller or much larger than above----- 63
63. Apex of abdomen with 5 pairs of setae----- 64
- Apex of abdomen with 6 pairs of setae----- 66
64. Dorsal 8-shaped pores distinctly smaller than marginal, 5  $\mu$  long and 3 wide----- *tokyonis* Kuwana, p. 206.
- Dorsal 8-shaped pores of same size as, or slightly smaller than, marginal, some 12-16  $\mu$  long and 8-10 wide----- 65
65. Dorsal median 8-shaped pores about 18  $\mu$  long and 12 wide, larger than marginal; marginal quinquelocular pores present only near spiracular pore bands; 75-105 multilocular pores; apical setae 80-108  $\mu$  long; interapical setae 16-20  $\mu$  long----- *grandiculum*, new species, p. 100.
- Dorsal median 8-shaped pores around 12  $\mu$  long and 8 wide, of same size as marginal; marginal quinquelocular pores usually present except near posterior end of body; 100-130 multilocular pores; apical setae 54-64  $\mu$  long; interapical setae around 12.6  $\mu$  long----- *viridulum* Cockerell, p. 223.
66. (63) Multilocular pores arranged either in 6 complete and 3 interrupted or in 7 or 8 complete rows; tubular ducts about 32  $\mu$  long----- 67
- Multilocular pores arranged in 3 or 4 complete rows, and sometimes in 1-4 interrupted rows, but with less than 5 complete rows; tubular ducts at least 40  $\mu$  long----- 68
67. Dorsal 8-shaped pores arranged in short, transverse rows along median line and in circles paralleling the margin elsewhere; multilocular pores, totaling approximately 100, apparently arranged in 6 complete and 3 interrupted rows  
*brachylenae* Brain, p. 55.
- Dorsal 8-shaped pores arranged in longitudinal rows along median line, tending toward arrangement in transverse rows elsewhere; multilocular pores, totaling approximately 180, apparently arranged in 7 or 8 complete rows  
*thespesiae* Green, p. 205.



## Key to Adult Females—Continued

68. (66) Marginal quinquelocular pores absent, or only 1-4 such pores where each spiracular pore band meets body margin  
*zanthencs*, new species, p. 227.  
Marginal quinquelocular pores present and at least fairly numerous ----- 69
69. Dorsal 8-shaped pores usually absent, but 2-6 such pores rarely present along median line  
*fimbriatum* (Fonscolombe), p. 91.  
Dorsal 8-shaped pores present, more numerous than above, arranged in transverse rows, at least in median area ----- 70
70. Multilocular pores, totaling 55-180, arranged in 3 or 4 complete and 2-4 interrupted rows, but with a total of at least 5 and sometimes 6-8 rows; apical setae 100-128  $\mu$  long ----- 71
- Multilocular pores, totaling 14-55, arranged in 3 complete rows, or in 3 complete and 1 interrupted row, but with a total of less than 5 rows; apical setae less than 100  $\mu$  long ----- 72
71. Dorsal 8-shaped pores in median groups and scattered from these to body margin, numerous, the majority as large as marginal 8-shaped pores; marginal row of quinquelocular pores interrupted for at least 30 8-shaped pores of nearer row anteriorly and terminating as near to posterior spiracular pore bands as to apical setae<sup>6</sup>  
*alycriense* (Newstead), p. 42.  
Dorsal 8-shaped pores in median groups and sometimes scattered from these to body margin, the scattered pores either numerous and much smaller than marginal pores or sparse and slightly smaller; marginal row of quinquelocular pores interrupted for less than 30 8-shaped pores of nearer row anteriorly and terminating slightly or much nearer to apical setae than to posterior spiracular pore bands  
*arabidis* (Signoret), p. 44.
72. (70) Marginal quinquelocular pores in a single row starting about 4 pores anterior to anterior spiracular pore bands and ending about 10 pores posterior to posterior spiracular pore bands; dorsal 8-shaped pores usually arranged in 3 or 4 transverse rows in median area, and totaling no more than 20, but with a few sometimes scattered between median group and body margin; 14-29 multilocular pores; without disk pores among spiracular quinquelocular pores and with about 4 among multilocular pores  
*launcae*, new species, p. 119.  
Marginal quinquelocular pores much more numerous than above, interrupted for a few pores at anterior end and terminating about as near or nearer to posterior 8-shaped pores than to posterior spiracular pore bands; dorsal 8-shaped pores arranged in 5-9 transverse rows in median area and with many scattered between median groups and body margin; 20-55 multilocular pores; with disk pores among spiracular quinquelocular pores and usually with more than 4 among multilocular pores ----- 73
73. Dorsal 8-shaped pores arranged in 5 or 6 transverse groups in median area and scattered from them to body margin; 24-36 quinquelocular pores in each spiracular band; multilocular pores in 3 complete rows near genital opening and in 1 interrupted row anterior to posterior spiracles; anal ring setae around 72  $\mu$  long. *nevadense* Balachowsky, p. 138.  
Dorsal 8-shaped pores arranged in 7-9 transverse groups in median area and scattered from them to body margin; 43-65 quinquelocular pores in each spiracular band; multilocular pores in 3 complete rows near genital opening and without any anterior to posterior spiracles; anal ring setae 80-92  $\mu$  long ----- *stentae* Brain, p. 196.

<sup>6</sup>There is so much variation in these characters that associated larvae should be examined for a positive segregation of the 2 species.

## Key to Adult Females—Continued

74. (56) Dorsal tubes absent; submarginal setae in a complete row (present anterior, as well as posterior, to anterior spiracles) except in *euryopsis*, where they are absent; beak with setae except in *epidendri* and *ungulatum*. Not found on Bambuseae----- 75
- Dorsal tubes present; submarginal setae in an interrupted row (absent anterior to anterior spiracles, and usually absent anterior to posterior spiracles); beak without setae. Found only on Bambuseae----- 102
75. Apex of abdomen with 3 pairs of setae, an apical, an inter-apical, and a ventral pair----- 76
- Apex of abdomen with more than 3 pairs of setae----- 78
76. Marginal 8-shaped pores with a sclerotized tongue-shaped projection on dorsal edge; approximately 44 multilocular pores; apical setae approximately 55  $\mu$  long  
*borneense*, new species, p. 54.
- Marginal 8-shaped pores without such a sclerotized projection; at least 50 multilocular pores; apical setae at least 63  $\mu$  long----- 77
77. Marginal row of 8-shaped pores terminating around twice the length of a posterior pore from bases of apical setae; dorsal 8-shaped pores larger than marginal; tubular ducts around 24  $\mu$  long; apical setae about 81  $\mu$  long; apex of abdomen with a sclerotized area ventrally  
*garcinia*, new species, p. 96.
- Marginal row of 8-shaped pores terminating around two-thirds the length of an apical seta from setal bases; dorsal 8-shaped pores smaller than marginal; tubular ducts around 18  $\mu$  long; apical setae about 63  $\mu$  long; apex of abdomen without a sclerotized area ventrally  
*sumatrae*, new species, p. 204.
78. (75) Apex of abdomen with 4 pairs of setae, an apical, an inter-apical, and 2 ventral pairs----- 79
- Apex of abdomen either with 5 or with 6 pairs of setae----- 83
79. Marginal quinquelocular pores absent; dorsal 8-shaped pores present; 2 or 3 quinquelocular pores between spiracle and body margin; 70-81 multilocular pores  
*ungulatum*, new species, p. 213.
- Marginal quinquelocular pores present; dorsal 8-shaped pores present or absent; at least 5 quinquelocular pores between spiracle and body margin; fewer than 71 or more than 81 multilocular pores----- 80
80. Marginal row of quinquelocular pores interrupted for 10-20 8-shaped pores at anterior end of body and terminating 5-20 8-shaped pores from posterior marginal 8-shaped pores, conspicuously removed from 8-shaped pores; pores in transverse rows on ventral surface of abdomen with only 3-5 loculi, but much larger than marginal quinquelocular pores; with 3 pairs of claws. *lacrimula*, new species, p. 117.
- Marginal row of quinquelocular pores not interrupted at anterior end of body and terminating 1-5 8-shaped pores from, or posterior to, the posterior marginal 8-shaped pores, close to the 8-shaped pores; pores in transverse rows on ventral surface of abdomen with more than 5 loculi; with or without 3 pairs of claws----- 81
81. Dorsal 8-shaped pores present; with 3 pairs of claws  
*litsae* Kuwana, p. 120.
- Dorsal 8-shaped pores absent; without claws----- 82
82. Marginal row of quinquelocular pores triple at anterior end of body, double or triple on lateral margins, and double or single at posterior end; a group of 7-11 quinquelocular pores in atrium of spiracle and 3-10 similar pores between this group and body margin, a total of 12-17 in atrium and row combined; 116-140 multilocular pores  
*multiporum* Green, p. 137.

## Key to Adult Females—Continued

- Marginal quinquelocular pores in a single row; without a group of pores at opening of spiracle, 5-12 quinquelocular pores between the spiracle and body margin; 54-71 multilocular pores-----*stypheciae* (Maskell), p. 199.
83. (78) Apex of abdomen with 6 pairs of setae----- 84  
 Apex of abdomen with 5 pairs of setae----- 91
84. Marginal row of 8-shaped pores poorly defined, rather difficult to distinguish; marginal and dorsal 8-shaped pores conspicuously invaginated; marginal quinquelocular pores absent; apical setae 18-20  $\mu$  long; anal ring setae 72-80  $\mu$  long  
*curyopsis* Fuller, p. 88.
- Marginal row of 8-shaped pores well defined, easy to distinguish; marginal and dorsal 8-shaped pores not conspicuously invaginated; marginal quinquelocular pores present; apical setae at least 54  $\mu$  long; anal ring setae not more than 45  $\mu$  long----- 85
85. Dorsal 8-shaped pores absent----- 86  
 Dorsal 8-shaped pores present----- 87
86. Marginal row of 8-shaped pores terminating about the length of an apical seta from setal bases; marginal row of quinquelocular pores terminating 6-17 8-shaped pores from the posterior 8-shaped pores; without submarginal disk pores interspersed with submarginal 8-shaped pores; apical setae around 54  $\mu$  long; anal ring setae 40-45  $\mu$  long  
*euphorbiae*, new species, p. 87.
- Marginal row of 8-shaped pores terminating about the length of a posterior pore from bases of apical setae; marginal row of quinquelocular pores terminating at the posterior 8-shaped pores; with submarginal disk pores interspersed with submarginal 8-shaped pores; apical setae around 72  $\mu$  long; anal ring setae around 28  $\mu$  long  
*machili*, new species, p. 125.
87. (85) Disk pores in a ventral submarginal row close to submarginal 8-shaped pores, not in a row close to marginal quinquelocular pores----- 88  
 Disk pores not in a ventral submarginal row close to submarginal 8-shaped pores, sometimes in a row close to marginal quinquelocular pores----- 90
88. With 3 pairs of claws; dorsal 8-shaped pores smaller than majority of marginal----- *corallinum* Takahashi, p. 71.  
 With either 1 pair of claws or with none; some dorsal 8-shaped pores distinctly larger than marginal----- 89
89. Bar of spiracle subcircular, about 32  $\mu$  wide; a group of 15-20 quinquelocular pores at opening of spiracle and 10-13 similar pores between group and body margin; largest dorsal 8-shaped pores measuring 16  $\mu$  long and 10 wide; without claws-----*javae*, new species, p. 116.  
 Bar of spiracle subcircular, but only about 24  $\mu$  wide; a group of 2 or 3 quinquelocular pores at opening of spiracle and 10-17 similar pores between group and body margin; largest dorsal 8-shaped pores measuring 20  $\mu$  long and 12 wide; with 1 pair of rather slender claws in position occupied by posterior pair when 3 pairs are present  
*psychotriae*, new species, p. 162.
90. (87) With a row of disk pores close to marginal quinquelocular pores; dorsal 8-shaped pores 12-16  $\mu$  long and 8-12 wide, larger than marginal; tubular ducts about 34  $\mu$  long; 132-177 multilocular pores----- *pustulans* (Cockerell), p. 165.  
 Without a row of disk pores close to marginal quinquelocular pores; dorsal 8-shaped pores 4-6  $\mu$  long and 2.5-4 wide, smaller than marginal; tubular ducts about 22  $\mu$  long; 60-80 multilocular pores----- *striatum*, new species, p. 198.
- 91 (83) Dorsal 8-shaped pores absent----- 92  
 Dorsal 8-shaped pores present----- 93



## Key to Adult Females—Continued

92. Apex of abdomen with 5 pairs of setae, 1 apical, 1 interapical, and 3 ventral; 9-16 quinquelocular pores in each spiracular band; 74-88 multilocular pores; apical setae around 60  $\mu$  long; anal ring setae around 27  $\mu$  long  
*transversum* Morrison and Morrison, p. 209.
- Apex of abdomen with 5 pairs of setae, 1 apical, 1 interapical, 1 dorsal, and 2 ventral; 35-55 quinquelocular pores in each spiracular band; 98-130 multilocular pores; apical setae around 80  $\mu$  long; anal ring setae 36-40  $\mu$  long  
*sanbernardense* Hempel, p. 181.
93. (91) Marginal 8-shaped pores terminating three times the length of an apical seta from setal bases; 72-88 multilocular pores-----*ingae*, new species, p. 111.
- Marginal 8-shaped pores terminating not more than the length of an apical seta from setal bases; fewer than 72 or more than 88 multilocular pores, except in *epidendri*, which has less than 80----- 94
94. Mounted insect around 2.25 mm. in diameter; about 271 multilocular pores-----*townsendi* Cockerell, p. 207.
- Mounted insect not more than 1.75 mm. in diameter; fewer than 150 multilocular pores----- 95
95. Anal ring without pores; 4-6 marginal quinquelocular pores where each spiracular pore band meets body margin; around 50 multilocular pores----*inconspicuum*, new species, p. 110.
- Anal ring with pores; marginal quinquelocular pores more numerous than above; 49-131 multilocular pores----- 96
96. Without a marginal row of disk pores dorsad of 8-shaped pores or ventrad of quinquelocular pores  
*putcanum*, new species, p. 168.
- With a marginal row of disk pores either dorsad of 8-shaped pores or ventrad of quinquelocular pores----- 97
97. With a marginal row of disk pores ventrad of quinquelocular pores but without a row dorsad of 8-shaped pores----- 98
- Without a marginal row of disk pores ventrad of quinquelocular pores but with a row dorsad of 8-shaped pores----- 100
98. Dorsal 8-shaped pores sparse, a few in median area and none or a few in submarginal area; atrium of spiracle slightly enlarged and containing 2-7 quinquelocular pores; apical setae around 76  $\mu$  long-----*epacridis* (Maskell), p. 82.
- Dorsal 8-shaped pores numerous, present on most of dorsum; atrium of spiracle not enlarged and not containing pores; apical setae less than 60  $\mu$  long----- 99
99. Dorsal 8-shaped pores varying in size from smaller to larger than marginal pores; marginal quinquelocular pores in a complete row terminating near the posterior 8-shaped pores; the posterior 2 or 3 pairs of marginal 8-shaped pores larger than adjacent pores-----*coffecae* Newstead, p. 67.
- Dorsal 8-shaped pores varying in size, but at least as large as majority of marginal pores; marginal quinquelocular pores in an interrupted row from near antennae to near the posterior 8-shaped pores; the posterior 2 or 3 pairs of marginal 8-shaped pores smaller than adjacent pores  
*conspicuum* Brain, p. 69.
100. (97) Marginal quinquelocular pores in a complete row terminating at or posterior to the posterior 8-shaped pores; 49-80 multilocular pores; 8-17 quinquelocular pores in each spiracular band; dorsal 8-shaped pores arranged in groups in median and submedian areas and often in lateral area, also in a single submarginal row---*epidendri* (Bouché), p. 83.
- Marginal quinquelocular pores in an interrupted row, absent between antennae, terminating anterior to the posterior 8-shaped pores; 88-105 multilocular pores; 18-40 quinquelocular pores in each spiracular band; dorsal 8-shaped pores not arranged as above----- 101

## Key to Adult Females—Continued

101. Dorsal 8-shaped pores nearly uniform in size and same size as or slightly smaller than marginal, largest 12-14  $\mu$  long and 8-9 wide; tubular ducts about 30  $\mu$  long; anal ring setae 20-27  $\mu$  long----- *agavis*, new species, p. 40.  
Dorsal 8-shaped pores varying in size with some much larger than marginal, largest 16-20  $\mu$  long and 12-15 wide; tubular ducts about 36  $\mu$  long; anal ring setae 30-36  $\mu$  long----- *crisatum* Ferris, p. 74.
102. (74) Apex of abdomen with 1 pair of setae measuring 3.4  $\mu$  long----- *pusillum*, new species, p. 163.  
Apex of abdomen with more than 1 pair of setae, and with at least 1 pair measuring more than 5  $\mu$  long----- 103
103. Apex of abdomen with 3 pairs of setae----- 104  
Apex of abdomen with 4 pairs of setae----- 113
104. Without multilocular or enlarged quinquelocular pores in genital area----- 105  
With multilocular pores or enlarged quinquelocular pores in genital area----- 106
105. Dorsal 8-shaped pores in a submarginal row, much larger than marginal pores; tubular ducts 32  $\mu$  long; 8-16 quinquelocular pores in each spiracular band----- *amboinae*, new species, p. 43.  
Dorsal 8-shaped pores absent; tubular ducts about 24  $\mu$  long; 7-10 quinquelocular pores in each spiracular band----- *captiosum*, new species, p. 59.
106. (104) Enlarged quinquelocular pores on ventral surface of abdomen in 8 complete rows anterior to genital opening, none posterior to genital opening; apical setae around 7-10  $\mu$  long----- *coronatum* Green, p. 72.  
Multilocular pores on ventral surface of abdomen in a variable number of rows, but 1 row posterior to genital opening; apical setae at least 20  $\mu$  long----- 107
107. Anal ring without pores; anal ring setae 5.4-18  $\mu$  long----- 108  
Anal ring with pores; anal ring setae at least 27  $\mu$  long----- 110
108. Marginal quinquelocular pores mostly in a single row, terminating 4-14 8-shaped pores from the posterior 8-shaped pores; 3 pairs of claws; 2 anal ring setae about 9  $\mu$  long, and 4 about 18  $\mu$  long----- *rubrocomatum* Green, p. 178.  
Marginal quinquelocular pores absent; without claws; anal ring setae varying in length but none as long as 18  $\mu$ ----- 109
109. With about 11 dorsal 8-shaped pores in submedian area on each half of body; mounted insect around 0.8 mm. long; majority of marginal 8-shaped pores 6  $\mu$  long and 4 wide----- *exiguum* Green, p. 89.  
Without dorsal 8-shaped pores except for a pair of large pores near posterior end; mounted insect at least 1.75 mm. long; majority of marginal 8-shaped pores 9-10  $\mu$  long and 5 wide----- *udagamae* Green, p. 212.
110. (107) Mounted insects around 3.8 mm. long and 1.75-1.9 wide; dorsal 8-shaped pores numerous, arranged in about 11 groups along median line; 40-60 quinquelocular pores in each spiracular band; approximately 162 multilocular pores; both apical and anal ring setae around 40  $\mu$  long----- *largum*, new species, p. 118.  
Mounted insects not more than 3 mm. long and 1.25 wide; dorsal 8-shaped pores less numerous and not arranged as above, or absent; less than 26 quinquelocular pores in each spiracular band; less than 100 multilocular pores; apical setae and anal ring setae less than 35  $\mu$  long----- 111
111. Dorsal 8-shaped pores absent; 12-25 quinquelocular pores in each spiracular band----- *masuii* Kuwana, p. 126.  
Dorsal 8-shaped pores present; less than 18 quinquelocular pores in each spiracular band----- 112



## Key to Adult Females—Continued

112. Marginal quinquelocular pores sometimes absent between antennae, and terminating 10-20 8-shaped pores from the posterior 8-shaped pores; dorsal 8-shaped pores in median and submarginal areas; mounted specimens measuring 1.25-1.85 mm. long and 0.75-1 wide  
*sasae*, new species, p. 182.
- Marginal quinquelocular pores present between antennae, and terminating at the posterior 8-shaped pores; dorsal 8-shaped pores in submarginal area; mounted specimens measuring 1.7-2.25 mm. long and 1-1.25 wide  
*florum*, new species, p. 94.
113. (103) Apical setae around 7.2  $\mu$  long; anal opening very small, on ventral surface well removed from margin; anal tube funnel-shaped, with smaller end at opening; anal ring without pores, the ring setae around 1.8  $\mu$  long; disk pores on ventral surface of abdomen in complete transverse rows, replacing multilocular pores-----*gemmae*, new species, p. 97.
- Apical setae at least 16  $\mu$  long; anal opening larger, not on ventral surface well removed from margin; anal tube not funnel-shaped, with one end only slightly smaller than the other; anal ring with pores, the ring setae at least 20  $\mu$  long; disk pores not as above----- 114
114. With 2 or many multilocular or quinquelocular pores on ventral surface near genital opening----- 115
- Without multilocular or quinquelocular pores on ventral surface near genital opening----- 126
115. With 2 quinquelocular pores posterior to genital opening and none anterior; marginal row of 8-shaped pores terminating at least twice length of an apical seta from setal bases; insects rather slender----- 116
- With more than 2 multilocular pores near genital opening, and with pores anterior, as well as posterior, to opening; marginal row of 8-shaped pores terminating much less than twice length of an apical seta from setal bases; insects slender or stout----- 118
116. Marginal quinquelocular pores 4-14 (usually 6) in number where each spiracular pore band meets body margin, interrupted between anterior and posterior spiracular pore bands; marginal row of 8-shaped pores terminating two and a half times the length of an apical seta from setal bases-----*solenophoroides* (Green), p. 192.
- Marginal quinquelocular pores in a single row starting near midpoint between antennae and anterior spiracular pore bands and ending 2-12 8-shaped pores from the posterior 8-shaped pores, continuous between anterior and posterior spiracular pore bands; marginal 8-shaped pores terminating at least three times the length of an apical seta from setal bases----- 117
117. With 2-5 quinquelocular pores between spiracle and body margin; insects elongate and very slender, usually about 1.75 mm. long and 0.25 wide; marginal row of 8-shaped pores interrupted near anterior end, and terminating four to eight times the length of an apical seta from setal bases  
*penicillatum*, new species, p. 150.
- With 6-9 quinquelocular pores between spiracle and body margin; insects not so elongate and slender, around 1.25 mm. long and 0.3 wide; marginal row of 8-shaped pores complete and terminating three or four times the length of an apical seta from setal bases  
*pseudolanccolatatum* Takahashi, p. 158.
118. (115) Marginal quinquelocular pores absent, or 2-8 where each spiracular pore band meets body margin----- 119
- Marginal quinquelocular pores in a complete row terminating at or near the posterior 8-shaped pores----- 122

## Key to Adult Females—Continued

119. Disk pores in a marginal row dorsad of 8-shaped pores; apical setae 76-80  $\mu$  long----- 120  
 Disk pores not in a marginal row dorsad of 8-shaped pores; apical setae 56-68  $\mu$  long----- 121
120. Dorsal 8-shaped pores absent; marginal row of 8-shaped pores terminating twice a posterior pore's length from bases of apical setae, pores nearly contiguous  
*delicatum* (Green), p. 76.  
 Dorsal 8-shaped pores numerous; marginal row of 8-shaped pores terminating one-half the length of an apical seta from bases of setae, posteriorly pores at least twice a pore's length apart----- *vulgare*, new species, p. 226.
121. (119) Insects tapering strongly from anterior third to posterior end, measuring 0.75-1.5 mm. long and 0.4-0.5 wide; marginal 8-shaped pores rather elongate and slender, 8-9  $\mu$  long and about 4.5 wide; without claws; usually several dorsal 8-shaped pores in submarginal area  
*acutulum*, new species, p. 38.  
 Insects not tapering strongly from anterior third to posterior end, measuring around 2.25 mm. long and 0.4 wide; marginal 8-shaped pores not particularly elongate and slender, 6-8  $\mu$  long and 4-5 wide; with 3 pairs of claws; 1 median dorsal 8-shaped pore anteriorly  
*disiunctum*, new species, p. 79.
122. (118) Multilocular pores, totaling 6-12, in 2 rows; more than 43 quinquelocular pores between each spiracle and body margin  
*notabile*, new species, p. 140.  
 Multilocular pores, totaling at least 34, in more than 2 rows; less than 43 quinquelocular pores between each spiracle and body margin----- 123
123. With 22-42 quinquelocular pores in each spiracular band and approximately the same number in the anterior as in the posterior band; apical setae 72-80  $\mu$  long; dorsal 8-shaped pores present----- *bambusae* (Boisduval), p. 47.  
 With 3-30 quinquelocular pores in a spiracular band, anterior band with 12-30 and posterior band with 3-7; apical setae 28-36  $\mu$  long; dorsal 8-shaped pores present or absent----- 124
124. Dorsal 8-shaped pores numerous----- *chinae*, new species, p. 65.  
 Dorsal 8-shaped pores absent----- 125
125. Marginal row of 8-shaped pores terminating nearly the length of an apical seta from bases of setae; 34-40 multilocular pores----- *fusum*, new species, p. 95.  
 Marginal row of 8-shaped pores terminating about a pore's width from bases of apical setae; about 80 multilocular pores  
*subdolum*, new species, p. 201.
126. (114) Tubular ducts 9-12  $\mu$  long; insects 2-3 mm. long and 1-1.5 wide. Tubular ducts usually at least 24  $\mu$  long, but 12  $\mu$  long in *parvum*, which is 0.5 mm. in diameter----- 128
127. With 60-100 quinquelocular pores in each spiracular band; marginal row of 8-shaped pores terminating a pore's length from bases of apical setae; tubular ducts 9  $\mu$  long; posterior third of body not conspicuously narrowed  
*bambusicola* Kuwana, p. 49.  
 With 16-21 quinquelocular pores in each spiracular band; marginal row of 8-shaped pores terminating the length of an apical seta from bases of setae; tubular ducts 12  $\mu$  long; posterior third of body conspicuously narrowed  
*sparus*, new species, p. 193.
128. (126) Apical setae 16-30  $\mu$  long, not conspicuously longer than anal ring setae; atrium of spiracle enlarged and containing 2-5 quinquelocular pores----- 129  
 Apical setae at least 38  $\mu$  long and distinctly longer than anal ring setae; atrium of spiracle not enlarged and not containing pores, except in *mimicum*, in which it is very slightly enlarged and contains 1 or 2 pores----- 131

## Key to Adult Females—Continued

129. Dorsal 8-shaped pores numerous; marginal row of 8-shaped pores terminating the length of an apical seta from setal bases; apical setae around  $30 \mu$  long; anal ring setae  $27-30 \mu$  long----- *ordinarium*, new species, p. 144.  
Dorsal 8-shaped pores absent; marginal row of 8-shaped pores terminating two to four times the length of an apical seta from setal bases; apical setae  $16-20 \mu$  long; anal ring setae  $24-29 \mu$  long----- 130
130. Submarginal 8-shaped pores in a single row, usually 1 opposite every other marginal 8-shaped pore; antenna with 2 setae longer and 2 shorter than diameter of antenna  
*oblongum*, new species, p. 142.  
Submarginal 8-shaped pores in a double row, usually 2 opposite every other marginal 8-shaped pore; antenna with 2 setae longer but none shorter than diameter of antenna  
*longulum*, new species, p. 121.
131. (128) Mounted insect nearly circular or broadly ovoid,  $0.4-1$  mm. long and wide----- 132  
Mounted insect elongate,  $0.7-3$  mm. long and  $0.3-0.7$  wide----- 137
132. Marginal quinquelocular pores absent, or 2-4 where each spiracular pore band meets body margin----- 133  
Marginal quinquelocular pores present on at least anterior half of body----- 134
133. Dorsal 8-shaped pores in a submarginal row; 3-5 quinquelocular pores in each spiracular band-- *brunetae*, new species, p. 58.  
Dorsal 8-shaped pores absent; 10-12 quinquelocular pores in each spiracular band----- *radiatum*, new species, p. 175.
134. (132) Dorsal 8-shaped pores absent; marginal row of 8-shaped pores terminating one and a half to two times the length of an apical seta from setal bases, the space between pores about equal to a pore's width-- *circulare*, new species, p. 66.  
Dorsal 8-shaped pores present; marginal row of 8-shaped pores either terminating slightly more than the length of an apical seta from setal bases and the space between pores equal to at least twice a pore's length, or the row terminating three to six times the length of an apical seta from setal bases and the space between pores equal to at least a pore's length----- 135
135. Tubular ducts around  $12 \mu$  long; marginal row of 8-shaped pores terminating slightly more than the length of an apical seta from setal bases, the pores usually two to four times a pore's length apart----- *parvum*, new species, p. 148.  
Tubular ducts  $24-27 \mu$  long; marginal row of 8-shaped pores terminating three to six times the length of an apical seta from setal bases, the pores at varying distances apart----- 136
136. With 4-8 dorsal 8-shaped pores; anal ring setae practically uniform in length and about  $20 \mu$  long; usually 5 or 6 marginal 8-shaped pores posterior to posterior spiracular pore bands----- *minutum* Takahashi, p. 135.  
With 8-17 dorsal 8-shaped pores; anal ring setae varying in length, 2 setae  $24 \mu$  and 4 setae  $26-30 \mu$  long; usually 2 or 3 marginal 8-shaped pores posterior to posterior spiracular pore bands----- *minusculum*, new species, p. 133.
137. (131) Marginal 8-shaped pores greatly reduced in number, a total of 1-11 observed, usually present on lateral margins of body----- *longum* (Green), p. 122.  
Marginal 8-shaped pores sometimes reduced in number but more numerous than above, in a definite row around margin----- 138
138. Marginal 8-shaped pores usually at least twice a pore's length apart, the row of pores terminating more than twice the length of an apical seta from setal bases; without marginal quinquelocular pores and with 3-6 quinquelocular pores between spiracle and body margin-- *caudatum* Green, p. 61.



## Key to Adult Females—Continued

- Marginal 8-shaped pores usually not more than a pore's length apart; if the row of these pores terminates more than twice the length of an apical seta from setal bases, then there is a distinct row of marginal quinquelocular pores; if marginal quinquelocular pores are absent, then there are at least 8 quinquelocular pores between spiracle and body margin--- 139
139. Marginal row of 8-shaped pores terminating about two and a half times the length of an apical seta from setal bases; atrium of spiracle slightly enlarged and containing 1 or 2 quinquelocular pores----- *mimicum*, new species, p. 130.
- Marginal row of 8-shaped pores terminating not more than the length of an apical seta from setal bases; atrium of spiracle not enlarged and not containing pores----- 140
140. Dorsal 8-shaped pores present; a rather sparse row of disk pores dorsad of marginal 8-shaped pores  
*pseudomillaris* Green, p. 160.
- Dorsal 8-shaped pores absent; without a row of disk pores dorsad of marginal 8-shaped pores----- 141
141. Marginal 8-shaped pores rather elongate and slender, 12-14  $\mu$  long and around 5 wide; tubular ducts about 34  $\mu$  long; 17-32 quinquelocular pores in each spiracular band  
*abietum*, new species, p. 35.
- Marginal 8-shaped pores not so elongate and slender, about 8  $\mu$  long and 4.5 wide; tubular ducts about 24  $\mu$  long; 10-18 quinquelocular pores in each spiracular band----- 142
142. Marginal row of quinquelocular pores single, starting between antennae and anterior spiracular pore bands and ending about half way between posterior spiracular pore bands and the posterior marginal 8-shaped pores  
*miliaris miliaris* (Boisduval), p. 129.
- Without marginal quinquelocular pores or with 2-15 (usually less than 6) such pores where each spiracular pore band meets body margin, interrupted between anterior and posterior spiracular pore bands  
*miliaris robustum* Green, p. 130.

## KEY TO LARVAE

1. Anal ring or margin of anal opening without setae or with 1 or 2 setae----- 2
- Anal ring with 4 or 6 setae----- 48
2. Marginal 8-shaped pores absent----- 3
- Marginal 8-shaped pores present----- 7
3. Without a pair of minute setae on lateral margins of penultimate segment and of first 2 segments anterior to penultimate segment of body----- 4
- With a pair of minute setae on lateral margins of penultimate segment and of first 2 segments anterior to penultimate segment of body----- 6
4. Anterior spiracle with 2 pores, posterior with none; dorsal 8-shaped pores usually absent but very rarely up to 11 present; apical setae 58-72  $\mu$  long  
*ilicicola* Targioni-Tozzetti, p. 107.
- Anterior spiracle with 2 pores, posterior with 1 or 2; 32-44 dorsal 8-shaped pores; apical setae about 90  $\mu$  long----- 5
5. With about 34 large dorsal 8-shaped pores; posterior spiracle with 2 pores----- *borboniae* Brain, p. 53.
- With about 44 large dorsal 8-shaped pores; posterior spiracle with 1 pore----- *viennae*, new species, p. 222.
6. (3) Anterior spiracle with 2 pores, posterior with none; anal ring with 2 minute setae; apical setae 55-60  $\mu$  long  
*petrophilae* (Fuller), p. 153.
- Anterior and posterior spiracles each with 2 pores; anal ring without setae; apical setae about 40  $\mu$  long  
*spectabile* Newstead, p. 194.
7. (2) With fewer than 28 marginal 8-shaped pores----- 8
- With 28 marginal 8-shaped pores----- 9

## Key to Larvae—Continued

8. Anterior and posterior spiracles each with 2 pores; 1 or 2 dorsal submedian 8-shaped pores on each half of body; apical setae about  $40\ \mu$  long----- *scirrosis*, new species, p. 184.  
Anterior spiracle with 2 pores, posterior with 1; dorsal 8-shaped pores arranged in a submedian row of 4-7, and a lateral row of 7-11, on each half of body; apical setae about  $80\ \mu$  long----- *bellum*, new species, p. 50.
9. (7) Axes of all or of the majority of marginal 8-shaped pores transverse or diagonal to body margin----- 10  
Axes of all or of the majority of marginal 8-shaped pores longitudinal to body margin----- 17
10. Anal ring or margin of anal opening with setae----- 11  
Anal ring or margin of anal opening without setae----- 13
11. Antenna 5-segmented; spiracle with 1 trilocular and 1 quinquelocular pore----- *urichi* Cockerell, p. 215.----- 12
12. Antenna 6-segmented; spiracle with 2 trilocular pores----- 12  
Sixth antennal segment with 3 long, 2 stout, and 2 fairly stout setae; tibia approximately one-third length of tarsus; 9 pairs of minute and 2 pairs of larger submarginal setae  
*degeneratum*, new species, p. 75.  
Sixth antennal segment with 3 long, 2 stout, and 3 fairly stout setae; tibia approximately one-half length of tarsus; 9 pairs of minute and 1 pair of larger submarginal setae  
*simile*, new species, p. 187.
13. (10) Femur with 1 seta on inner margin near base and 1 on outer margin near center; tarsus with 2 setae on inner and 1 on outer margin----- *flagellariae*, new species, p. 93.  
Femur with 1 seta on inner margin near base, without other setae; tarsus with 1 seta on inner margin and sometimes with 1 on outer margin----- 14
14. Coxa with 3 setae; tarsus with 1 seta on inner margin and none on outer----- *truncatum*, new species, p. 211.  
Coxa with 2 or 3 setae; tarsus with 1 seta each on inner and outer margins----- 15
15. Coxa with 3 setae; anal opening not apparent  
*distinctum*, new species, p. 80.----- 16  
Coxa with 2 setae; anal opening apparent-----
16. Antenna 6-segmented, first segment with 1 seta; about 16 dorsal 8-shaped pores; apical setae about  $30\ \mu$  long  
*difficile*, new species, p. 78.  
Antenna 5-segmented, first segment without setae; 27-36 dorsal 8-shaped pores; apical setae about  $45\ \mu$  long  
*sabalis*, new species, p. 180.
17. (9) With a pair of minute setae close to each of the posterior 2 or 3 pairs of marginal 8-shaped pores----- 18  
Without minute setae as above----- 29
18. With fewer than 9 pairs of submarginal 8-shaped pores----- 19  
With 9 pairs of submarginal 8-shaped pores----- 20
19. Minute dorsal 8-shaped pores arranged in a lateral row of 9 on each half of body; beak short and rather blunt; 5 pairs of submarginal 8-shaped pores; anal ring without setae  
*hilli* Green, p. 105.  
Large dorsal 8-shaped pores arranged in a submedian row of 7 or 8, and a lateral row of 9, on each half of body; beak long and pointed; 7 pairs of submarginal 8-shaped pores; anal ring with setae----- *proboscidis*, new species, p. 157.
20. (18) Anal ring or margin of anal opening with setae----- 21  
Anal ring or margin of anal opening without setae----- 23
21. Femur with 1 seta; around 2 large dorsal 8-shaped pores  
*boliviae*, new species, p. 52.  
Femur without setae; at least 20 large dorsal 8-shaped pores----- 22
22. First antennal segment with 1 seta; about 42 dorsal 8-shaped pores, nearly uniform in size and slightly smaller than marginal pores of same segments  
*oraniae*, new species, p. 143.

## Key to Larvae—Continued

- First antennal segment without setae; 20-40 dorsal 8-shaped pores, varying in size, some much smaller, others much larger, than marginal pores of same segments  
*pinangae*, new species, p. 156.
23. (20) Apex of abdomen with 3 or 4 pairs of setae; fewer than 18 dorsal 8-shaped pores, which are very small, not approximating the marginal in size----- 24  
Apex of abdomen with at least 4 pairs of setae; at least 18 dorsal 8-shaped pores, which are fairly large, some approximating the marginal in size----- 25
24. Anal ring differentiated from anal opening; beak with 4 pairs of setae; about 12 dorsal 8-shaped pores; anterior margin of body with 1 pair of setae  
*phoenicis* Ramachandra Rao, p. 154.  
Anal ring not differentiated from anal opening; beak with 2 pairs of setae; about 7 dorsal 8-shaped pores; anterior margin of body with 3 pairs of setae  
*inlabfactum*, new species, p. 112.
25. (23) Femur without setae; sixth antennal segment with 2 long setae; 18 dorsal 8-shaped pores, the largest distinctly smaller than a marginal pore--- *singulare*, new species, p. 190.  
Femur with 1 seta; sixth antennal segment with 3 long setae; at least 26 dorsal 8-shaped pores, some nearly or actually as large as marginal----- 26
26. Coxa with 2 setae----- 27  
Coxa with 3 setae----- 28
27. Fifth antennal segment without setae; about 40 dorsal 8-shaped pores; marginal and dorsal 8-shaped pores conspicuously elongate and slender----- *gilvum*, new species, p. 99.  
Fifth antennal segment with 1 seta; about 30 dorsal 8-shaped pores; marginal and dorsal 8-shaped pores not conspicuously elongate and slender----- *bondari* Lepage, p. 210.
28. (26) Apex of abdomen with 5 pairs of setae; apical setae about 54  $\mu$  long; 26-33 dorsal 8-shaped pores  
*inusitatum*, new species, p. 113.  
Apex of abdomen with 4 pairs of setae; apical setae about 36  $\mu$  long; about 36 dorsal 8-shaped pores  
*palmae* Cockerell, p. 146.
29. (17) Anterior margin of body without setae; antenna 5-segmented; 8 pairs of submarginal 8-shaped pores; anal tube not apparent----- *acaciae* Morrison and Morrison, p. 37.  
Anterior margin of body with setae; antenna 6-segmented; 8 pairs of submarginal 8-shaped pores in *roboris*, but usually more, rarely less; anal tube very short, but present and differentiating anal ring from anal opening----- 30
30. Anterior margin of body with 3 pairs of setae; coxa with 4 setae; apex of abdomen with 2 pairs of ventral setae--- 31  
Anterior margin of body with 2 pairs of setae; coxa with 3 setae; apex of abdomen either without ventral setae or with only 1 pair----- 33
31. With 32-36 dorsal 8-shaped pores which are at least as large as marginal pores; first antennal segment with 2 setae; 3 pairs of submarginal 8-shaped pores; 5 pairs of submarginal setae----- *brevispinum* Brain, p. 56.  
With about 20 dorsal 8-shaped pores much smaller than marginal, and 2-5 of practically the same size as marginal; first antennal segment with 1 seta; 9 pairs of submarginal 8-shaped pores; either 9 or 11 pairs of submarginal setae----- 32
32. Anterior and posterior spiracles each with 2 pores; about 20 dorsal 8-shaped pores which are much smaller than marginal----- *simplex*, new species, p. 189.  
Anterior spiracle with 2 pores, posterior with none; about 5 dorsal 8-shaped pores of practically the same size as marginal and around 25 minute--- *vitreum*, new species, p. 225.



## Key to Larvae—Continued

33. (30) Eight pairs of submarginal 8-shaped pores; apex of abdomen apparently without ventral setae  
*robotis*, new species, p. 177.  
 Nine pairs of submarginal 8-shaped pores; apex of abdomen with 1 pair of ventral setae..... 34
34. Posterior spiracle without pores..... 35
35. Posterior spiracle with 1 or 2 pores..... 36
- Two pairs of setae between antennae and mouth parts  
*semisepultum*, new species, p. 186.  
 Three pairs of setae between antennae and mouth parts  
*nitidum*, new species, p. 139.
36. (34) Posterior spiracle with 2 pores..... 37
37. Posterior spiracle with 1 pore..... 39
- Twenty-two to 28 dorsal 8-shaped pores, the largest of practically the same size as posterior marginal pores; apical setae about 65  $\mu$  long..... *japonicum* Cockerell, p. 114.  
 Usually fewer than 22 or more than 28 dorsal 8-shaped pores, the largest slightly larger than posterior marginal pores; apical setae less than 65  $\mu$  long..... 38
38. Two pairs of setae between antennae and mouth parts  
*lutecolum*, new species, p. 124.  
 Three pairs of setae between antennae and mouth parts  
*variabile*, new species, p. 217.
39. (36) Anal ring without setae..... 40
40. Anal ring with setae..... 41
- Largest dorsal 8-shaped pores about two-thirds the size of posterior marginal 8-shaped pores  
*castancae*, new species, p. 59.  
 Largest dorsal 8-shaped pores about one-half the size of posterior marginal 8-shaped pores  
*pasaniae* Kuwana and Cockerell, p. 149.
41. (39) Usually without but rarely with 1-3 dorsal 8-shaped pores  
*variolosum* (Ratzeburg), p. 218.
- With at least 20 dorsal 8-shaped pores..... 42
42. Apical setae at least 50  $\mu$  long..... 43
43. Apical setae less than 50  $\mu$  long..... 45
44. Beak with 2 pairs of setae; apical setae about 72  $\mu$  long  
*perplexum*, new species, p. 151.  
 Beak with 3 pairs of setae; apical setae less than 70  $\mu$  long..... 44
44. Apical setae about 54  $\mu$  long; normally 20-30 (usually about 30) dorsal 8-shaped pores..... *minus* Lindinger, p. 132.  
 Apical setae about 66  $\mu$  long; fewer than 25 dorsal 8-shaped pores..... *quercicola* (Bouché), p. 173.
45. (42) Apical setae about 32  $\mu$  long; dorsal 8-shaped pores varying in size..... *horishae*, new species, p. 106.  
 Apical setae at least 40  $\mu$  long; all dorsal 8-shaped pores rather small, no longer or only slightly longer than the width of marginal 8-shaped pores..... 46
46. Two pairs of setae between antennae and mouth parts; dorsal 8-shaped pores slightly longer near anterior than posterior end of row and slightly longer than the width of marginal 8-shaped pores..... *castancae*, new species, p. 59.  
 Three pairs of setae between antennae and mouth parts; dorsal 8-shaped pores practically uniform in size and about as long as the width of marginal 8-shaped pores..... 47
47. Bases of antennae one-third length of antenna apart<sup>7</sup>  
*skanianae*, new species, p. 191.  
 Bases of antennae one-half length of antenna apart<sup>7</sup>  
*suishae*, new species, p. 203.

<sup>7</sup>The character used in separating the larvae of *skanianae* and *suishae* is not very satisfactory since the space between the bases compared with the length of the antenna varies very slightly and the difference between the comparative lengths of the two in these species is so small that it cannot be relied on completely. Larvae of these two species appear to be practically identical.

Key to Larvae—Continued

48.	(1) Anal ring with 4 setae.....	49
	Anal ring with 6 setae.....	51
49.	Anterior and posterior spiracles each with 2 pores; 66-76 dorsal 8-shaped pores..... <i>medium</i> , new species, p. 127.	
	At least not both anterior and posterior spiracles with 2 pores each; fewer than 50 dorsal 8-shaped pores.....	50
50.	Anterior spiracle with 2 pores, posterior with none; axes of all marginal 8-shaped pores longitudinal to body margin; about 14 dorsal 8-shaped pores	
	<i>victoriae</i> , new species, p. 221.	
	Anterior spiracle with 1 pore, posterior with 2; axes of at least the posterior 6 pairs of marginal 8-shaped pores transverse to body margin; 36-40 dorsal 8-shaped pores	
	<i>quadrisetosum</i> , new species, p. 170.	
51.	(48) Apex of abdomen with 3 pairs of setae.....	52
	Apex of abdomen with more than 3 pairs of setae.....	62
52.	Anterior spiracle with 2 pores, posterior with 1.....	53
	Anterior spiracle with 1 pore and posterior with 1, or anterior spiracle with 2 pores and posterior spiracle with 2.....	55
53.	Fifth antennal segment without setae; femur with 1 seta; tarsus with 2 setae; about 16 dorsal 8-shaped pores arranged in a submedian row of about 3 and a lateral row of about 5 on each half of body	
	<i>borncense</i> , new species, p. 54.	
	Fifth antennal segment with 1 or 2 setae; femur with 3 setae; tarsus with 3 setae; more than 16 dorsal 8-shaped pores arranged in a submedian and in a lateral row on each half of body, but the number in each row not as above.....	54
54.	First antennal segment with 1 seta; about 32 dorsal 8-shaped pores arranged in a submedian row of about 10 and a lateral row of about 6. on each half of body; 2 pairs of setae between antennae and mouth parts	
	<i>exiguum</i> Green, p. 89.	
	First antennal segment with 2 setae; about 24 dorsal 8-shaped pores arranged in a submedian row of about 10 and a lateral row of about 2 on each half of body; 3 pairs of setae between antennae and mouth parts	
	<i>rubrocomatum</i> Green, p. 178.	
55.	(52) Anterior and posterior spiracles each with 1 pore.....	56
	Anterior and posterior spiracles each with 2 pores.....	59
56.	Anal ring with approximately 16 pores; anal ring setae about 12.6 $\mu$ long.....	
	<i>florum</i> , new species, p. 94	
57.	Anal ring without pores; anal ring setae less than 8 $\mu$ long....	57
	Fifth antennal segment with 1 seta; about 18 dorsal 8-shaped pores arranged in a submedian row of about 9 on each half of body; apical setae about 28 $\mu$ long	
	<i>udagamae</i> Green, p. 212.	
	Fifth antennal segment without setae; either less or more than 18 dorsal 8-shaped pores; apical setae about 45 $\mu$ long.....	58
58.	About 16 dorsal 8-shaped pores arranged in a submedian row of about 8 on each half of body; axes of the posterior 6 pairs of marginal 8-shaped pores longitudinal or slightly diagonal to body margin.....	
	<i>masuii</i> Kuwana, p. 126.	
	About 35 dorsal 8-shaped pores arranged in a submedian row of about 10 or 11 and a lateral row of about 7 or 8 on each half of body; axes of the posterior 6 pairs of marginal 8-shaped pores transverse to body margin... <i>sasae</i> , new species, p. 182.	
59.	(55) Fifth antennal segment without setae; femur without setae; 10 pairs of submarginal 8-shaped pores; about 44 dorsal 8-shaped pores.....	
	<i>sumatrae</i> , new species, p. 204.	
	Fifth antennal segment with 1 seta; femur with at least 1 seta; 9 pairs of submarginal 8-shaped pores; fewer than 40 dorsal 8-shaped pores.....	60



## Key to Larvae—Continued

60. Coxa with 3 setae, femur with 1 seta, and tarsus with 2 setae; about 22 dorsal 8-shaped pores; apical setae about 40  $\mu$  long  
*garcinia*, new species, p. 96.
61. Coxa with 4 setae, femur with 2 or 3, and tarsus with 2 or 3; about 32 dorsal 8-shaped pores; apical setae about 28  $\mu$  long. 61
61. Femur and tarsus each with 2 setae; axes of all marginal 8-shaped pores longitudinal to body margin  
*pusillum*, new species, p. 163.
- Femur and tarsus each with 3 setae; axes of the posterior 6 pairs of marginal 8-shaped pores transverse to body margin, axes of the other longitudinal.---- *coronatum* Green, p. 72.
62. (51) Apex of abdomen with 5 pairs of setae. Not known to occur on Bambuseae.----- 63
- Apex of abdomen either with 4 or with 6 pairs of setae. Some species occurring on Bambuseae.----- 78
63. Anal ring with 6 pores; anal ring setae about 12.6  $\mu$  long; anterior and posterior spiracles each apparently with 1 pore  
*inconspicuum*, new species, p. 110.
- Anal ring with at least 16 pores; anal ring setae 9 or at least 16  $\mu$  long; anterior spiracle with 2 pores, posterior either with 1 or with 2 pores.----- 64
64. Anterior spiracle with 2 pores, posterior with 1  
*transversum* Morrison and Morrison, p. 209.
- Anterior and posterior spiracles each with 2 pores.----- 65
65. Without a pair of minute setae close to each of the posterior 3 pairs of marginal 8-shaped pores.----- 66
- With a pair of minute setae close to each of the posterior 3 pairs of marginal 8-shaped pores.----- 68
66. First antennal segment with 1 seta; coxa with 3 setae  
*epidendri* (Bouché), p. 83.
- First antennal segment with 2 setae; coxa with 4 setae.----- 67
67. Around 20 dorsal 8-shaped pores; minute setae in a double row on abdomen.----- *sanbernardense* Hempel, p. 181.
- Around 40 dorsal 8-shaped pores; minute setae in a single row on abdomen.----- *putcanum*, new species, p. 168.
68. (65) Femur and tarsus each with 2 setae.----- 69
- Femur with 3 setae, tarsus with 2 or 3 setae.----- 71
69. Ten pairs of submarginal 8-shaped pores; axes of all marginal 8-shaped pores longitudinal to body margin; apical setae about 45  $\mu$  long; anal ring setae about 9  $\mu$  long  
*stypchiae* (Maskell), p. 199.
- Nine or 10 pairs of submarginal 8-shaped pores; axes of the posterior 6 pairs of marginal 8-shaped pores diagonal or transverse to body margin; apical setae at least 65  $\mu$  long; anal ring setae at least 16  $\mu$  long.----- 70
70. Ten pairs of submarginal 8-shaped pores; 22-32 dorsal 8-shaped pores, slightly smaller than marginal  
*epacridis* (Maskell), p. 82.
- Nine pairs of submarginal 8-shaped pores; 14-18 dorsal 8-shaped pores, distinctly smaller than marginal  
*multiporum* Green, p. 137.
71. (68) Disk pores either in a complete or in an interrupted ventral submarginal row.----- 72
- Disk pores absent from ventral surface.----- 73
72. Seven pairs of submarginal 8-shaped pores; 6 or 8 disk pores in an interrupted, ventral, submarginal row, occurring on abdomen only; tarsus with 3 setae; apex of abdomen with a densely sclerotized rectangular area ventrally  
*coffea* Newstead, p. 67.
- Nine pairs of submarginal 8-shaped pores; 16 disk pores in a complete, ventral, submarginal row, occurring on abdomen, thorax, and head; tarsus with 2 setae; apex of abdomen without a densely sclerotized rectangular area ventrally  
*ingae*, new species, p. 111.

## Key to Larvae—Continued

- |     |      |  |    |
|-----|------|--|----|
| 73. | (70) | A total of 1-23 dorsal 8-shaped pores.....   | 74 |
|     |      | A total of 35-44 dorsal 8-shaped pores.....  | 75 |
| 74. |      | Fifth antennal segment with 1 seta; a pair of submarginal 8-shaped pores between antennae<br><i>conspicuum</i> Brain, p. 39.   |    |
|     |      | Fifth antennal segment without setae; no submarginal 8-shaped pores between antennae.....<br><i>agavis</i> , new species, p. 40.   |    |
| 75. | (73) | Six or 7 pairs of submarginal 8-shaped pores, none of which are between the antennae.....  | 76 |
|     |      | Eight pairs of submarginal 8-shaped pores, of which 1 pair is between the antennae.....  | 77 |
| 76. |      | Six pairs of submarginal 8-shaped pores; 1 pair of setae between antennae and mouth parts. <i>grandiculum</i> , new species, p. 100.   |    |
|     |      | Seven pairs of submarginal 8-shaped pores; 2 pairs of setae between antennae and mouth parts<br><i>cristatum</i> Ferris, p. 74.  |    |
| 77. | (75) | Dorsal 8-shaped pores of practically the same size as marginal pores of same segments; anterior margin of body with 4 pairs of setae.....<br><i>townsendi</i> Cockerell, p. 207.   |    |
|     |      | Dorsal 8-shaped pores distinctly smaller than marginal pores of same segments; anterior margin of body with 3 pairs of setae.....<br><i>viridulum</i> Cockerell, p. 223.   |    |
| 78. | (62) | Apex of abdomen with 6 pairs of setae. Not known to occur on Bambuseae.....  | 79 |
|     |      | Apex of abdomen with 4 pairs of setae. Some species occurring on Bambuseae.....  | 93 |
| 79. |      | Without a pair of minute setae close to each of the posterior 3 or 4 pairs of marginal 8-shaped pores.....   | 80 |
|     |      | With a pair of minute setae close to each of the posterior 3 or 4 pairs of marginal 8-shaped pores.....  | 85 |
| 80. |      | Anterior and posterior spiracles each with 1 pore.....   | 81 |
|     |      | Anterior and posterior spiracles each with 2 pores.....  | 82 |
| 81. |      | Axis of the posterior pair of marginal 8-shaped pores transverse to body margin, axes of other pores diagonal or longitudinal; 44-48 dorsal 8-shaped pores arranged in a submedian row of 9 or 10 and a submarginal row of 13 or 14 on each half of body, the submarginal row so close to marginal as to appear almost as a second marginal row; 6 pairs of submarginal 8-shaped pores, none of which are between the antennae.....<br><i>curyopsis</i> Fuller, p. 88. |    |
|     |      | Axes of the posterior 6 pairs of marginal 8-shaped pores transverse to body margin, axes of other pores longitudinal; about 34 dorsal 8-shaped pores arranged in a submedian row of 7 or 8 and a lateral row of 9 on each half of body, lateral row not close to marginal; 10 pairs of submarginal 8-shaped pores, of which 1 pair is between the antennae.....<br><i>javae</i> , new species, p. 116.   |    |
| 82. | (80) | Fourth and fifth antennal segments each with 1 seta; sixth antennal segment with 4 long setae.....   | 83 |
|     |      | Fourth antennal segment without setae and fifth with 1, or fourth segment with 1 seta and fifth with none; sixth antennal segment with 2 long setae.....   | 84 |
| 83. |      | Femur with 3 setae, tarsus with 2; penultimate segment of body with 2 pairs of submarginal setae<br><i>quaesitum</i> , new species, p. 171.  |    |
|     |      | Femur with 2 setae, tarsus with 3; penultimate segment of body with 1 pair of submarginal setae<br><i>striatum</i> , new species, p. 198.  |    |
| 84. | (82) | Fourth antennal segment without setae, fifth with 1; anterior and middle coxae each with 4 setae, but posterior coxa with only 3; 10 pairs of submarginal 8-shaped pores<br><i>pustulans</i> (Cockerell), p. 165.  |    |
|     |      | Fourth antennal segment with 1 seta, fifth with none; each coxa with 4 setae; 8 pairs of submarginal 8-shaped pores<br><i>euphorbiae</i> , new species, p. 87.   |    |

## Key to Larvae—Continued

85. (79) Anterior and posterior spiracles each with 2 pores----- 86  
 Anterior and posterior spiracles each with 1 pore----- 89
86. A total of about 20 dorsal 8-shaped pores, arranged in a sub-  
 median row on each half of body; 7 pairs of submarginal  
 8-shaped pores----- 87  
 A total of about 46 dorsal 8-shaped pores, arranged in a sub-  
 median and a lateral or submarginal row on each half of  
 body; 9 pairs of submarginal 8-shaped pores----- 88
87. Dorsal 8-shaped pores slightly larger than marginal pores of  
 same segments----- *stentae* Brain, p. 196.  
 Dorsal 8-shaped pores of same size as marginal pores of same  
 segments----- *arabidis* (Signoret), p. 44.
88. (86) Anterior margin of body with 3 pairs of setae; 2 pairs of setae  
 between antennae and mouth parts  
*brachylenae* Brain, p. 55.  
 Anterior margin of body with 4 pairs of setae; 3 pairs of setae  
 between antennae and mouth parts  
*thespesiae* Green, p. 205.
89. (85) A pair of minute setae close to each of the posterior 3 pairs of  
 marginal 8-shaped pores (rarely 2 setae on 1 side of body  
 and 3 on the other)----- 90  
 A pair of minute setae close to each of the posterior 4 pairs of  
 marginal 8-shaped pores (rarely 3 setae on 1 side of body  
 and 4 on the other)----- 91
90. Seven pairs of submarginal 8-shaped pores; apical setae about  
 125  $\mu$  long----- *algeriense* (Newstead), p. 42.  
 Usually 6, rarely 5, pairs of submarginal 8-shaped pores; apical  
 setae 100–108  $\mu$  long ----- *nevadense* Balachowsky, p. 138.
91. (89) Eight pairs of submarginal 8-shaped pores  
*fimbriatum* (Fonscolombe), p. 91.  
 Seven pairs of submarginal 8-shaped pores----- 92  
 With 16–20 dorsal 8-shaped pores; apical setae about 135  $\mu$  long;  
 interapical setae 36–41  $\mu$  long  
*zanthenes*, new species, p. 227.  
 Without dorsal 8-shaped pores; apical setae about 120  $\mu$  long;  
 interapical setae about 32  $\mu$  long  
*launeae*, new species, p. 119.
93. (78) Anterior spiracle with 1 pore, posterior with 1----- 94  
 Anterior spiracle with 1 or 2 pores, posterior with 2----- 101
94. Anal ring with more than 2 pores; anal ring setae 12–18  $\mu$  long----- 95  
 Anal ring without pores or with 2; anal ring setae 2–8  $\mu$  long----- 97
95. Fifth antennal segment with 1 seta; femur and tarsus each  
 with 2 setae; about 16 dorsal 8-shaped pores; apical setae  
 about 36  $\mu$  long----- *acutulum*, new species, p. 38.  
 Fifth antennal segment without setae; femur with 2 or 3  
 setae, tarsus with 3; fewer or more than 16 dorsal 8-  
 shaped pores; apical setae at least 45  $\mu$  long----- 96
96. Axes of all marginal 8-shaped pores longitudinal to body margin;  
 femur with 3 setae; about 7 dorsal 8-shaped pores  
*chinae*, new species, p. 65.  
 Axes of the posterior 6 pairs of marginal 8-shaped pores trans-  
 verse to body margin, axes of others longitudinal; femur  
 with 2 setae; about 22 dorsal 8-shaped pores  
*fusum*, new species, p. 95.
97. (94) Fifth antennal segment without setae----- 98  
 Fifth antennal segment with 1 seta----- 99
98. Without dorsal 8-shaped pores; apical setae about 72  $\mu$  long  
*notabile*, new species, p. 140.  
 With about 14 dorsal 8-shaped pores; apical setae about 54  
 $\mu$  long----- *oblongum*, new species, p. 142.
99. (97) Two pairs of setae near antennae (1 pair anterior to antennae  
 and 1 pair between antennae and mouth parts); largest  
 dorsal 8-shaped pores slightly smaller than marginal pores  
 of same segment----- *brunctae*, new species, p. 58.



## Key to Larvae—Continued

- One pair of setae near antennae (between antennae and mouth parts); largest dorsal 8-shaped pores at least as large as marginal pores of same segment----- 100
100. About 2 dorsal submedian 8-shaped pores on each half of body, the anterior pore smaller than the posterior  
*minusculum*, new species, p. 133.
- About 5 dorsal lateral 8-shaped pores on each half of body, the anterior pore larger than the posterior  
*parvum*, new species, p. 148.
101. (93) Anterior spiracle with 2 pores, posterior with 2----- 102  
Anterior spiracle with 1 pore, posterior with 2----- 110
102. Anal ring with 6 or with 14-20 pores----- 103  
Anal ring without pores----- 106
103. Axes of the posterior 6 pairs of marginal 8-shaped pores transverse to body margin; first and fifth antennal segments without setae; femur and tarsus each with 2 setae. Not found on Bambuseae-- *subventruosum*, new species, p. 202.
- Axes of the posterior 6 pairs of marginal 8-shaped pores slightly diagonal or longitudinal to body margin; either the first or fifth antennal segment with 1 seta; femur and tarsus each with 3 setae. Found only on Bambuseae----- 104
104. Anal ring with 6 pores; some marginal 8-shaped pores no longer than width of others-- *sparus*, new species, p. 193.
- Anal ring with 14 or 18 pores; no marginal 8-shaped pores as short as the width of others----- 105
105. Fifth antennal segment with 1 seta; about 7 dorsal 8-shaped pores----- *bambusicola* Kuwana, p. 49.
- Fifth antennal segment without setae; about 22 dorsal 8-shaped pores----- *hemisphaericum* Kuwana, p. 104.
106. (102) Marginal 8-shaped pores 22 in number, of unusual shape, with halves closely appressed, nearly as wide as long, axes of all diagonal or transverse to body margin  
*gutta* Green, p. 101.
- Marginal 8-shaped pores 26 or 28 in number, not shaped as above, longer than wide, axes of all longitudinal, or axes of the posterior 6 pairs transverse and axes of the other pores longitudinal to body margin----- 107
107. Fifth antennal segment with 1 seta; dorsal 8-shaped pores arranged in a submedian and a lateral row on each half of body. Not occurring on Bambuseae  
*lacrimula*, new species, p. 117.
- Fifth antennal segment without setae; dorsal 8-shaped pores arranged either in a submedian or in a lateral row on each half of body. Occurring only on Bambuseae----- 108
108. Axes of the posterior 6 pairs of marginal 8-shaped pores transverse to body margin, axes of others longitudinal  
*ordinarium*, new species, p. 144.
- Axes of all marginal 8-shaped pores longitudinal to body margin----- 109
109. First antennal segment with 2 setae; 11-20 dorsal 8-shaped pores; apical setae about 36  $\mu$  long  
*gemmae*, new species, p. 97.
- First antennal segment with 1 seta; 9-12 dorsal 8-shaped pores; apical setae about 52  $\mu$  long  
*longulum*, new species, p. 121.
110. (101) Anal ring without pores----- 111  
Anal ring with at least 2 pores, usually with 8 or more----- 112
111. First antennal segment with 1 seta; 7-10 dorsal 8-shaped pores, varying in size, the largest slightly smaller than posterior marginal 8-shaped pores-- *minutum* Takahashi, p. 135.
- First antennal segment with 2 setae; 13-15 dorsal 8-shaped pores, uniform in size, about one-half the size of posterior marginal 8-shaped pores-- *circulare*, new species, p. 66.
112. (110) Without dorsal 8-shaped pores----- 113  
With at least 2 dorsal 8-shaped pores, usually with at least 9-- 114

## Key to Larvae—Continued

113. Axes of the posterior 6 pairs of marginal 8-shaped pores diagonal to body margin, all pores uniform in size except anterior pair, which is slightly larger than the others  
*caudatum* Green, p. 61.  
Axes of all marginal 8-shaped pores longitudinal to body margin, the posterior 6 pairs of pores uniform in size and slightly smaller than the next 7 pairs, which are smaller than the anterior pair----- *longum* (Green), p. 122.
114. (112) Femur with 2 setae----- 115  
Femur with 3 setae----- 118
115. Coxa with 3 setae----- *mimicum*, new species, p. 130.  
Coxa with 4 setae----- 116
116. Anal ring with a total of 4-8 pores arranged in an inner row of 2 and an outer row of 6 when 8 are present  
*pseudolanceolatum* Takahashi, p. 158.  
Anal ring with a total of 14 or 16 pores arranged in an inner row of 6 and an outer row of 8 or 10----- 117
117. Bases of antennae one-third length of antenna apart; marginal 8-shaped pores uniform in size  
*solenophoroides* (Green), p. 192.  
Bases of antennae one-half length of antenna apart; marginal 8-shaped pores with posterior, penultimate, and anterior pairs distinctly larger than the others  
*penicillatum*, new species, p. 150.
118. (114) Anal ring with 2-6 pores; marginal 8-shaped pores rather elongate and slender, rather pointed at ends  
*abiectionum*, new species, p. 35.  
Anal ring with 16-20 pores; marginal 8-shaped pores not particularly elongate and slender, rounded at ends----- 119
119. Fifth antennal segment with 2 setae; 2 pairs of setae between antennae and mouth parts; apical setae about 55  $\mu$  long; anal ring setae about 18  $\mu$  long  
*delicatum* (Green), p. 76.  
Fifth antennal segment without setae or with only 1; 1 pair of setae between antennae and mouth parts except in *subdolum*; apical setae not more than 45  $\mu$  long; anal ring setae not more than 16.6  $\mu$  long----- 120
120. Fifth antennal segment without setae; about 9 dorsal 8-shaped pores----- *subdolum*, new species, p. 201.  
Fifth antennal segment with 1 seta; at least 11 dorsal 8-shaped pores----- 121
121. First antennal segment with 2 setae; apical setae about 45  $\mu$  long; 16-19 dorsal 8-shaped pores  
*bambusae* (Boisduval), p. 47.  
First antennal segment with 1 seta; apical setae 27-30 $\mu$  long; 11-16 dorsal 8-shaped pores----- 122
122. Antennal bases one-half length of antenna apart  
*pseudomiliaris* Green, p. 160.  
Antennal bases one-fourth length of antenna apart—*miliaris miliaris* (Boisduval) and *miliaris robustum* Green, pp. 129, 130.

## DESCRIPTIONS

## ASTEROLECANIUM ABIECTIONUM, new species

(Fig. 2, A-I; pl. 7, 1.)

*Habit*.—Living on both surfaces of leaves.*Test of female*.—Elongate elliptical, 1.5-2 mm. long, 0.75-1 wide; flat dorsally and ventrally, with a faint longitudinal median carina dorsally; pale yellow, transparent, thin, finely punctate; marginal filaments usually deep salmon; larval exit a slit in margin.*Adult female*.—Elongate elliptical, posterior end slightly produced; 1.3-1.8 mm. long, 0.65-0.95 wide.Margin: 8-shaped pores in a single row terminating around length of apical seta from setal bases, the individual pores about 14  $\mu$  long and 5-6 wide, usually

spaced a pore's width apart; quinquelocular pores in a single row from nearly opposite antennae to about halfway between posterior spiracular pore bands and apical setae, usually as numerous as 8-shaped pores near ends of row and twice as numerous as 8-shaped pores elsewhere.

Dorsal surface: Minute 8-shaped pores and disk pores sparse; tubular ducts about  $34 \mu$  long; dorsal tubes present.

Ventral surface: Antenna rough, irregularly elliptical, with 2 setae as long as greater diameter of antenna and 1-3 much shorter; beak without setae; spiracular bar fairly broad; 17-32 quinquelocular pores extending from spiracle to body margin in an irregularly double row; 1 or 2 dark-rimmed 8-shaped pores each side of beak, a few in submarginal area and in 2 transverse rows in genital area; submarginal 8-shaped pores in a single row terminating opposite genital opening, usually half as numerous as marginal 8-shaped pores; 6 pairs of submarginal setae on abdomen, the posterior pair slightly nearer to apical setae than to the posterior pair of marginal 8-shaped pores; 1 pair of setae posterior to genital opening, 1 pair anterior to opening, and 1 pair anterior to those.

Apex of abdomen: Notch present; setae, apical  $50-60 \mu$  long, interapical  $8 \mu$  long, intermediate ventral  $5.2 \mu$  long, outer ventral  $7.2 \mu$  long; anal ring with 6 setae, each  $24 \mu$  long, also with an inner row of 6 and an outer row of 12 pores.

Larva.—Elongate elliptical.

Margin: With 28 rather elongate 8-shaped pores which are smallest at the posterior end of the row and gradually increase in size anteriorly, axes of the posterior 6 pairs diagonal,<sup>8</sup> axes of other pores longitudinal; 3 pairs of setae anteriorly.

Dorsal surface: A submedian row of 6 or 7 8-shaped pores on each half of body, the anterior pores slightly larger than the others and about as long as the width of an anterior marginal pore; disk pores in lateral area.

Ventral surface: Antennal setae, I,<sup>9</sup> 1; IV, 1; V, 1; VI, 2 long, 2 stout, 2 fairly stout, 1 slender; antennal bases one-fourth length of antenna apart; beak setae, 2 pairs apical, 1 pair median; anterior spiracle with 1 trilocular pore and posterior spiracle with 1 trilocular and 1 quinquelocular pore; leg setae, coxa 4, femur 1 on inner margin near base and 1 each on inner and outer margins near center, tarsus 2 on inner and 1 on outer margin; tibia one-half length of tarsus; 9 pairs of submarginal 8-shaped pores; 6 pairs of minute submarginal setae on the abdomen and 2 pairs of larger submarginal setae anteriorly; 1 pair of setae between antennae and mouth parts.

Apex of abdomen: Notch present; setae, apical  $32 \mu$  long, interapical  $7.2 \mu$  long, intermediate ventral (fairly near median line)  $3.6 \mu$  long, outer ventral  $4.6 \mu$  long; anal ring with 6 setae, each about  $5.4 \mu$  long, also with 2 or 6 pores in an outer row.

Data.—Described from unmounted and mounted material as follows: On *Bambusa vulgaris*, Los Banos, Luzon, Philippine Islands, A. S. Hitchcock, June 10, 1921, U. S. N. H.,<sup>10</sup> holotype and paratypes (1 female and 1 larva mounted); on *Gigantochloa apus*, Buitenzorg, Java, G. Haley, 1919, U. S. N. H., paratypes (2 females mounted); on *Bambusa* sp., Tung Heung, Kwong Ning, Kwangtung, China, F. A. McClure, April 25, 1925, paratypes (3 females and 45 larvae mounted); on *Dendrocalamus* sp., Philippine Islands, F. A. McClure, September 1925, paratypes (1 female and 8 larvae, all available material, mounted).

This species resembles *miliaris* but is larger, and the marginal 8-shaped pores, which are longer in proportion to their width than those of *miliaris*, terminate farther from the bases of the apical setae. In the shape of the marginal 8-shaped pores, as well as in other characters, it resembles *captiosum*, but differs from that species in having four, instead of three, pairs of setae on the apex of the abdomen.

<sup>8</sup> Axes of pores are in respect to body margin at point where pores are situated.

<sup>9</sup> Roman numerals refer to antennal segments.

<sup>10</sup> Many specimens described in this paper have been collected by the writer from plants in herbaria. In the data given under the various species, specimens from this source are indicated by the letters U. S. N. H. if from the U. S. National Herbarium, and N. Y. B. G. if from the Herbarium of the N. Y. Botanic Garden. The name of the collector of the plant material is given if known. Specimens removed by the writer from preserved bamboo collected by F. A. McClure are indicated by his name.



## ASTEROLECANIUM ACACIAE Morrison and Morrison

(Fig. 2, J-S; pl. 6, K)

Described in 1927 (73, pp. 3-4).

*Habit.*—Living on bark, in shallow or fairly deep pits.*Test of female.*—Varying in outline, usually practically circular, measuring 1.25-1.5 mm. in diameter, and with posterior end occasionally slightly produced and upturned; very slightly convex dorsally, usually with a few faint transverse striations posteriorly, slightly convex ventrally; brownish yellow, semitransparent, punctate in submarginal area; fragmentary marginal filaments whitish or very pale pinkish; elliptical larval exit in margin.*Adult female.*—Practically circular, 1.25-1.5 mm. in diameter.*Margin:* 8-shaped pores mostly in a double row, but posterior 6-12 pores usually in a single row terminating about four times a posterior pore's length from bases of apical setae, posterior pores 8  $\mu$  long and 5.4 wide, the others about 10  $\mu$  long and 7.2 wide, spaced once, twice, or rarely three times a pore's length apart; the double rows separated by a distance varying from the width to the length of a pore; quinquelocular or small multilocular pores in a complete single row or missing for a few 8-shaped pores at anterior end, terminating near end of double row of 8-shaped pores, usually twice as numerous as 8-shaped pores of nearer row between spiracular pore bands and as numerous as 8-shaped pores elsewhere.*Dorsal surface:* Minute 8-shaped pores numerous; disk pores very sparse; tubular ducts 28  $\mu$  long.*Ventral surface:* Antenna roughly conical, with 2 setae as long as, and 1 shorter than, diameter of antenna; beak apparently without setae; spiracular bar rather broad; 22-35 quinquelocular pores extending from spiracle to body margin in an irregularly single to a quadruple row; multilocular pores, with 10 loculi, arranged in 4 complete and 1 or 2 interrupted rows, with 8-10 in each of the posterior 3 rows, 6-8 in anterior complete row, and 2 in each of interrupted rows, a total of 35-40; 4-6 dark-rimmed 8-shaped pores each side of mouth parts, a few scattered anterior to mouth parts, others arranged in rather indefinite transverse rows posterior to mouth parts; submarginal 8-shaped pores in a single row terminating near posterior row of multilocular pores, about one-half as numerous as marginal 8-shaped pores of nearer row; submarginal setae apparently in 7 pairs, all posterior to posterior spiracles, the posterior pair sometimes nearly opposite the posterior pair of marginal 8-shaped pores but occasionally close to outer ventral setae; 2 pairs of setae in each complete row of multilocular pores, except sometimes only 1 pair in anterior row.*Apex of abdomen:* Setae, apical broken, apparently 35  $\mu$  long, interapical (on ventral surface near margin) about 8  $\mu$  long, intermediate ventral about 6  $\mu$  long, outer ventral apparently 8  $\mu$  long; anal opening apical, circular, its margin slightly sclerotized.*Larva.*—Apparently elongate ovoid.*Margin:* With 28 8-shaped pores which are smallest at the posterior end of the row and gradually increase in size anteriorly, where they are distinctly larger than the posterior 3 pairs, axes of all pores longitudinal; apparently without setae anteriorly.*Dorsal surface:* 8-shaped pores apparently in a submedian and a lateral row of about 6 or 8 each, on each half of body, with a total of about 30, slightly variable in size, the largest smaller than a posterior marginal pore; disk pores between submedian and lateral 8-shaped pores.*Ventral surface:* Antenna apparently 5-segmented; antennal setae, I, 1; IV probably normally with 1, but sometimes with 2; V, 2 long, 4 stout, and 1 slender; antennal bases apparently separated by two-fifths length of antenna; beak setae, 1 pair apical, 1 pair median, 1 pair basal; spiracle with 1 trilobular pore; leg setae, coxa 3, femur 1 on inner margin near base, tarsus 1 each on inner and outer margins (minute setae on inner margin near claw present in most species, not apparent); tibia one-half length of tarsus; 8 pairs of submarginal 8-shaped pores of which 1 pair is between the antennae; apparently 6 pairs of submarginal minute setae posterior to posterior spiracles and 1 pair of submarginal larger setae anteriorly; 2 pairs of setae between antennae and mouth parts.*Apex of abdomen:* Setae, apical apparently 45  $\mu$  long, interapical 3.6  $\mu$  long, intermediate ventral (observed only on 1 side of body) 1.5  $\mu$  long, outer ventral 1.8  $\mu$  long; anal opening ventral, close to margin, circular, the surrounding derm faintly sclerotized.

*Data.*—Redescribed from two mounted females, Maskell Collection No. 423, U. S. National Museum Catalogue No. 40359, holotype and paratype, concerning which Morrison and Morrison (73, p. 4) said, "obtained from the Maskell collection, and, on the basis of his descriptive notes, collected at Sydney, New South Wales, on *Acacia* species. This material was a part of his lot No. 423, and was regarded by him as the species *ventruosum*"; unmounted material, three mounted females, and two mounted larvae, Maskell, Cockerell Collection.

The diameter of the specimens is 1.25–1.5 mm. instead of "0.7," and the number of rows of multilocular pores is four complete and one or two interrupted instead of "apparently two," as given in the original description. The authors stated, "apparently without quinquelocular disk pores, replaced at spiracles and along margin by small size multilocular disk pores, mostly with 10 loculi, but somewhat variable" (73, p. 4). In 1 of the specimens examined the majority of these pores have 5 loculi, and in the other specimens the majority have 6 to 8 loculi, but there are some pores in all specimens with 5 to 10 loculi.

In adults of this species the interapical setae are situated on the ventral surface close to the ventral setae and appear to be more closely associated with the latter than with the apical. Moreover, what is believed to be the posterior pair of submarginal setae is sometimes so close to the ventral setae that it actually appears to be a ventral pair. Thus the general appearance is, as shown in figure 2, *K*, of a pair of apical setae and four pairs of ventral setae rather than an apical, an interapical, two ventral, and a submarginal pair.

### ASTEROLECANIUM ACUTULUM, new species

(Fig. 3, A–K; pl. 9, L)

*Habit.*—Living on the lower surface of leaves.

*Test of female.*—Elongate, widest on anterior third, tapering to a rather pointed posterior end, margin sometimes indented by growth against hairs on leaf; 0.85–1.6 mm. long, 0.5–0.6 wide; slightly convex dorsally, usually with a faint longitudinal median carina, flat ventrally; brownish or very pale yellow, nearly colorless, transparent, thin; marginal filaments colorless, glassy, longest at anterior end, and whitish or brownish dorsal filaments longer than marginal and sparse in submarginal area or along median line; circular larval exit in ventral surface at margin.

*Adult female.*—Same shape as test, 0.75–1.5 mm. long, 0.4–0.5 wide.

*Margin:* 8-shaped pores in a single row terminating around one-half length of apical seta from setal bases, posterior pores 6  $\mu$  long, or all pores 8–9  $\mu$  long and 4–4.5 wide, intervals between them ranging from the width to the length of a pore; quinquelocular pores absent or 2 or 3 present opposite spiracular pore bands.

*Dorsal surface:* 8-shaped pores sometimes absent but usually present in submarginal area and occasionally along median line, 8–9  $\mu$  long and 4–5 wide; minute 8-shaped pores rather numerous; disk pores very sparse; tubular ducts 24  $\mu$  long; dorsal tubes present.

*Ventral surface:* Antenna short, often sunken in derm, with 2 setae longer than diameter of antenna; beak without setae; spiracular bar slender and slightly expanded at inner end; 10–13 (including those on margin) quinquelocular pores extending from spiracle to body margin in a single row; multilocular pores, totaling 19–21, with 5–9 loculi, arranged in 3 complete rows each having 4–7, and 1 interrupted row having 2; 1 or 2 dark-rimmed 8-shaped pores each side of beak, others occurring sparsely in lateral area of abdomen and in a transverse row in each of anterior 2 complete rows of multilocular pores; submarginal 8-shaped pores in a single row ending opposite the posterior marginal 8-shaped pores, usually as numerous as marginal 8-shaped pores; 6 pairs of submarginal setae on abdomen, the posterior pair opposite the penultimate pair of marginal 8-shaped pores; 1 pair of setae in each complete row of multilocular pores.

Apex of abdomen: Slightly concave, lobes indicated; setae, apical  $56\ \mu$  long, interapical  $9\ \mu$  long, intermediate ventral (close to margin)  $4\ \mu$  long, outer ventral  $7.2\ \mu$  long; anal ring with 6 setae, each  $28\ \mu$  long, also with an inner row of 6 and an outer row of 14 pores, possibly divided on dorsal side.

*Larva*.—Elliptical.

Margin: With 28 8-shaped pores, the anterior 3 pairs slightly larger than others, axes of the posterior 6 pairs diagonal, the others longitudinal; apparently 3 pairs of setae anteriorly.

Dorsal surface: 8-shaped pores in a submedian row of 8 on each half of body, anterior pore largest and practically equal in size to marginal pores of same segment, the others as long as the width of marginal pores of same segments; disk pores in lateral area.

Ventral surface: Antennal setae, I, 1; IV, 1 very short; V, 1; VI, 2 long, 2 stout, 3 fairly stout, 1 slender; antennal bases one-third length of antenna apart; beak setae, 2 pairs apical, 1 pair median; spiracle with 1 trilocular pore; leg setae, coxa 4, femur 1 on inner margin near base and 1 on outer margin near center, tarsus 1 each on inner and outer margins; tibia one-half length of tarsus; 9 pairs of submarginal 8-shaped pores; 6 pairs of submarginal minute setae on abdomen, apparently 3 pairs of submarginal larger setae anteriorly; 1 pair of setae between antennae and mouth parts.

Apex of abdomen: Slightly concave; setae, apical  $36\ \mu$  long, interapical  $9\ \mu$  long, intermediate ventral (rather close to median line)  $2\ \mu$  long, outer ventral  $3.6\ \mu$  long; anal ring with 6 setae  $14\ \mu$  long, and with an inner row of 6 and an outer row of 12 pores, possibly divided on dorsal side.

*Data*.—Described from unmounted material, seven mounted females, and three mounted larvae on *Bambusa* sp., Antipolo, Luzon, Philippine Islands, A. S. Hitchcock, June 9, 1921, U. S. N. H., holotype and paratypes; unmounted specimens, four mounted females, and five mounted larvae on *Bambusa blumeana*, Balic-Balic, Luzon, Philippine Islands, A. Loher, June 20, 1893, U. S. N. H., paratypes.

Closely related to *pseudomiliaris*, but adults differ from those of *pseudomiliaris* in having multilocular pores, and larvae of *acutulum* have one instead of two pores near the posterior spiracle.

### ASTEROLECANIUM ADJUNCTUM, new species

(Fig. 3, L-Z; pl. 9, DD)

*Habit*.—Living on twigs.

*Test of female*.—Elongate, tapering toward posterior end, posterior tip broken off, margin indented by growth against hairs on twigs; broken test 0.95 mm. long, 0.5 wide; strongly convex dorsally, flat ventrally; bright yellow, transparent, rather thick, shiny, smooth; marginal and dorsal filaments rubbed off; larval exit absent from broken test.

*Adult female*.—Elongate, 0.9 mm. long, 0.5 wide.

Margin: 8-shaped pores in a single row terminating two-thirds the length of an apical seta from setal bases, each pore with a conspicuous, sclerotized, tongue-shaped projection on dorsal edge, posterior pores  $6\ \mu$  long and 4 wide, the others gradually increasing in size anteriorly to  $9\ \mu$  long and 5 wide, approximately a pore's length apart; quinquelocular pores in a single row, interrupted at anterior end opposite about 16 8-shaped pores, and terminating about 8 8-shaped pores from the posterior pair of those pores, about as numerous as 8-shaped pores at ends of row, slightly more numerous before ends of row, and at least twice as numerous as 8-shaped pores near spiracular pore bands.

Dorsal surface: 8-shaped pores somewhat scattered but tending toward arrangement in longitudinal rows, fairly numerous,  $3.6-7.5\ \mu$  long and  $2.5-5.5$  wide, with the majority of lateral and submarginal pores  $4-5\ \mu$  long and  $2-3.5$  wide and majority of submedian pores  $7.2\ \mu$  long and 4 wide; minute 8-shaped pores very sparse, present only in posterior median area; disk pores fairly numerous; tubular ducts  $23\ \mu$  long.

Ventral surface: Antenna roughly conical, with 1 or possibly 2 setae; beak apparently without setae; spiracle with bar expanded at inner end, with atrium slightly enlarged and containing 2-4 quinquelocular pores, and with 9 or 10 similar pores extending to body margin in an irregularly single or double row;



multilocular pores, with 10 loculi, in 4 complete and 3 interrupted rows, 6 in each of the posterior 3 rows, 4 in the anterior complete row, and 2 in each of the interrupted rows, making a total of 28; 3 or 4 dark-rimmed 8-shaped pores each side of mouth parts and a few arranged in 2 transverse rows posterior to beak; submarginal 8-shaped pores in a single row terminating near anterior complete row of multilocular pores, usually about as numerous as the marginal 8-shaped pores; 7 pairs of submarginal setae posterior to posterior spiracles, the posterior pair slightly nearer to the posterior pair of marginal 8-shaped pores than to bases of apical setae; 2 pairs of setae in posterior row of multilocular pores, and 1 pair in each of the other complete rows and in posterior interrupted row.

Apex of abdomen: Lobes barely indicated; setae, apical  $54\ \mu$  long, interapical (on ventral surface close to margin)  $3.6\ \mu$  long, outer ventral  $3\ \mu$  long; anal opening ventral, its own diameter from body margin, circular, its margin sclerotized, with 2 setae, each apparently  $2\ \mu$  long, on anterior edge.

*Data.*—Described from one unmounted specimen, paratype, and one mounted female, holotype, on *Quercus hemisphaerica*, Indo-China, August 1922, N. Y. B. G.

Resembling several oak-inhabiting species from the Orient, but differing from each of those in being elongate rather than circular, and in having somewhat scattered dorsal 8-shaped pores.

### ASTEROLECANIUM AGAVIS, new species

(Fig. 4, A-K; pl. 1, C)

*Habit.*—Living on both surfaces of leaves, usually in shallow depressions.

*Test of female.*—Nearly circular, posterior end slightly produced; 1.5–2 mm. in diameter; convex dorsally, sometimes with faint transverse striations, flat ventrally; bright yellow, transparent, fairly thin, slightly punctate; marginal and slightly shorter dorsal filaments white, the latter present in median area, entad of submarginal area, and sometimes over most of surface; elliptical larval exit in margin.

*Adult female.*—Shape similar to that of test, 1.25–1.75 mm. in diameter.

Margin: 8-shaped pores in a single row terminating around one-half length of apical seta from setal bases, posterior pores  $12\ \mu$  long and 8 wide, others 12–14  $\mu$  long and 8–9 wide, usually spaced around a pore's width apart; quinquelocular (often actually trilocular or multilocular) pores in a single row starting about 10 8-shaped pores anterior to anterior spiracular pore bands and ending about 15 8-shaped pores posterior to posterior spiracular pore bands, sometimes interrupted for 1–8 8-shaped pores between anterior and posterior spiracular pore bands, usually as numerous as corresponding 8-shaped pores; disk pores dorsad of 8-shaped pores, irregularly spaced and less numerous than those and terminating near the posterior pair of 8-shaped pores.

Dorsal surface: 8-shaped pores in median area and few to many entad of submarginal area, sometimes arranged in transverse groups entad of submarginal area, reaching median group only near mouth parts, rarely scattered between median group and margin, 12–14  $\mu$  long and 8–9 wide; minute 8-shaped and disk pores numerous; tubular ducts  $30\ \mu$  long.

Ventral surface: Antenna short, sunken in derm, with 3 setae about equal to, and 1 slightly longer than, diameter of antenna; beak with 2 pairs of setae; spiracular bar slightly expanded at inner end; 20–40 (usually 30–40) quinquelocular pores extending from spiracle to body margin in a double to quadruple row; multilocular pores, with 10 or 11 loculi, in 5 complete and 3 or 4 interrupted rows, each of the posterior 4 rows with 13–22, anterior complete with 11 or 12, and each of the interrupted rows with 2–9, making a total of 89–105; 1–4 dark-rimmed 8-shaped pores each side of mouth parts, others scattered anteriorly, some in a rather indefinite lateral row, and in 2 or 3 indefinite transverse rows on abdomen; submarginal 8-shaped pores in a single row terminating near posterior row of multilocular pores, in proportion of 1 to 3 or 4 marginal 8-shaped pores; submarginal setae in a complete row terminating near the posterior pair of marginal 8-shaped pores; 4 or 5 setae in posterior row, and 2 or 3 in each of next 2 rows of multilocular pores.

Apex of abdomen: Notch present; lobes indicated; setae, apical 72–82  $\mu$  long, interapical broken, at least  $14.4\ \mu$  long, dorsal 9–14.4  $\mu$  long, intermediate ventral

about  $7.2 \mu$  long, outer ventral 9–12.6  $\mu$  long; anal ring with 6 setae 20–27  $\mu$  long, and with an inner row of 6 and an outer one of 14 or 16 pores; ventral surface of apex slightly sclerotized.

*Larva*.—Elongate ovoid.

Margin: With 28 8-shaped pores, the posterior 6 pairs slightly smaller than the others, which are nearly uniform in size, but the anterior pair slightly the largest, axes of the posterior 6 pairs of pores transverse, of the others longitudinal; a pair of setae close to each of the posterior 3 pairs; 3 pairs of setae anteriorly.

Dorsal surface: 8-shaped pores in a lateral row of 1–6 (usually 3–6) on only one-half or on each half of body, with a total of 1–12 (usually 9–11), larger than marginal pores of same segments near posterior end, but of practically the same size as marginal near anterior end; disk pores near marginal 8-shaped pores and a few in median area.

Ventral surface: Antennal setae, I, 2; IV, 1; V, 0; VI, 2 long, 2 stout, 3 fairly stout, 2 slender; bases of antennae one-half length of antenna apart; beak setae, 2 pairs apical and 1 pair basal; each spiracle with 1 trilocular and either 1 quadrilocular, quinquelocular, or small multilocular pore; leg setae, coxa 4, femur 1 on inner margin near base and 1 each on inner and outer margins near center, tarsus 2 on inner and 1 on outer margin; tibia one-half length of tarsus; 8 pairs of submarginal 8-shaped pores, none between antennae; 9 pairs of submarginal minute setae, on abdomen and thorax, 3 pairs of submarginal larger setae on head; 1 pair of setae between antennae.

Apex of abdomen: Notch present, lobes indicated; setae, apical apparently  $7.2 \mu$  long, interapical  $9 \mu$  long, dorsal  $3 \mu$  long, intermediate ventral  $3.6 \mu$  long, outer ventral  $5.4 \mu$  long; anal ring with 6 setae, each about  $23 \mu$  long, also with an inner row of 6 and an outer one of 12 pores, divided on dorsal and ventral sides.

*Test of male*.—Elliptical, with a minute notch in posterior margin; 1.25 mm. long, 0.85 wide; slightly convex dorsally and faintly striated transversely, flat ventrally; bright yellow, transparent, thin, shiny; fragmentary marginal filaments whitish.

*Adult male*.—1 mm. long.

Head: Antenna 10-segmented, formula (longest to shortest), (III, IV, X), (V, VI), (VII, VIII, IX), (I, II); antennal setae, I, 4; II, 11; III–VIII, 13–17; IX, 21; X, 21 short and 4 very long; basal bars strongly diagonal; 20 setae anterior to ventral eyespots; 3 or 4 minute tubercles dorsally near antennae.

Thorax: Bar between wing bases curved on anterior margin, four times as long as wide; with a large triangular clear area and a longitudinal fold in center; tibia one and a half times length of tarsus.

Abdomen: Six segments each with a pair of setae dorsally on lateral margin, 3 segments each with a pair of setae in ventral lateral area; lobes indicated, each with 1 long and 4 short setae; penis sheath with 1 pair of setae dorsally near base, 2 pairs of setae ventrally near base, and at least 5 smaller setae on each side of ventral opening.

*Male nymph*.—Exhibiting no distinguishing characters other than those described for adult male.

*Data*.—Described from unmounted and the following mounted material (all unmounted and mounted specimens, except holotype, are paratypes): Fifteen females on *Agave palmeri*, El Paso, Tex., C. H. Popenoe, October 1, 1922, holotype and paratypes; 2 females on *Yucca* sp.?, Ariz., D. W. Coquillett, November 8, 1893; 10 females and 7 larvae on *Agave* sp., El Paso, Tex., J. N. Rose, May 18, 1908; 16 females and 5 larvae on *Agave* sp., El Paso, Tex., C. R. Orcutt, May 6, 1924; 12 females, 4 larvae, 2 adult males, and 2 male nymphs on *Yucca* sp., Franklin Mountains, Tex., N. Perrine, February 1926.

This species resembles *cristatum* and *puteanum*. It can be distinguished from *cristatum* by the practically uniform size and smaller number of dorsal 8-shaped pores, and from *puteanum* by a smaller number of marginal quinquelocular pores, and the presence of a marginal row of disk pores.



## ASTEROLECANIUM ALGERIENSE (Newstead)

(Fig. 4, L-O; fig. 5, A-D; pl. 1, B)

Described in 1897 (75, p. 99) as *Planchonia algeriensis* on *Spartium junceum* from Constantine, Algeria.

*Habit.*—Living on stems.

*Test of female.*—Somewhat ovoid, posterior end slightly produced; 3 mm. long, 2 wide; convex dorsally with posterior tip flattened and sometimes elevated, flat or slightly convex ventrally; whitish with a pale yellowish cast, translucent, rather thick; marginal and dorsal filaments whitish, fragmentary in specimens examined; larval exit elongate elliptical, in margin.

*Adult female.*—Somewhat ovoid, 3 mm. long, 2 wide.

Margin: 8-shaped pores mostly in a double row but posterior 25-30 pores in a single row terminating about twice a pore's length from bases of apical setae, posterior pores 12  $\mu$  long and 8 wide, the others 16-17  $\mu$  long and 10 wide, intervals between pores ranging from the width to the length of a pore, the two rows less than a pore's width apart; quinquelocular pores mostly in a double row, but single at ends of row, starting posterior to antennae and terminating about halfway between posterior spiracular pore bands and apical setae, as numerous as the 8-shaped pores of the nearer row at ends of row, and two or three times as numerous as that elsewhere; disk pores dorsad of 8-shaped pores, extending to apical setae and continued anterior to setae along edge of anal opening, irregularly spaced, sometimes 1 near each 8-shaped pore, but usually much less numerous than that, also ventrad of quinquelocular pores, terminating anterior to bases of apical setae, as numerous as those dorsad of 8-shaped pores.

Dorsal surface: 8-shaped pores in 7 or 8 transverse groups along median line and tending toward arrangement in transverse rows between groups and margin, numerous median pores 16-18  $\mu$  long and 12 wide, majority of others 15-16  $\mu$  long and 11-12 wide, a few near posterior end 9-12  $\mu$  long and 5-6 wide; minute 8-shaped pores absent; disk pores numerous; tubular ducts 40  $\mu$  long.

Ventral surface: Antenna a circular disk, sunken in derm, with 2 setae longer and 2 or 4 shorter than diameter of antenna; 1-3 quinquelocular pores near antenna; beak with 2 pairs of setae; spiracular bar broad; a subcircular sclerotized area around spiracular opening having 6 or 7 quinquelocular pores, and 35-39 similar pores extending to body margin in a double or triple row, a total of 42-44 in group and row combined; multilocular pores in 3 complete and 3 interrupted rows with anterior interrupted row anterior to posterior spiracles, posterior row with 21 pores, penultimate with 33, anterior complete with 25, each of interrupted rows with 1-6, making a total of 91, the pores with 6-10 (usually 10) loculi; 8 dark-rimmed 8-shaped pores each side of mouth parts, some scattered anteriorly and others arranged in 7 transverse rows on abdomen; submarginal 8-shaped pores in a triple or quadruple row terminating near the posterior marginal quinquelocular pores, the row broken up into groups which are placed at fairly uniform intervals, but which contain a variable number of pores, 1-5 pores opposite some marginal 8-shaped pores and none opposite others; disk pores in each spiracular quinquelocular pore band ranging from none to 4, 2 in each complete row of multilocular pores; submarginal setae in a complete row terminating 2 8-shaped pores from the posterior pair of marginal 8-shaped pores; 2 setae in posterior and penultimate rows of multilocular pores, 1 in anterior complete row.

Apex of abdomen: Notch very small; setae, apical apparently 108  $\mu$  long, interapical about 40  $\mu$  long, dorsal 28  $\mu$  long, inner ventral 8  $\mu$  long, intermediate ventral 10  $\mu$  long, outer ventral 12  $\mu$  long; anal ring with 6 setae, each about 96  $\mu$  long, apparently with around 45 pores arranged in an inner and outer row; ventral surface of apex heavily sclerotized in a small area around inner ventral setae, the surrounding area slightly sclerotized in dentate rows.

*Larva.*—Elongate elliptical.

Margin: With 28 8-shaped pores, anterior pores slightly larger than the others, axes of the posterior 6 pairs transverse, others longitudinal; a pair of setae close to each of the posterior 3 pairs of these pores; 4 pairs of setae anteriorly.

Dorsal surface: 8-shaped pores in a submedian row of 9 or 10 on each half of the body, anterior pores very slightly larger than the others, practically equal in size to marginal pores of same segments; disk pores close to submedian 8-shaped pores and a few near margin; a pair of setae near the anterior pair of 8-shaped pores.



Ventral surface: Antennal setae, I, 2; IV, 1; V, 1; VI, 2 long, 2 stout, 3 fairly stout, 2 slender; bases of antennae one-fifth length of antenna apart; beak setae, 2 pairs apical, 1 pair basal; spiracle with 1 trilocular (occasionally 1 quinquelocular) pore; leg setae, coxa 4, femur 1 on inner margin near base and 1 each on inner and outer margins near center, tarsus 2 on inner and 1 on outer margin; tibia three-fifths as long as tarsus; 7 pairs of submarginal 8-shaped pores, none between antennae; 8 pairs of submarginal minute setae, on abdomen and thorax, 4 pairs of submarginal larger setae at anterior end; 3 pairs of setae between antennae and mouth parts.

Apex of abdomen: Truncate or slightly concave; setae, apical about  $126 \mu$  long, interapical about  $25 \mu$  long, dorsal about  $5.4 \mu$  long, inner ventral  $7.2 \mu$  long, intermediate ventral  $9 \mu$  long, outer ventral  $10.8 \mu$  long; anal ring with 6 setae  $28-30 \mu$  long, and an inner row of 6 and an outer one of 14 pores; ventral surface of apex slightly sclerotized near margin.

*Data.*—Redescribed from unmounted material, 1 mounted female, and 22 mounted larvae on *Cistus salviaefolius*, Azazga, Kabylie, Algeria, A. Balachowsky, December 13, 1936.

Material at hand has been placed as *algeriense* on the basis of comparison with Newstead's description. Although Newstead described stages which he called "larva" and "♀ second stage," both descriptions apparently referred to the larval stage. He stated that the second and fourth segments of the antenna had each a single hair, and the sixth one long and two shorter; the second segment has two long setae, and the sixth more than one long and two short setae.

Although listed as a synonym of *fimbriatum* by Lindinger in 1912 (61, p. 360), *algeriense* is not a synonym of *fimbriatum* or of *arabidis*, to which it is more closely related. The adult female is difficult to differentiate from *arabidis*, but the dorsal 8-shaped pores are more numerous than in most specimens of that species, and those between the median groups and the body margin tend to be larger than those in the same area in *arabidis*; the marginal quinquelocular pores are interrupted for a slightly greater distance at the anterior end and terminate a little farther from the apical setae than in *arabidis*. Larvae of the two species differ distinctly, *algeriense* having one and *arabidis* two pores near each spiracle.

### ASTEROLECANIUM AMBOINAE, new species

(Fig. 5, E-J; pl. 9, R)

*Habit.*—Living on the lower surface of leaves.

*Test of female.*—Distinctly longer than wide, posterior end narrowed, somewhat produced and upturned, margin sometimes indented by growth against hairs on leaf; 1.25–1.35 mm. long, 0.6 wide; very slightly convex dorsally, flat ventrally; pale yellow, transparent, very thin, slightly punctate; marginal and dorsal filaments whitish, the latter fragmentary, but much longer than marginal, present in submarginal area; larval exit apparently elliptical, in margin.

*Adult female.*—Shape similar to that of test, 1.25 mm. long, 0.5 wide.

Margin: 8-shaped pores in a single row terminating around the length of apical seta from setal bases, posterior pores  $8 \mu$  long and 5 wide, the others  $9-10 \mu$  long and 5.4 wide, about a pore's width apart; quinquelocular pores in a single row from opposite antennae to halfway between posterior spiracular pore bands and the posterior pair of 8-shaped pores, as numerous as 8-shaped pores near ends of row, and one and a half times as numerous as 8-shaped pores between, and for a short distance outside of, spiracular pore bands.

Dorsal surface: 8-shaped pores in a submarginal row of 25, a few  $12 \mu$  long and 8 wide, but the majority  $16 \mu$  long and 10 wide; minute 8-shaped pores sparse; disk pores fairly numerous; tubular ducts  $32 \mu$  long; dorsal tubes present.

Ventral surface: Antenna short, with 2 setae longer than diameter of antenna; beak without setae; spiracle with bar fairly slender, with atrium slightly

enlarged, shallow, and containing 2 or 3 quinquelocular pores, and with 8-15 quinquelocular pores extending to body margin in an irregularly single or double row; 1 or 2 dark-rimmed 8-shaped pores each side of beak, a few scattered on anterior end, and others in a lateral row on abdomen and in 2 sparse transverse rows anterior to genital opening; submarginal 8-shaped pores in a single row terminating opposite genital opening, usually half as numerous as marginal 8-shaped pores; 6 pairs of submarginal setae on abdomen, the posterior pair slightly nearer to the posterior pair of marginal 8-shaped pores than to bases of apical setae; 1 pair of setae posterior to genital opening, 1 pair anterior to it, and 1 pair anterior to those.

Apex of abdomen: Notch present; lobes barely indicated; setae, apical about  $56 \mu$  long, interapical about  $6.5 \mu$  long, outer ventral  $4-5 \mu$  long; anal ring with 6 setae  $24-27 \mu$  long, with an inner row of 6 and an outer row of 12 pores, tending toward division on dorsal side; ventral surface of apex rugose.

*Data.*—Described from parasitized unmounted material, one intact mounted female, and half of another, on *Bambusa atra*, Amboina, Moluccas Islands, C. B. Robinson, July–November 1913, U. S. N. H., holotype and paratypes.

Most closely related to *captiosum*, from which it differs most conspicuously in having dorsal 8-shaped pores.

### ASTEROLECANIUM ARABIDIS (Signoret)

(Fig. 6, A-I; pl. 2, E, H)

Described by Signoret in 1876 (89, p. 608) as *Planchonia arabidis*, from specimens received from Lichtenstein. Although Signoret listed the species as "*Planchonia arabidis* Licht. mss.," there is no indication that Lichtenstein was responsible for any part of the description. Consequently the species is credited to Signoret.

Four names are here suppressed as synonyms of *arabidis*. *Planchonia hederæ*, described by Lichtenstein in 1880 (58, pp. *alv-alvi*) on *Hedera helix* from Montpellier, is placed as a synonym because specimens presumed to be type material of *hederæ* are specifically identical with *arabidis*. In 1882 (59, p. *lxxv*) Lichtenstein gave the name *Planchonia valloti* to specimens which he had not seen, that had been described briefly, but not named, by Vallot, in 1838 (99, pp. 50-51). Although Vallot's material, found on ivy at Dijon, or other material from this source, is not available, it seems likely that his specimens belonged to *arabidis*, the species found commonly on ivy in Europe. Vallot did not indicate whether he removed any insects from the ivy, and the specimens treated by him and Lichtenstein probably are not extant. The name *valloti* was listed as a synonym of *hederæ* by Fernald in 1903 (32, p. 51) and of *fimbriatum* by Lindinger in 1912 (61, p. 375).

*A. massalongianum* was described by Targioni-Tozzetti in 1892 (98, pp. 295-298, 312) on *Hedera* from Italy. Type material of the species is not available, but other specimens on *Hedera* from Italy represent *arabidis*. Moreover, from the original description of *massalongianum* it seems certain that this name is synonymous with *arabidis*. It was given as a synonym of *hederæ* by Fernald in 1903 (32, p. 51), and as a synonym of *fimbriatum* by Lindinger in 1912 (61, p. 175) and by Leonardi in 1920 (57, p. 241).

In 1893 Douglas described *Pollinia thesii*, on *Thesium humifusum* from the Isle of Purbeck (29, pp. 55-57). A mounted specimen from type material of *thesii* is the same as *arabidis*, and as a consequence the



name is suppressed. It was listed as a synonym of *fimbriatum* by Lindinger in 1912 (61, p. 360).

*Habit*.—Living on twigs, stems, and leaf petioles.

*Test of female*.—Usually broadly pyriform, posterior end slightly produced and often upturned; 2-3.5 mm. long, 1.5-2.5 wide, usually 2.5-3 mm. long, 2-2.5 wide; strongly convex dorsally, posterior tip flattened, flat or very slightly convex ventrally; whitish, brownish, or pale yellowish, translucent to nearly opaque; rather thick, slightly punctate; marginal and dorsal filaments whitish, the latter in a conspicuous tuft along median line and sometimes scattered elsewhere, the median dorsal filaments longer and the others shorter than the marginal, all dorsal filaments tending toward arrangement in transverse rows, but this tendency most apparent along median line; larval exit elongate elliptical, in margin.

*Adult female*.—Broadly pyriform, 1.75-3.25 mm. long, 1.25-2.25 wide.

Margin: 8-shaped pores mostly in a double or (for a short distance) in a triple row, but posterior 15-32 pores usually in a single row, terminating one to two times a pore's length from bases of apical setae, 16-18  $\mu$  long and 10-12 wide, usually around a pore's length apart; the rows usually separated by a space equal to a pore's width; quinquelocular pores usually in a double or irregularly triple row (rarely in a crowded single row) in lateral area, but single at ends of row, terminating 15-32 8-shaped pores from the posterior pair of 8-shaped pores, the row usually interrupted for 3-25 8-shaped pores anteriorly; quinquelocular pores usually as numerous as 8-shaped pores at ends of row and two or three times as numerous as 8-shaped pores between and outside of spiracular pore bands; disk pores irregularly spaced dorsad of, and less numerous than, 8-shaped pores, either terminating with the latter or extending to apical setae and continued anterior to them near edge of anal opening; disk pores also ventrad of quinquelocular pores, terminating near apical setae, as numerous as those dorsad of 8-shaped pores.

Dorsal surface: 8-shaped pores in 5-7 transverse groups in median area, sometimes also in inconspicuous transverse rows between median groups and margin, majority of median pores 16-18  $\mu$  long and 12 wide, a few in median posterior group and the majority of the others 12  $\mu$  long and 8 wide, although some are only 8-10  $\mu$  long and 5-6 wide; minute 8-shaped pores numerous between median 8-shaped pores and margin, or absent if large 8-shaped pores are scattered between median groups and margin; disk pores fairly numerous; tubular ducts 40  $\mu$  long.

Ventral surface: Antenna roughly circular, with 2 setae longer and 2-7 shorter than diameter of antenna; 0-3 quinquelocular pores near antenna; beak with 2 pairs of setae; spiracle with bar broad; a subcircular sclerotized area around spiracular opening, 4-10 quinquelocular pores in sclerotized area and 30-60 (usually around 50, very rarely with less than 40) extending to margin in an irregularly single to quadruple row, making a total of 34-70 in group and row combined; multilocular pores, having 6-11 loculi, in 3 or 4 complete and 2-4 interrupted rows, the anterior interrupted row anterior to posterior spiracles, posterior row with 16-32 pores (usually 22-27), penultimate with 19-52 (usually 24-38), first row anterior to penultimate with 9-51 (usually 23-33), next with 1-28 (usually 3-8), without other rows posterior to spiracles or with 1 or 2 additional rows each with 1-10 (usually 2-5), row anterior to posterior spiracles with 1-12 (usually 3-7), making a total of 55-180 (usually 95-125); 4-10 dark-rimmed 8-shaped pores each side of mouth parts, some scattered on anterior end and others arranged in 6 or 7 transverse rows on abdomen; submarginal 8-shaped pores in an irregularly double to quadruple row terminating near anterior complete row of multilocular pores, the row broken up into groups which are placed irregularly, so that there are no pores opposite some marginal 8-shaped pores and 1-5 opposite others; 1-6 disk pores in each spiracular quinquelocular pore band and usually 1-4 in each row of multilocular pores except the anterior row, sometimes occurring between fourth and anterior rows of multilocular pores; submarginal setae in a complete row terminating opposite the penultimate pair of marginal 8-shaped pores; 1-3 setae in each of posterior 3 rows of multilocular pores and 0-2 in fourth row.

Apex of abdomen: Usually slightly concave; setae, apical 100-128  $\mu$  long, interapical 32-40  $\mu$  long, dorsal 24-36  $\mu$  long, inner ventral usually 6-9  $\mu$  long (12  $\mu$  long on 1 half of type specimen), intermediate ventral 8-12  $\mu$  long, outer ventral 10-16  $\mu$  long; anal ring with 6 setae 80-104  $\mu$  long (usually 88-92) and with approximately 46 pores; ventral surface of apex heavily sclerotized about inner ventral setae, the surrounding area lightly sclerotized in dentate rows.



*Second stage.*—Resembling adult female, but smaller; margin with 8-shaped pores mostly in a single row, but in an irregularly double row at a few points; quinquelocular pores less numerous than 8-shaped pores, disk pores fairly sparse dorsad of, and very sparse ventrad of, 8-shaped pores; dorsal surface with a few 8-shaped pores arranged in 4 or 5 transverse rows, minute 8-shaped pores scattered, fairly numerous; ventral surface with around 12 quinquelocular pores in each spiracular pore band, 2 or 3 disk pores on abdomen; apex of abdomen as in adult but all setae about one-third shorter.

*Larva.*—Elongate ovoid.

Margin: With 28 8-shaped pores, the posterior 6 pairs slightly smaller than the next 7 and the anterior pair slightly larger than any others, axes of the posterior 6 pairs transverse, axes of others longitudinal; a pair of setae close to each of the posterior 3 pairs of pores; 4 pairs of setae anteriorly.

Dorsal surface: 8-shaped pores in a submedian row of 9 or 10 on each half of body, anterior 3 pairs usually slightly larger than the others, of practically same size as marginal pores of same segments; disk pores near margin, and 1-3 near submedian 8-shaped pores; a pair of setae near anterior pair of 8-shaped pores.

Ventral surface: Antennal setae, I, 2; IV, 1; V, 1; VI, 2 long, 2 stout, 3 fairly stout, 2 slender; antennal bases one-fifth length of antenna apart; beak setae, 2 pairs apical, 1 pair basal; each spiracle with 2 pores, usually 1 quinquelocular and 1 trilocular at anterior spiracle, and 2 trilocular or a trilocular and a quadrilocular at posterior spiracle; leg setae, coxa 4, femur 1 on inner margin near base and 1 each on inner and outer margins near center, tarsus 2 on inner and 1 on outer margin; tibia one-half as long as tarsus; 7 pairs of submarginal 8-shaped pores, none of which are between the antennae; 8 pairs of submarginal minute setae, on abdomen and thorax, 3 pairs of submarginal larger setae at anterior end; 3 pairs of setae between antennae and mouth parts.

Apex of abdomen: Truncate or slightly concave; lobes barely or not indicated; setae, apical 118-126  $\mu$  long, interapical about 21.6  $\mu$  long, dorsal about 5.4  $\mu$  long, inner ventral 5.4-6.8  $\mu$  long, intermediate ventral 9-10.8  $\mu$  long, outer ventral 10.8-12.6  $\mu$  long; anal ring with 6 setae 28.8-30.4  $\mu$  long, and with an inner row of 6 and an outer row of 14 pores; ventral surface of apex membranous or slightly sclerotized near inner ventral setae.

*Data.*—Redescribed from 1 unmounted specimen, 1 mounted female, and 58 mounted larvae on *Arabis stricta*, Montpellier, France, from the Signoret Collection, loaned by M. Beier, probably type material of *arabidis*; 3 mounted females and 5 mounted larvae, labeled *hederae*, from the Lichtenstein Collection, loaned by P. Vayssière, probably type material of *hederae*; 1 unmounted specimen and 1 mounted female on *Thesium humifusum*, The Rectory, Corfe Castle, Isle of Purbeck, E. R. Bankes, July 12, 1892, type specimens of *thesii*, loaned by F. Laing; unmounted material, 1 mounted female, and 1 mounted larva on *Hedera helix*, northern Italy, Chermotheca Italica IV, No. 76; unmounted material, 2 mounted females, and 1 mounted second-stage specimen on *Pittosporum tobira*, Varazze, Liguria, Italy, O. Jaap, January 24, 1913; 1 unmounted specimen, 1 mounted female, and 8 larvae on *Hedera* sp., Naples, Italy, from F. Silvestri; 1 mounted female on *Pittosporum* sp., Italy, intercepted at New York, April 18, 1937; unmounted material and 1 mounted female on *Hieracium umbellatum*, Znaim, Moravia, Czechoslovakia, loaned by M. Beier; a mass of unmounted material, 116 mounted females, 3 mounted second-stage specimens, and 8 mounted larvae bearing the following data: *Lechea* sp., Mt. Carmel, Conn., W. E. Britton, July-September 1925; *Panax* sp., Paw Paw, W. Va., O. M. McDonald, September 1926; *Fraxinus pennsylvanica lanceolata*, Pa., F. M. Trimble, February 1927; *Osmodum carolinum*, St. Thomas, Pa., F. M. Trimble, March 1927; *Phlox subulata lilacina* and *Phlox* sp., Brookline, Mass., Ohmstead Bros., July 1928; Pittsburgh, Pa., Mrs. J. V. Cook, August-September 1930; *Phlox* sp., Bradford, Mass., C. W. Collins, August 1930; *Phlox divaricata*,

Demarest, N. J., W. S. Fields, May 30, 1931; *Phlox subulata*, Chevy Chase, D. C., D. P. Limber, July 15, 1932; privet, Washington, D. C., Mrs. W. F. Shenton, February 10, 1933; New Brunswick, N. J., C. Ilg, March 29, 1933; garden sage, Takoma Park, D. C., A. J. Pieters, April 1933; *Lychnis alba*, Pittsburgh, Pa., J. M. R. Adams, June 26, 1933; *Phlox subulata*, Swarthmore, Pa., G. S. Wherry, July 1933; *Pentstemon* sp., Gladwine, Pa., Mrs. J. N. Henry, June 15, 1934; jasmine, N. Y., intercepted at San Diego, Calif., March 12, 1935, loaned by G. F. Ferris; Reading, Pa., A. Landen, August 5, 1935; privet, Washington, D. C., A. W. Soverhill, October 8, 1935; red clover, Saratoga Springs, N. Y., G. Rau, July 1936; *Weigela* sp., Youngstown, Ohio, H. L. Jacobs, September 1936; *Linaria canadensis*, Orient, N. Y., R. Latham, June 25, 1937; white ash, Lancaster, Pa., G. E. Sherbrooks, August 1937; *Aralia nudicaulis*, Orient, N. Y., R. Latham, November 1937.

Females of this species show more than the ordinary amount of variation both in arrangement and number of multilocular pores. The same condition is found in *stentae*, a species closely related to *arabidis*, and to a less marked extent, probably owing to the few specimens studied, in other closely related forms such as *launeae* and *fimbriatum*.

### ASTEROLECANIUM BAMBUSAE (Boisduval)

(Fig. 6, J-O; fig. 7, A-G; pl. 2, F, G)

Described by Boisduval in 1869, as *Chermes bambusae*, on *Bambusa arundinacea* and *distorta* from the garden of Hamma, Alger, Algeria (9, pp. 261-262); redescribed by Signoret in 1870 (88, pp. 280-281). Signoret indirectly disclosed the source of his material of *bambusae* in the following statement contained in his description of *miliaris*, which follows that of *bambusae*: "Cette espèce, comme la précédente, se trouve en quantité quelquefois considérable sur les divers bambous des Indes, *Bambusa distorta*, *arundinacea*, *stricta*, et elle nous a été donnée par M. Boisduval et par M. Rivière, qui nous en a fait venir obligeamment du Jardin d'Acclimatation du Hamma (Algérie)." Thus it is reasonable to assume that his specimens of *bambusae* were received from Boisduval or Rivière, and as such represent type material.

Type specimens of *bambusae* var. *bambusulae*, described by Cockerell in 1897 (20, p. 590), on bamboo from Grenada, are identical with *bambusae*; consequently the varietal name is suppressed.

*Habit.*—Living on stems and both surfaces of leaves.

*Test of female.*—Usually distinctly longer than wide, somewhat ovoid, posterior end slightly produced and often upturned; 1.5-3.5 mm. long, 1-2.5 wide; slightly to rather strongly convex dorsally, sometimes with a faint longitudinal median carina near posterior end, flat ventrally; greenish, brownish, or pale yellow, transparent, thin, shiny; marginal and dorsal filaments whitish to pale pinkish, a few of the latter along median line, and sometimes in submedian, lateral, or submarginal area; larval exit narrow elliptical, in margin.

*Adult female.*—Broadly ovoid to elliptical, 1.25-3.25 mm. long, 0.75-2.25 wide.

Margin: 8-shaped pores in a single row terminating two or three times a pore's length from bases of apical setae, posterior pores 8-9  $\mu$  long and 4 wide, others around 12  $\mu$  long and 5 wide, spaces between pores ranging from the width to the length of a pore; quinquelocular pores in a single row terminating at the posterior pair of 8-shaped pores or 1-16 (usually 1-3) 8-shaped pores from that pair, rarely interrupted at anterior end for 4-12 8-shaped pores, usually one and a half times as numerous as 8-shaped pores but occasionally not more numerous, particularly at anterior end; disk pores dorsal of 8-shaped pores, terminating



near the penultimate pair of 8-shaped pores, irregularly spaced and not more than half as numerous as 8-shaped pores.

Dorsal surface: 8-shaped pores totaling 3-30 (usually 12-20), confined to median area, or 16-30 additional pores in submarginal and lateral areas, these pores in rather indefinite groups or in inconspicuous transverse rows; majority of pores 16-18  $\mu$  long and 8 wide; minute 8-shaped pores fairly numerous or rather sparse; disk pores fairly numerous; no tubular ducts among median 8-shaped pores but scattered elsewhere, 36  $\mu$  long; dorsal tubes present.

Ventral surface: Antenna circular, flattish, with 2 setae longer and 1 or 2 shorter than diameter of antenna; beak without setae; spiracular bar subcircular; usually 22-42 quinquelocular pores extending from spiracle to body margin in an irregularly double or triple row; multilocular pores in 5 complete rows (fifth row usually complete) and 3 or 4 interrupted rows, posterior row with 16-28 pores, penultimate with 20-38, next with 24-41, next with 11-20, anterior complete with 8-16, each of interrupted rows with 2-9, a total of 90-154, with 6-10 (usually 10) loculi; 5-10 dark-rimmed 8-shaped pores each side of mouth parts, some scattered anterior and lateral to mouth parts, others in a longitudinal row about 5 pores wide posterior to posterior spiracles, and a few in median area of abdomen; submarginal 8-shaped pores usually in a single row terminating about midway between posterior row of multilocular pores and the posterior pair of marginal 8-shaped pores, as numerous as marginal 8-shaped pores; 7 pairs of submarginal setae, posterior to anterior spiracles, the posterior pair near the posterior or penultimate pair of marginal 8-shaped pores; 1 pair of setae in each of the posterior 3 rows of multilocular pores.

Apex of abdomen: Notch present; lobes broad; setae, apical 72-80  $\mu$  long, interapical 8  $\mu$  long, inner ventral 5.2  $\mu$  long, outer ventral 8  $\mu$  long; anal ring with 6 setae 32-36  $\mu$  long, also with an inner row of 6 and an outer one of 18-20 pores; ventral surface of lobes and margin of body between lobes somewhat sclerotized.

*Second stage.*—Resembling adult but smaller and more elongate; margin with disk pores slightly less numerous than in adult; dorsal surface with 3 8-shaped pores in median area; ventral surface with 5 or 6 quinquelocular pores in each spiracular row, no setae observed in median area; apex of abdomen as in adult but all setae about one-third shorter.

*Larva.*—Elliptical or elongate elliptical.

Margin: With 28 8-shaped pores, the posterior 6 pairs of pores slightly smaller than the next 7, and the anterior pair slightly larger than any others, axes of all pores longitudinal; 3 pairs of setae anteriorly.

Dorsal surface: 8-shaped pores in a submedian row of 7-10 on each half of body, with a total of 16-19 observed, the next to anterior pore slightly smaller than marginal pores of same segment, others one-half to two-thirds size of a posterior marginal pore; disk pores near marginal 8-shaped pores and a few near dorsal 8-shaped pores.

Ventral surface: Antennal setae, I, 2; IV, 1; V, 1; VI, 2 long, 2 stout, 3 fairly stout, 2 slender; antennal bases one-third length of antenna apart; beak setae, 2 pairs apical, 1 pair median; anterior spiracle with 1 trilocular pore, posterior spiracle with 1 trilocular and 1 quinquelocular pore; leg setae, coxa 4, femur 1 on inner margin near base and 1 each on inner and outer margins near center, tarsus 2 on inner and 1 on outer margin; tibia two-thirds as long as tarsus; 9 pairs of submarginal 8-shaped pores; apparently 8 pairs of submarginal minute setae, on abdomen and thorax, 3 pairs of submarginal larger setae anteriorly; 1 pair of setae between antennae and mouth parts.

Apex of abdomen: Notch very small or absent; lobes present or absent; setae, apical 45  $\mu$  long, interapical 5.4  $\mu$  long, inner ventral 2  $\mu$  long, outer ventral 2.2  $\mu$  long; anal ring with 6 setae, each about 12.6  $\mu$  long, also with an inner row of 6 and an outer row of apparently 14 pores, and with a tendency toward division on dorsal and ventral sides.

*Data.*—Redescribed from unmounted material, 1 mounted female, and 6 mounted larvae on *Bambusa* sp., Algeria, determined by Signoret, loaned by M. Beier, presumably type; unmounted material, 8 mounted females, and 2 mounted larvae on bamboo, Botanic Gardens, Grenada, West Indies, W. E. Broadway, November 16, 1895, type of *bambusae* var. *bambusulae*; a mass of unmounted material, approximately 600 mounted females, several mounted second-stage specimens, and sev-



eral mounted larvae collected on the following hosts from the following localities: On *Arundinaria* sp.; on the following species of *Bambusa*: *Alphonse kurri*, *argentea-striata*, *arundinacea*, *aurea*, *avreco-striata*, *balcooa*, *beecheiana*, *blumeana*, *macroculmis*, *multiplex* vars. *disticha* and *distincta*, *nana*, *palmata*, *spinosa*, *thouarsii*, *tulda*, *viridis-striata*, *vulgaris* var. *vulgaris*, sp.; on *Dendrocalamus latiflorus* and *D. strictus*; on *Gigantochloa aspera* and *G. scribneriana*; on *Oxytenanthera abyssinica*; on *Phyllostachys* sp.; from New York (in greenhouses), Pennsylvania (in greenhouses), Washington, D. C. (in greenhouses), Illinois (in greenhouses), Missouri (in greenhouses), Georgia, Florida, Alabama, Mississippi, Louisiana, Texas, California, Honduras, El Salvador, Guatemala, Canal Zone, Venezuela, British Guiana, Brazil, Argentina, Trinidad, Tobago, Grenada, Barbados, Dominica, Guadeloupe, Montserrat, Antigua, St. John (Virgin Islands), Puerto Rico, Dominican Republic, Haiti, Jamaica, Cuba, Bermuda, Italy, Algeria, Egypt, Gold Coast, Angola, Belgian Congo, Portuguese East Africa, Reunion Island, India, Ceylon, China (Kwangtung and Kwangsi), Philippine Islands, Guam, Hawaii, New Caledonia, Australia.

Males have not been observed among the material examined.

#### ASTEROLECANIUM BAMBUSICOLA Kuwana

(Fig. 7, H-P; pl. 2, A)

Described in 1916 (55, pp. 146-147). *Asterolecanium tuberculatum*, described by Takahashi as a variety of *bambusae* in 1928 (91, p. 339) and elevated to specific rank in 1929 (92, pp. 8, 46), is here suppressed because specimens of *tuberculatum* studied, which are presumed to be type material, are identical with *bambusicola*.

*Habit.*—Living on stems.

*Test of female.*—Nearly elongate elliptical, 2.5-3.5 mm. long, 1.25-1.5 wide; convex dorsally, with a broad, transverse, prominent carina immediately anterior to transverse median line, the surface gradually sloping from carina to margin, sometimes also with a faint longitudinal median carina; strongly concave or nearly flat ventrally; greenish or clear yellow, transparent, thin, shiny; marginal filaments pinkish; elliptical larval exit in ventral surface at margin.

*Adult female.*—Nearly elongate elliptical, 2-3 mm. long, 1-1.5 wide.

Margin: 8-shaped pores in a single row terminating a pore's length from bases of apical setae, 14  $\mu$  long and 8 wide, less than a pore's width apart; quinquelocular pores in a single or an irregularly double row, terminating at or slightly beyond the posterior pair of 8-shaped pores, as numerous as 8-shaped pores near ends of body, more numerous near center, and two to four times as numerous as 8-shaped pores between spiracular pore bands; disk pores dorsad of 8-shaped pores, terminating at the posterior pair of those pores and about as numerous.

Dorsal surface: Minute 8-shaped pores rather numerous; disk pores numerous; tubular ducts about 9  $\mu$  long; dorsal tubes present.

Ventral surface: Antenna short, rough, with 2 setae longer and 3 slightly shorter than diameter of antenna; 5 or 6 quinquelocular pores between antenna and margin; beak without setae; spiracular bar subcircular; 60-100 (usually 90-100) quinquelocular pores extending from spiracle to body margin in a row 3-8 pores wide; 5-12 dark-rimmed 8-shaped pores each side of mouth parts, others in a longitudinal row 3 pores wide in lateral area of abdomen; submarginal 8-shaped pores in a single row terminating 3-5 8-shaped pores from the posterior pair of marginal 8-shaped pores and one-half as numerous as those pores; 6 pairs of submarginal setae on abdomen, the posterior pair 3 8-shaped pores from the posterior pair of marginal 8-shaped pores; a group of 8-13 setae posterior to genital opening, a group of 4-7 anterior to opening, and another group of 2-4 anterior to that group.

Apex of abdomen: Notch present; lobes indicated; setae, apical 90-100  $\mu$  long, interapical 8  $\mu$  long, inner ventral 8  $\mu$  long, outer ventral 9-10  $\mu$  long; anal ring

with 6 setae, each about  $32\ \mu$  long, also with an inner row of 6 and an outer one of 12 pores, and divided on dorsal side and tending toward division on ventral.

*Larva*.—Elliptical.

Margin: With 28 8-shaped pores, anterior pair slightly larger than the others, axes of all longitudinal; 3 pairs of setae anteriorly.

Dorsal surface: On each half of body a submedian row of 3 or 4 8-shaped pores and sometimes 1 pore laterally, anterior submedian pore slightly larger than the others and two-thirds the size of marginal pores of same segment; disk pores in submarginal area and a few in lateral area.

Ventral surface: Antennal setae, I, apparently 1; IV, 1; V, 1; VI, 2 long, 2 stout, 3 fairly stout, 1 slender; antennal bases one-half length of antenna apart; beak setae, 2 pairs apical, 1 pair basal; spiracle with 1 trilocular and 1 quinquelocular pore; leg setae, coxa 4, femur 1 on inner margin near base and 1 each on inner and outer margins near center, tarsus 2 on inner and 1 on outer margin; tibia one-half as long as tarsus; 9 pairs of submarginal 8-shaped pores; 6 pairs of minute submarginal setae on abdomen, 2 pairs of submarginal larger setae anteriorly; 2 pairs of setae between antennae and mouth parts.

Apex of abdomen: Notch shallow; setae, apical  $62\ \mu$  long, interapical  $9\ \mu$  long, inner ventral (fairly close to median line)  $3.6\ \mu$  long, outer ventral  $5.4\ \mu$  long; anal ring with 6 setae, each about  $16.2\ \mu$  long, also with an inner row of 6 and an outer row of 12 pores, and divided on dorsal and ventral sides.

*Data*.—Redescribed from unmounted material and the following mounted specimens: One female on bamboo, Japan, I. Kuwana, 5-X-1913, from E. E. Green, possibly type; 11 females on bamboo, New Orleans, La., E. R. Sasser, March 9, 1919; 6 females on *Bambusa* sp., Taihoku, Taiwan (Formosa), R. Takahashi, January 1928, possibly type material of *tuberculatum*; 2 females on *Phyllostachys bambusoides*, Keijo, Chosen, S. Nakayama, November 3, 1928; 1 female and 2 larvae on bamboo, Ocean Springs, Miss., H. Gladney, April 12, 1929; 8 females and 2 larvae on bamboo, Japan, intercepted at Philadelphia, Pa., A. B. Wells, December 19, 1932.

In the paper containing the original description of *bambusicola* Kuwana (55, p. 147) published the following note:

With regard to this species, Prof. Green has given me the following remark: "This resembles *A. bambusae* Bdv. superficially, but differs from that species in several important particulars. In the first place the marginal fringe is of a bright pink color. I note that the marginal series of paired glands is single on the abdomen but irregularly double on the thorax. There are numerous simple circular glands immediately within the paired series, and bands of similar pores connect the stigmata with the margin. There are no supplementary paired glands on the dorsum." The writer should state here that he has not been able to recognize the double series of paired glands on the thorax, mentioned by Prof. Green.

As shown by Kuwana, there is no indication of a double series of marginal 8-shaped pores on the thorax or elsewhere on the margin. Green might have been dealing with another species, or notes concerning two species might have become confused.

In the description of *tuberculatum* Takahashi mentioned a "transverse tubercular ridge across about the middle of the scale." The ridge is characteristic of the test, and appears as two tiny humps immediately anterior to an imaginary transverse median line.

### ASTEROLECANIUM BELLUM, new species

(Fig. 8, A-L; pl. 3, E)

*Habit*.—Living on bark, usually in shallow pits, and occasionally on the lower surface of leaves.

*Test of female*.—Circular or nearly ovoid, 0.9–1 mm. in diameter; convex dorsally, with or without faint transverse striations, posterior end flattened and often upturned, flat or slightly convex ventrally; greenish, brownish, or, rarely, clear

yellow, semitransparent, thin; marginal and dorsal filaments whitish, the latter scattered and shorter than marginal; elliptical larval exit in margin.

*Adult female*.—Nearly circular, posterior end slightly produced; 0.8–0.9 mm. in diameter.

Margin: 8-shaped pores in a single row continued across apex of abdomen between apical setae, individual pores measuring  $9\ \mu$  long and 6 wide, one to three times (usually twice) a pore's length apart.

Dorsal surface: 8-shaped pores scattered, present or absent at posterior end, a few  $5\ \mu$  long and 3 wide, majority  $8\ \mu$  long and 5 wide; minute 8-shaped pores absent; disk pores fairly numerous; tubular ducts 26–28  $\mu$  long.

Ventral surface: Antenna short, with 2 setae slightly longer than diameter of antenna; beak with 3 pairs of setae near tip; spiracular bar expanded at inner end; with or without a group of 5 or 6 quinquelocular pores outside spiracular opening, in either case 22–36 quinquelocular pores between spiracle and body margin in a row which is double near spiracle and 6 or 8 pores wide near margin; multilocular pores, totaling 4–9, in 2 or 3 rows of 1–4 pores each, having 5–8 (usually 5) loculi: a loose group of 5–7 dark-rimmed 8-shaped pores each side of mouth parts and some arranged in 2 rather indefinite transverse rows posterior to beak; submarginal 8-shaped pores in a single row terminating near anterior row of multilocular pores, somewhat less numerous than marginal 8-shaped pores; submarginal setae in a complete row terminating nearly length of apical seta from bases of apical setae; 2 pairs of setae in posterior row of multilocular pores, 1 pair in anterior row, 1 pair anterior to those, and 1 pair anterior to the last-mentioned pair.

Apex of abdomen: Setae, apical 20–22  $\mu$  long, interapical 1.5–3.5  $\mu$  long, outer ventral 2  $\mu$  long; anal opening ventral, rather close to body margin, nearly circular, its margin slightly sclerotized, with 2 setae, each about 1  $\mu$  long, on anterior edge.

*Larva*.—Nearly elliptical, posterior end slightly narrowed.

Margin: With 16–24 8-shaped pores, the posterior pair usually slightly larger than anterior, distinctly larger than the others, and sometimes seeming to belong with dorsal lateral rather than marginal pores; axes of the posterior 4 or 5 pairs of pores sometimes somewhat diagonal, but usually axes of all longitudinal; 2 pairs of setae anteriorly.

Dorsal surface: 8-shaped pores, totaling 26–34, in a submedian row of 4–7 and a lateral row of 7–11 (usually 9 or 10), on each half of body, the anterior 2 lateral pores sometimes seeming to belong in an intermediate rather than in a lateral row, slightly larger than posterior marginal pores; disk pores near lateral 8-shaped pores; a pair of minute setae often present near anterior pair of submedian 8-shaped pores.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 0; VI, 2 long, 2 stout, 2 fairly stout, 2 slender; antennal bases one-third length of antenna apart; beak with 3 pairs of setae near tip; anterior spiracle with 1 trilocular and 1 quinquelocular, posterior spiracle with 1 trilocular, pore; leg setae, coxa 3, femur 1 on inner margin near base, tarsus 1 each on inner and outer margins; tibia one-third as long as tarsus; 8 pairs of submarginal 8-shaped pores, of which 1 pair is between the antennae; 7 pairs of submarginal minute setae posterior to posterior spiracles, 1 pair of submarginal slightly larger setae anteriorly; 2 pairs of setae between antennae and mouth parts.

Apex of abdomen: Setae, apical about 80  $\mu$  long, interapical about 4.5  $\mu$  long, outer ventral 2.5  $\mu$  long; anal opening in margin; anal tube membranous and so short that ventral side of anal ring is almost on surface; anal ring sclerotized, with 2 setae about 7.2  $\mu$  long.

*Data*.—Described from unmounted specimens (paratypes) and the following mounted material on *Quercus*: Five females on *Q. suber*, San Felice, Italy, 1915. U. S. N. H., holotype and paratypes; 3 females and 3 larvae on *Q. humilis*, Cape Spartel, Morocco, T. Williams, 1889. U. S. N. H., paratypes; 2 females on *Q. cerris*, Hungary, 1892. N. Y. B. G., paratypes; 2 females and 40 larvae on *Q. aegilops*, Melissiatika and Nea Ankhialos, Greece, from J. Koroneos, paratypes.

This species resembles *repugnans* and *roboris*, but can be separated from them, as well as from other species inhabiting oak, by the presence of marginal 8-shaped pores between the apical setae. The larvae are unusual in having a variable number of marginal 8-shaped pores.



### ASTEROLECANIUM BOLIVIAE, new species

(Fig. 8, M-V; pl. 9, K)

*Habit.*—Living on both surfaces of leaves.

*Test of female.*—Elongate, truncate at anterior end, widest on anterior third, tapering gradually to posterior end; 1.4–1.5 mm. long, 0.4–0.5 wide; dorsally broadly convex from margin to margin, or strongly convex only in longitudinal median area, with marginal area nearly flat, flat ventrally; pale greenish yellow, transparent, thin, slightly punctate; marginal filaments brighter yellow than body of test, shortest near posterior end; dorsal filaments of same color as test or slightly pinkish, arranged in a submedian row and twice as long as marginal; circular larval exit in margin.

*Adult female.*—Shape similar to that of test, 1.25 mm. long, 0.4 wide.

Margin: 8-shaped pores in a single row terminating around twice the length of apical seta from setal bases, posterior pores 6–7  $\mu$  long and 4 wide, others 9  $\mu$  long and 5 wide, posterior 3 or 4 pores sometimes two or three times a pore's length apart, others separated by less than the width of a pore; trilobular pores in a single complete row or interrupted at anterior end for about 7 8-shaped pores, apparently usually terminating with the 8-shaped pores, approximately one-third as numerous as 8-shaped pores at ends of row, usually half as numerous as 8-shaped pores elsewhere.

Dorsal surface: 8-shaped pores tending to be concentrated along submedian line and scattered from it to margin, less numerous close to margin, particularly at posterior end, 6 or 8 at intervals along submedian line, measuring 16–20  $\mu$  long and 12–16 wide, the others 7–10  $\mu$  long and 5 wide; minute 8-shaped pores sparse; disk pores fairly sparse; tubular ducts 28  $\mu$  long.

Ventral surface: Antenna slightly raised, nearly circular, with 3 setae about equal to, and 2 longer than, diameter of antenna; 0–4 quinquelocular pores between antenna and margin; beak apparently with 2 pairs of setae; spiracle with bar slender, widest at inner end, with atrium enlarged, shallow, and containing 4–7 quinquelocular pores, 3–5 similar pores extending to body margin in a single row; multilocular pores totaling about 22 and having 7–10 loculi, in 2 complete and 3 or 4 interrupted rows, each complete row with 7 or 8, each interrupted row with 2; 2–4 dark-rimmed 8-shaped pores each side of mouth parts, others in a group posterior to antennae, in an irregular lateral row on posterior part of abdomen, and in 1 or 2 transverse rows anterior to complete rows of multilocular pores; submarginal 8-shaped pores in a single row terminating near posterior row of multilocular pores, about one-half as numerous as marginal 8-shaped pores; submarginal setae in a complete row terminating two-thirds length of apical seta from their bases; 2 pairs of setae in posterior complete row of multilocular pores, 1 or 2 pairs in anterior complete row.

Apex of abdomen: Lobes indicated; setae, apical 46–56  $\mu$  long, interapical 8–10  $\mu$  long, intermediate and outer ventral each about 3.6  $\mu$  long; anal opening ventral; anal tube very short, membranous; anal ring sclerotized, apparently with 6 corrugations around outside, and with 2 setae each 20–24  $\mu$  long arising from outer section of ring; ventral surface of lobe area slightly sclerotized in dentate rows.

*Larva.*—Elliptical.

Margin: With 28 8-shaped pores, axes of all longitudinal; a pair of minute setae close to each of the posterior 3 pairs of pores; 3 pairs of setae anteriorly.

Dorsal surface: 8-shaped pores in a submedian row of 6 and a lateral row of 10, on each half of body, second pore from anterior end of submedian row larger than marginal, all others minute; disk pores near several lateral 8-shaped pores; a pair of minute setae near anterior pair of submedian 8-shaped pores.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 1; VI, 3 long, 2 stout, 3 fairly stout; antennal bases one-half length of antenna apart; beak setae, 2 pairs apical, 1 pair basal; spiracle with 1 trilobular and 1 quinquelocular pore, or with 2 quinquelocular pores; leg setae, coxa 3, femur 1 on inner margin near base, tarsus 1 each on inner and outer margins; tibia one-fourth as long as tarsus; 9 pairs (10 pairs in 1 of specimens studied) of submarginal 8-shaped pores; apparently 10 pairs of minute submarginal setae, on abdomen, thorax, and head; 4 pairs of setae near antennae.

Apex of abdomen: Notch small; lobes indicated; setae, apical 54  $\mu$  long, interapical 5.4  $\mu$  long, dorsal 1  $\mu$  long, intermediate ventral (nearly anterior to apical) around 1  $\mu$  long, outer ventral (slightly outside apical) around 1  $\mu$  long; anal opening indistinct; anal tube membranous, very short; anal ring circular, sclerotized, with 2 setae around 1  $\mu$  long.

*Data.*—Described from one test, one mounted female, and four mounted larvae on *Palmae* (*Catostigma radiata?*), Cordoba, State of Cauca, Colombia. C. B. Doyle, December 1905, U. S. N. H., paratypes; unmounted specimens, two mounted females, and two mounted larvae on *Palmae*, San Carlos, Bolivia, O. Buchtier, November 9, 1907, U. S. N. H., holotype and paratypes.

Most closely related to *palmae*, from which it differs in several characters, the most conspicuous being the number and arrangement of the dorsal 8-shaped pores, the presence of 22 multilocular pores instead of 43 to 51, and the shorter anal ring setae, which are only about one-half as long as the apical setae.

### ASTEROLECANIUM BORBONIAE Brain

(Fig. 9, A-H)

Described in 1920 (*12*, p. 111).

*Habit.*—"On leaves" (*12*, p. 111).

*Test of female.*—"Test of adult ♀ small, about 1 mm. long and 0.75 mm. broad, rounded in front and rather pointed behind, slightly convex with the margin rather thickened and slightly crenulate. The extreme posterior extremity appears tubular and is upturned or recurved over the back. There is apparently no marginal or dorsal fringe. The colour is pale greenish yellow and the test is almost transparent, showing the dark body of the female at the anterior end." (*12*, p. 111.)

*Adult female.*—Somewhat ovoid, posterior end narrowed and slightly produced; 0.9–1.10 mm. long, 0.6–0.7 wide.

Margin: 8-shaped pores in a single row terminating around a pore's length from bases of apical setae, 12  $\mu$  long and 7–8 wide, two to six times a pore's length apart.

Dorsal surface: 8-shaped pores scattered over anterior two-thirds of body, not numerous, 8–9  $\mu$  long and 5 wide; minute 8-shaped pores not observed; disk pores fairly numerous; tubular ducts 32  $\mu$  long.

Ventral surface: Antenna faintly sclerotized, circular, often sunken in derm, with 3 setae longer than diameter of antenna; beak with 2 pairs of setae; spiracular bar fairly broad; 20–35 quinquelocular pores extending from spiracle to body margin in a double to quadruple row; multilocular pores totaling 7–10 and having 5–10 loculi, in 3 rows, posterior row with 2, median with 2 or 3, anterior with 4 or 5; 3 or 4 dark-rimmed 8-shaped pores in a loose group each side of beak, 1 or 2 anterior to mouth parts, and a few posterior to beak; submarginal 8-shaped pores in a single row terminating near anterior row of multilocular pores, usually as numerous as marginal 8-shaped pores; apparently 6 pairs of submarginal setae posterior to posterior spiracles, the posterior pair near the posterior pair of marginal 8-shaped pores; 1 pair of setae in posterior row of multilocular pores, 2 pairs each in median and anterior rows, 2 pairs anterior to those, and 1 pair still further anteriorly.

Apex of abdomen: Setae, apical 44–60  $\mu$  long, interapical 5.4  $\mu$  long, outer ventral about 6.4  $\mu$  long; anal opening in margin, circular; anal tube nearly cylindrical, sclerotized near opening and near ring, membranous in middle; anal ring a sclerotized band.

*Larva.*—Elongate ovoid.

Margin: Without 8-shaped pores; 2 pairs of setae at anterior end.

Dorsal surface: 8-shaped pores, totaling 32 or 34, in a submedian row of 4 or 5 and a lateral row of 12, on each half of body, anterior lateral pores very slightly larger than posterior pores, submedian pores practically equal in size to posterior lateral pores; disk pores between submedian and lateral 8-shaped pores.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 0; VI, 2 long, 2 stout, 3 fairly stout; antennal bases one-fourth length of antenna apart; beak setae, 2 pairs apical, 1 pair basal; spiracle with 1 trilocular and 1 quinquelocular pore or with 2 trilocular pores; leg setae, coxa 4, femur 1 on inner margin near base and 1 each on inner and outer margins near center, tarsus 2 on inner and 1 on outer margin; tibia around one-third as long as tarsus; 7 pairs of submarginal 8-shaped pores, none between antennae; apparently 5 pairs of minute submarginal setae on abdomen; 1 pair of setae between antennae and mouth parts.

Apex of abdomen: Notch small; setae, apical  $90\ \mu$  long, interapical  $5.4\ \mu$  long, outer ventral  $3.6\ \mu$  long; anal opening in dorsal margin; anal tube very short, faintly sclerotized; anal ring a sclerotized band.

*Adult male*.—1 mm. long.

Head: Antenna broken (10-segmented according to Brain (12, p. 111), formula (longest to shortest), (V, VI), (III, IV, VII), (VIII), (IX), (II), (I), (X missing); antennal setae, I, 5; II, 4; III-IX, 10-15; basal bars diagonal; 7 setae anterior to ventral eye spots.

Thorax: Bar between wing bases curved on anterior margin, twice as long as wide, with an indication of a median longitudinal fold; tibia nearly twice length of tarsus.

Abdomen: Four segments each with a pair of setae dorsally on lateral margin and a pair in ventral lateral area; lobes indicated, each with 1 long and 2 short setae; penis sheath with 3 or 4 pairs of long setae ventrally near base, and smaller setae on each side of ventral opening.

*Data*.—Redescribed from 15 females, 20 larvae, and 1 male, all mounted, from *Borbonia cordata*, Ceres, Cape Province, South Africa, November 23, 1906, Brain No. 302, type.

This is one of the few species without setae on the anal ring in which the anal opening, anal tube, and anal ring are clearly differentiated. The larvae differ from larvae of many species in lacking marginal 8-shaped pores.

### ASTEROLECANIUM BORNEENSE, new species

(Fig. 9, I-Q; pl. 9, N)

*Habit*.—Living on the lower surface of leaves.

*Test of female*.—Somewhat ovoid, 1.4 mm. long, 0.85 wide, slightly convex dorsally, with a faint longitudinal median carina, flat ventrally; greenish yellow, transparent, thin, punctate; marginal and dorsal filaments broken off; larval exit a slit in margin.

*Adult female*.—Somewhat ovoid, 1 mm. long, 0.7 wide.

Margin: 8-shaped pores in a single row terminating about three times the length of a pore from bases of apical setae, each pore with a sclerotized projection on dorsal edge, posterior pores 7-8  $\mu$  long and 5 wide, others 9  $\mu$  long and 5 wide, around a pore's length apart; quinquelocular pores in a single row terminating at the penultimate or posterior pair of 8-shaped pores, one-fourth to one-half as numerous as 8-shaped pores at ends of body, as numerous as 8-shaped pores elsewhere.

Dorsal surface: 8-shaped pores in a median row, and in 14 or 16 groups of 2-4 each in lateral area, about 6  $\mu$  long and 4 wide; minute 8-shaped pores very numerous; disk pores fairly numerous; tubular ducts 24  $\mu$  long.

Ventral surface: Antenna bluntly conical, with 1 seta shorter (or broken) and 1 longer than diameter of antenna; beak apparently with 1 pair of setae; spiracular bar fairly broad; 9 or 10 quinquelocular pores extending from spiracle to body margin in a double row; multilocular pores, with 10 loculi, in 4 complete and 4 interrupted rows, posterior row with 8, each of next 2 rows with 10, next with 6, each of interrupted rows with 2 or 3, and a total of about 44; 4 dark-rimmed 8-shaped pores each side of beak, a few scattered elsewhere, and some tending toward arrangement in a longitudinal lateral row on abdomen; submarginal 8-shaped pores in a single row terminating near posterior row of multilocular pores, nearly or quite as numerous as marginal 8-shaped pores; submarginal setae in a complete row terminating 3 8-shaped pores from the posterior pair of marginal 8-shaped pores; 3 setae in posterior row of multilocular pores, 2 in each of other complete rows.

Apex of abdomen: Notch small; lobes indicated; setae, apical, tip broken, 55  $\mu$  long, probably no more than 60 if unbroken, interapical 5  $\mu$  long, outer ventral 6  $\mu$  long; anal ring with 6 setae, each apparently at least 27  $\mu$  long, also with an inner row of 6 and an outer row of apparently 12 pores, and with a very slight indication of division on dorsal and ventral sides.

*Larva*.—Elongate ovoid.

Margin: With 28 8-shaped pores, axes of all longitudinal; 2 pairs of setae anteriorly.



Dorsal surface: 8-shaped pores in a submedian row of 3 and a lateral row of 5, on each half of body, the 3 lateral pores less than half the size of marginal pores, others slightly larger than marginal; disk pores between lateral and marginal 8-shaped pores.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 0; VI, 2 long, 2 stout, 2 fairly stout, 2 slender; bases of antennae one-third length of antenna apart; beak with 2 pairs of apical setae; anterior spiracle with 1 trilocular and 1 quadrilocular or quinquelocular pore, posterior spiracle with 1 trilocular pore; leg setae, coxa 3, femur 1 on inner margin at base, tarsus 1 each on inner and outer margins; tibia one-half as long as tarsus; apparently 9 pairs of submarginal 8-shaped pores; 7 pairs of submarginal minute setae on abdomen, apparently 2 pairs of submarginal larger setae at anterior end; 3 pairs of setae near antennae.

Apex of abdomen: Notch present; setae, apical  $38 \mu$  long, interapical  $2.5 \mu$  long, outer ventral  $2 \mu$  long; anal opening in margin; anal tube very short and slightly sclerotized throughout, but heavily sclerotized in a transverse band near opening; anal ring with 6 setae, each apparently  $1.8 \mu$  long.

*Data*.—Described from one unmounted specimen, one mounted female, and three mounted larvae on *Quercus borneensis*, Tawao, Elphinstone Province, British North Borneo. A. D. E. Elmer, October 1922 to March 1933, N. Y. B. G., holotype and paratypes.

This species seems rather closely related to *sumatrae*, from which it can be easily segregated by the presence of a sclerotized projection on each marginal 8-shaped pore.

#### ASTEROLECANIUM BRACHYLENAE Brain

(Fig. 10, A-E)

Listed by Brain in 1920, in explanations of plates VII and VIII (12), as *A. pustulans* var. *brachylenae*. Although a section of the body margin, the posterior apex of the body, and a photograph of tests were shown in plates VII and VIII, *brachylenae* was not mentioned in the text dealing with *Asterolecanium* (12, pp. 108-115). It differs from *pustulans* so strongly that it is here given specific rank.

*Habit*.—Living on bark, in pits.

*Test of female*.—Slightly longer than wide or nearly circular, 1.5 mm. long, 1.25-1.5 wide; flat dorsally, strongly convex ventrally; brownish yellow, transparent, fairly thin, smooth; marginal filaments whitish, dorsal filaments broken off; elliptical larval exit in margin.

*Adult female*.—Nearly circular, posterior end slightly produced; 1.25 mm. in diameter.

Margin: 8-shaped pores mostly in a double row but the posterior 7-14 pores usually in a single row, terminating twice a pore's length from bases of apical setae. 12-13  $\mu$  long and 7-8 wide, the spaces between the pores ranging from the width to the length of a pore, the two rows usually a pore's width apart; quinquelocular pores in a crowded single or irregularly double row terminating at, or 2 or 3 8-shaped pores from, the posterior pair of 8-shaped pores, one or two times as numerous as 8-shaped pores of nearer row near ends of body, and three or four times as numerous as 8-shaped pores near spiracular pore bands; disk pores dorsad of 8-shaped pores, terminating at the posterior or penultimate pair of 8-shaped pores, one-third as numerous as 8-shaped pores of nearer row at some points, quite as numerous at other points, also occurring ventrad of quinquelocular pores, terminating at the posterior pair of 8-shaped pores and as numerous as those dorsad of 8-shaped pores.

Dorsal surface: 8-shaped pores numerous, arranged in short transverse rows along median line, and in circles paralleling the margin elsewhere, 12-13  $\mu$  long and 7-8 wide; minute 8-shaped and disk pores fairly numerous; tubular ducts  $32 \mu$  long.

Ventral surface: Antenna dome-shaped, with 2 setae slightly longer and 3 shorter than diameter of antenna; 6-8 quinquelocular pores between antenna and margin; beak with 2 pairs of setae; spiracular bar subcircular; derm around spiracular opening with a fold containing 2-4 quinquelocular pores, 16-26 similar pores extending to body margin in a row which is usually irregularly single

except close to margin, where it is 4 or 5 pores wide, 19-30 pores in group and row combined; multilocular pores, totaling 93-100 and with 9 or 10 loculi, in 6 complete and 3 interrupted rows, the anterior row anterior to posterior spiracles, posterior row with 8, penultimate with 8-13, each of next 4 rows with 12-20, each of interrupted rows with 3-7; 2 or 3 dark-rimmed 8-shaped pores each side of beak, a few scattered anterior to mouth parts, and a few on abdomen tending toward arrangement in 6 transverse rows; submarginal 8-shaped pores in an irregularly double row, terminating near penultimate row of multilocular pores, at least as numerous as marginal 8-shaped pores of nearer row; 1 or 2 disk pores sometimes near 1 or both ends of penultimate row of multilocular pores and next anterior row; submarginal setae in a complete row terminating nearly anterior to the posterior pair of marginal 8-shaped pores; 2 pairs of setae in posterior row of multilocular pores and 1 pair in each of next 2 rows.

Apex of abdomen: Notch present; lobes indicated; setae, apical 72  $\mu$  long, interapical 18  $\mu$  long, dorsal 9  $\mu$  long, inner ventral 8  $\mu$  long, intermediate ventral 8  $\mu$  long, outer ventral 8  $\mu$  long; anal ring with 6 setae, each 32  $\mu$  long, also with an inner row of 6 and an outer row of 14 or 15 pores, and divided on dorsal side and tending toward division on ventral; ventral surface of apex slightly sclerotized and rugose, but with a more heavily sclerotized, roughly linear area extending anteriorly from base of each interapical seta.

*Larva*.—Nearly elliptical.

Margin: With 28 8-shaped pores, the posterior 6 pairs of pores slightly smaller than the next 7 and the anterior pair slightly the largest of all, axes of the posterior 6 pairs transverse, of the others longitudinal; a pair of minute setae close to each of the posterior 3 pairs of pores; 3 pairs of setae anteriorly.

Dorsal surface: 8-shaped pores, totaling 43 or 44, in a submedian row of 9 or 10, a lateral of 9, and a submarginal of 3, on each half of body, anterior submedian and lateral pores slightly larger than posterior pores but all nearly uniform in size and slightly smaller than marginal pores of same segments; disk pores between submedian and lateral and a few between lateral and marginal 8-shaped pores.

Ventral surface: Antennal setae, I, 2; IV, 1; V, 1; VI, 2 long, 2 stout, 3 fairly stout, 2 slender; antennal bases about one-third length of antenna apart; beak setae, 2 pairs apical, 1 pair basal; spiracle with 1 trilocular and 1 quadrilocular or quinquelocular pore; leg setae, coxa 4, femur 1 on inner margin at base and 1 each on inner and outer margins near center, tarsus 2 on inner and 1 on outer margin; tibia around one-third as long as tarsus; 9 pairs of submarginal 8-shaped pores; apparently 10 pairs of submarginal minute setae, on abdomen and thorax, and 3 pairs of submarginal larger setae anteriorly; 2 pairs of setae between antennae and mouth parts.

Apex of abdomen: Notch present; setae, apical 54  $\mu$  long, interapical 9  $\mu$  long, dorsal 2  $\mu$  long, inner ventral 3.6-5.4  $\mu$  long, intermediate ventral 3.6  $\mu$  long, outer ventral 3.6  $\mu$  long; anal ring with 6 setae 20-22  $\mu$  long, also with an inner row of 6 and an outer row of 12 pores; divided on dorsal side and tending toward division on ventral.

*Data*.—Described from unmounted material, 7 mounted females, and 42 mounted larvae on *Brachylena discolor*, Durban, Cape Province, South Africa, 1916, Brain No. 28, paratypes, part of material from H. K. Munro.

Closely related to *thespesiae*, but differing from it in possessing a few more marginal quinquelocular pores, in having the outer dorsal 8-shaped pores arranged in circular rather than transverse rows, and in having a conspicuously smaller number of multilocular pores.

### ASTEROLECANIUM BREVISPINUM Brain

(Fig. 10, F-P; fig. 11, A)

Described in 1920 (*12*, p. 109).

*Habit*.—Apparently living on twigs (*12*, pl. VII, fig. 188).

*Test of female*.—"Test of adult ♀ about 3 mm. long, 2.2 mm. broad, very convex, with the caudal extremity produced into a narrow upturned process. The colour is bright yellow and somewhat transparent, except at the anterior end which is bright brown in the few specimens at hand, probably owing to the



presence of the shrivelled female body. Of the eight specimens in this collection five of the tests are entirely naked. The other three show the presence of long large curved glassy filaments (fig. 188), which were apparently equally long and equally numerous over the whole dorsal and marginal areas." (12, p. 109.)

*Adult female*.—Slightly longer than wide, anterior end broadly rounded, posterior end produced; 1.75–2 mm. long, 1.25–1.5 wide.

*Margin*: 8-shaped pores in a single rather indefinite row terminating twice length of apical seta from setal bases, individual pores slightly invaginated, about 12  $\mu$  long and 9 wide, two to six times a pore's length apart; quinquelocular pores in a single row of 10–15 outside of anterior and posterior spiracular pore bands, and in an irregularly single or double row between spiracular pore bands, three or four times as numerous as 8-shaped pores.

*Dorsal surface*: 8-shaped pores scattered, numerous, especially near margin slightly invaginated, 14–22  $\mu$  long and 9–16 wide, the majority 18–20  $\mu$  long and 14 wide; minute 8-shaped pores not observed; disk pores numerous; tubular ducts 48  $\mu$  long.

*Ventral surface*: Antenna a circular, thick disk, with 3 setae shorter than diameter of antenna; beak apparently without setae; spiracle with bar greatly expanded at inner end, with atrium enlarged and containing 10–15 quinquelocular pores, and 30–40 similar pores extending to body margin in a fan-shaped row; multilocular pores, totaling approximately 135 and with 10 loculi, apparently in 6 complete rows, posterior row with 12, penultimate with 30, next with 36, each of next 2 with 24, anterior with 10; dark-rimmed 8-shaped pores very numerous, tending toward arrangement in transverse rows posterior to mouth parts, scattered anterior and lateral to mouth parts; submarginal 8-shaped pores in a very irregular double row terminating near anterior row of multilocular pores, two or three times as numerous as marginal 8-shaped pores; 4 pairs of submarginal setae on posterior part of abdomen, the posterior pair slightly nearer to the posterior pair of marginal 8-shaped pores than to apical setae; 1–3 pairs of setae in each of the 4 central rows of multilocular pores.

*Apex of abdomen*: Setae, apical 20  $\mu$  long, interapical, 5.4  $\mu$  long, inner ventral 3.6  $\mu$  long, outer ventral 5.4  $\mu$  long; anal opening apparently in margin, circular, its margin sclerotized; anal tube very short, sclerotized; anal ring sclerotized.

*Larva*.—Broadly elliptical.

*Margin*: With 28 8-shaped pores, axes of all longitudinal; 3 pairs of setae anteriorly.

*Dorsal surface*: 8-shaped pores in a submedian row of 5–7 and a lateral row of 11, on each half of body, with a total of 32–36, submedian pores practically equal in size to marginal, lateral pores of same size or slightly larger than marginal; disk pores between lateral and marginal and a few between submedian and lateral 8-shaped pores; a pair of setae anterior to anterior pair of submedian pores.

*Ventral surface*: Antennal setae, I, 2; IV, 1; V, 1; VI, 2 long, 2 stout, 2 fairly stout; antennal bases one-third length of antenna apart; beak setae, 2 pairs apical, 1 pair basal; spiracle with 1 trilocular pore; leg setae, coxa 4, femur 1 on inner margin near base and 1 each on inner and outer margins near center, tarsus 1 each on inner and outer margins; tibia slightly more than one-half as long as tarsus; 3 pairs of submarginal 8-shaped pores, 1 pair between anterior and posterior spiracles and 2 pairs posterior to posterior spiracles; 5 pairs of minute submarginal setae on abdomen; 2 pairs of setae between antennae and mouth parts.

*Apex of abdomen*: Notch present; lobes indicated; setae, apical 100  $\mu$  long, interapical 1.8  $\mu$  long, inner ventral 1.8  $\mu$  long, outer ventral (nearly anterior to the latter) 1.8  $\mu$  long; anal opening apical; anal tube very short, membranous; anal ring sclerotized.

*Data*.—Redescribed from 2 mounted intact and 2 mounted fragmentary females, and 23 mounted larvae on veld-bush, Ceres, Cape Province, South Africa, C. P. L. 1898, Brain No. 21, type and paratypes.

Adults of this species are unusual in having the row of marginal 8-shaped pores indefinite owing to the distance between these, to their position, and to the proximity of the dorsal pores to the marginal. The larvae are unusual in having only three pairs of minute submarginal 8-shaped pores. The species resembles *euryopsis* in having invaginated 8-shaped pores and a poorly defined row of marginal 8-shaped pores.



## ASTEROLECANIUM BRUNETAE, new species

(Fig. 11, B-L; pl. 9, Z)

*Habit*.—Living on the lower surface of leaves.

*Test of female*.—Slightly longer than wide, posterior end produced and turned up against dorsal surface: 0.75–0.95 mm. long, 0.6–0.75 wide; convex dorsally, sides slightly curved, top flat with a faint longitudinal median carina and faint transverse striations, flat ventrally; pale yellow, transparent, thin, slightly punctate; marginal filaments pale yellow, very short, fragmentary; dorsal filaments rubbed off; elliptical larval exit at tip of produced area in dorsal surface.

*Adult female*.—Slightly longer than wide, posterior end slightly produced; about 0.75 mm. long, 0.6 wide.

Margin: 8-shaped pores in a single row terminating around one and a half times the length of apical seta from setal bases, measuring  $6\ \mu$  long and 4 wide, four to seven (usually six) times a pore's length apart.

Dorsal surface: 8-shaped pores 14–16 in number, occurring at fairly uniform intervals in submarginal area, 8–10  $\mu$  long and 6–8 wide, posterior pores as large as any; minute 8-shaped pores not observed; disk pores fairly numerous; tubular ducts 28  $\mu$  long; dorsal tubes present.

Ventral surface: Antenna globular, with 2 setae slightly longer than diameter of antenna; beak without setae; spiracular bar fairly broad; 1 quinquelocular pore close to spiracular opening and 2–4 near body margin; 1 or 2 dark-rimmed 8-shaped pores each side of beak, a few on anterior end, and a few in 2 transverse rows near posterior end of abdomen; submarginal 8-shaped pores in a single row terminating slightly anterior to genital opening, placed at uniform intervals equivalent to slightly more than the length of a marginal 8-shaped pore, usually at least twice as numerous as marginal 8-shaped pores; 5 pairs of submarginal setae on abdomen, the posterior pair closer to bases of apical setae than to the posterior pair of marginal 8-shaped pores; 1 pair of setae posterior to genital opening, 1 pair anterior to opening, and 1 pair anterior to those.

Apex of abdomen: Lobes indicated; setae, apical 54  $\mu$  long, interapical 7.2  $\mu$  long, inner ventral 3.6  $\mu$  long, outer ventral 4  $\mu$  long; anal ring with 6 setae, each about 27  $\mu$  long, with an inner row of 6 and an outer one of 12 pores, and with a tendency toward division on ventral side; ventral surface of apex slightly sclerotized and rugose.

*Larva*.—Elliptical.

Margin: With 28 8-shaped pores, anterior pair slightly the largest, axes of the posterior 3 pairs diagonal or longitudinal, the others longitudinal; 2 pairs of setae anteriorly.

Dorsal surface: 8-shaped pores in a submedian row of 2 or 3 on each half of body, posterior pore much smaller than middle pore when this is present and middle pore slightly smaller than anterior, which is a little smaller than marginal pores of same segment; disk pores in lateral area and a few near margin.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 1; VI, 2 long, 2 stout, 3 fairly stout, 1 slender; beak setae, 2 pairs apical, 1 pair median; spiracle apparently with 1 trilocular pore; leg setae, coxa 4, femur 1 on inner margin near base and 1 each on inner and outer margins near center, tarsus 2 on inner and 1 on outer margin; tibia one-half as long as tarsus; 9 pairs of submarginal 8-shaped pores; 6 pairs of submarginal minute setae on abdomen, 3 pairs of submarginal larger setae at anterior end; 2 pairs of setae near antennae.

Apex of abdomen: Lobes indicated; setae, apical 29  $\mu$  long, interapical 5.4  $\mu$  long, inner ventral 5.4  $\mu$  long, outer ventral 3.6  $\mu$  long; anal ring with 6 setae, each about 3.6  $\mu$  long.

*Data*.—Described from unmounted material, two mounted females, and three mounted larvae on *Bambusa* sp., Antipolo, Luzon, Philippine Islands, A. S. Hitchcock, June 9, 1921, U. S. N. H., holotype and paratypes.

Closely related to *parvum*, but differing from it in lacking marginal quinquelocular pores and in having tubular ducts 28 instead of 12  $\mu$  long.

## ASTEROLECANIUM CAPTIOSUM, new species

(Fig. 12, A-K; pl. 9, S)

*Habit.*—Living on the lower surface of leaves.*Test of female.*—Elongate, 1–1.25 mm. long, 0.5 wide; flat dorsally and ventrally, with a faint longitudinal median carina dorsally; pale greenish yellow, transparent, very thin; marginal filaments very pale yellow, slightly longer at anterior end than elsewhere; elliptical larval exit in margin.*Adult female.*—Elongate, 0.9–1.10 mm. long, 0.45 wide.Margin: 8-shaped pores in a single row terminating slightly more than length of apical seta from setal bases, posterior pores 8–9  $\mu$  long and 4 wide, the others 10  $\mu$  long and 4.5 wide, less than a pore's width apart; quinquelocular pores in a single row from near antennae to about halfway between posterior spiracular pore bands and the posterior pair of 8-shaped pores, as numerous as 8-shaped pores at ends of row, nearly or quite twice as numerous as 8-shaped pores elsewhere.Dorsal surface: Minute 8-shaped and disk pores rather sparse; tubular ducts 24  $\mu$  long; dorsal tubes present.

Ventral surface: Antenna very short, with 2 setae longer than diameter of antenna; beak without setae; spiracular bar short and fairly slender; 7–10 quinquelocular pores extending from spiracle to body margin in a single row; 1 or 2 dark-rimmed 8-shaped pores each side of beak, 3 or 4 anterior to mouth parts and 5 or 6 in lateral area of abdomen; submarginal 8-shaped pores in a single row terminating slightly posterior to the posterior pair of marginal 8-shaped pores, nearly as numerous as marginal 8-shaped pores; 4 pairs of submarginal setae on abdomen, the posterior pair slightly nearer to the posterior pair of marginal 8-shaped pores than to bases of apical setae; 1 pair of setae posterior to genital opening, 1 pair anterior to opening, and 1 pair anterior to the latter.

Apex of abdomen: Slightly concave and with a small notch; lobes indicated; setae, apical 44  $\mu$  long, interapical 6–7.2  $\mu$  long, outer ventral 2  $\mu$  long; anal ring with 2 setae apparently 14.4  $\mu$  long and four 18  $\mu$  long and apparently with 12 pores not arranged in definite rows, not noticeably divided; ventral surface between lobes slightly sclerotized and rugose.*Data.*—Described from unmounted material and four mounted females on *Bambusa* sp., Antipolo, Luzon, Philippine Islands, A. S. Hitchcock, June 9, 1921. U. S. N. H., holotype and paratypes.This species resembles *abietum*, but has three pairs of setae instead of four on the apex of the abdomen. It is closely related to *amboinae*, but does not have dorsal 8-shaped pores. In each of these species the marginal 8-shaped pores are conspicuously long and slender.

## ASTEROLECANIUM CASTANEAEE, new species

(Fig. 12, L-Y; pl. 8, R)

*Habit.*—Living on bark, in pits.*Test of female.*—Ovoid or nearly circular, 0.75–1 mm. long, 0.6–0.75 wide, or around 0.75 mm. in diameter; dorsally slightly to conspicuously convex with posterior tip flattened and slightly produced, with or without faint median and lateral carinae and faint transverse striations, flat or slightly convex ventrally; greenish yellow, transparent to semitransparent, often shiny; marginal filaments pale salmon to nearly white, slightly shorter at posterior end than elsewhere; elliptical larval exit in dorsal surface at margin.*Adult female.*—Usually ovoid, sometimes circular, posterior end usually slightly produced; 0.7–0.9 mm. long, 0.5–0.7 wide, or around 0.65 mm. in diameter.Margin: 8-shaped pores in a single row terminating two to three times a pore's length from bases of apical setae, each pore with a sclerotized tongue-shaped projection on dorsal edge (often inconspicuous if weakly stained), posterior pores 7  $\mu$  long and 4 or 5 wide, the others 8–9  $\mu$  long and 5 wide, usually a pore's length apart; quinquelocular pores in a single row (sometimes

in a double row near spiracular pore bands) terminating at the posterior pair of 8-shaped pores or 1-8 8-shaped pores from it, nearly or quite as numerous as 8-shaped pores near posterior end, and two to three times as numerous as 8-shaped pores between and outside of spiracular pore bands, twice as numerous as 8-shaped pores at anterior end.

Dorsal surface: Minute 8-shaped and disk pores usually numerous; tubular ducts  $24\ \mu$  long.

Ventral surface: Antenna thimble-shaped or conical, with 1 seta as long as diameter of antenna; beak with 2 pairs of setae; spiracular bar expanded at inner end or throughout its length; 20-30 quinelocular pores extending from spiracle to body margin in an irregularly double row; multilocular pores, totaling 20-30 (usually 26 or 27), with 10 loculi, in 4 complete rows, posterior row with 9 or 10, each of next 2 with 4-7, and anterior row with 5; a loose group of 5-10 dark-rimmed 8-shaped pores each side of mouth parts, a few scattered between mouth parts and margin, and a few sometimes in a transverse row posterior to beak; submarginal 8-shaped pores in an irregularly single row (occasionally appearing double at some points) terminating near posterior row of multilocular pores, nearly or quite as numerous as marginal 8-shaped pores; submarginal setae in a complete row terminating near the posterior pair of marginal 8-shaped pores; 2 pairs of setae in the posterior row of multilocular pores and 1 pair in each of the other rows.

Apex of abdomen: Lobes sometimes indicated; setae, apical 44-52  $\mu$  long, interapical 4.5-5.2  $\mu$  long, outer ventral 5.2  $\mu$  long; anal opening ventral, circular, its margin membranous or faintly sclerotized.

Larva.—Elliptical.

Margin: With 28 8-shaped pores, axes of all longitudinal; 2 pairs of setae anteriorly.

Dorsal surface: 8-shaped pores in a submedian row of 7-9 and a lateral row of 9, on each half of body, with a total of 32-36, anterior pores slightly larger than posterior, the largest about two-thirds as large as a marginal pore; disk pores between submedian and lateral 8-shaped pores.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 0; VI, 2 long, 2 stout, 2 fairly stout, 2 slender; bases of antennae one-half length of antenna apart; beak with 2 pairs of setae at tip; anterior spiracle with 1 trilocular and 1 quinelocular pore, posterior spiracle with 1 trilocular pore; leg setae, coxa 3, femur 1 on inner margin near base, tarsus 1 each on inner and outer margins; tibia one-fifth as long as tarsus; 9 pairs of submarginal 8-shaped pores; 7 pairs of submarginal minute setae posterior to spiracles, 1 pair of submarginal larger setae anteriorly; 2 pairs of setae between antennae and mouth parts.

Apex of abdomen: Notch small; setae, apical 42  $\mu$  long, interapical 7.2-9  $\mu$  long, outer ventral 5.2  $\mu$  long; anal opening in margin; anal tube very short, especially on ventral side, membranous; anal ring a sclerotized band, apparently normally without setae, but some specimens with 1 or 2 about 7.2  $\mu$  long.

Data.—Described from unmounted and the following mounted material collected on *Castanea* from China (all unmounted and mounted specimens, except holotype, are paratypes): Two females and 11 larvae on *C. henryi*, Tientai Shan, Chekiang, R. C. Ching, May 5-18, 1924, U. S. N. H.; 1 female on *C. sequinii*, near Siachu, Chekiang, R. C. Ching, May 22-24, 1924, U. S. N. H.; the following material intercepted at Washington, D. C., in January 1932, January 1934, January and February 1935, and January and April 1936 by the Division of Foreign Plant Quarantines, Bureau of Entomology and Plant Quarantine: 7 females on *C. mollissima*, Ysi Hong, holotype and paratypes; 54 females and 3 larvae on *C. mollissima*, *C. sequinii*, or *Castanea* sp., from near Nanking, Kiangsu; near Hangchow, Chekiang; Kiangsi.

This species is closely related to *pasaniae*, but differs from it in several particulars. Tests of *castaneae* are ovoid or circular and distinctly smaller than the one available authentic test of *pasaniae*, which is distinctly longer than wide. The most obvious microscopic difference between the two is the arrangement of the multilocular pores, which in *castaneae* are represented only by four complete rows and in



*pasaniae* by four complete and four interrupted rows. There are also 20 to 30 multilocular pores in *castaneae*, and 36 in *pasaniae*. Another obvious difference is the greater number of marginal quinquelocular pores in proportion to the marginal 8-shaped pores in *castaneae*, and the fact that the row extends as far, or nearly as far, posteriorly as the marginal 8-shaped pores. Furthermore, the habits of the two are different, *castaneae* being known only from bark and *pasaniae* from leaves.

### ASTEROLECANIUM CAUDATUM Green

(Fig. 13, A-F; pl. 5, P)

Described in 1930 (49, pp. 214-215).

*Habit*.—Living on the lower surface of leaves.

*Test of female*.—Elongate, rounded at anterior end, lateral margins of anterior two-thirds of test parallel or indented by growth against hairs of leaf, posterior third usually strongly narrowed and produced, but sometimes tapering rather gradually from broader area to tip; 1.4-3 mm. long, 0.4-0.75 wide; slightly raised dorsally, with a faint longitudinal median carina, flat ventrally; greenish or very pale clear yellow, transparent, thin, slightly punctate; marginal filaments colorless, or whitish to very pale yellowish, usually absent from posterior end and rather sparse to fairly numerous elsewhere; sometimes with 1-20 whitish dorsal filaments placed at varying intervals in submarginal area, longer than marginal; circular larval exit in margin.

*Adult female*.—Shape similar to that of test, parasitized specimens apparently not strongly narrowed; 1.4-2.75 mm. long, 0.4-0.65 wide.

*Margin*: 8-shaped pores in a single row, the posterior pair of pores usually around four times the length of apical seta from setal bases and penultimate pair of pores at posterior third, or about six times the length of apical seta from setal bases; if posterior third is strongly narrowed, the row sometimes terminates at posterior third; if specimens taper rather gradually, the pores terminate about twice length of apical seta from bases of setae, several of the pores posteriorly being closer together; the spaces between the pores range normally from more than one to three or four times a pore's length, but sometimes there are long areas without pores, the latter condition probably being due to growth against hairs on the leaf; individual pores measuring 7-8  $\mu$  long and 4 wide.

*Dorsal surface*: None or 1-20 8-shaped pores in submarginal area, 8-10  $\mu$  long and 6-8 wide; minute 8-shaped and disk pores rather sparse; tubular ducts 32  $\mu$  long; dorsal tubes present.

*Ventral surface*: Antenna circular, flat, with 2 setae slightly longer than diameter of antenna; beak without setae, but rarely with 4 clear areas suggesting setal bases; spiracular bar somewhat rectangular; 3-6 quinquelocular pores close to spiracular opening or, rarely, extending toward body margin; 1 or 2 dark-rimmed 8-shaped pores sometimes present each side of mouth parts, usually 2 anterior to mouth parts, 1 each side of, and 2 anterior to, genital opening, and usually a few in lateral area of abdomen arranged in 2-7 short transverse rows; submarginal 8-shaped pores in a single row terminating near genital opening, spaces between pores about equal to twice the length of a marginal 8-shaped pore; 4 pairs of submarginal setae near posterior end of abdomen, the posterior pair about midway between genital opening and apical setae; 1 pair of setae posterior and 1 pair anterior to genital opening.

*Apex of abdomen*: Notch present; lobes rarely indicated; setae, apical 60-64  $\mu$  long, interapical 12  $\mu$  long, inner ventral 7-8  $\mu$  long, outer ventral 8  $\mu$  long; anal ring with 6 setae 32-36  $\mu$  long, and with an inner row of 6 and an outer row of 14 pores, divided on dorsal side and tending toward division on ventral.

*Second stage*.—Elongate, slender, tapering gradually from anterior third to posterior tip; margin with 8-shaped pores once or twice a pore's length apart, the row terminating three times a pore's length from bases of apical setae; available specimens poor and characters on dorsal surface indeterminate; ventral surface with 1 or 2 quinquelocular pores outside spiracle, minute characters indeterminate; apex of abdomen as in adult but apical setae broken, and other setae one-fourth shorter.

*Larva*.—Elongate elliptical.

Margin: With 28 8-shaped pores, anterior pore one-fourth larger than the others, axes of the posterior 6 pairs of pores diagonal, of the others longitudinal; 3 pairs of setae anteriorly.

Dorsal surface: Disk pores in lateral area and a few in submarginal area.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 1; VI, 2 long, 2 stout, 3 fairly stout, 1 slender; antennal bases one-third length of antenna apart; beak setae, 2 pairs apical, 1 pair median; anterior spiracle with 1 trilocular pore, posterior spiracle with 1 trilocular and 1 quinquelocular pore; leg setae, coxa 4, femur 1 on inner margin near base and 1 each on inner and outer margins near center, tarsus 2 on inner and 1 on outer margin; tibia one-half as long as tarsus; 9 pairs of submarginal 8-shaped pores; 6 pairs of submarginal minute setae on abdomen, 3 pairs of submarginal larger setae anteriorly; 1 pair of setae between antennae and mouth parts.

Apex of abdomen: Notch present; setae, apical 36  $\mu$  long, interapical 9  $\mu$  long, inner ventral 5.4  $\mu$  long, outer ventral 4  $\mu$  long; anal ring with 6 setae, each about 12.6  $\mu$  long, and with an inner row of 6 and an outer row of 12 or 13 pores, divided on dorsal side.

*Test of male*.—Nearly elongate elliptical, but somewhat pointed at posterior end and with a notch in posterior margin; 1 mm. long, 0.4–0.5 wide; slightly convex dorsally, particularly near anterior end, with a faint longitudinal median carina often disappearing near anterior margin, flat ventrally; pale greenish yellow, transparent, very thin, finely punctate; marginal filaments colorless to pale greenish yellow, sparse; dorsal filaments not observed.

*Adult male*.—0.8 mm. long.

Head: Antenna 10-segmented; formula (longest to shortest), (III), (IV, VII, X), (V, VI, VIII, IX), (I), (II); antennal setae, I–V, 12–15; VI, 18; VII, 20 (1 or 2 of which may be stout); VIII, 18; IX, 20; X, 1 very long (probably others broken), 3 stout, and 17 slender; basal bars diagonal; 16 setae between ventral eyespots and antennae.

Thorax: Bar between wing bases rectangular, two and a half times as long as wide; tibia slightly shorter than tarsus.

Abdomen: Four or five segments each with a pair of setae dorsally on lateral margin; 2 segments each with a pair of setae in ventral lateral area; lobes indicated, each with 1 long and 3 short setae; penis sheath with 3 or 4 setae dorsally near base, and 5 or 6 on each side of ventral opening.

*Male nymph*.—Distinguishing characters similar to those of adult male.

*Third-stage male*.—Nearly elliptical, posterior third tapering; margin with 8-shaped pores terminating one-half the length to the length of apical seta from setal bases, usually one to two times a pore's length apart; dorsal surface with 0–14 8-shaped pores in submarginal area; ventral surface with 1 quinquelocular pore outside spiracle, legs represented by 3 pairs of very small, inconspicuous, circular areas, 5 pairs of submarginal setae on abdomen, and 1 pair of setae in median area; apex of abdomen as in adult female, but all setae about one-fourth shorter.

*Data*.—Redescribed from unmounted material and mounted specimens consisting of 2 females and 2 adult males on *Bambusa* sp., Sao Paulo, Brazil, J. Melzer, from E. E. Green, types; 66 adult females, 1 second-stage specimen, 85 larvae, 2 adult males, 1 male nymph, and 5 third-stage males, all on *Bambusa*, unless otherwise indicated, the data for these being as follows: *B. vulgaris*, Brazil, P. H. Dorsett, U. S. N. H.; *B. flexuosa*, Ding Bang, between Hanoi and Boi, Indo-China, May 3, 1891, U. S. N. H.; *B. pallescens*, Sao Paulo, Brazil, J. Barbosa, 1907?, U. S. N. H.; *B. pallescens* var. *usteri*, Sao Paulo, Brazil, April 5, 1907, U. S. N. H.; *B. pallescens*, Botanic Gardens, Sao Paulo, Brazil, J. Barbosa, May 1907, U. S. N. H.; *B. pallescens*, Rio de Janeiro, Brazil, P. H. Dorsett, October 26, 1913, U. S. N. H.; *B. pallescens*, Santos, Brazil, H. M. Curran, 1915, U. S. N. H.; *B. pallescens*, Botanic Gardens near Rio de Janeiro, Brazil, H. M. Curran, November 1915, U. S. N. H.; *Bambusa (Guadua)* sp., Botanic Gardens near Rio de Janeiro, Brazil, H. M. Curran, November 1915, U. S. N. H.; *Dendrocalamus* sp., Sai Lin, Kwangtung, China, F. A. McClure, January 21, 1925; *B. pallescens*,

Juiz de Fora, Minas Geraes, Brazil, Agnes Chase, February 21, 1925, U. S. N. H.; *Bambusa* sp., T'ai P'ing Shi, Ts'ing Uen district, Kwangtung, China, F. A. McClure, April 20, 1925; *Bambusa* sp., Lingnan University, Canton, China, F. A. McClure, August 19, 1926; *B. cf. spinosa*, Honam Island, Kwangtung, China, F. A. McClure, August 20, 1926; *Dendrocalamus strictus*, Jardin d'essai, Alger, Algeria, A. Balachowsky, November 27, 1927; *Bambusa* sp., Chung Chou, Kwangsi, China, F. A. McClure, December 10, 1928; *Dendrocalamus* sp., Wuchow, Kwangsi, China, F. A. McClure, December 14, 19, 1928; *Bambusa* sp., San Ts'uen, Hainan Island, Kwangtung, China, F. A. McClure, November 18, 1929; *B. nana*, Lingnan University, Canton, China, F. A. McClure, December 24, 1929; *B. pallescens*, Rio de Janeiro, Brazil, Agnes Chase, April 26, 1930, U. S. N. H.; *Bambusa* sp., Lingnan University, P'oon Ue district, Kwangtung, China, F. A. McClure, September 8, 1931; *Bambusa* sp., Po T'ing Shi, Ling Shui district, Kwangtung, China, F. A. McClure, April 29, 1932; bamboo, Rio de Janeiro, Brazil, D. T. Fullaway, November 6, 1935.

The following statement occurs in the original description of *caudatum* (49, p. 215):

Margin of body with a series of rather large paired pores at intervals of approximately four times their own longer diameter; with an irregular submarginal series of very much smaller paired pores. The paired pores are inconspicuous and difficult to demonstrate.

Actually, the smaller paired pores are the marginal, and the larger pores are in the submarginal area of the dorsal surface. The marginal 8-shaped pores often occur at varying intervals. The dropping out of pores at various points and the variability of the terminating point of the 8-shaped pores probably are due to growth against hairs or veins of the leaves.

The species is closely related to *pseudomiliaris*, but as a rule is much larger, being 1.4–2.75 mm. long instead of 0.7–1.2; the marginal 8-shaped pores are usually at least twice a pore's length apart and they terminate around four times the length of an apical seta from the bases of apical setae. *Asterolecanium caudatum* also has 3 to 6 instead of 8 to 14 quinquelocular pores in each spiracular pore band.

#### ASTEROLECANIUM CERIFERUM variety CERIFERUM Green

(Fig. 13, G–M; pl. 8, P)

Described in 1909 (42, pp. 324–325).

*Habit*.—"On leaves of a species of bamboo, the insects resting in shallow pits on the under surface of the leaf, these hollows appearing on the upper surface as raised orange-coloured patches bearing ridge-like rows of hypertrophied cuticular cells."

*Test of female*.—"Test of adult female elongate, narrow; lateral margins approximately parallel, extremities rounded. Dorsum moderately convex, the posterior third depressed and slightly concave; sides and front almost perpendicular, slightly sloping inwards, demarked from the dorsum by the angular marginal line; posterior extremity free, the under parts sloping sharply inwards so that, in profile (fig. 4), it appears to be sharply pointed. Ventral surface convex, owing to a marked depression in the leaf beneath the insect. Margin with straight stout glassy colourless filaments, rather widely spaced, longest at the two extremities. Sides thickly coated with opaque, white, mealy secretion, which extends slightly over the margin, concealing the bases of the glassy filaments. Colour, during life, pale lemon yellow, darkening afterwards to ochreous. Length 1.5 mm. Breadth 0.5 mm." (42, p. 324.)



*Adult female*.—Elongate, lateral margins nearly parallel, somewhat constricted near posterior end; 1 mm. long, 0.45 wide.

Margin: 8-shaped pores in a single row terminating near posterior constriction or six or seven times a posterior pore's length from bases of apical setae, anterior and posterior pores largest, one 12  $\mu$  long and 8 wide, the majority around 8  $\mu$  long and 5 or 6 wide, varying in size on lateral margins with the smallest 6  $\mu$  long and 4 wide, axes of pores transverse, longitudinal or diagonal to body margin, usually twice a pore's length apart; quinquelocular pores ventrad of 8-shaped pores in a single or double row near posterior end, and in a row 2-6 pores wide elsewhere, terminating at the posterior pair of 8-shaped pores or 3 8-shaped pores from it, also in a double row dorsad of 8-shaped pores, terminating at posterior third, the rows either distinct or interspersed among the 8-shaped pores; disk pores in a fairly regular row in the ventral row of quinquelocular pores, and in an irregular row in the dorsal row of quinquelocular pores, both rows of disk pores terminating slightly more than the length of an apical seta from bases of setae.

Dorsal surface: Both large and minute 8-shaped pores absent; disk pores fairly numerous; tubular ducts 28  $\mu$  long; dorsal tubes present.

Ventral surface: Antenna stout thimble-shaped, with 2 setae slightly shorter and 1 much shorter than diameter of antenna; beak without setae; spiracle with bar rather broad, with atrium large and with opening very large, quinquelocular pores in atrium and extending over edge of opening to marginal row of quinquelocular pores, around 20 pores in and on edge of spiracle, around 10 or 12 outside opening of anterior spiracle in a band 5 or 6 pores wide, giving the appearance of a widening of marginal row rather than that of a spiracular row extending to body margin; posterior spiracle opening directly into marginal row of quinquelocular pores; 8-shaped pores 5  $\mu$  long and 4 wide, scattered on anterior half of body and concentrated between mouth parts and posterior spiracles; dark-rimmed 8-shaped pores observed only on abdomen, arranged in a fairly definite single and double row from posterior spiracles to near penultimate pair of marginal 8-shaped pores, and tending toward distribution in 2 or 3 sparse transverse rows in lateral area; submarginal 8-shaped pores apparently absent, the only indication of a submarginal row being the dark-rimmed 8-shaped pores in lateral area; 6 pairs of submarginal setae posterior to posterior spiracles, the posterior pair nearer to the posterior pair of marginal 8-shaped pores than to the apical setae; 1 pair of setae posterior to genital opening, 1 pair anterior to opening, and 2 additional pairs placed at uniform intervals anterior to the latter.

Apex of abdomen: Setae, apical 5.4  $\mu$  long, outer ventral 3  $\mu$  long; anal opening in margin, circular; anal tube small at opening, greatly enlarged near center, smaller at inner end, heavily sclerotized on outer half, and slightly sclerotized on inner end; anal ring a sclerotized, circular band, with 2 setae apparently 2.7  $\mu$  long.

*Second stage*.—Resembling adult female in shape but without constriction near posterior end; margin with quinquelocular pores in a single row only ventrad of 8-shaped pores, disk pores very sparse, all ventrad of 8-shaped pores; ventral surface with atrium of spiracle slightly enlarged and with 3-5 quinquelocular pores in atrium and extending to body margin, large 8-shaped pores less numerous but in same relative position as in adult, dark-rimmed 8-shaped pores very sparse, setae not observed, possibly owing to poor condition of specimen; apex of abdomen with apical and ventral setae broken, anal tube shorter than in adult, anal opening, anal ring, and ring setae as in adult.

*Third-stage male*.—Resembling adult female in shape and size but without constriction near posterior end; margin with 8-shaped pores much less numerous than in adult female, only 2 or 3 at anterior end and 1 in lateral area, quinquelocular pores in a single row ventrad of 8-shaped pores, terminating before the 8-shaped pores, disk pores sparse and in a definite row only near posterior end; dorsal surface with a semicircular submarginal row of 7 or 8 8-shaped pores near anterior margin, which are one-third larger than posterior marginal 8-shaped pores; ventral surface with 4 pores in spiracle and 3 or 4 outside spiracular opening, large 8-shaped pores somewhat smaller in comparison to marginal than in female, legs represented by 3 pairs of circular, slightly sclerotized areas, apparently without claws, apparently without dark-rimmed 8-shaped pores but with submarginal (possibly actually dark-rimmed) 8-shaped pores in a single row on posterior half of body, terminating at the posterior pair of marginal 8-shaped pores and as numerous as corresponding marginal 8-shaped pores, setae present in median area; apex of abdomen with apical setae minute, anal tube apparently sclerotized throughout, no ring setae observed.

*Data.*—Redescribed from one test, two mounted females, one mounted second-stage specimen, and one mounted third-stage male on bamboo, Hewaheta, Ceylon. E. E. Green, March 1910.

The test available for study is in such condition that little of value can be added to Green's excellent description, but it should be noted that the sides, though nearly perpendicular, curve from the dorsum rather than being demarked by an "angular marginal line."

The species is unusual morphologically. The presence of quinquelocular pores on each side of the marginal 8-shaped pores has not been observed elsewhere in the genus and the presence of relatively large 8-shaped pores on the ventral surface has been observed rarely. Green associated the 8-shaped pores with the dorsal surface. In all adult females at hand, however, there are no 8-shaped pores on the dorsal surface although they do occur on the ventral surface. Green stated (42, p. 324), "anal ring apparently hairless, at the base of a remarkable funnel-shaped chitinous tube." The ring has two setae, however.

### ASTEROLECANIUM CHINAE, new species

(Fig. 14, A-I; pl. 6, E)

*Habit.*—Living on the lower surface of leaves.

*Test of female.*—Somewhat elongate ovoid, tapering strongly from center to posterior tip, 1.75–2.25 mm. long, 1.10–1.45 wide; nearly flat dorsally, with a faint longitudinal median carina, flat ventrally; brownish or very pale yellow, transparent, thin, slightly punctate; marginal and dorsal filaments whitish, the latter fragmentary, present in submarginal and a few in lateral or median areas; elliptical larval exit in margin.

*Adult female.*—Somewhat elongate ovoid, tapering rather strongly from center to posterior tip, or not tapering strongly from center, but with posterior tip narrowed and produced; 1.25–2 mm. long, 1–1.25 wide.

*Margin:* 8-shaped pores in a single row terminating about a posterior pore's width from bases of apical setae, anterior pores around 14.4  $\mu$  long and 9 wide, the others around 10.8  $\mu$  long and 7.2 wide, interspaces usually less than the width of a pore but occasionally equal to the length of a pore; quinquelocular pores in a single row normally terminating at the posterior or penultimate pair of 8-shaped pores, usually as numerous as 8-shaped pores; disk pores dorsal of, and terminating with, the 8-shaped pores, about as numerous as those pores.

*Dorsal surface:* 8-shaped pores distributed in submarginal and lateral areas and a few in median area, tending toward arrangement in indefinite transverse rows, 29 and 112 the greatest range noted, some 10.8  $\mu$  long and 7.2 wide, but the majority about 14.4  $\mu$  long and 9 wide; minute 8-shaped and disk pores numerous; tubular ducts 36–40  $\mu$  long; dorsal tubes present.

*Ventral surface:* Antenna short, with 2 setae longer and 1 or 2 shorter than diameter of antenna; beak without setae; spiracular bar fairly broad; anterior spiracle with 13–26 quinquelocular pores extending to body margin, usually in a loose group near opening, then in an irregularly single row but usually in a triple row at margin; posterior spiracle with 3–7 quinquelocular pores in a loose group around opening, rarely with 1 or 2 at intervals between group and body margin; multilocular pores, totaling 63–76 and with 10 loculi, in 5 complete rows (1 of which is sometimes interrupted) and in 2, or sometimes in 3, interrupted rows, posterior row with 10–16, penultimate with 15–21, next with 16–23, next with 7–12, next with 2–6, and each of next 2 or 3 with 1–3; none or 1 dark-rimmed 8-shaped pore each side of beak, a few scattered anterior to mouth parts, a few in lateral area of abdomen, and others arranged in 4 or 5 transverse rows among multilocular pores; submarginal 8-shaped pores in a slightly irregular single row terminating near posterior row of multilocular pores, nearly or quite as numerous as marginal 8-shaped pores; 5 pairs of submarginal setae on abdomen, the posterior pair 3 or 4 8-shaped pores from the posterior pair of marginal 8-shaped pores; 1 pair of setae in each of the posterior 3 rows of multilocular pores.



Apex of abdomen: Notch present; setae, apical 30–36  $\mu$  long, one 7–9  $\mu$  long presumably interapical and normally inside the apical, but sometimes actually outside apical, inner ventral 5.4–7.2  $\mu$  long, outer ventral 5.4–7.2  $\mu$  long; anal ring with 2 setae 27–30  $\mu$  long and four 32–36 and with an inner row of 6 and an outer row of 16 or 17 pores, divided on dorsal side; ventral surface of apex slightly sclerotized close to margin and median line.

*Larva*.—Elongate elliptical.

Margin: With 28 8-shaped pores, the anterior pair slightly larger than the others, axes of all longitudinal; 3 pairs of setae anteriorly.

Dorsal surface: 8-shaped pores in a submedian row of 1–5 on each half of body, a total of 6 or 7 observed, the anterior pore the largest and about the same size as marginal pores of same segment, the others around three-fourths as large as marginal pores of same segments; disk pores sparse, in submarginal area.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 0; VI, 2 long, 2 stout, 3 fairly stout, 1 slender; antennal bases about one-half length of antenna apart; beak setae, 2 pairs apical, 1 pair median; spiracle with 1 trilobular pore; leg setae, coxa 4, femur 1 on inner margin near base and 1 each on inner and outer margins near center, tarsus 2 on inner and 1 on outer margin; tibia one-half as long as tarsus; 9 pairs of submarginal 8-shaped pores; apparently 6 pairs of submarginal minute setae on abdomen, 3 pairs of submarginal larger setae at anterior end; 1 pair of setae between antennae and mouth parts.

Apex of abdomen: Notch present; setae, apical 63  $\mu$  long, interapical 11  $\mu$  long, inner ventral 3.6  $\mu$  long, outer ventral 3.6  $\mu$  long; anal ring with 6 setae 16–18  $\mu$  long, also with an inner row of 6 and an outer row of 10–12 pores, divided on dorsal side.

*Data*.—Described from 2 mounted females on *Bambusa* sp., Kowloon, China, A. Koebele, February 25, 1900, paratypes; 4 mounted females on bamboo, Foochow, China, C. R. Kellogg, March 1, 1919, paratypes; 1 mounted female on *Bambusa flexuosa*, Chekiang, China, C. V. Chiao, April 1925, U. S. N. H., paratype; unmounted material, 2 mounted females, and 11 mounted larvae on *Phyllostachys* sp., Ho Ch'uen, Kaang Shek, Ts'uen Fong, Kwangtung, China, F. A. McClure, April 25, 1926, holotype and paratypes.

Most closely related to *fusum*, *subdolum*, and *vulgare*. The combined number and arrangement of spiracular quinquelocular pores in *chinae* is unusual.

### ASTEROLECANIUM CIRCULARE, new species

(Fig. 14, J–Q; pl. 7, T)

*Habit*.—Living on the upper surface of leaves.

*Test of female*.—Circular or slightly longer than wide, posterior end slightly produced and upturned; approximately 0.65–0.85 mm. in diameter; strongly convex dorsally, flat ventrally; very pale greenish yellow, transparent, thin, smooth; marginal filaments bright salmon or whitish, not observed at posterior end; elliptical larval exit in margin.

*Adult female*.—Practically circular, 0.55–0.8 mm. in diameter.

Margin: 8-shaped pores in a single row terminating one and a half to twice length of apical seta from setal bases, posterior pores 9  $\mu$  long and 4 wide, the others about 11  $\mu$  long and 4.5 wide, nearly contiguous; quinquelocular pores in a single row terminating at the posterior or penultimate pair of 8-shaped pores, as numerous as, or slightly more numerous than, 8-shaped pores.

Dorsal surface: Minute 8-shaped pores very sparse, a few on abdomen; disk pores sparse; tubular ducts 28  $\mu$  long; dorsal tubes present.

Ventral surface: Antenna short, sometimes very rough, with 2 setae longer than diameter of antenna; 3 or 4 quinquelocular pores between antenna and margin; beak without setae; spiracular bar fairly broad; 8–14 quinquelocular pores extending from spiracle to body margin in a single row; 1 or 2 dark-rimmed 8-shaped pores each side of beak, a few in lateral area of abdomen, and a few in 1 or 2 transverse rows anterior to genital opening; submarginal 8-shaped pores in a single row terminating near the posterior pair of marginal 8-shaped pores, about one-half as numerous as marginal 8-shaped pores; 5 pairs of sub-



marginal setae on abdomen, the posterior pair around length of apical seta from bases of apical setae; 1 pair of setae posterior to genital opening, 1 pair anterior to opening, and 1 pair anterior to those.

Apex of abdomen: Notch present; setae, apical 38-44  $\mu$  long, interapical 4-5.4  $\mu$  long, intermediate ventral 3-5.4  $\mu$  long, outer ventral 4.6-5.4  $\mu$  long; anal ring with 6 setae, each about 24  $\mu$  long, also with an inner row of 6 and an outer row of 12 pores; ventral surface of apex slightly sclerotized in dentate rows or sclerotized and rugose.

*Larva*.—Nearly elliptical.

Margin: With 28 rather elongate, slender 8-shaped pores, the posterior 2 pairs of pores slightly larger than those adjacent, next 4 pairs uniform in size, the others gradually increasing in size to anterior pair, which is slightly larger than posterior pair; axes of the posterior 6 pairs strongly diagonal or actually transverse, the others longitudinal; apparently 3 pairs of setae anteriorly.

Dorsal surface: 8-shaped pores, totaling 13-15, in a submedian row of 6-8 on each half of body, about one-half the size of a posterior marginal 8-shaped pore; disk pores in lateral area and a few in submarginal area.

Ventral surface: Antennal setae, I, 2; IV, 1; V, 1; VI, 2 long, 2 stout, 3 fairly stout, 1 slender; bases of antennae about one-half length of antenna apart; beak setae, 2 pairs apical, 1 pair median; anterior spiracle with 1 trilobular, posterior with 1 trilobular and 1 quinquelocular pore; leg setae, coxa 4, femur 1 on inner margin near base and 1 each on inner and outer margins near center, tarsus 2 on inner and 1 on outer margin; tibia one-half length of tarsus; 9 pairs of submarginal 8-shaped pores; 7 pairs of submarginal minute setae, on abdomen and thorax, 3 pairs of submarginal larger setae at anterior end; 1 pair of setae between antennae and mouth parts.

Apex of abdomen: Setae, apical 36-42  $\mu$  long, interapical 3.6  $\mu$  long, intermediate ventral (rather close to median line) 3.6  $\mu$  long, outer ventral 3.6  $\mu$  long; anal ring with 6 setae, each about 5.2  $\mu$  long.

*Data*.—Described from specimens (30 females and 75 larvae mounted) removed from *Bambusa* sp. unless otherwise indicated. The following records are represented: *B. spinosa*, Hué, Annam, Indo-China, A. S. Hitchcock, September 26, 1921, U. S. N. H.; Au Tsai and Chung Chou, Kwangsi, China, F. A. McClure, September 21, 1925, November 5 and December 10, 1928. The following lots collected in Kwangtung, China: *B. stenostachya*, Canton, E. D. Merrill, October 3-November 9, 1916, U. S. N. H.; *B. beecheyana*, Canton, C. W. Howard, March 21, 1918; *B. beecheyana*, Canton, A. S. Hitchcock, September 1, 1921, U. S. N. H. Host material for the following remaining lots collected in China by F. A. McClure: Tai P'ing Shi, Ts'ing Uen district, April 20, 1925, including holotype; Bamboo Garden, Lingnan University, Canton, August 19 and September 3, 1926, September 8 and October 31, 1931, and March 15, 1932; *B. spinosa*?, Honam Island, August 20, 1926; San Ts'uen, Hainan Island, November 18, 1929; Sing Kok, Yeung Kong district, December 18, 1931; Shek Kwat, She Ts'uen, Mau Ming district, December 22, 1931.

Rather closely related to *parvum*, but having marginal 8-shaped pores close together and tubular ducts 28 instead of 12  $\mu$  long. Closely related to *radiatum*, but with many marginal quinquelocular pores, while *radiatum* has none.

#### ASTEROLECANIUM COFFEAEE Newstead

(Fig. 15, A-K; pl. 4, C)

Described in 1911 (76, pp. 161-162) on *Coffea arabica* from Dutch East Africa.

*Habit*.—Living on bark.

*Test of female*.—Elongate ovoid or broadly ovoid, posterior end slightly produced and often slightly upturned; 1.5 mm. long, 1-1.25 wide; convex dorsally,

most strongly so at anterior end, sloping to posterior end, with 3 faint longitudinal carinae or with none; flat ventrally; greenish or clear yellow, transparent, fairly thick, punctate; marginal filaments pale yellowish or deep pinkish, fragmentary, but apparently shorter near posterior end than elsewhere; dorsal filaments of same color as marginal, occurring along median line and sparse on either side of median crest but more numerous in submarginal area, as long as to twice as long as marginal filaments; circular larval exit in ventral surface at the margin.

*Adult female*.—Shape similar to that of test, 1.10–1.25 mm. long, 1 wide.

Margin: 8-shaped pores in a single row terminating nearly length of apical seta from setal bases; the posterior 3 pairs of pores 12  $\mu$  long and 8–9 wide, those adjacent 9–10  $\mu$  long and 7 wide, most of the others 10–12  $\mu$  long and 6–7 wide, usually a pore's length apart, usually the axes of a few diagonal or somewhat out of alignment; quinquelocular pores in a single row terminating at the posterior or penultimate pair of 8-shaped pores, or with 1 pair posterior to the posterior 8-shaped pores, about one-half as numerous as 8-shaped pores at ends of body, and one and a half times as numerous elsewhere; disk pores ventrad of quinquelocular pores, terminating posterior to 8-shaped pores nearly directly anterior to apical setae, posteriorly as numerous as 8-shaped pores and usually nearly as numerous elsewhere.

Dorsal surface: 8-shaped pores along median line, in lateral and submarginal areas, and sometimes a few or many in submedian area, a few 10  $\mu$  long and 7 wide, majority 12–14  $\mu$  long and 8–9 wide, and many 16–18  $\mu$  long and 10–12 wide; the largest pores placed at regular or irregular intervals along median line with smaller pores surrounding them, these sometimes arranged in circles, majority of submedian pores small, a fairly definite row of the larger pores paralleling margin but well removed from it, a few smaller pores between the larger ones, number and size of pores varying considerably but general arrangement rather uniform; minute 8-shaped pores sparse among large 8-shaped pores, numerous elsewhere; disk pores fairly numerous; tubular ducts 30  $\mu$  long.

Ventral surface: Antenna dome shaped, with 2 setae longer than diameter of antenna; 3 or 4 quinquelocular pores between antenna and margin; beak with 2 pairs of setae; spiracle with bar broad, nearly subcircular; a sclerotized area extending around spiracular opening inclosing a group of 8–12 quinquelocular pores, and 8–13 similar pores extending to body margin in an irregularly single row; multilocular pores, totaling 101–117 and having 6–10 (usually 10) loculi, apparently in 7 complete and 2 interrupted rows, with anterior row anterior to posterior spiracles, posterior and penultimate rows each with 8–10, next with 15 or 16, each of next 2 with 19–27, next with 12–15, next with 7–9, and each of anterior 2 rows with 4–6; 3–6 dark-rimmed 8-shaped pores each side of beak, a few scattered anterior to mouth parts, and a few arranged in 5 or 6 transverse rows on abdomen: submarginal 8-shaped pores in a single row terminating near penultimate row of multilocular pores, plainly single except near posterior end, where a few pores are so placed as to suggest a double row, nearly or actually as numerous as marginal 8-shaped pores; 1–4 disk pores near ends of penultimate row (sometimes in submedian area also) and of each of the 4 or 5 rows anterior to penultimate row of multilocular pores; submarginal setae in a complete row terminating nearly directly anterior to the penultimate or posterior pair of marginal 8-shaped pores; 2 pairs of setae in posterior row of multilocular pores, 1 pair in penultimate row, and 1 pair in first row anterior to penultimate.

Apex of abdomen: Notch present; lobes strongly developed; setae, apical 57  $\mu$  long, interapical 12.6  $\mu$  long, dorsal 9  $\mu$  long, inner ventral 5.4  $\mu$  long, intermediate ventral 5.4  $\mu$  long; anal ring with 6 setae about 37  $\mu$  long, and with an inner row of apparently 6 and an outer one of apparently 12 pores, tending toward division on dorsal side: ventral surface of apex with a densely sclerotized, irregularly elongate area extending anteriorly from margin of notch on each half of body, the surrounding area slightly sclerotized and rugose.

*Larva*.—Elongate ovoid, tapering near posterior end.

Margin: With 28 8-shaped pores, the posterior, and the anterior 8 pairs, slightly larger than the other 5 pairs, axes of the posterior 6 pairs transverse, of the others longitudinal; a pair of minute setae close to each of the posterior 3 pairs of pores; 4 pairs of setae anteriorly.

Dorsal surface: 8-shaped pores in a submedian row of 10 and a lateral row of 9 or 10, on each half of body, the posterior pores slightly smaller than the anterior, all slightly smaller than, or same size as, marginal pores of same segments; disk pores rather close to marginal, and a few between lateral and

submedian 8-shaped pores; a pair of setae anterior to the anterior pair of submedian pores.

Ventral surface: Antennal setae, I, 2; IV, 1; V, 1; VI, 2 long, 2 stout, 3 fairly stout, 2 slender; antennal bases one-third length of antenna apart; beak setae, 2 pairs apical, 1 pair basal; spiracles each with 1 trilocular and 1 quinquelocular pore, or anterior spiracle with 2 trilocular pores; leg setae, coxa 4, femur 1 on inner margin near base and 1 each on inner and outer margins near center, tarsus 2 on inner and 1 on outer margin; tibia one-half as long as tarsus; 7 pairs of submarginal 8-shaped pores of which 1 pair is between the antennae and the posterior pair on the third segment anterior to penultimate segment of body; disk pores 6-8 in number, all posterior to the posterior submarginal 8-shaped pores or 1 anterior to these and on same segment; 10 pairs of submarginal minute setae, on abdomen and thorax, 3 pairs of submarginal larger setae at anterior end; 2 pairs of setae between antennae and mouth parts.

Apex of abdomen: Notch present; setae, apical,  $63 \mu$  long, interapical  $5.4 \mu$  long, dorsal  $2.6 \mu$  long, inner ventral  $3.6 \mu$  long, intermediate ventral apparently  $2.4 \mu$  long; anal ring with 6 setae about  $23.4 \mu$  long and with an inner row of 6 and an outer one of 12 pores, tending toward division on dorsal side; ventral surface of apex with a heavily sclerotized, irregularly rectangular area anterior to intermediate ventral setae, surrounding area slightly sclerotized and rugose.

*Data*.—Redescribed from unmounted material, three mounted females, and six mounted larvae on *Coffea* sp., Kenya, Africa, R. H. Le Pelley, March 1933, from E. E. Green.

Both Laing (56, p. 467) and James (53, p. 421) have pointed out that the filaments of the tests of this species are distinctly pinkish instead of golden yellow as stated by Newstead. In some tests at hand, all of which are dry, the filaments are the same color as the test, while in others they are distinctly pinkish.

Newstead stated (76, p. 161), "Margin with two rows of figure-of-8 spinnerets and also a number of others arranged irregularly along the submarginal area; first marginal row placed closely together: second marginal row widely separated." There is only one marginal row of 8-shaped pores, the "second marginal row" of Newstead being on the dorsal surface. In the antennae of the larva, according to James (53, p. 424), "eight joints can be distinguished in the majority of specimens." The specimens at hand, however, have the antennae six-segmented. Eight antennal segments have not been found in any species of this genus.

### ASTEROLECANIUM CONSPICUUM Brain

(Fig. 15, L-S; fig. 16, A; pl. 3, D)

Described in 1920 (12, p. 112).

*Habit*.—Living on bark in shallow or fairly deep pits.

*Test of female*.—Usually nearly circular, but often slightly longer than wide or wider than long, approximately 1-1.5 mm. in diameter; nearly flat or very slightly convex dorsally, sometimes with a faint longitudinal median carina, and with faint transverse striations, slightly to rather strongly convex ventrally; light brownish or greenish yellow, translucent, fairly thick; marginal filaments silvery or very pale yellowish, dorsal filaments of the same color and very slightly longer than marginal, numerous; elliptical larval exit in margin.

*Adult female*.—Of same shape as test, 1-1.25 mm. in diameter.

Margin: 8-shaped pores in a single row terminating length of apical seta from setal bases, individual pores measuring 12-13  $\mu$  long and 8-9 wide, around a pore's width apart; quinquelocular pores in a single row from near antennae to 3-9 8-shaped pores from the posterior pair of 8-shaped pores, half as numerous as 8-shaped pores at ends of row, elsewhere as numerous; disk pores mostly in a single row but double near posterior end, situated ventrad of quinquelocular pores, and terminating posterior to the 8-shaped pores nearly directly anterior to apical setae, about as numerous as 8-shaped pores.



Dorsal surface: 8-shaped pores tending toward arrangement in short transverse rows on median line and in circles near margin, those between definite circles and the median line somewhat scattered but tending toward arrangement in circles, 13-16  $\mu$  long and 9-10 wide, the median pores as large as any; minute 8-shaped pores present; disk pores numerous; tubular ducts 36  $\mu$  long.

Ventral surface: Antenna nearly flat, sunken in derm, with 2 setae longer and 3 shorter than diameter of antenna; with 3 or 4 quinquelocular pores between antenna and margin or with none; beak with 2 pairs of setae; spiracular bar fairly broad, sometimes nearly subcircular; 18-29 quinquelocular pores extending from spiracle to body margin in a row which is single to triple or even 4 pores wide at margin, occasional pores in some specimens with an elongate, slender, sclerotized projection on edge; multilocular pores, totaling 118-131 and having 10 loculi, in 9 rows of which 5-7 are complete and 2-4 interrupted, anterior row anterior to posterior spiracles, interrupted rows very irregularly arranged; posterior and penultimate rows each with 10-15 pores, next with 16-22, each of next 2 with 20-28, next with 15 or 16, next with 6-11, next with 8-15, and anterior row with 2-4; a few anterior multilocular pores sometimes with an elongate, slender, sclerotized projection on edge; 3-5 dark-rimmed 8-shaped pores each side of beak, some scattered anterior to mouth parts, a few scattered in lateral area, and a few arranged in 2 transverse rows among multilocular pores; submarginal 8-shaped pores in an irregularly single row terminating near the second row anterior to the penultimate row of multilocular pores, about as numerous as corresponding marginal 8-shaped pores; submarginal setae in a complete row terminating two-thirds length of apical seta from bases of apical setae; 2 pairs of setae in posterior row of multilocular pores, 1 pair in penultimate row, and 1 pair in first row anterior to penultimate.

Apex of abdomen: Notch present; lobes sometimes indicated; setae, apical 48 or possibly 50  $\mu$  long, interapical 10.8  $\mu$  long, dorsal 5.4-7.2  $\mu$  long, inner ventral 5.4  $\mu$  long, intermediate ventral 5.4  $\mu$  long; anal ring with 6 setae 39-43  $\mu$  long and with an inner row of 6 and an outer one of 14 or 15 pores, divided on dorsal and ventral sides; ventral surface of apex with a slightly sclerotized, elongate area extending anteriorly from base of each interapical seta, surrounding area slightly sclerotized in dentate rows, or sclerotized and rugose.

*Larva*.—Nearly elliptical.

Margin: With 28 8-shaped pores, the posterior 6 pairs slightly smaller than the others and their axes transverse, axes of the others longitudinal; a pair of minute setae close to each of the posterior 3 pairs of pores; 3 pairs of setae anteriorly.

Dorsal surface: 8-shaped pores in a submedian row of 9 and a lateral row of 2 or 3, on each half of body, with a total of 22 or 23, submedian pores very slightly larger than lateral, and practically same size as marginal pores of same segments; disk pores in lateral area.

Ventral surface: Antennal setae, I, 2; IV, 1; V, 1; VI, 2 long, 2 stout, 3 fairly stout, 2 slender; bases of antennae one-fourth length of antenna apart; beak setae, 2 pairs apical, 1 pair basal; anterior spiracle with 2 trilocular pores, posterior spiracle with 1 trilocular and 1 quinquelocular pore; leg setae, coxa 4, femur 1 on inner margin near base and 1 each on inner and outer margins near center, tarsus 2 on inner and 1 on outer margin; tibia one-half length of tarsus; apparently 8 pairs of submarginal 8-shaped pores, 1 pair of which is between the antennae; apparently 10 pairs of submarginal minute setae, on abdomen and thorax, 2 pairs of submarginal larger setae at anterior end; 2 pairs of setae between antennae and mouth parts.

Apex of abdomen: Notch present; setae, apical 56  $\mu$  long, interapical about 7.2  $\mu$  long, dorsal 2  $\mu$  long, inner ventral 3  $\mu$  long, intermediate ventral 3  $\mu$  long; anal ring with 6 setae apparently 20  $\mu$  long and with an inner row of 6 and an outer row of 12 pores, divided on dorsal and ventral sides; ventral surface of apex slightly sclerotized in dentate rows, or rugose; a small area anterior to each intermediate ventral seta apparently slightly more heavily sclerotized than elsewhere.

*Data*.—Redescribed from unmounted material and the following mounted specimens on *Acacia* sp., from Pretoria, South Africa: Six females and 2 very poor larvae, C. K. Brain, September 1914, Brain No. 17, type and paratypes, and 4 females and 10 larvae from H. K. Munro, August 24, 1938.

The filaments of available tests are whitish or yellowish instead of reddish, as stated by Brain (*l.c.*, p. 112).

This species is more closely related to *coffear* than to other known species. Both are unusual in having what appears to be an intermediate ventral seta unaccompanied by an outer ventral seta.

### ASTEROLECANIUM CORALLINUM Takahashi

(Fig. 16, B-M; pl. 9, M)

Described in 1928 (*l.c.*, pp. 339-340).

*Habit*.—Living on bark, in shallow pits.

*Test of female*.—Slightly longer than wide, about 1.4 mm. long, 1 wide; slightly convex dorsally, with a faint longitudinal median carina and faint transverse striations, slightly convex ventrally; greenish yellow, transparent, thin, punctate; marginal filaments pale salmon, slightly shorter near posterior end than elsewhere; dorsal filaments whitish, very short (possibly broken), and sparse; elliptical larval exit in margin.

*Adult female*.—Longer than wide, 1-1.3 mm. long, 0.75-1 wide.

Margin: 8-shaped pores in a single row terminating around twice a pore's length from bases of apical setae, posterior pores 11-12  $\mu$  long and 8 wide, the others 12-13  $\mu$  long and 8-9 wide, usually a pore's width apart; quinquelocular pores in a single row terminating at the posterior pair of 8-shaped pores, at least as numerous as 8-shaped pores near ends of body and usually slightly more than twice as numerous elsewhere.

Dorsal surface: 8-shaped pores in median and submarginal areas, tending toward arrangement in transverse rows, fairly numerous, about 10  $\mu$  long and 8 wide; minute 8-shaped pores numerous; disk pores rather sparse; tubular ducts 28  $\mu$  long.

Ventral surface: Antenna short, rounded, sunken in derm, with 2 setae slightly longer, and apparently 5 much shorter, than diameter of antenna; 3 or 4 quinquelocular pores between antenna and margin; beak with 2 pairs of setae; spiracle with bar nearly circular and with lines extending around opening, the lined area sometimes slightly sunken and containing 7-15 quinquelocular pores, 15-25 similar pores extending to body margin in an irregularly single or double row, a total of 23-37 in group and row combined; legs represented by 3 pairs of small sclerotized areas each with a slightly curved, short, rather stout claw, 2 or 3 minute setae, and many clear areas suggestive of setal bases; multilocular pores, totaling 95-106 and having 6-11 (usually 10) loculi, in 9 rows, of which 5 or 6 are complete and 3 or 4 are interrupted, anterior row anterior to posterior spiracles, posterior and penultimate rows each with 8-12, next with 14-16, next with 18-22, each of next 2 with 9-13, each of next 2 with 8 or 9, and anterior row with 2-5; 2-6 dark-rimmed 8-shaped pores each side of beak, a few scattered anterior to mouth parts, and a few tending toward arrangement in 5 or 6 transverse rows on abdomen; submarginal 8-shaped pores in a single row terminating 3 or 4 8-shaped pores from the posterior pair of marginal 8-shaped pores, usually as numerous as marginal 8-shaped pores; submarginal disk pores in a single row interspersed among submarginal 8-shaped pores, and terminating anterior to the posterior pair of those pores, not nearly so numerous as submarginal 8-shaped pores; submarginal setae in a complete row terminating near the posterior pair of marginal 8-shaped pores; 5 setae in posterior row of multilocular pores and 2 in penultimate row.

Apex of abdomen: Notch present; lobes indicated; setae, apical 72-74  $\mu$  long, interapical 10.8  $\mu$  long, dorsal 12.6  $\mu$  long, inner ventral 5.4  $\mu$  long, intermediate ventral 5.4  $\mu$  long, outer ventral 9  $\mu$  long; anal ring with 6 setae 27-30  $\mu$  long and with an inner row of 6 and an outer one of 14 pores, divided on dorsal side; ventral surface with an irregularly rectangular area between lobes, strongly sclerotized in dentate rows, the surrounding area faintly sclerotized in slightly dentate rows.

*Data*.—Redescribed from unmounted material and four mounted females, apparently on *Sideroxylon ferrugineum*, Keelung, Taiwan (Formosa), R. Takahashi, August 1, 1927, presumably cotype material.

This species is closely related to *javiae* and *psychotriar* and rather so to *pustulans*; it may also be related to *loranthi*, but the dorsal 8-shaped pores of that species are the same size as the marginal.

## ASTEROLECANIUM CORONATUM Green

(Fig. 16, N; fig. 17, A-E; pl. 5, H)

Described in 1909 (*42*, p. 327).*Habit*.—Living on stems.

*Test of female*.—Anterior five-sixths usually nearly circular and posterior sixth strongly narrowed, produced, and tip upturned, but test rarely elongate ovoid; 0.85–1 mm. long, 0.65–0.85 wide; strongly convex dorsally with sides nearly perpendicular, a strong longitudinal median, a curved lateral carina, and a deep sunken area between median and lateral carinae; flat ventrally; brownish yellow, transparent to translucent, punctate; marginal and dorsal filaments pale to bright pink, the latter arranged in 12 or 14 groups within a submarginal ring (situated on lateral carinae, the longest ones sometimes fused and appearing of same consistency as test) and scattered elsewhere; filaments of the groups variable in length, but some longer than the marginal ones, the others mostly shorter; circular larval exit at end of produced area.

*Adult female*.—Of same shape as test, 0.75–0.9 mm. long, 0.6–0.8 wide.

Margin: 8-shaped pores in a single row terminating about three times the length of a posterior pore from bases of apical setae, usually 6–8  $\mu$  long and 4–5 wide on narrowed area and 8–9  $\mu$  long and 4.5 wide elsewhere, usually a pore's length apart, but sometimes slightly more; quinquelocular pores in a crowded single or irregularly double row, the position of several posterior pores shifting dorsad, and the row terminating slightly dorsad of the margin anterior to, and slightly entad of, apical setae, with 3 or 4 posterior to the posterior pair of 8-shaped pores; 1 opposite each 8-shaped pore and 1 opposite each interval between 8-shaped pores on produced area, two or three times as numerous as 8-shaped pores elsewhere.

Dorsal surface: 8-shaped pores scattered over most of surface except produced area, usually 13 large pores arranged in a submarginal row and each of large pores surrounded by a circle of 6–13 smaller pores, also several pores between outer circumference of circles and body margin; median area strewn with 8-shaped pores tending toward arrangement in transverse rows; largest pores in submarginal row 12–16  $\mu$  long and 8–9 wide, most of pores in circles 8–9  $\mu$  long and 5 wide, others 7–8  $\mu$  long and 4 wide; minute 8-shaped pores on base of produced area and a few scattered wherever the large 8-shaped pores are rather sparse; disk pores very sparse; tubular ducts 27  $\mu$  long; dorsal tubes present.

Ventral surface: Antenna circular, dome-shaped, sunken in derm, with 2 setae longer than diameter of antenna; beak without setae; spiracle with bar fairly broad and with atrium somewhat enlarged; anterior spiracle with 3–6 quinquelocular pores in atrium and 7–15 such pores between spiracle and body margin in a double or triple row; posterior spiracle with 7–12 pores in atrium and over edge of opening, 9–20 between spiracle and body margin in a double or triple row; enlarged quinquelocular pores, replacing multilocular pores and totaling 22–25, in 8 rows, all anterior to genital opening, 4 pores in each of posterior 4 rows and 3–6 in each of anterior 4 rows; 4 or 5 dark-rimmed 8-shaped pores each side of mouth parts, a few in lateral area anterior to mouth parts and arranged roughly in 5 or 6 transverse rows on abdomen; submarginal 8-shaped pores in a crowded single row (at some points an irregularly double row) terminating near narrowed part of abdomen, at least as numerous as marginal 8-shaped pores and occasionally slightly more so; 2 or 3 disk pores posterior to terminating point of submarginal 8-shaped pores; 6 pairs of submarginal setae on abdomen, the posterior pair opposite the posterior pair of marginal 8-shaped pores; 1 pair of setae posterior to genital opening and 1 pair each in posterior and penultimate rows of enlarged quinquelocular pores.

Apex of abdomen: Setae, apical 7–10  $\mu$  long, interapical apparently absent, inner ventral 3.6  $\mu$  long, outer ventral (possibly the interapical, but directly anterior to apical on ventral surface) 3.6  $\mu$  long; anal opening in margin, anal tube sclerotized, rather short, nearly cylindrical; anal ring with 6 setae 25–27  $\mu$  long, and with an inner row of 6 and an outer one of 12 pores, tending toward division on dorsal side; ventral surface of apex slightly rugose.

*Second stage*.—Resembling adult but all observed specimens elongate ovoid in outline; margin with quinquelocular pores in a single row terminating 5 8-shaped pores from the posterior pair of 8-shaped pores, 1 opposite each



8-shaped pore near posterior end, elsewhere 1 opposite each 8-shaped pore and 1 opposite nearly every interval between 8-shaped pores; dorsal surface without large 8-shaped pores; ventral surface with bar of spiracle narrow, atrium with 1 quinquelocular pore and 1 or 2 pores between spiracular opening and body margin; apex of abdomen with setae arranged as in adult, but apical setae broken, and ventral setae one-half length of corresponding setae in adult; anal ring without pores, not divided; ventral surface of apex not rugose.

*Larva*.—Elliptical.

Margin: With 28 8-shaped pores, the posterior 6 pairs slightly larger than the next 7, and the anterior pair largest, axes of the posterior 6 pairs transverse, of the others longitudinal; 1 pair of setae anteriorly.

Dorsal surface: 8-shaped pores in a submedian row of 10 and a lateral of 6, on each half of the body, the posterior 4 submedian pores slightly smaller than marginal pores of same segments, next 4 practically same size as the latter, and the anterior 2 pores slightly larger; the posterior 4 lateral pores about same size as marginal pores of same segments, the anterior 2 pores distinctly larger; disk pores near marginal, and a few between lateral and submedian 8-shaped pores.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 1; VI, 2 long, 1 very stout, 3 fairly stout, 1 slender; bases of antennae one-third length of antenna apart; beak very sharply pointed, with 2 pairs of setae at tip and 1 pair in median area; spiracle with 1 trilocular and 1 quinquelocular pore; leg setae, coxa 4, femur 1 on inner margin near base and 1 each on inner and outer margins near center, tarsus 2 on inner and 1 on outer margin; tibia one-half length of tarsus; 9 pairs of submarginal 8-shaped pores; 6 pairs of submarginal minute setae on abdomen, 2 pairs of submarginal larger setae anteriorly; 1 pair of setae between antennae and mouth parts.

Apex of abdomen: Notch very narrow; setae, apical  $27 \mu$  long, interapical possibly absent, inner ventral apparently  $1 \mu$  long, outer ventral (possibly the interapical situated entad of apical and nearly or actually on the margin)  $2 \mu$  long; anal opening a very narrow incision in margin; anal tube slightly sclerotized throughout, short, wider at ring than at opening; anal ring with 6 setae, each approximately  $1 \mu$  long.

*Data*.—Redescribed from unmounted material and the following mounted specimens: Two females, two second-stage specimens, and three larvae on *Dendrocalamus giganteus*, Peradeniya, Ceylon, E. E. Green, January 1902, type material; five females and three larvae on bamboo, Peradeniya, Ceylon, C. L. Marlatt, January 13, 1902, and five females and one larva on bamboo, Royal Botanic Garden, Peradeniya, Ceylon, R. S. Woglum, October 1910.

Green (*ibid.*, p. 327) said, "Posterior extremity without caudal setae, but with two small marginal spines on each side." The larger of the two small setae is considered as apical even though it is small. Green did not mention the small seta on the ventral surface close to the median line. Because of its position in the larva, there is some question as to whether the seta here called outer ventral is correctly labeled. From its position in other stages, and from the condition observed in the species most closely related to *coronatum*, however, it seems likely that this seta does actually represent the outer ventral rather than the interapical. This is the only known species of the genus in which multilocular (enlarged quinquelocular) pores occur only anterior to the genital opening.

The "male puparium" described and figured by Green probably is an adult female. All specimens mounted from this type of test have been females, no males having been found in the material at hand. Some adult females have the same shape as second-stage specimens, there being a great deal of variation in the extent to which the posterior end is narrowed and produced.

## ASTEROLECANIUM CRISTATUM Ferris

(Fig. 17, F-0; pl. 7, J)

Described in 1921 (33, pp. 73-74).

*Habit.*—Living on bark.

*Test of female.*—"Test about 1.5 mm. long, oval, high convex, in unrubbed specimens entirely covered with short curling wax filaments and with numerous long filaments which are as long as the test itself, these frequently forming a prominent crest. Rubbed specimens of a uniform green." (33, pp. 73-74.)

*Adult female.*—Practically circular, posterior end slightly produced; around 1 mm. in diameter.

*Margin:* 8-shaped pores in a single row terminating two or three times a pore's length from bases of apical setae, posterior pores 10  $\mu$  long and 6 wide, the others 12  $\mu$  long and 8 wide, about the length of a pore apart; quinquelocular pores in a single row between the spiracular pore bands, extending 6-14 8-shaped pores anterior to anterior spiracular pore bands and 14-27 posterior to posterior spiracular pore bands, as numerous as 8-shaped pores at ends of row, elsewhere up to twice as numerous as the corresponding 8-shaped pores; disk pores dorsad of 8-shaped pores or between them, terminating with 2 or 3 posterior to the posterior pair of 8-shaped pores, irregularly spaced and less numerous than 8-shaped pores.

*Dorsal surface:* 8-shaped pores tending toward a broad longitudinal grouping along median line and toward indefinite transverse groupings on posterior half of specimen, but without apparent arrangement on anterior half, relatively few pores 16-20  $\mu$  long and 12-15 wide interspersed among many pores 12-14  $\mu$  long and 8-10 wide; minute 8-shaped pores not observed; disk pores fairly numerous; tubular ducts 36  $\mu$  long.

*Ventral surface:* Antenna circular, dome-shaped, sunken in derm, with 2 setae slightly longer and 2 or 3 slightly shorter than diameter of antenna; beak with 2 pairs of setae; spiracular bar broad, nearly subcircular, 20-27 quinquelocular pores extending from spiracle to body margin in an irregularly double or triple row; multifolocular pores, with 8-10 loculi, apparently arranged in 5 complete and 4 interrupted rows, with anterior row anterior to posterior spiracles, arrangement not exactly determinable in available specimens but somewhat as follows: Posterior row with 10-16, penultimate with 20-25, each of next 2 with 15-22, next with 10, each of next 3 with 4-6, anterior row with 2, a total of 88-98; 3 or 4 dark-rimmed 8-shaped pores each side of beak, a few scattered on anterior end, and a few on abdomen in lateral area; submarginal 8-shaped pores in an irregularly single row terminating near posterior row of multifolocular pores, usually 1 opposite each marginal 8-shaped pore anteriorly and 1 opposite every other 8-shaped pore elsewhere; submarginal setae in a complete row terminating nearly directly anterior to the posterior pair of marginal 8-shaped pores; 1 pair of setae in each of the posterior 3 rows of multifolocular pores.

*Apex of abdomen:* Notch present, lobes indicated; setae, apical 92  $\mu$  long, interapical 20  $\mu$  long, dorsal 10-12  $\mu$  long, intermediate ventral 6  $\mu$  long, outer ventral 8  $\mu$  long; anal ring with 2 setae 30  $\mu$  long and four 36  $\mu$  long, the number of pores indeterminable, apparently tending toward division on dorsal side; ventral surface of apex sclerotized and rugose.

*Larva.*—Nearly elliptical, posterior end slightly narrowed.

*Margin:* With 28 8-shaped pores, the posterior 6 pairs slightly smaller than the others and their axes transverse, axes of the others longitudinal; a pair of setae close to each of the posterior 3 pairs of pores; 4 pairs of setae anteriorly.

*Dorsal surface:* 8-shaped pores in a submedian row of 10 and a lateral row of 11 (2 or 3 lateral pores outside a straight line), on each half of body, posterior pore of each row slightly smaller than the others, all slightly smaller than marginal pores of same segments; disk pores between lateral and marginal and a few between submedian and lateral 8-shaped pores.

*Ventral surface:* Antennal setae I, 2; IV, 1; V, 0; VI, 2 long, 2 stout, 3 fairly stout, 2 slender; bases of antennae one-third length of antenna apart; beak setae, 2 pairs apical, 1 pair basal; spiracle with 1 trilocular and 1 quinquelocular pore or with 2 trilocular pores; leg setae, coxa 4, femur 1 on inner margin near base and 1 each on inner and outer margins near center, tarsus 2 on inner and 1 on outer margin; tibia one-half as long as tarsus; 7 pairs of submarginal 8-shaped pores, none present between antennae; 10 pairs of submarginal minute setae, on abdomen and thorax, 2 pairs of submarginal larger setae anteriorly; 2 pairs of setae between antennae and mouth parts.

Apex of abdomen: Notch present; setae, apical  $81\ \mu$  long, interapical  $11\ \mu$  long, dorsal  $3\ \mu$  long, intermediate ventral  $2.5\ \mu$  long, outer ventral  $4\ \mu$  long; anal ring with 4 setae about  $21.6\ \mu$  long and 2 setae about  $25\ \mu$  long, also with an inner row of 6 and an outer row of 12 pores, divided on dorsal side and tending toward division on ventral.

*Data*.—Redescribed from the following mounted paratype material collected by G. F. Ferris in Lower California: One female on *Solanum hindnarian*, East of Rosario; 1 female and 6 larvae on *Jatropha canescens*, San Antonio, 1919; 2 females on *Celosia floribunda*, San Bartolo, July 17, 1919; and 2 females on *Heteromeles arbutifolia*, La Laguna, August 1919.

This species is closely related to *townsendi*, but differs from it in being much smaller, in having an interrupted row of marginal quinquelocular pores, 20 to 27 instead of 35 to 55 quinquelocular pores in each spiracular band, 88 to 98 instead of about 271 multilocular pores, and fewer submarginal 8-shaped pores.

In the specimens at hand there is no indication of the small, densely sclerotized area outside the outer ventral seta shown in the illustration accompanying the original description (33, p. 73), and the inner ventral seta is not shown on that illustration. Tests examined by the writer were too poor to permit a complete redescription.

### ASTEROLECANIUM DEGENERATUM, new species

(Fig. 18, A-J; pl. 9, U)

*Habit*.—Living on leaves.

*Test of female*.—Longer than wide, posterior end narrowed and produced; 0.95–1.10 mm. long, 0.65 wide; flat dorsally and ventrally; pale greenish or brownish yellow, transparent, slightly punctate; marginal filaments nearly same color as test, or whitish, slightly longer at ends of body than elsewhere; elliptical larval exit in margin.

*Adult female*.—Same shape as test, 0.85–1 mm. long, 0.6 wide.

Margin: 8-shaped pores in a single row interrupted for 4–10 pores near posterior end but continued across apex of abdomen, 8 or 10 pores across apex between interruptions; anterior and posterior pores 8–9  $\mu$  long and 5 wide, lateral pores usually 7  $\mu$  long and 4 wide, the width to the length of a pore apart; the size and distribution of the pores varying considerably, however, owing to growth against hairs, or irregularities on the surface of the leaf; trilocular pores in a single row terminating at or near interruption in marginal 8-shaped pores, 1 trilocular pore to about every 4 8-shaped pores near posterior end, becoming more numerous cephalad (rarely lacking at anterior end), usually lacking or reduced in number where 8-shaped pores drop out or are reduced in size.

Dorsal surface: Minute 8-shaped pores rather sparse; disk pores sparse, a few near margin; tubular ducts about 22  $\mu$  long.

Ventral surface: Antenna roughly circular, with 2 setae as long as, and 1 shorter than, diameter of antenna; beak with 2 pairs of setae; spiracle with bar expanded at inner end, atrium enlarged, bag-shaped, and containing 5–8 quinquelocular pores, 5–17 similar pores in a single or double row, extending from spiracle to body margin; multilocular pores in 2 indefinite rows of 2 or 3 pores each, slightly larger than trilocular pores, loculi 5 in number when determinable; a group of 4–14 dark-rimmed 8-shaped pores each side of beak, a few smaller pores scattered in lateral area, and a few in 3 or 4 rather indefinite transverse rows posterior to beak; submarginal 8-shaped pores in a single row terminating at interruption in row of marginal 8-shaped pores, about half as numerous as corresponding marginal 8-shaped pores; submarginal setae in a complete row terminating near posterior end of interruption in row of marginal 8-shaped pores; 1 pair of setae posterior to multilocular pores, 1 pair in each row of those pores, and 1 pair in posterior row and also in penultimate row of dark-rimmed 8-shaped pores.

Apex of abdomen: Setae, apical 9  $\mu$  long, interapical 4  $\mu$  long, outer ventral 3  $\mu$  long; anal opening in dorsal surface at the body margin between bases of interapical setae, very inconspicuous, elliptical, margin of opening membranous:



anal tube either absent or very short; anal opening and tube sometimes not differentiated from anal ring, which is close to or actually on the surface; ring represented by a somewhat elliptical plate, sclerotized on 1 side only in a narrow band connecting bases of 2 setae 9–10  $\mu$  long; a sclerotized collarlike area inclosing a minute pore at base of each seta; a circular opening in curve of sclerotized band similar to opening in center of circular anal rings; ventral surface of apex, near margin, slightly sclerotized and rugose.

*Larva*.—Elliptical.

Margin: With 28 8-shaped pores, axes of all diagonal or transverse; a pair of minute setae close to each of the posterior 3 pairs of pores; 3 pairs of setae anteriorly.

Dorsal surface: 8-shaped pores in a lateral row of 9 on each half of body, uniform in size or anterior pores slightly larger than the others, at least three-fourths the size of marginal pores; disk pores between dorsal and marginal 8-shaped pores.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 0; VI, 3 long, 2 stout, 2 fairly stout; antennal bases one-half length of antenna apart; beak setae, 2 pairs apical, 1 pair basal; spiracle with 2 trilocular pores; leg setae, coxa 2, femur 1 on inner margin near base, tarsus 1 each on inner and outer margins; tibia one-third as long as tarsus; 9 pairs of submarginal 8-shaped pores; 9 pairs of minute submarginal setae, on abdomen and thorax, 2 pairs of submarginal larger setae at anterior end; 3 pairs of setae between antennae and mouth parts.

Apex of abdomen: Setae, apical 30  $\mu$  long, interapical 7.2  $\mu$  long, outer ventral 2  $\mu$  long; anal opening minute, in margin; anal tube very short, barely evident; anal ring a circular sclerotized band almost on surface, with 2 setae 1.8  $\mu$  long.

*Data*.—Described from tests, 3 mounted females, and 2 mounted larvae on *Maximilliana* sp., Esmeralda, Venezuela, G. H. Tate, November 8, 1928, N. Y. B. G., paratypes; tests, 2 mounted females, and 10 mounted larvae on *Cocos nucifera*, Bahia, Brazil, intercepted at Philadelphia, Pa., W. J. Ehinger, January 12, 1934, holotype and paratypes.

This species appears to be a degenerate form closely resembling *urichi*, *simile*, and *difficile*. It differs from *urichi* in having multilocular pores, and apical setae the same length as the ring setae; from *simile* in having marginal 8-shaped pores extending across the apex of the abdomen, in having fewer marginal trilocular pores with none across the apex of the abdomen, and in having only 4 or 5 multilocular pores, and from *difficile* in having at least 8 marginal 8-shaped pores across the apex of the abdomen, in lacking a sclerotized heart-shaped plate composing the anal ring, as well as in having the ring setae practically the same length as the apical setae, and in having only 5 to 8 pores in the atrium of each spiracle.

### ASTEROLECANIUM DELICATUM (Green)

(Fig. 18, K–N; pl. 8, A)

Described briefly in 1896 (40, p. 5) as *Planchonia delicata*, and re-described and placed in *Asterolecanium* by Green in 1909 (42, p. 332).

*Habit*.—Living on the lower surface of leaves.

*Test of female*.—Nearly elliptical, posterior end sometimes rather pointed; 2–2.5 mm. long, 1.25–1.5 wide; flat or very slightly convex dorsally, with a faint longitudinal median carina, flat or slightly convex ventrally; bright brownish yellow, transparent, fairly thin, finely punctate; marginal filaments very pale yellow; elliptical larval exit in ventral surface close to margin.

*Adult female*.—Shape similar to that of test, 1.7–2.25 mm. long, 1–1.4 wide.

Margin: 8-shaped pores in a single row terminating around twice length of a posterior pore from bases of apical setae, anterior pores 13–14  $\mu$  long and 9 wide, the others 12–13  $\mu$  long and 7–8 wide, nearly contiguous; 6–8 quinquelocular pores where each spiracular pore band meets body margin, usually 1 opposite each 8-shaped pore at these points; disk pores dorsad of, and less numerous than, 8-shaped pores.

Dorsal surface: Minute 8-shaped pores fairly numerous; disk pores rather sparse; tubular ducts  $40\ \mu$  long; dorsal tubes present.

Ventral surface: Antenna dome-shaped, slightly sunken in derm. with 2 setae longer than diameter of antenna; beak without setae but with 4 clear areas at tip; spiracular bar broad, atrium slightly enlarged but without pores; 11-20 quinquelocular pores extending from spiracle to body margin in an irregularly single to triple row; multilocular pores, totaling 43-59 and having 7-10 loculi, arranged in 4 complete and 2 or 3 interrupted rows, the posterior row with 7-11, each of the next 3 with 10-15, each of the interrupted rows with 1-5; 3 or 4 dark-rimmed 8-shaped pores each side of beak, a few scattered on anterior end, and a few arranged in 4 or 5 transverse rows on abdomen; submarginal 8-shaped pores in a single row terminating near the posterior pair of marginal 8-shaped pores and usually about as numerous as marginal 8-shaped pores; 5 pairs of submarginal setae on abdomen, the posterior pair near the third or fourth pore from the posterior end of the row of marginal 8-shaped pores; 1 pair of setae in each of the posterior 3 rows of multilocular pores.

Apex of abdomen: Notch present; lobes indicated; setae, apical  $80\ \mu$  long, interapical  $10-12\ \mu$  long, inner ventral  $6-8\ \mu$  long, outer ventral  $8\ \mu$  long; anal ring with 6 setae  $32-36\ \mu$  long and with an inner row of 6 and an outer row of 14 pores, apparently tending toward division on dorsal side.

*Second stage.*—Resembling adult, but much smaller; margin without quinquelocular pores; ventral surface with 2 quinquelocular pores between spiracle and body margin, 1 pair of setae observed in median area; apex of abdomen as in adult but setae one-fourth to one-sixth shorter.

*Larva.*—Elliptical.

Margin: With 28 8-shaped pores, the posterior 6 pairs slightly smaller than the next 7, anterior pair slightly the largest, axes of all longitudinal; 3 pairs of setae anteriorly.

Dorsal surface: 8-shaped pores in a submedian row of 1-7 (usually 4 or 5) on each half of body, and totaling 2-10 (usually 9 or 10), anterior pore two-thirds size of marginal pores of same segment and about one-fourth larger than the other dorsal pores; disk pores fairly close to marginal 8-shaped pores.

Ventral surface: Antennal setae, I, 2; IV, 1; V, 2; VI, 2 long, 2 stout, 3 fairly stout, 1 slender; bases of antennae one-third length of antenna apart; beak setae, 2 pairs apical, 1 pair median; anterior spiracle with 1 trilocular pore, posterior spiracle with 1 trilocular and 1 quinquelocular pore; leg setae, coxa 4, femur 1 on inner margin near base and 1 each on inner and outer margins near center, tarsus 2 on inner and 1 on outer margin; tibia around one-half length of tarsus; 9 pairs of submarginal 8-shaped pores; 8 pairs of submarginal minute setae, on abdomen and thorax, 3 pairs of submarginal larger setae at anterior end; 2 pairs of setae between antennae and mouth parts.

Apex of abdomen: Setae, apical  $55\ \mu$  long, interapical  $9\ \mu$  long, inner ventral  $7.2\ \mu$  long, outer ventral  $7.2\ \mu$  long; anal ring with 6 setae, each about  $18\ \mu$  long, with an inner row of 6 and an outer row of 12 pores, divided on dorsal side and tending toward division on ventral.

*Test of male.*—Nearly elliptical, posterior end narrowed, a notch in posterior margin; 1.4 mm. long, 0.75 wide; flat dorsally with a faint longitudinal median carina, flat or slightly convex ventrally; yellow, transparent, thin, punctate; marginal filaments pale yellow, longest at anterior end.

*Male nymph.*—Antenna 10-segmented; 5 segments of abdomen each with a pair of setae dorsally on lateral margin and at least 2 segments each with a pair of setae in ventral lateral area; lobes well developed, each with 1 long and 2 short setae.

*Third-stage male.*—Resembling second stage; ventral surface with 3-5 quinquelocular pores in each spiracular row, legs represented by 3 pairs of rather small claws, 3 pairs of setae in median abdominal region.

*Data.*—Redescribed from 1 mounted second-stage specimen, Ceylon, Maskell Collection No. 353; unmounted material, 1 mounted female, Ceylon, E. E. Green Collection and Cockerell Collection; unmounted material, 2 mounted females, 13 mounted larvae, 1 mounted male nymph, and 1 mounted third-stage male on *Arundinaria* sp., Pundaluoya, Ceylon, E. E. Green Collection, March 18, 1895, type.

Larvae of this species are unusual in having two setae on the fifth segment of the antenna.



## ASTEROLECANIUM DIFFICILE, new species

(Fig. 19, A-H; pl. 9, V)

*Habit.*—Living on bark.

*Test of female.*—Longer than wide or roughly triangular, with margin often indented by growth against hairs on bark, posterior end narrowed, produced into a very short, upturned tube; 1.10–1.5 mm. long, 0.55–0.75 wide; nearly flat to oval dorsally, flat ventrally; pale greenish yellow, transparent, smooth, shiny; marginal filaments colorless, glassy, fragmentary; circular larval exit at end of tube.

*Adult female.*—Shape similar to that of test, 1–1.4 mm. long, 0.5–0.7 wide.

Margin: 8-shaped pores in a single row interrupted at produced area but continuing for 1 or 2 pores and terminating one or two times a pore's length from bases of apical setae, pores near apical setae  $8\ \mu$  long and 5 wide, anterior pores usually 7 or  $8\ \mu$  long and 5 wide, the others slightly smaller, those anterior to interruption 6  $\mu$  long and 4 wide, usually slightly more than a pore's length apart; trilocular pores in a single row terminating 10–20 8-shaped pores from interruption in marginal 8-shaped pores, in proportion of 1 to every 3 8-shaped pores near posterior end, 2 and occasionally 3 to each 8-shaped pore from posterior spiracular area cephalad, but reduced in number or missing for 6–10 8-shaped pores at anterior end.

Dorsal surface: Usually 1–13 8-shaped pores in submarginal area, measuring 8–10  $\mu$  long and 5 or 6 wide; minute 8-shaped pores numerous; disk pores very sparse; tubular ducts 22  $\mu$  long.

Ventral surface: Antenna flat, with 2 setae slightly longer than diameter of antenna; beak with 2 pairs of setal bases; spiracle with bar very narrow, atrium enlarged, bag-shaped, and containing 12–20 quinquelocular pores, 10–20 trilocular pores extending from spiracle to margin in a row which is single or double at opening and triple or quadruple at body margin; multilocular pores, totaling 14–18 and with loculi 6 in number when determinable, arranged in 2 complete indefinite rows of 3–5 pores each, and 3 or 4 interrupted rows, each of the latter represented by a single pore; a group of approximately 10 dark-rimmed 8-shaped pores each side of beak and a few smaller ones on abdomen anterior to multilocular pores; submarginal 8-shaped pores in a single row apparently terminating near interruption in marginal row of 8-shaped pores, nearly or quite as numerous as corresponding marginal 8-shaped pores; submarginal setae in a complete row terminating near center of interruption in marginal row of 8-shaped pores; 1 pair of setae posterior to multilocular pores, 1 pair in each complete row of these pores, and 1 pair in the posterior interrupted row.

Apex of abdomen: Setae, apical  $9\ \mu$  long, interapical  $7.2\ \mu$  long, outer ventral  $2\ \mu$  long; anal opening in dorsal surface at body margin, between bases of apical setae, margin of opening membranous; anal tube apparent only on dorsal side; anal ring apparently greatly modified, sclerotized in a heart-shaped area extending to margin of body, 2 setae  $16\ \mu$  long arising from short collars at base of heart-shaped area and a small opening in sclerotized area halfway between bases of setae and body margin possibly corresponding to opening in center of circular anal rings.

*Larva.*—Elliptical.

Margin: With 28 8-shaped pores, the anterior pores slightly the largest, axes of all usually transverse; 3 pairs of setae anteriorly.

Dorsal surface: 8-shaped pores in a lateral row of 8 on each half of body, about one-half the size of a posterior marginal pore.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 0; VI, 3 long, 2 stout, 3 fairly stout; antennal bases nearly length of antenna apart; beak setae, 2 pairs apical, 1 pair basal; spiracle with 2 trilocular pores; leg setae, coxa 2, femur 1 on inner margin near base, tarsus 1 each on inner and outer margins; tibia one-third as long as tarsus, its articulation with tarsus rather indistinct; 9 pairs of submarginal 8-shaped pores; apparently 9 pairs of minute submarginal setae, on abdomen, thorax, and head; 3 pairs of setae between antennae and mouth parts.

Apex of abdomen: Setae, apical apparently  $30\ \mu$  long, interapical  $4\ \mu$  long, outer ventral  $2\ \mu$  long; anal opening in margin, circular, its margin membranous; anal tube very short, membranous; anal ring a sclerotized band close to opening, apparently without setae but specimens too poor for certain determination of this point.



*Data.*—Described from unmounted specimens (paratypes) and the following mounted material removed from U. S. N. H. plants collected by H. Pittier in the Canal Zone: Eleven females and 3 larvae on Palmae (*Cocos* sp.?), vicinity of Las Cruces, February 1, 1911, holotype and paratypes; 2 females on *Acristacea* ? and 2 females on Palmae, between Gorgona and Gatun, June 7, 1911, paratypes.

Although this species is closely related to *simile*, it differs from it in having only 1 or 2 8-shaped pores in the marginal row between the interruptions and the apical setae, approximately 14 multilocular pores, the ring setae twice the length of the apical setae, and a sclerotized heart-shaped area associated with the anal ring setae.

The available larvae are very poor. Consequently the recorded absence of minute setae near the posterior marginal 8-shaped pores is not positive, and the exact number of submarginal setae is uncertain.

### ASTEROLECANIUM DISIUNCTUM, new species

(Fig. 19, I-P; pl. 6, L)

*Habit.*—Living on the lower surface of leaves.

*Test of female.*—Very elongate and slender, posterior end strongly upturned; 2.5 mm. long, 0.4–0.5 wide; strongly convex dorsally, sloping from median line to margin, flat ventrally; pale or bright yellow, transparent, fairly thin, slightly punctate; marginal and dorsal filaments rubbed off; elliptical larval exit in posterior surface of upturned area.

*Adult female.*—Elongate and slender, about 2.25 mm. long, 0.4 wide.

*Margin:* 8-shaped pores in a single row terminating length of apical seta from bases of setae, posterior pores 6  $\mu$  long and 4 wide, others 8  $\mu$  long and 5 wide, less than a pore's width apart at posterior end, slightly more than a pore's length apart elsewhere; quinquelocular pores absent, or 2 or 3 where each spiracular pore band meets margin.

*Dorsal surface:* One 8-shaped pore 12  $\mu$  long and 8 wide at anterior end, sometimes 1–8 pores on median line posterior to mouth parts and measuring 9  $\mu$  long and 7 wide; minute 8-shaped pores very numerous along median line, sparse elsewhere; disk pores sparse; tubular ducts 24  $\mu$  long; dorsal tubes present.

*Ventral surface:* Antenna dome-shaped, with 2 setae longer than diameter of antenna; beak without setae; spiracular bar fairly broad; 6–10 quinquelocular pores extending from spiracle to body margin in an irregularly single row; legs represented by 3 pairs of fairly stout claws; multilocular pores, totaling 20 or 21 and with 10 loculi, arranged in 3 complete rows, the posterior row with 5, middle with 7–9, and anterior with 7 or 8; 2 or 3 dark-rimmed 8-shaped pores each side of beak, a very few on anterior end, and a few apparently arranged in 3 or 4 transverse rows anterior to anterior row of multilocular pores; submarginal 8-shaped pores in a single row terminating near anterior row of multilocular pores, about one-half as numerous as marginal 8-shaped pores; 5 pairs of submarginal setae on abdomen, the posterior pair about halfway between the posterior pair of marginal 8-shaped pores and bases of apical setae; 1 pair of setae in each row of multilocular pores.

*Apex of abdomen:* Notch present; lobes indicated; setae, apical 68  $\mu$  long, inter-apical 8–10  $\mu$  long, inner ventral 5.2  $\mu$  long, outer ventral 6  $\mu$  long; anal ring with 6 setae 30–32  $\mu$  long and an inner row of 6 and an outer row of 16 pores, divided on dorsal side.

*Data.*—Described from one empty test and one mounted female on *Bambusa* sp., Mengtze, Yunnan, China, N. Y. B. G., holotype, and one empty test and two mounted females on *Schizostachyum* sp., Tung King, Kwangtung, China, F. A. McClure, January 21, 1932, paratypes.

The presence of 3 pairs of claws differentiates this species from all other known species on bamboo except *rubrocomatum*, from which it differs in many respects. It is rather closely related to *acutulum*.

## ASTEROLECANIUM DISTINCTUM, new species

(Fig. 29, A-P; pl. 4, B)

*Habit*.—Living on the lower surface of leaves.

*Test of female*.—Flat to oval dorsally, flat ventrally; elongate elliptical, 2.5-3 mm. long, 1.25-1.5 wide; bright, or pale brownish, yellow, transparent, punctate; with portion posterior to shriveled female having a honeycomb appearance which is due to relatively clear areas in the mass of fine, curly, white or yellowish filaments in which the eggs are deposited and from which the larvae have escaped, the larvae leaving the test through a slit between the dorsal and ventral surfaces on the posterior margin; fine curly filaments and eggs also are sometimes thrust out onto the leaf; marginal filaments whitish or very pale pinkish; dorsal filaments not observed, presumably present in submarginal area of some specimens.

*Adult female*.—Elongate elliptical, posterior end drawn out to a narrow truncate tip; 2-2.5 mm. long, 1-1.25 wide.

Margin: 8-shaped pores in a single row terminating about one-half length of apical seta from setal bases, individual pores measuring  $8\ \mu$  long and 5 wide, one to three times a pore's length apart; trilocular pores in a single row terminating near the posterior end of the row of 8-shaped pores, usually as numerous as the latter near the posterior end and somewhat more numerous elsewhere.

Dorsal surface: 8-shaped pores absent, or 1-16 such pores in submarginal area, about  $9\ \mu$  long and 6 wide; minute 8-shaped pores numerous or sparse in lateral area, not present along median line or close to margin; disk pores fairly numerous in lateral area and occasionally a few in median area; tubular ducts scattered in lateral area, rarely present along median line or close to margin, about  $7.2\ \mu$  long; 2, or rarely 3, elongate, tapering, internal ducts, opening near posterior end.

Ventral surface: Antenna flat, with 1 or 2 setae as long as, and 2 longer than, diameter of antenna; beak with 2 pairs of setal bases; spiracle with bar elongate, expanded at inner end, atrium enlarged, bag-shaped, and containing 12-15 quinquelocular pores, 20-30 similar pores extending from spiracle to body margin in an irregularly single or double row; multilocular pores, with 8-12 loculi, in 7 rows, the posterior 5 rows usually complete and the anterior 2 rows usually interrupted, each row segregated into groups, with a group of 1 row sometimes appearing to merge with a group from an adjoining row, so that it is difficult to determine the number of pores in each row, but the numbers in the various rows approximately as follows: Posterior row with 38, penultimate with 25, next with 57, next with 51, next with 45, next with 32, next with 10, the total approximately 250; a group of 30-50 dark-rimmed 8-shaped pores each side of mouth parts, usually a group of 5-10 posterior to each antenna, and 6 or 7 groups on each half of body posterior to, and in direct line with, outer pores of the group beside beak. 15-20 in each of the anterior 2 of these groups, 6-10 in next, 1-5 in each of the others, the posterior 3 or 4 groups usually among the multilocular pores; submarginal 8-shaped pores in a single row but more crowded on posterior third than elsewhere, terminating at or near median line at posterior end, two or three times as numerous as marginal 8-shaped pores; submarginal setae in a complete row terminating near the posterior pair of marginal 8-shaped pores; 2 pairs of setae in the posterior row of multilocular pores and 1 pair in each of the other complete rows.

Apex of abdomen: Setae, apical  $66\ \mu$  long, interapical apparently  $2\ \mu$  long, outer ventral (outside apical on margin)  $2\ \mu$  long; anal opening and anal tube not apparent; 2 heavily sclerotized contiguous collars, without setae, but with inner ends divided into a varying number of clear areas suggestive of pores, sunken in derm. their circular openings in margin; a smaller opening, presumably corresponding to opening in the center of a circular anal ring, contiguous to collar openings and on ventral side of them, its margin heavily sclerotized; derm surrounding collars slightly sclerotized.

*Larva*.—Elliptical.

Margin: With 28 8-shaped pores, axes of the majority transverse or diagonal; 3 pairs of setae at anterior end.

Dorsal surface: 8-shaped pores in a submedian and a lateral row of 9 each on each half of body, about two-thirds the size of a marginal pore; 3 or 4 disk pores observed; 1 pair of submedian setae near anterior end.

Ventral surface: Antenna apparently 5-segmented; antennal setae, I, 1; IV, 1; V, 3 long, 2 stout, 3 fairly stout; bases of antennae one-half length of antenna

apart; beak setae, 2 pairs apical and 1 pair basal; spiracle with 1 trilocular and 1 quinquelocular pore, or with 2 quinquelocular pores; leg setae, coxa 3, femur 1 on inner margin near base, tarsus 1 each on inner and outer margins; tibia one-half as long as tarsus; 9 pairs of submarginal 8-shaped pores; apparently 9 pairs of submarginal minute setae, on abdomen and thorax, 1 pair of submarginal larger setae at anterior end; 3 pairs of setae between antennae.

Apex of abdomen: Notch minute; lobes sometimes indicated; setae, apical  $45\ \mu$  long, interapical  $5.4\ \mu$  long, outer ventral (outside apical on margin) apparently about  $2.5\ \mu$  long; without anal opening, anal tube, or anal ring.

*Data.*—Described from unmounted material (paratype) and the following mounted specimens collected on *Attalea cohune*: One female, "Monte Cachimulo," Guatemala, April 1869, U. S. N. H., paratype; four females and one larva, Livingston, Guatemala, O. F. Cook, April 7, 1902, U. S. N. H., paratypes; one female, Puerto Sierra, Honduras, Percy Wilson, February 18, 1903, U. S. N. H., paratype; nine females and nine larvae, La Ceiba, Honduras, intercepted at New Orleans, La., Benton and Kostal, November 24, 1920, holotype and paratypes.

This species is unusual in having a large number of multilocular pores segregated into groups within a row, and an extremely large number of dark-rimmed 8-shaped pores, also arranged in groups on the abdomen. It is the only species observed by the writer in which the eggs are deposited in a thick mass of curly filaments that are thrust out of the test through a splitting of the entire posterior margin.

### ASTEROLECANIUM ELONGATUM, new species

(Fig. 20, Q-U; fig. 21, A, B; pl. 7, D)

*Habit.*—Living along midrib on upper surface of leaves.

*Test of female.*—Lanceolate, 2.25–3 mm. long, 0.4–0.5 wide; so strongly convex dorsally that the raised area along median line appears as a strong carina with slightly concave sides, flat ventrally; pale yellow or light brownish yellow translucent, dull, slightly punctate; marginal and dorsal filaments rich golden brown, the marginal ones slightly longer at anterior end than elsewhere, the dorsal ones extending along median line and varying in length from half to quite the width of test; larval exit not apparent.

*Adult female.*—Lanceolate, 2.25–2.85 mm. long, 0.45 wide.

Margin: 8-shaped pores in a single row terminating about four times the length of a posterior pore from bases of apical setae, posterior pores 8–9  $\mu$  long and 4 wide, increasing in size to 12  $\mu$  long and 6 wide at anterior end, the width to the length of a pore apart near posterior end, but almost contiguous at anterior end; quinquelocular pores in a single row terminating between the posterior pair of 8-shaped pores and apical setae, 3–6 posterior to posterior 8-shaped pores, at least as numerous as 8-shaped pores near posterior end, elsewhere one and a half to two times as numerous.

Dorsal surface: 8-shaped pores arranged in a group of 3 close to anterior margin, and in a single row extending along median line nearly to apex of body, irregularly spaced, 54 counted in 1 specimen and 58 in the only other mounted specimen available, the smallest pores 12–13  $\mu$  long and 6–7 wide, but the majority 20  $\mu$  long and 12 wide; minute 8-shaped and disk pores fairly numerous; tubular ducts 36  $\mu$  long; dorsal tubes present.

Ventral surface: Antenna thimble-shaped, with 2 setae as long as diameter of antenna; beak without setae; spiracular bar fairly broad; derm around spiracular opening wrinkled, expanded, cup-shaped, and containing 4–9 quinquelocular pores, 13–19 similar pores extending from spiracle to body margin in a row 3 or 4 pores wide; 1 dark-rimmed 8-shaped pore each side of beak, 6 or 8 in median area arranged in 3 or 4 groups anterior to genital opening, and a few scattered in lateral area; submarginal 8-shaped pores in a single row terminating near the thirteenth pore from the end of the marginal row and about one-half as numerous as marginal 8-shaped pores; apparently 6 pairs of submarginal setae on abdomen, the posterior pair near the fifth pore from the posterior end of



the marginal row of 8-shaped pores; 1 pair of setae posterior to genital opening, 1 pair anterior to opening, and 1 pair anterior to those.

Apex of abdomen: Setae, apical  $4\ \mu$  long, interapical  $1.8\ \mu$  long, both on ventral surface close to margin, outer ventral  $2\ \mu$  long, anterior to and outside apical; anal opening ventral, close to margin, narrow horseshoe-shaped; anal tube sclerotized at opening, membranous in center, and sclerotized at inner end, where it is larger than at outer end; anal ring sclerotized, thickened.

*Data*.—Described from two unmounted and two mounted females on *Bambusa* sp., near Tung Heung, Kwong Ning district, Kwangtung, China, F. A. McClure, April 25, 1925, holotype and paratypes.

This species resembles *ceriferum* in some of the structures of the apex of the abdomen, but differs from it in practically all other characters.

### ASTEROLECANIUM EPACRIDIS (Maskell)

(Fig. 21, C-N; pl. 8, I)

Described in 1882 (68, pp. 224-226) as *Planchonia epacridis* on *Leucopogon frazeri* from Amberley, New Zealand.

*Habit*.—Living on the upper surface of leaves, in shallow pits.

*Test of female*.—Rather elongate ovoid, posterior end sometimes slightly produced; 1.3-1.6 mm. long, 0.85-1 wide; strongly convex dorsally, most strongly so at anterior third, sloping to margins, nearly flat at posterior end, with or without a faint longitudinal median carina near posterior end; flat or slightly convex ventrally; greenish yellow, transparent, thin, shiny, slightly punctate in submarginal area; marginal filaments whitish and dorsal filaments broken off; elliptical larval exit in ventral surface.

*Adult female*.—Slightly longer than wide, 1-1.4 mm. long, 0.9-1 wide.

Margin: 8-shaped pores in a single row terminating around twice the length of posterior pore from bases of apical setae, posterior pores  $10\ \mu$  long and 7 wide, the others  $12\ \mu$  long and 8 wide, usually about a pore's width apart; quinquelocular pores in a single row terminating near the fourth to the eighth pore from the posterior end of the row of 8-shaped pores and at least as numerous as the 8-shaped pores; disk pores ventrad of quinquelocular pores, terminating near the posterior pair of 8-shaped pores, much less numerous than the latter.

Dorsal surface: 8-shaped pores in a median group of 5-9, and none, or 3-11, in a submarginal row, median pores apparently arranged in a loose group near center, submarginal pores placed at irregular intervals, and measuring  $12\ \mu$  long and 8 wide; minute 8-shaped and disk pores numerous; tubular ducts about  $32\ \mu$  long.

Ventral surface: Antenna very short, with 3 setae as long as, or slightly shorter than, diameter of antenna; beak with 2 pairs of setae; spiracle with bar expanded at inner end, atrium somewhat enlarged but shallow, 2-7 quinquelocular pores in atrium and on edge of opening, and 2-10 extending from spiracle to body margin in an irregularly single row, 7-17 pores in atrium and row combined; multilocular pores, totaling 49-68 and having 7-11 loculi, in 5 complete and 3 or 4 poorly defined interrupted rows, posterior row with 4 or 5, penultimate with 9-13, next with 8-15, next with 7-13, next with 5-8, each of next 3 with 2-7 and occasionally a single pore representing another row anterior to posterior spiracles; 2-4 dark-rimmed 8-shaped pores each side of beak, a few on anterior end, and a few arranged in 5 or 6 transverse rows on abdomen; submarginal 8-shaped pores in a single row terminating near penultimate row of multilocular pores, usually as numerous as marginal 8-shaped pores; submarginal setae in a complete row terminating anterior to the posterior pair of marginal 8-shaped pores; 2 pairs of setae in posterior row of multilocular pores and 1 pair in each of the next 3 rows.

Apex of abdomen: Notch present; lobes indicated; setae, apical  $76\ \mu$  long, interapical  $7.2-9\ \mu$  long, dorsal  $3\ \mu$  long, inner ventral  $5.4-7\ \mu$  long, outer ventral  $7.2-9\ \mu$  long; anal ring with 6 setae  $32-38\ \mu$  long, also with an inner row of apparently 6 and an outer one of at least 14 pores, divided on dorsal side and tending toward division on ventral; ventral surface of apex sclerotized in a roughly linear area anterior to interapical setae, area between linear bars sclerotized in dentate rows.

*Larva*.—Nearly elliptical, posterior end narrowed.

Margin: With 28 8-shaped pores, the posterior 6 pairs very slightly smaller than the next 7, anterior pair slightly the largest, axes of the posterior 6 pairs diagonal, of the others longitudinal; a pair of minute setae close to each of the posterior 3 pairs of pores; apparently normally 3 pairs of setae anteriorly.

Dorsal surface: 8-shaped pores in a submedian row of 2-7 and a lateral row of 9, on each half of body, posterior and anterior submedian, and the anterior 3 lateral pores slightly larger than the others, all very slightly smaller than posterior marginal 8-shaped pores; disk pores close to marginal 8-shaped pores and a few in lateral area; a pair of small setae anterior to anterior submedian pair of pores.

Ventral surface: Antennal setae, I, 2; IV, 1; V, 1; VI, 2 long, 2 stout, 3 fairly stout, 2 slender; bases of antennae one-third length of antenna apart; beak setae, 2 pairs apical, 1 pair basal; spiracle with 1 trilocular and 1 quinquelocular pore; leg setae, coxa 4, femur 1 on inner margin near base and 1 on outer margin near center, tarsus 1 each on inner and outer margins; tibia one-third length of tarsus; 10 pairs of submarginal 8-shaped pores; apparently normally 9 pairs of minute submarginal setae, on abdomen and thorax, and 3 pairs of submarginal larger setae at anterior end; 1 pair of setae between antennae and mouth parts.

Apex of abdomen: Notch present; setae, apical 72  $\mu$  long, interapical 9-10.8  $\mu$  long, dorsal 1.8-2  $\mu$  long, inner ventral 9-10.8  $\mu$  long, outer ventral 5.4  $\mu$  long; anal ring with 6 setae about 18  $\mu$  long and with an inner row of 6 and an outer one of 10 or 12 pores, divided on dorsal side and tending toward division on ventral side; ventral surface of apex sclerotized between inner and outer ventral setae.

*Data*.—Redescribed from one mounted female and one mounted larva on *Styphelia scoparia*, Oakleigh, Victoria, Australia, A. Morrison, June 5, 1891, U. S. N. H., and unmounted material, four mounted females, and eight mounted larvae on *Leucopogon frazeri*, Motueka, New Zealand, from G. Brittin, December 19, 1937, No. 134. These specimens have been identified from the description and figures given by Maskell (68, pp. 224-226, pl. 16) and Morrison and Morrison (73, pp. 4-5, pls. 2, 27). Tests at hand agree with those described by Maskell, including the position on the host with the anterior end of the test always toward the point of leaf attachment, and the females studied agree rather well with the characters given by Maskell and by Morrison and Morrison. Morrison and Morrison prepared their description from a single specimen labeled as being second stage, but which they presumed to be an adult. Maskell described the second stage but it is impossible to be certain whether he had a second-stage specimen or an adult female, since he did not mention the tubular ducts. No second-stage specimens being available, it cannot be determined whether the form described by Morrison and Morrison actually belonged to the second stage. They did not mention either the presence or absence of tubular ducts although they did state that the presence or absence of multilocular disk pores was not determined.

### ASTEROLECANIUM EPIDENDRI (Bouché)

(Fig. 22, A-G; pl. 5, K)

In 1844 (10, p. 300) Bouché described *Lecanium epidendri* as follows:

“♂ dunkelgelb mit braunem Kopfe, die weisslichen Flügel am Vorderrande röthlich. Länge  $\frac{1}{2}$  Linie.

“♀ rundlich, flach, grünlichgelb, der Rand mit dicht stehenden verlängerten Absonderungsfäden gefranzt. Länge  $\frac{1}{2}$  Linie.

“Wohnort auf *Epidendrum cuspidatum* in den Treibhäusern. Das eigentliche Vaterland ist wohl Westindien.

"Die männlichen Puppen haben ein bräunliches Schild und sind kleiner wie bei den Weibern. An letzteren ist die Rüsselgegend dunkelbraun; das Afterende ausgerandet. Jung sind sie länglich, hinten verschmälert, flach, gelb mit kurzen Borsten gefranzt (an denen sich im Alter die Absonderungen ansetzen). Afterende mit vortretender Fleischspitze und jederseits eine lange Borste; sie haben alsdann nur eine Länge von  $\frac{1}{8}$  Linie.

"Es ist eine der zierlichsten Scharlachläuse."

In 1851 (11, p. 112), he again described *Lecanium epidendri* as follows:

"♀ oval, stark gewölbt, runzlig, filzig, dunkelbraun. Länge 4 Linie. Vaterland Amerika. Auf den Arten von Epidendron."

The female described in 1844 was unquestionably a species of *Asterolecanium*, but the one described in 1851 was probably a species of *Coccus*. Its size differentiates it from the *epidendri* described in 1844, and there is no reason to believe that Bouché was in error in the measurement published in 1851, as has been suggested by Lindinger (62, p. 167). So far as known, there were no references to *Lecanium epidendri* Bouché from 1851 until 1868, when Boisduval published three notes concerning *Chermes epidendri* (Bouché) in *Insectologie Agricole*, the first on April 2 (5, p. 95), the second on May 2 (6, p. 127), and the third in October (7, p. 281). In each note Boisduval listed the host as *Epidendrum*, and in two of them stated that the insects were found in greenhouses. In *Insectologie Agricole*, November 1868 (8, p. 301), however, Boisduval described *Coccus aureus* from *Maranta vittata* from hothouses in Paris, and stated that the insect had been brought to them by a foreigner with exotic plants. In 1869 Targioni-Tozzetti established the genus *Asterolecanium* and selected *aureum* as its type (96, p. 734).

In 1870 Signoret redescribed *aureum* and indicated that he had discussed and illustrated this species, though without naming it, in a characterization of the genus *Asterolecanium* published in 1869 (87, p. 101, pl. 4, figs. 5, 6). He made the following statement at the end of the description (88, pp. 277-278): "Nous devons cette espèce intéressante à l'obligeance de notre collègue et ami M. le docteur Boisduval, sans lequel nous n'aurions pu faire qu'un travail peu important sur cette famille." Study of type material of *aureum* which has been available to the writer has settled the identity of the specimens described by Boisduval and Signoret under that name, and has proved the correctness of Targioni-Tozzetti's identification of specimens from *Anthurium* in 1892 (98, pp. 304-311), which Cockerell questioned in 1896 (19, p. 8).

*Asterolecanium aureum* is doubtless a synonym of *epidendri*, but the synonymy must be assumed because Bouché's specimens of *epidendri* presumably do not exist today and it is impossible to place the species from his description. Bouché described *epidendri* from orchids in greenhouses, and Boisduval so reported it, although he later described *aureum* from *Maranta vittata*, a host belonging to the Marantaceae but rather closely related to the Orchidaceae. Since his specimens from *Maranta* are the same species found on orchids in greenhouses in Europe and on orchids in the West Indies, tropical America, and Ceylon, and since no other valid species of *Asterolecanium* from orchids has been encountered in greenhouses in Europe, the writer assumes that *aureum* is a synonym of *epidendri*, as indicated by Lindinger in 1934 (62, pp. 162, 169), and in 1937 (65, p. 180).



Study of the type material of *oncidii* and *greeni* shows that they also are synonyms of *epidendri*. In April 1893 (16, p. 255) Cockerell listed *oncidii* as *Planchonia oncidii*, n. sp., and in another publication, also published in April 1893 (17, p. 78), he described the species and suggested that *Lecanium epidendri* Bouché might be the same. In discussing *oncidii* in 1896 (19, p. 8) he wrote: "It is probable that the '*Lecanium*' *epidendri* of Bouché is identified with this, but Bouché's description is very short. If the identity be assumed, *epidendri* has long priority." Thus, in 1893 and 1896 he indicated the possibility of the synonymy which Fernald listed in 1903 (32, p. 50). Lindinger was in error in accepting *oncidii* as a valid species in 1936 (64, pp. 153-154). *A. greeni*, described by Marchal in 1904 (67, pp. 455-457), was placed as a synonym of *aureum* by Green in 1909 (42, p. 320).

*Habit*.—Living on leaves, stems, and seeds.

*Test of female*.—Slightly longer than wide or nearly circular, posterior end produced; 1-1.6 mm. long, 0.8-1.5 wide; nearly flat to slightly convex dorsally, often with a faint longitudinal median carina and a curved submarginal carina meeting a transverse carina near anterior end, the median carina crossing the latter and extending to margin, but the submarginal terminating at the transverse carina, all carinae often obscure; flat ventrally; greenish, pale or clear bright yellow, transparent, thin, punctate, shining; marginal and dorsal filaments pale golden to bright salmon, the dorsal filaments arranged in about 6-11 groups along median line, in about 14 groups in submedian and submarginal areas, and in a single submarginal row, usually slightly shorter than marginal filaments; circular larval exit in ventral surface at margin.

*Adult female*.—Shape similar to that of test, 0.9-1.5 mm. long, 0.7-1.4 wide.

Margin: 8-shaped pores in a single row terminating around twice a pore's length from bases of apical setae, posterior pores 10  $\mu$  long and 6 wide, the others 12  $\mu$  long and 8 wide, usually around a pore's width apart; quinquelocular pores in a single row terminating at the posterior pair of 8-shaped pores or just beyond, usually one and one-half to two times as numerous as corresponding 8-shaped pores; disk pores dorsad of 8-shaped pores and much less numerous than those, terminating at the penultimate or posterior pair of 8-shaped pores, spaced irregularly.

Dorsal surface: 8-shaped pores arranged in 6-11 median groups, 12-14 submedian groups, and 2 lateral groups (totals for entire body), also normally 24-26 individual pores in submarginal area; pores along median line usually arranged in definitely transverse groups, but the anterior ones occasionally scattered, submedian groups circular, oval, or transverse, submarginal pores in a single row, lateral group sometimes apparently part of the second submedian group; all pores usually 10-12  $\mu$  long and 7-8 wide, but there is an occasional larger pore measuring 16  $\mu$  long and 10 wide; minute 8-shaped pores numerous; disk pores rather sparse; tubular ducts 27  $\mu$  long.

Ventral surface: Antenna conical, sunken in derm, with 2 setae longer than diameter of antenna; beak without setae, but sometimes with 2 or 4 clear areas suggesting setal bases; spiracle with bar broad, usually subcircular, with wrinkles passing from bar around opening, and 8-17 quinquelocular pores extending from spiracle to body margin in an irregularly single or double row; multilocular pores totaling 49-80 and with 8-11 loculi, arranged in 5 complete and 4 or 5 interrupted rows, the anterior row anterior to posterior spiracles, the posterior and penultimate rows each with 7-12 pores, each of next 3 with 7-16, and each of interrupted rows with 2-4; 1-5 dark-rimmed 8-shaped pores each side of mouth parts, a very few scattered on anterior end, a few in lateral area of abdomen and in each of the anterior 3 complete rows of multilocular pores; submarginal 8-shaped pores in a single row terminating near posterior row of multilocular pores, as numerous as marginal 8-shaped pores; submarginal setae in a complete row terminating near the penultimate pair of marginal 8-shaped pores; 1 pair of setae each in posterior and penultimate rows of multilocular pores.

Apex of abdomen: Notch present; lobes strongly developed; setae, apical 90  $\mu$  long, interapical 14.4  $\mu$  long, dorsal 7.2  $\mu$  long, intermediate ventral 7.2  $\mu$  long, outer ventral 7.2  $\mu$  long; anal ring with 6 setae about 36  $\mu$  long and with an inner row of 6 and an outer row of 12 or 14 pores, divided on dorsal side and

tending toward division on ventral; ventral surface of apex with a heavily sclerotized, roughly triangular area extending anteriorly from bases of inner lobes, surrounding area sclerotized in dentate rows.

*Second stage*.—Resembling adult female, but smaller; margin with quinquelocular pores usually present opposite spiracles and at a few other points; dorsal surface with 3 or 4 8-shaped pores in submedian area, these distinctly larger than marginal 8-shaped pores; ventral surface with 2 or 3 quinquelocular pores in each spiracular row; apex of abdomen as in adult, but all setae about one-fourth shorter.

*Larva*.—Broadly elliptical.

Margin: With 28 8-shaped pores, the posterior 6 pairs slightly smaller, and the anterior 3 pairs slightly larger than the others, axes of the posterior 6 pairs transverse, the others longitudinal; 3 pairs of setae anteriorly.

Dorsal surface: 8-shaped pores in a submedian row of 10, a lateral row of 8, and a submarginal row of 2 or 3, on each half of body; in the submedian row the posterior 3 pores slightly smaller, and the anterior 2 or 3 pores slightly larger than the others, all around one-fourth smaller than marginal pores of same segment; anterior pore of lateral row much larger, and the one next to it slightly larger than posterior pores, which are a little smaller than the submedian pores; 1 or 2 submarginal pores the same size as those situated posteriorly in the lateral row, but the anterior submarginal pores as large as anterior lateral or anterior submedian pore; disk pores near marginal 8-shaped pores and between submedian and lateral 8-shaped pores.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 0; VI, 2 long, 2 stout, 3 fairly stout, 2 slender; bases of antennae one-third length of antenna apart; beak setae, 2 pairs apical, 1 pair basal; spiracle with 1 trilocular and 1 quinquelocular pore; leg setae, coxa 3, femur 1 on inner margin near base and 1 on inner margin near center, tarsus 1 each on inner and outer margins; tibia one-half as long as tarsus; 9 pairs of submarginal 8-shaped pores; 9 pairs of submarginal minute setae, on abdomen and thorax, 3 pairs of submarginal larger setae anteriorly; 2 pairs of setae between antennae and mouth parts.

Apex of abdomen: Notch present; lobes not, or barely, indicated; setae, apical  $42\ \mu$  long, interapical  $5.4\text{--}6\ \mu$  long, dorsal  $3.6\ \mu$  long, intermediate ventral  $3.6\text{--}4\ \mu$  long, outer ventral  $4.2\ \mu$  long; anal ring with 6 setae, each about  $21.6\ \mu$  long, also with an inner row of 6 and an outer one of apparently 14 or 15 pores, divided on dorsal side and tending toward division on ventral; ventral surface of apex sclerotized in dentate rows near median notch, but sometimes with a more heavily sclerotized, roughly triangular area outlined.

*Data*.—Redescribed from unmounted material, 2 mounted females, and 25 mounted larvae on *Maranta vittata* in greenhouses [Paris, France], type material of *aureum*, determined by Signoret, loaned by M. Beier; unmounted material and 2 mounted females on *Broughtonia sanguinea*, Kingston, Jamaica, Cockerell Collection, types of *oncidii*; unmounted material, 5 mounted females, and 6 mounted larvae on *Rhedia lateriflora*, taken in greenhouses in Paris, France, P. Marchal, 1904, types of *greeni*; and a mass of unmounted material, 132 mounted females, 3 mounted second-stage specimens, and 25 mounted larvae from the following sources: On *Angraecum* from Jamaica and British Guiana; on *Anthurium* from New York (in greenhouses), Puerto Rico, Italy (in greenhouses); on *Brassia* from Costa Rica, Dominican Republic; on *Cattleya* from Costa Rica, Colombia, Brazil; on *Epidendrum* from Dominican Republic, Cuba, Guatemala; on *Gongora* from Trinidad; on *Hippeastrum* from Trinidad; on *Laelia* from Mexico; on *Oncidium* from England (in greenhouses), Dominican Republic, Costa Rica, Canal Zone, Trinidad; on *Zamia* from Trinidad; on unknown genera of Orchidaceae from many of the preceding localities and Cuba, Venezuela, Portugal, Ceylon; and on *Chamaedorea* (Palmae) from Guatemala.

This species differs from *ingae*, which it resembles, in having normally a dorsal submarginal row of 24 to 26 8-shaped pores, as well as in other characters.



## ASTEROLECANIUM EUPHORBIAE, new species

(Fig. 22, H-L; fig. 23, A; pl. 6, O)

*Habit.*—Unknown.

*Test of female.*—Nearly circular, 1.4–1.9 mm. in diameter; nearly flat or very slightly convex dorsally and ventrally; pale yellow, sometimes almost colorless, transparent, very thin, shiny or dull; marginal filaments whitish, fragmentary; elliptical larval exit in margin.

*Adult female.*—Nearly circular, 1–1.5 mm. in diameter.

Margin: 8-shaped pores in a single row terminating around length of apical seta from setal bases, posterior pores 9–10  $\mu$  long and 6–8 wide, the others 10–12  $\mu$  long and 8 wide, at least a pore's length apart; quinquelocular pores in a single row terminating 6–17 8-shaped pores from the posterior pair of those pores, only about half as numerous as 8-shaped pores near posterior end of the row, elsewhere at least as numerous.

Dorsal surface: Minute 8-shaped and disk pores fairly sparse; tubular ducts 30  $\mu$  long.

Ventral surface: Antenna circular or oblong, sunken in derm, rough, sometimes ending in a sharp spine, with 1 or 2 setae shorter than diameter of antenna and 3 longer; without quinquelocular pores or with 1 or 2 between antenna and margin; beak with 1 pair of setae; spiracle with bar greatly expanded at inner end, the derm around opening and part of bar slightly sunken and containing 3–5 quinquelocular pores, 18–28 similar pores extending from spiracle to body margin in an irregularly double or triple row; multilocular pores, totaling 112–157 and with 8–10 loculi, arranged in 5 or 6 complete (sixth sometimes interrupted) and 3 or 4 interrupted rows, with anterior row anterior to posterior spiracles, posterior row with 10–14 pores, penultimate with 12–19, each of next 2 with 14–26, and each of next 3 or 4 with 3–10; 4–7 dark-rimmed 8-shaped pores each side of beak, some scattered on anterior end, a few in lateral area of abdomen, and a few arranged in 2 rows among multilocular pores; submarginal 8-shaped pores in an irregularly double row terminating near posterior row of multilocular pores, one-half as numerous as marginal 8-shaped pores at some points, quite as numerous at other points; submarginal setae in a complete row terminating halfway between the posterior pair of marginal 8-shaped pores and apical setae; 4 setae in posterior row of multilocular pores, 2 or 3 in penultimate, and 1 or 2 in first row anterior to penultimate.

Apex of abdomen: Concave; lobes indicated; setae, apical broken, apparently 54  $\mu$  long, interapical 7.2  $\mu$  long, dorsal 5.4–7.2  $\mu$  long, inner ventral 3.6  $\mu$  long, intermediate ventral 5.4  $\mu$  long, outer ventral 6–9  $\mu$  long; anal ring with 6 setae 40–45  $\mu$  long, and with an inner row of 6 and an outer one of apparently 14 pores; ventral surface of apex slightly rugose.

*Larva.*—Ovoid.

Margin: With 28 8-shaped pores, the posterior 6 pairs slightly smaller than the others, and with their axes transverse, axes of the others longitudinal; 2 pairs of setae at anterior end.

Dorsal surface: 8-shaped pores in a submedian and a lateral row of 9 each on each half of body, about as long as the width of a marginal pore; disk pores between lateral and marginal 8-shaped pores.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 0; VI, 2 long, 2 stout, 3 fairly stout, 2 slender; bases of antennae one-fourth length of antenna apart; beak setae, 2 pairs apical, 1 pair basal; spiracle with 1 trilocular and 1 quinquelocular pore; leg setae, coxa 4, femur 1 on inner margin at base and 1 each on inner and outer margins near center, tarsus 2 on inner and 1 on outer margin; tibia one-third as long as tarsus; apparently 8 pairs of submarginal 8-shaped pores, none noted between antennae; 10 pairs of submarginal minute setae, on abdomen, thorax, and head; 3 pairs of setae near antennae.

Apex of abdomen: Notch present; setae, apical 108  $\mu$  long, interapical 7.2  $\mu$  long, dorsal 3.6  $\mu$  long, inner ventral 5.4  $\mu$  long, intermediate ventral 5.4  $\mu$  long, outer ventral 5.4  $\mu$  long; anal ring with 6 setae, each about 22  $\mu$  long, and with an indeterminate number of pores, apparently not divided.

*Data.*—Described from two mounted females on *Euphorbia pulvinata*, South Africa, intercepted at Washington, D. C., L. L. Spessard, October 27, 1930, paratypes; unmounted material, four mounted females, and two mounted larvae on *Euphorbia ferox*, Tausenville, South



Africa, intercepted at Washington, D. C., H. L. Sanford, February 23, 1935, holotype and paratypes.

This species resembles *transversum*, but differs from it in several characters, the most important being the terminating point of the marginal quinquelocular pores, which is much farther from the posterior pair of marginal 8-shaped pores than in *transversum*, the presence of 22 to 32 pores in each spiracular pore band instead of 9 to 16, more than 100 multilocular pores instead of less than 90, and a dorsal seta on the apex of the abdomen.

### ASTEROLECANIUM EURYOPIS Fuller

(Fig. 22, *M*; fig. 23, *B-J*; pl. 1, *D*)

Described and named in 1899 (*38*, pp. 93-95; *39*, p. 818).

*Habit*.—Living on bark.

*Test of female*.—Practically circular, posterior end slightly produced and slightly to distinctly upturned; 2-2.5 mm. in diameter; strongly convex dorsally, flat ventrally; clear yellow, transparent, fairly thin; marginal filaments whitish, varying in length, and not differentiated from dorsal filaments, which are so numerous that test cannot be seen in unrubbed specimens, and which are sometimes replaced by a thin sheet of glassy material at any one spot although with many distinct filaments present; elliptical larval exit in margin.

*Adult female*.—Shape similar to that of test, about 1.5-2 mm. in diameter.

Margin: 8-shaped pores in a single row terminating around five times the length of apical seta from setal bases, the row poorly defined, not distinct from dorsal pores, and particularly difficult to observe at anterior end; pores slightly to deeply invaginated, 20-28  $\mu$  long and 12-13 wide, the posterior pores as small as any, one to three times a pore's length apart; disk pores on either side, or at end, of 8-shaped pores, terminating fairly close to apical setae, as numerous as 8-shaped pores.

Dorsal surface: 8-shaped pores scattered, and very numerous except close to posterior end, the majority distinctly invaginated, 20-28  $\mu$  long and 12-20 wide; minute 8-shaped pores absent; disk pores rather sparse; tubular ducts 46  $\mu$  long.

Ventral surface: Antenna normally a dome-shaped stub with 3 setae nearly as long as diameter of antenna; beak with 2 pairs of setae; spiracle with bar greatly enlarged at inner end, with atrium not enlarged and not containing pores, but derm surrounding opening and adjacent to bar sometimes sunken, pocket-like, and filled with quinquelocular pores, 75-125 pores extending from opening to body margin, either in an even band or in an irregular band which is broad near opening, then narrows and then broadens to as much as 6-12 pores wide; multilocular pores, totaling 145-170, with 6-10 (usually 10) loculi, in 4 complete and 1-3 interrupted rows, the posterior row with 26-31, penultimate with 42-55, next with 49-56, next with 13-24, and each of interrupted rows with 1-4; a loose group of 10-15 dark-rimmed 8-shaped pores each side of mouth parts, a few scattered on anterior end, and many in lateral area arranged in rather indefinite longitudinal rows 2 or 3 pores wide, and extending across median area in 5 or 6 transverse rows; submarginal 8-shaped pores in a single row terminating near first row anterior to penultimate row of multilocular pores, well removed from margin, slightly less numerous than marginal 8-shaped pores; submarginal setae absent; 3 pairs of setae in posterior row of multilocular pores and 1 pair in penultimate row.

Apex of abdomen: Notch present; setae, apical 18-20  $\mu$  long, interapical 12.6  $\mu$  long, dorsal 9-10.8  $\mu$  long (close to, and outside apical, sometimes missing on 1 side of body), inner ventral 5.4  $\mu$  long, intermediate ventral 5.4  $\mu$  long, outer ventral 7.2-9  $\mu$  long; anal ring with 6 setae 72-80  $\mu$  long, with around 40 pores tending toward arrangement in an inner row of 6 or 8 and an outer one of around 30; ventral surface of apex sclerotized close to margin of notch.

*Larva*.—Nearly elongate elliptical, posterior end narrowed.

Margin: 8-shaped pores 28 in number, axis of the posterior pair transverse, of the others slightly diagonal or longitudinal; 2 or 3 setae at anterior end (sometimes as nearly submarginal as marginal).

Dorsal surface: 8-shaped pores, totaling 44-48, in a submedian row of 9 or 10 and a submarginal row of 13 or 14, on each half of body, the submarginal

row very close to margin and appearing almost as a second marginal row; the anterior 4 submedian pores slightly larger than the posterior ones, which are the same size as marginal pores, submarginal pores very slightly larger than marginal; disk pores between submarginal and marginal, and a few between submarginal and submedian 8-shaped pores; a pair of minute setae close to anterior pair of submedian pores.

Ventral surface: Antennal setae, I, 2; IV, 1; V, 0; VI, 2 long, 2 stout, 2 fairly stout, and 2 slender; bases of antennae one-fifth length of antenna apart; beak setae, 2 pairs apical, 1 pair basal; spiracle with 1 trilocular pore; leg setae, coxa 4, femur 1 on inner margin near base and 1 each on inner and outer margins near center, tarsus 2 on inner and 1 on outer margin; tibia one-half as long as tarsus; 6 pairs of submarginal 8-shaped pores, none between antennae; usually 1 pair of submarginal minute setae near the third or fourth pair of pores from the anterior end of marginal row of 8-shaped pores, rarely 1 or 2 rudimentary setae on abdomen, 2-4 submarginal larger setae at anterior end; 4 or 5 setae between antennae and mouth parts.

Apex of abdomen: Notch present; setae, apical  $125\ \mu$  long, interapical  $5.4\ \mu$  long, dorsal  $3.6\ \mu$  long (anterior to interapical), inner ventral  $7.2-9\ \mu$  long, intermediate ventral  $5.4\ \mu$  long, outer ventral  $5.4\ \mu$  long; anal ring with 6 setae  $28-30\ \mu$  long, and with an inner row of 6 and an outer row of 12 pores.

*Data*.—Redescribed from unmounted material and the following mounted specimens: Ten females on *Euryops tenuissimus*, Tarkastad, Cape Province, South Africa, C. P. Lounsbury, 1898, Brain No. 20, type and paratypes; 2 females and 24 larvae, South Africa, from Collection of C. K. Brain, received from E. E. Green in 1934; 5 females and 14 larvae on *Euryops* sp., Tarkastad, Cape Province, South Africa, from H. K. Munro, received in 1938.

This species differs from all except *brevispinum* in having a poorly defined row of marginal 8-shaped pores, in having the majority of the marginal and dorsal 8-shaped pores conspicuously invaginated, and in lacking a ventral submarginal row of setae. In the larval stage it is difficult to determine whether the pores described as dorsal submarginal should be considered so or as a second marginal row. It is the only species where a well defined row of ventral submarginal setae has not been observed in the larva, and where the setae which are present are so variable in number.

As indicated by Fuller (38, p. 94) and Brain (12, pp. 113-114), tests of *euryopsis*, when unrubbed, are striking owing to the dense covering of waxy filaments. Fuller recommended infesting the Harpui Bosch (*Euryops tenuissimus*) with this insect in order to check the spread of that plant (38, pp. 93-95).

### ASTEROLECANIUM EXIGUUM Green

(Fig. 23, K-N; fig. 24, A-D; pl. 8, S)

Described in 1909 (42, p. 315).

*Habit*.—Living on the lower surface of leaves.

*Test of female*.—Longer than wide, anterior two-thirds broad, posterior third strongly narrowed; 0.85-1.10 mm. long, 0.3-0.4 wide; strongly convex dorsally on anterior two-thirds, slightly so on posterior third, flat ventrally; brownish yellow, transparent, rather thin, shiny; marginal and dorsal filaments whitish, fragmentary, a few dorsal ones along each side of median line, and 2 in submarginal area close to posterior end, the latter as long as width of test at that point; circular larval exit in ventral surface at margin.

*Adult female*.—Shape similar to that of test, 0.8 mm. long, 0.4 wide.

Margin: 8-shaped pores in a single row terminating around twice length of apical seta from bases of setae, the posterior pores  $4-5\ \mu$  long and 2-3 wide, the others  $6\ \mu$  long and 4 wide, usually a pore's length apart at posterior end, a pore's width apart elsewhere.



Dorsal surface: 8-shaped pores in a longitudinal group on each half of body in submedian area posterior to mouth parts, each group apparently composed of an inner row of 7 or 8 and an outer row of 3 or 4, individual pores measuring 6-8  $\mu$  long and 3-5 wide, a pair 9  $\mu$  long and 7 wide also in submarginal area about length of apical seta from bases of setae; minute 8-shaped pores fairly numerous; disk pores not observed; tubular ducts 20  $\mu$  long; dorsal tubes present.

Ventral surface: Antenna circular, very short, with 2 setae longer than diameter of antenna; beak without setae; spiracular bar fairly broad, atrium slightly enlarged and containing 1-3 quinquelocular pores, 3 or 4 similar pores extending to body margin in a single row; multilocular pores, totaling 28, with 6-10 (usually 10) loculi, in 3 complete and 3 interrupted rows, each of complete rows with 6-8, each of interrupted rows with 2; 2 or 3 dark-rimmed 8-shaped pores each side of beak and a few on abdomen arranged in 3 or 4 transverse rows; submarginal 8-shaped pores in a single row apparently terminating near genital opening, about as numerous as marginal 8-shaped pores; 4 pairs of submarginal setae on abdomen, the posterior pair the length of an apical seta from bases of apical setae; 1 pair of setae in each of the posterior 2 rows of multilocular pores.

Apex of abdomen: Notch present, lobes indicated; setae, apical 40  $\mu$  long, interapical 5.4  $\mu$  long, outer ventral 5.4  $\mu$  long; anal ring with 4 setae 5.4  $\mu$  long and two 10  $\mu$  long, a tendency toward division of ring on dorsal and ventral sides; dorsal surface of apex slightly sclerotized in dentate rows in median area.

*Larva*.—Nearly elongate elliptical, posterior end slightly narrowed.

Margin: With 28 8-shaped pores, the posterior and penultimate pairs slightly larger than the first pair anterior to the penultimate, the latter the smallest, and those anterior to it gradually increasing in size to the anterior pair, which is distinctly the largest, axes of all longitudinal; 4 pairs of setae at anterior end.

Dorsal surface: 8-shaped pores in a submedian row of 10 and a lateral row of 6, on each half of body, posterior submedian pores the smallest, increasing in size to near anterior end of row, the anterior 3 pores at least slightly larger than the marginal pores of same segments; the posterior 2-5 pores of lateral row about as large as posterior pore of submedian row, anterior lateral pore slightly larger than next to anterior submedian pore; disk pores sparse between submedian and lateral, and lateral and marginal, 8-shaped pores.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 1; VI, 2 long, 2 stout, 2 fairly stout, 1 slender; antennal bases one-half length of antenna apart; beak setae, 2 pairs apical, 1 pair median; anterior spiracle with 1 trilocular and 1 quinquelocular pore or with 2 trilocular pores, posterior spiracle with 1 trilocular pore; leg setae, coxa apparently 3, femur 1 on inner margin at base and 1 each on inner and outer margins near center, tarsus 2 on inner and 1 on outer margin; tibia one-half length of tarsus; 9 pairs of submarginal 8-shaped pores; 6 pairs of submarginal minute setae on abdomen, submarginal larger setae not observed; 2 pairs of setae between antennae and mouth parts.

Apex of abdomen: Notch small; setae, apical 21  $\mu$  long, interapical 3.6-4.4  $\mu$  long, outer ventral 2  $\mu$  long; anal ring with 6 setae 2-3  $\mu$  long, apparently not divided.

*Test of male*.—Elongate elliptical, a notch in posterior margin; 1 mm. long, 0.3 wide; convex dorsally, most strongly so at anterior third, sloping to posterior end, with median and lateral carinae rather faint on anterior third; flat ventrally; very pale yellow, transparent, very thin, shiny; marginal filaments pale yellow; dorsal filaments not observed.

*Adult male*.—0.8 mm. long.

Head: Antenna broken, only 5 segments present, but presumably 10-segmented, as in male nymph; antennal setae, I-V, 9-12; basal bars slightly diagonal; 22 setae between ventral eyespots and antennae, 3 setae along linear bar between antennae, and 1 on dorsal surface.

Thorax: Bar between wing bases rectangular, nearly four times as long as wide, with a fold in center; tibia three-fourths length of tarsus.

Abdomen: Five segments each with a pair of setae dorsally on lateral margin, 3 segments each with a pair of setae in ventral lateral area; lobe areas each with 1 long and 2 short setae; penis sheath rather short and stout, strongly curved near posterior end, with 1 pair of setae on dorsal surface near base and 4 setae on each side of ventral opening from near base toward tip, none at tip.



*Male nymph*.—Antenna 10-segmented; distinguishing characters similar to those of adult male.

*Third-stage male*.—Elongate, slender, posterior end slightly narrowed; margin with 8-shaped pores terminating about two-thirds length of apical seta from bases of setae, 3 or 4 quinquelocular pores opposite each spiracle; dorsal surface with a median row of 9 or 10 and a submarginal row of 6 or 8 8-shaped pores, anterior pore in each row and posterior pore of submarginal row at least as large as the others and larger than a posterior marginal pore; ventral surface without pores between spiracle and body margin, or with the 3 or 4 pores usually situated along margin placed between opening and margin but rather close to margin, legs represented by 3 pairs of circular, slightly sclerotized areas, each sometimes with a sharp, stout, straight claw and minute clear areas; apex of abdomen with setae as in adult female; anal ring with 6 setae  $21.6 \mu$  long, with an inner row of 6 and an outer one of at least 10 pores, and tending toward division on dorsal side.

*Data*.—Redescribed from unmounted material and mounted specimens consisting of two females, five larvae, one adult male, a fragment of a male nymph, and three third-stage males on bamboo, Yatiantota, Ceylon. E. E. Green, March 1902, types.

This species is most closely related to *udagamae*, but is different in shape, has smaller marginal 8-shaped pores, which terminate farther from the bases of the apical setae, and has about 22 dorsal 8-shaped pores. It is one of the few known species in which there are no pores in the anal ring of adult females and larvae but in which there are approximately 16 in the third-stage male.

#### ASTEROLECANIUM FIMBRIATUM (Fonscolombe)

(Fig. 24, E-N; pl. 2, D)

Described as *Coccus fimbriatus* in 1834 (34, p. 209), on *Coronilla glauca*. Although the collection locality was not given, it may have been Marseilles, France, because Fonscolombe stated that it was given to him by Casimir Rostan, then permanent secretary of the Academy of Marseilles. Also discussed briefly by Signoret in 1868 (86, p. 515). Material at hand probably represents as authentic material of the species as exists.

*Habit*.—Living on twigs and stems, in flattened areas or in shallow pits, margin of test not sunken in pit.

*Test of female*.—Nearly circular or broadly pyriform, posterior end slightly upturned; 2.5–3 mm. long, 2–2.5 wide; convex dorsally, sometimes rather strongly so, nearly flat or slightly convex ventrally; brownish or pale yellow, translucent, rather thick, punctate, shiny; marginal filaments whitish, fragmentary; elongate elliptical larval exit in margin.

*Adult female*.—Shape similar to that of test, approximately 2.5 mm. in diameter, or 2.5–2.9 mm. long, 2–2.5 wide.

Margin: 8-shaped pores in a double row (usually single at 1 or 2 points) terminating length of a posterior pore from bases of apical setae, 10–17  $\mu$  long and 8–9 wide, distances between pores of same row the width to twice the length (usually about the length) of a pore, the two rows less than a pore's width apart; quinquelocular pores in a single row, starting about 8 8-shaped pores anterior to anterior spiracular pore bands and ending slightly nearer to apical setae than to the posterior spiracular pore bands, the row sometimes interrupted between the pore bands; pores usually about as numerous as 8-shaped pores of nearer row near ends of row, and about twice as numerous as those pores near spiracular pore bands; disk pores along dorsal row of 8-shaped pores, terminating between apical setae and anal opening, nearly half as numerous as 8-shaped pores of dorsal row, also occurring ventrad of quinquelocular pores, and terminating near the posterior pair of submarginal setae, these pores about one-half as numerous as those dorsad of 8-shaped pores.

Dorsal surface: 8-shaped pores absent or 2-6 in number along median line, when present 8-12  $\mu$  long and 5-8 wide; minute 8-shaped pores very numerous; disk pores fairly numerous; tubular ducts 40  $\mu$  long.

Ventral surface: Antenna irregularly circular, sometimes sunken in derm, with 2 setae about twice as long as, and 2-6 shorter than, diameter of antenna; beak with 2 pairs of setae; spiracle with bar broad, a sclerotized band extending around opening, 3-8 (usually 6 or 7) quinquelocular pores in sclerotized area, and 40-65 extending to body margin in a row 2-5 pores wide, a total of 44-70 (usually 53-60) in group and row combined; multilocular pores, usually totaling 42-48 (1 of specimens examined with a total of 70), and with 7-11 (usually 10) loculi, in 3 complete rows, posterior and penultimate rows each with 15-20, anterior row with 11-15; 4 or 5 dark-rimmed 8-shaped pores each side of beak, a few scattered on anterior end, and others arranged in 6-8 transverse rows posterior to mouth parts; submarginal 8-shaped pores in an irregularly double to quadruple (usually triple) row terminating near anterior row of multilocular pores, 2-4 opposite nearly every marginal 8-shaped pore of nearer row; 4-8 disk pores in each spiracular pore band; submarginal setae apparently in a complete row terminating about 6 8-shaped pores from the posterior pair of marginal 8-shaped pores; 1 pair of setae each in posterior and penultimate rows of multilocular pores.

Apex of abdomen: Lobes barely indicated; setae, apical 88-100  $\mu$  long, interapical 40  $\mu$  long, dorsal 24-36  $\mu$  long, inner ventral 5.4  $\mu$  long, intermediate ventral 7.2  $\mu$  long, outer ventral 14-16  $\mu$  long; anal ring with 6 setae 92-100  $\mu$  long, usually with around 36 pores, but 1 of specimens examined with 54; ventral surface of apex heavily sclerotized around inner ventral setae, surrounding area lightly sclerotized in dentate rows.

*Larva*.—Elongate elliptical.

Margin: With 28 8-shaped pores, the posterior 6 pairs distinctly smaller than the others, and their axes transverse, axes of the others longitudinal; a pair of minute setae close to each of the posterior 4 pairs of pores; 3 pairs of setae at anterior end.

Dorsal surface: 8-shaped pores in a submedian row of 7-9 on each half of body, posterior pores possibly very slightly smaller than the others, all practically same size as posterior marginal pores; disk pores fairly close to marginal 8-shaped pores, and a few fairly close to dorsal 8-shaped pores; a pair of small setae sometimes present near anterior pair of 8-shaped pores.

Ventral surface: Antennal setae, I, 2; IV, 1; V, 1; VI, 2 long, 2 stout, 3 fairly stout, 2 slender; bases of antennae one-third length of antenna apart; beak setae, 2 pairs apical, 1 pair basal; spiracle usually with 1 trilocular pore, but anterior spiracle sometimes with 1 quinquelocular pore; leg setae, coxa 4, femur 1 on inner margin near base and 1 each on inner and outer margins near center, tarsus 2 on inner and 1 on outer margin; tibia one-half as long as tarsus; normally 8 pairs of submarginal 8-shaped pores, not present between antennae; 9 pairs of submarginal minute setae, on abdomen and thorax, 3 pairs of submarginal larger setae at anterior end; 3 pairs of setae between antennae and mouth parts.

Apex of abdomen: Setae, apical 118-125  $\mu$  long, interapical 45-49  $\mu$  long, dorsal 7.2  $\mu$  long, inner ventral 7.2  $\mu$  long, intermediate ventral 9-10.8  $\mu$  long, outer ventral 10.8-16.2  $\mu$  long; anal ring with 6 setae 36-41  $\mu$  long, and an inner row of 6 and an outer row of 12 pores; ventral surface of apex faintly sclerotized near margin.

*Data*.—Redescribed from unmounted material and the following mounted specimens: Two females and 25 larvae on *Coronilla glauca*, Montpellier, France, J. Lichtenstein, April 1880; 1 female and 10 larvae, Cockerell Collection; 1 female and 17 larvae on *Coronilla glauca*, Montpellier, France, determined by Lichtenstein and Löw, loaned by M. Beier; 1 female from the Lichtenstein Collection, loaned by P. Vayssière.

The species is closely related to *algeriense*, *arabidis*, *launeae*, *nevadense*, *stentae*, and less closely allied to *zanthenes*, but differs from all in being normally without dorsal 8-shaped pores.

## ASTEROLECANIUM FLAGELLARIAE, new species

(Fig. 25, A-H; pl. 7, N)

*Habit.*—Living on both surfaces of leaves.

*Test of female.*—Elongate ovoid, 0.7–0.9 mm. long, 0.5–0.75 wide; nearly flat to slightly oval dorsally, sometimes with faint transverse striations, flat ventrally; pale greenish yellow, transparent, shiny; marginal filaments deep salmon; elliptical larval exit in dorsal surface at margin.

*Adult female.*—Elongate ovoid, posterior end sometimes slightly produced; 0.65–0.85 mm. long, 0.5–0.7 wide.

Margin: 8-shaped pores in a single row, interrupted near posterior end for a space of 10–20 pores (1 of specimens examined, without interruption), continued for 2–12 pores beyond interruption and terminating one to three times a pore's length from bases of apical setae, 7 or 8  $\mu$  long and 3 wide, about the width of a pore apart; trilocular pores in a single row between spiracular pore bands, and 15–25 pores outside those bands, one and a half times as numerous as 8-shaped pores.

Dorsal surface: Minute 8-shaped pores in lateral areas, sparse; disk pores sparse; tubular ducts 20  $\mu$  long.

Ventral surface: Antenna slightly raised, more or less crenulate, with 2 setae as long as diameter of antenna; spiracle with bar very slender, atrium enlarged, bag-shaped, and containing 5–8 quinquelocular pores, opening broad, extending into a furrow which flattens out near margin, 8–15 trilocular pores extending to body margin in an irregularly single or double row; multilocular pores, totaling 20–26 and with 6–11 (usually 10 or 11) loculi, in 3 complete and 1 or 2 interrupted rows, posterior row with 8–10, penultimate with 8–12, next with 5–7, each of interrupted rows with 2; a group of 2–5 dark-rimmed 8-shaped pores each side of mouth parts, a few anterior and a few posterior to beak, mostly in lateral area, and a few in median area near or among multilocular pores; submarginal 8-shaped pores in a single row terminating near the posterior pair of marginal 8-shaped pores, about half as numerous as marginal 8-shaped pores; 3 pairs of submarginal setae on abdomen, the posterior pair fairly near the posterior pair of marginal 8-shaped pores; 2 pairs of setae in the posterior row, 1 pair in each of the other complete rows, and 1 pair in each of the interrupted rows of multilocular pores.

Apex of abdomen: Lobes barely indicated; setae, apical at least 36  $\mu$  long (tips broken), probably not more than 40, interapical (directly anterior to apical) 1–2  $\mu$  long, outer ventral 1–2  $\mu$  long; anal opening dorsal, close to body margin, circular, its margin membranous; anal tube membranous, cylindrical; anal ring a sclerotized band.

*Larva.*—Elliptical.

Margin: With 28 8-shaped pores, their axes transverse, anterior pair the largest; a pair of minute setae close to each of the posterior 3 pairs of pores; 3 pairs of setae at anterior end.

Dorsal surface: 8-shaped pores, totaling 28 or 30, arranged in a submedian row of 8 or 9 and a lateral row of 6 or 7 on each half of body, and apparently about two-thirds the size of a posterior marginal pore; disk pores sparse, between submedian and lateral and lateral and marginal 8-shaped pores.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 1; VI, apparently 2 long, 2 stout, 3 fairly stout, 1 slender; bases of antennae one-third length of antenna apart; beak apparently with 1 pair of setae at tip and 1 pair near base; spiracle with 1 trilocular and 1 quinquelocular pore; leg setae, coxa 3, femur 1 on inner margin near base and 1 on outer margin near center, tarsus 2 on inner and 1 on outer margin; tibia one-third as long as tarsus; 9 pairs of submarginal 8-shaped pores; submarginal setae apparently in 11 pairs, occurring on abdomen, thorax, and head; 3 pairs of setae between antennae and mouth parts.

Apex of abdomen: Lobes barely indicated; setae, apical 50  $\mu$  long, interapical 3.6  $\mu$  long, outer ventral minute, broken; anal opening in margin, circular; anal tube sclerotized near opening, membranous at inner end, fairly small at opening, then enlarged but constricted in center, large at inner end; anal ring sclerotized.

*Test of male.*—Elliptical, 0.75–1 mm. long, 0.45 wide; flat dorsally and ventrally; pale greenish yellow, transparent, thin; marginal filaments rubbed off.

*Adult male.*—0.95 mm long.



Head: Antenna 10-segmented; formula (longest to shortest), (III, IV), (V, VI), (VII, VIII, IX, X), (I), (II); antennal setae, I, 1; II and III, 8; IV-X, approximately 15, X also with at least 2 very long setae; basal bars transverse; approximately 25 setae anterior to ventral eyespots and along linear bar between antennae, and 1 or 2 on dorsal surface.

Thorax: Bar between wing bases rectangular, five times as long as wide, with an indication of median longitudinal fold and with a small clear area in center; tibia very slightly shorter than tarsus.

Abdomen: Four segments each with a pair of setae dorsally on lateral margin, 4 or 5 segments each with a pair of setae in ventral lateral area; lobes indicated, each with 1 long and 3 or 4 short setae; penis sheath with a few minute clear areas (possibly setal bases) on each side of ventral opening.

*Male nymph.*—Distinguishing characters similar to those of adult male.

*Third-stage male.*—Resembling adult female, but smaller; margin with 8-shaped pores in a complete row terminating a pore's width from bases of apical setae; presence or absence of trilocular pores at anterior end indeterminable, but such pores present elsewhere even between apical setae; ventral surface with atrium of spiracle apparently slightly enlarged but without pores; 6 or 8 pores in each spiracular pore band; legs represented by 3 pairs of very small, sclerotized, raised areas, apparently without claws; other characters on ventral surface indeterminable; apex of abdomen with broken apical setae, other characters indeterminable.

*Data.*—Described from unmounted material, and from mounted specimens consisting of 18 females, 7 larvae, 2 adult males, 1 male nymph, and 1 third-stage male on *Flagellaria indica*, Botanic Garden, Singapore, Straits Settlements; found in the Herbarium at Manila, Philippine Islands, by E. D. Merrill, received from R. C. McGregor in March 1921.

This species, the first to be reported from the Flagellariaceae, is rather similar to various species of *Asterolecanium* found on palm. It can be segregated from any known species on palm, however, by the presence of a well defined anal tube and anal ring in the adult female.

### ASTEROLECANIUM FLORUM, new species

(Fig. 25, I-P; pl. 8, B)

*Habit.*—Living on both surfaces of leaves.

*Test of female.*—Nearly elliptical, posterior end slightly produced; 1.9–2.40 mm. long, 1–1.25 wide; very slightly convex dorsally, sometimes with a faint longitudinal median carina, flat ventrally; bright brownish yellow, transparent, fairly thin, punctate; marginal filaments pale clear yellow or brownish yellow, longest at anterior end, and fragmentary dorsal filaments pale yellow, sparse in submarginal area; larval exit a slit in margin.

*Adult female.*—Similar to test in shape, 1.7–2.25 mm. long, 1–1.2 wide.

Margin: 8-shaped pores in a single row terminating length of apical seta from bases of setae, posterior pores 9  $\mu$  long and 7 wide, the others 12  $\mu$  long and 7 wide, usually a pore's width apart; quinquelocular pores in a single row terminating near the posterior pair of 8-shaped pores, usually as numerous as 8-shaped pores; disk pores dorsad of 8-shaped pores, terminating near the posterior pair of those pores, about one-third as numerous.

Dorsal surface: 8-shaped pores in a submarginal row of 10–20, placed at uniform or variable intervals, about 16  $\mu$  long and 12 wide; minute 8-shaped pores rather sparse; disk pores usually present near large 8-shaped pores, very sparse elsewhere; tubular ducts 32  $\mu$  long; dorsal tubes present.

Ventral surface: Antenna very short, with 2 setae longer and 2 shorter than diameter of antenna; beak without setae; spiracular bar fairly broad; derm outside spiracular opening slightly sunken; 11–15 quinquelocular pores extending from spiracle to body margin in a single row; multilocular pores, with 9 or 10 loculi, in 5 complete and 3 interrupted rows, each of the posterior 3 rows with 7–14, next with 5–8, next with 3 or 4, each of interrupted rows with 2, a total of 38–60 (usually at least 50); dark-rimmed 8-shaped pores very sparse in lateral area of abdomen and in 3 or 4 transverse rows among multilocular pores; submarginal 8-shaped pores in a single row terminating near the posterior row of

multilocular pores, nearly as numerous as marginal 8-shaped pores; 5 pairs of submarginal setae on abdomen, the posterior pair near the penultimate pair of marginal 8-shaped pores; 1 pair of setae in each of the posterior 3 rows of multilocular pores.

Apex of abdomen: Setae, apical 21-25  $\mu$  long, interapical 8  $\mu$  long, outer ventral 5.2  $\mu$  long; anal ring with 6 setae, each about 32  $\mu$  long, and with an inner row of 6 and an outer row of 16 pores, apparently not divided.

Larva.—Nearly elongate elliptical, posterior end narrowed.

Margin: With 28 8-shaped pores, the posterior 6 pairs slightly smaller than the others, which increase slightly in size from the sixth to the anterior pair, axis of each of the posterior 6 pairs transverse, axis of each of the others longitudinal; 3 pairs of setae at anterior end.

Dorsal surface: 8-shaped pores in a submedian row of 8-10 and a lateral row of 3-5, on each half of body, a total of 24-26, posterior pores of each row very slightly smaller than anterior pores, all except anterior pore of submedian row, which is slightly larger than anterior marginal pore, one-fourth smaller than marginal pores of same segments; disk pores in a single row between lateral and marginal, and a few between lateral and submedian 8-shaped pores.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 0; VI, 2 long, 2 stout, 3 fairly stout, 1 slender; bases of antennae one-half length of antenna apart; beak setae, 2 pairs apical, 1 pair median; spiracle with 1 trilocular pore; leg setae, coxa 4, femur 1 on inner margin near base and 1 on outer margin near center, tarsus 2 on inner and 1 on outer margin; tibia one-half length of tarsus; 9 pairs of submarginal 8-shaped pores; 6 pairs of submarginal minute setae on abdomen, 3 pairs of submarginal larger setae at anterior end; 1 pair of setae between antennae and mouth parts.

Apex of abdomen: Setae, apical 50  $\mu$  long, interapical 10.8  $\mu$  long, outer ventral 2.5  $\mu$  long; anal ring with 6 setae, each about 12.6  $\mu$  long, and with an inner row of 6 and an outer of apparently 10 pores, apparently not divided.

Data.—Described from unmounted specimens (paratypes) and the following mounted specimens (host material collected by F. A. McClure in China): One female on *Arundinaria amabilis*, Yung Hui, Kwangsi, November 12, 1925, paratype; three females and three larvae on *Arundinaria amabilis*, Koo Shui, Kwong Ning district, Kwangtung, March 24, 1929, holotype and paratypes; two females on *Arundinaria* sp., Naam Fung to Nodoo, Hainan, Kwangtung, August 29, 1929, paratypes; one female on *Arundinaria* sp., between Yan Ping and Yeung Kong, Kwangtung, December 15, 1931, paratype.

Closely related to *masuii* and *sasae*, but having dorsal 8-shaped pores, which are not found in *masuii*, and having more marginal quinquelocular pores than occur in *sasae*. The larvae differ from those of *masuii* and *sasae* in having only one seta on the inner margin of the femur.

### ASTEROLECANIUM FUSUM, new species

(Fig. 26, A-D; pl. 9, P)

Habit.—Living on the lower surface of leaves.

Test of female.—Longer than wide, posterior end slightly produced; 1.4 mm. long, 1 wide; slightly convex dorsally, with a faint longitudinal median carina, flat ventrally; yellow, transparent, rather thick; marginal filaments rubbed off; larval exit a slit in margin.

Adult female.—Similar to test in shape, 1.25 mm. long, 0.85 wide.

Margin: 8-shaped pores in a single row terminating about the length of apical seta from bases of setae, posterior pores 8  $\mu$  long and 5 wide, the others 10  $\mu$  long and 6 wide, about a pore's width apart; quinquelocular pores in a single row terminating at, or posterior to, the posterior pair of 8-shaped pores, usually 1 near each 8-shaped pore; disk pores dorsal of 8-shaped pores, terminating between the posterior pair of 8-shaped pores and apical setae, usually 1 near every fourth 8-shaped pore at anterior end, and somewhat more numerous elsewhere.

Dorsal surface: Minute 8-shaped pores rather sparse; disk pores very sparse; tubular ducts 27  $\mu$  long; dorsal tubes present.

Ventral surface: Antenna dome-shaped, with 2 setae longer than diameter of antenna; beak without setae; spiracular bar nearly subcircular; anterior spiracle with 12 or 13 quinquelocular pores extending to body margin, the row single near spiracle and 3 or 4 pores wide near margin; posterior spiracle with 3 pores in a group near spiracle and with none or with 1 or 2 extending toward margin; multilocular pores, with 10 loculi, in 4 complete and 4 interrupted rows, the posterior complete row with 4-6, penultimate with 7-9, next with 8-10, next with 5-7, and each of interrupted rows with 2-4, making a total of 34-40; dark-rimmed 8-shaped pores sparse, occurring in lateral area near posterior spiracles and among multilocular pores; submarginal 8-shaped pores in a single row apparently terminating near the posterior row of multilocular pores, irregularly spaced, approximately one-half as numerous as marginal 8-shaped pores; 8 disk pores in submarginal area near the posterior 4 pairs of submarginal setae; 6 pairs of submarginal setae on abdomen, the posterior pair near the posterior pair of marginal 8-shaped pores; 1 pair of setae in each of the posterior 3 rows of multilocular pores.

Apex of abdomen: Setae, apical 28-31  $\mu$  long, interapical 7.2  $\mu$  long, inner ventral 4  $\mu$  long, outer ventral 5.4  $\mu$  long; anal ring with 6 setae 30-32  $\mu$  long, and an inner row of 6 and an outer one of 16 pores, apparently divided on dorsal side.

*Larva*.—Elliptical.

Margin: With 28 8-shaped pores, the posterior and anterior pairs larger than the others, axes of the posterior 6 pairs transverse, of the others longitudinal; 3 pairs of setae at anterior end.

Dorsal surface: 8-shaped pores in a submedian row of 10 or 11 on each half of body, posterior pores smaller than anterior ones and one-fifth or one-sixth smaller than marginal pores of same segments; disk pores in lateral area.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 0; VI, 2 long, 2 stout, 3 fairly stout, 1 slender; bases of antennae one-third length of antenna apart; beak setae, 2 pairs apical, 1 pair median; spiracle with 1 trilocular pore; leg setae, coxa 4, femur 1 on inner margin near base and 1 on outer margin near center, tarsus 2 on inner and 1 on outer margin; tibia about one-half as long as tarsus; 9 pairs of submarginal 8-shaped pores; apparently 6 pairs of submarginal minute setae on abdomen, 2 pairs of submarginal larger setae at anterior end; 1 pair of setae between antennae and mouth parts.

Apex of abdomen: Notch small; lobes indicated; setae, apical 45  $\mu$  long, interapical 12.6  $\mu$  long, inner ventral 3.6  $\mu$  long, outer ventral 3.6  $\mu$  long; anal ring with 6 setae about 12  $\mu$  long and apparently with a total of 12 or 14 pores.

*Data*.—Described from an empty test, three mounted females, and five mounted larvae of *Arundinaria* sp., Hung Mo Shan, Hainan, Kwangtung, China, F. A. McClure, August 22-27, 1929, holotype and paratypes.

This species is closely related to *chinae* and *subdolum*, but the adult female differs from that of *chinae* in lacking dorsal 8-shaped pores, and from *subdolum* in having the marginal 8-shaped pores terminating farther from the apical setae. The larvae differ from those of *chinae* and *subdolum* in having the axes of the posterior 6 pairs of marginal pores transverse, and in having about 22 dorsal 8-shaped pores.

### ASTEROLECANIUM GARCINIAE, new species

(Fig. 26, E-K; pl. 7, G)

*Habit*.—Living on the lower surface of leaves.

*Test of female*.—Longer than wide, posterior end slightly produced; 2 mm. long, 1.5 wide; slightly convex dorsally, with a faint longitudinal median carina, and indications of a broad, curved, submarginal carina meeting median at anterior third, also with 2 flat tubercles at anterior end; flat ventrally; rich yellow, transparent, fairly thin, slightly punctate; marginal filaments pale golden, dorsal filaments rubbed off; larval exit a slit in margin.

*Adult female*.—Similar to test in shape, 1.8 mm. long, 1.3 wide.

Margin: 8-shaped pores in a single row terminating about twice a pore's length from bases of apical setae, 12  $\mu$  long and 6 wide, a pore's width to length apart;



quinquelocular pores in a single row terminating at or within 5 pores from the posterior pair of 8-shaped pores, slightly more numerous than 8-shaped pores.

Dorsal surface: 8-shaped pores in a median row of 3 or 4 posterior to mouth parts, and in 12 or 14 fairly definite groups in submarginal area, the anterior group with 3-5 pores, the others with 2-5, individual pores measuring 15-16  $\mu$  long and 9-10 wide; minute 8-shaped and disk pores very sparse; tubular ducts rather sparse, 24  $\mu$  long.

Ventral surface: Antenna conical, sunken in derm, with 2 setae longer than diameter of antenna and apparently sometimes with 1 shorter; 1 or 2 quinquelocular pores between antenna and margin; beak with 2 pairs of setal bases; spiracular bar subcircular; 6-12 quinquelocular pores extending from spiracle to body margin in a single or double row; multilocular pores, totaling 86-92 and with 10 loculi, arranged in 5 complete and 3 interrupted rows, posterior row with 12 or 13, each of next 2 with 10-14, each of next 2 with 10-12, and each of interrupted rows with 5-9; 9-12 dark-rimmed 8-shaped pores each side of mouth parts, a few on anterior end, and others tending toward arrangement in 3 or 4 transverse rows among multilocular pores; submarginal 8-shaped pores in an irregularly double row terminating near the posterior row of multilocular pores, about one-half as numerous as marginal 8-shaped pores; submarginal setae in a complete row terminating near the penultimate pair of marginal 8-shaped pores; 1 pair of setae in each of the posterior 5 rows of multilocular pores.

Apex of abdomen: Notch present; lobes well developed; setae, apical 81  $\mu$  long, interapical 7.2-9  $\mu$  long, outer ventral 5.4-7  $\mu$  long; anal ring with 6 setae 30  $\mu$  long and apparently with an inner row of 6 and an outer row of 12 pores, divided on dorsal and ventral sides; ventral surface of apex with a narrow sclerotized area extending anteriorly from inner lobe on each half of body, slightly sclerotized on margin.

*Larva*.—Elliptical.

Margin: With 28 8-shaped pores, the posterior 6 pairs distinctly smaller, the anterior pair slightly larger, than the others, axes of the posterior 6 pairs transverse, of the others longitudinal; 3 pairs of setae anteriorly.

Dorsal surface: 8-shaped pores in a submedian row of 6 and a lateral row of 5, on each half of body, in each row, the posterior 3 pores smaller, and the anterior one larger, than the others, which are about the same size as marginal pores of same segments; disk pores closer to lateral than to marginal 8-shaped pores.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 1; VI, 2 long, 2 stout, 3 fairly stout, 2 slender; bases of antennae one-half length of antenna apart; beak apparently with 2 pairs of setae at tip; spiracle with 1 trilocular and 1 quinquelocular pore; leg setae, coxa 3, femur 1 on inner margin near base, tarsus 1 each on inner and outer margins; tibia one-half as long as tarsus; 9 pairs of submarginal 8-shaped pores; apparently 9 pairs of submarginal minute setae, on abdomen and thorax, 2 pairs of submarginal larger setae at anterior end; 4 pairs of setae between antennae.

Apex of abdomen: Notch minute; setae, apical 40  $\mu$  long, interapical apparently 5.4  $\mu$  long, outer ventral 2.5  $\mu$  long; anal opening in margin, anal tube short, sclerotized throughout; anal ring with 6 setae, each about 7  $\mu$  long.

*Data*.—Described from the following material: Unmounted specimens, two mounted females, and one mounted larva on *Garcinia mangostana*, Soekaboema, Java, C. L. Marlatt, December 19, 1901, holotype and paratypes, and unmounted specimens and three mounted females on *Garcinia mangostana*, Buitenzorg, Java, Dr. Treub, received May 19, 1905, paratypes.

Resembling *sumatrae*, but with dorsal 8-shaped pores larger than marginal.

#### ASTEROLECANIUM GEMMAE, new species

(Fig. 27, A-J; pl. 6, D)

*Habit*.—Living on buds, and almost indistinguishable from them, having the same shape and size, and practically the same color.

*Test of female*.—Longer than wide, posterior end produced and either conical or flattened; 1-1.25 mm. long, 0.65-0.8 wide; convex dorsally, flat or slightly

concave or convex ventrally; light brownish yellow, translucent to opaque, apparently slightly punctate; marginal filaments rubbed off; elliptical larval exit in ventral surface of produced area.

*Adult female*.—Broadly ovoid, posterior end narrowed and produced; 1 mm. long, 0.55 wide.

Margin: 8-shaped pores in a single row terminating around eight times a pore's length from bases of apical setae, 10–12  $\mu$  long and 7 wide, around a pore's width apart normally; quinquelocular pores in a single to quadruple row terminating posterior to the 8-shaped pores and close to produced area of abdomen, the row normally single between antennae, double, then triple or quadruple from well anterior to anterior spiracular pore bands to near the posterior 8-shaped pores, and irregularly single or double from there to end of row, sometimes lacking, or reduced in number if corresponding 8-shaped pores have dropped out; disk pores dorsad of 8-shaped pores, terminating close to median line at posterior end, 1 near each 8-shaped pore and occurring at the same intervals posterior to 8-shaped pores, usually reduced in number if some 8-shaped pores have dropped out.

Dorsal surface: Minute 8-shaped pores fairly numerous in lateral and submarginal areas; disk pores fairly numerous in lateral and submarginal areas and a few in median area near posterior end; tubular ducts absent along median line, scattered elsewhere, 32  $\mu$  long; dorsal tubes present.

Ventral surface: Antenna rough, irregular, dome-shaped, with 2 setae as long as diameter of antenna and 2 or 3 much shorter; beak without setae; spiracular bar subcircular, atrium slightly enlarged and containing quinquelocular pores, pores extending from atrium over opening of spiracle and continuing to body margin in a row 6–8 pores wide, a total of 75–100 pores in atrium and row combined; 5–8 dark-rimmed 8-shaped pores each side of mouth parts, a few anterior to mouth parts, and others arranged in 5 or 6 transverse rows in median and lateral (or only in lateral) area of abdomen; submarginal 8-shaped pores absent; disk pores scattered on anterior end, arranged in 7 transverse rows on the abdomen in the position usually occupied by the multilocular pores, and in a submarginal row terminating close to median line, disk pores in submarginal row much less numerous than marginal 8-shaped pores; 8 pairs of submarginal setae posterior to anterior spiracles, the posterior pair well anterior to apical seta; 1 pair of setae in each of the posterior 3 rows of disk pores.

Apex of abdomen: Setae, apical 7.2  $\mu$  long, interapical (on ventral surface close to margin) 3  $\mu$  long, inner and outer ventral each 3.6  $\mu$  long; anal opening ventral, well removed from margin, small, circular, its margin membranous; anal tube funnel-shaped, small at opening and large at inner end, lightly sclerotized close to anal ring, heavily sclerotized elsewhere; anal ring with 6 setae 1.8  $\mu$  long.

*Larva*.—Elliptical.

Margin: With 28 8-shaped pores, the posterior pair slightly larger than the others, axes of all longitudinal; 3 pairs of setae at anterior end.

Dorsal surface: 8-shaped pores in a submedian row of 5–10 on each half of body, uniform in size if in a row of 7 or less, the anterior 3 pores larger than the others if in a row of 10, larger pores seven-eighths, smaller pores about two-thirds, the size of marginal pores of same segments; disk pores close to marginal 8-shaped pores, and a few in lateral area.

Ventral surface: Antennal setae, I, 2; IV, 1; V, 0; VI, 2 long, 2 stout, 3 fairly stout, 1 slender; bases of antennae one-third length of antenna apart; beak setae, 2 pairs apical, 1 pair median; spiracle with 1 trilocular and 1 quinquelocular pore; leg setae, coxa 4, femur 1 on inner margin near base and 1 each on inner and outer margins near center, tarsus 2 on inner and 1 on outer margin; tibia one-half as long as tarsus; apparently 8 pairs of submarginal 8-shaped pores, of which 1 pair is between the antennae; 8 pairs of submarginal minute setae, on abdomen and thorax, 3 pairs of submarginal larger setae at anterior end; 1 pair of setae between antennae and mouth parts.

Apex of abdomen: Setae, apical 36  $\mu$  long, interapical 7.2  $\mu$  long, inner ventral 2  $\mu$  long, outer ventral 3.6  $\mu$  long; anal opening in ventral surface and margin, longitudinally elongate, its margin sclerotized; anal tube rather short and bulbous, heavily sclerotized throughout; anal ring with 6 setae 4  $\mu$  long; ventral surface of apex membranous, slightly rugose.

*Data*.—Described from unmounted material, 4 mounted females, and 50 mounted larvae on *Schizostachyum* sp., Bikal, Philippine Islands, F. A. McClure, October 1925, holotype and paratypes.

This is the only known species having numerous disk pores on the ventral surface arranged in complete rows in the position usually occupied by multilocular pores. It is also unusual in lacking submarginal 8-shaped pores in the adult females.

### ASTEROLECANIUM GILVUM, new species

(Fig. 27, K-T; pl. 9, CC)

*Habit*.—Living on the lower surface of leaves.

*Test of female*.—Nearly circular, about 0.6 mm. in diameter; strongly convex dorsally, flat ventrally; pale yellow, nearly colorless, transparent, thin, smooth; marginal filaments whitish, shortest on posterior half; elliptical larval exit in margin.

*Adult female*.—Nearly circular, 0.45–0.55 mm. in diameter, posterior end sometimes slightly produced.

*Margin*: 8-shaped pores in a single row, interrupted 1–3 times for 1–4 pores near posterior end, but continued beyond for 3–5 pores and terminating once or twice a pore's length from bases of apical setae, the pores in that part of the row having the interruptions, those just anterior to this section and sometimes 1 posterior to it 7  $\mu$  long and 4 wide, the others 8  $\mu$  long and 4.5 wide, usually about a pore's width apart, but the 2 or 4 pores anterior to the interrupted section sometimes nearly a pore's length apart; trilocular pores in a single row interrupted for 1–5 8-shaped pores at anterior end, terminating 2–5 8-shaped pores anterior to interruption, 1 near each or near every other 8-shaped pore at posterior end of row, elsewhere 1 near each such pore and usually 1 opposite each interval between 8-shaped pores.

*Dorsal surface*: Minute 8-shaped pores numerous in submarginal and lateral areas, rather sparse elsewhere; disk pores fairly numerous; tubular ducts in submarginal and lateral areas, 24  $\mu$  long.

*Ventral surface*: Antenna irregularly circular, flat, with 2 setae slightly longer than diameter of antenna; beak with 2 pairs of setae; spiracle with bar slender and expanded at inner end, atrium enlarged, bag-shaped, and containing 6–10 trilocular pores, 6–10 similar pores extending to body margin in an irregularly double row; a group of 4–7 dark-rimmed 8-shaped pores each side of beak, and a few smaller pores in an irregular longitudinal lateral row; submarginal 8-shaped pores in a single row terminating near anterior end of interruption in row of marginal 8-shaped pores, usually as numerous as marginal 8-shaped pores; apparently 8 pairs of submarginal setae posterior to anterior spiracles, the posterior pair near the penultimate pair of marginal 8-shaped pores; 2 pairs of setae posterior to genital opening, 1 pair anterior to opening, 1 pair anterior to those setae, and 1 pair still farther anteriorly.

*Apex of abdomen*: Lobes indicated; setae, apical 48  $\mu$  long, outer ventral 3.6  $\mu$  long; anal opening ventral, close to margin, small, circular, its margin membranous or faintly sclerotized.

*Larva*.—Nearly elliptical, posterior end narrowed.

*Margin*: With 28 elongate, slender 8-shaped pores, axes of all nearly longitudinal; a pair of minute setae close to each of the posterior 3 pairs of pores; 2 pairs of setae at anterior end.

*Dorsal surface*: 8-shaped pores in a submedian and a lateral row of 10 each, on each half of body; in the lateral row the next to the anterior pore much smaller than marginal, the 3 posterior to it, the 1 anterior, and the posterior pore larger than the other 4, which are practically the same size as marginal pores; in the submedian row, the posterior and the anterior 3 pores larger than the others, which are smaller than the marginal pores; disk pores between lateral and marginal 8-shaped pores.

*Ventral surface*: Antennal setae, I, 1; IV, 1; V, 0; VI, 3 long, 2 stout, 2 fairly stout; antennal bases one-half length of antenna apart; beak setae, 2 pairs apical, 1 pair basal; spiracle with 2 trilocular pores; leg setae, coxa 2, femur 1 on inner margin near base, tarsus 1 each on inner and outer margins; tibia nearly one-half length of tarsus; 9 pairs of submarginal 8-shaped pores; 10 pairs of minute submarginal setae, on abdomen, thorax, and head; 2 pairs of setae between antennae and mouth parts.

*Apex of abdomen*: Notch minute; setae, apical 18  $\mu$  long, interapical 1–2  $\mu$  long, dorsal (anterior to apical) 1–2  $\mu$  long, outer ventral 1–2  $\mu$  long; anal opening apical, minute, its margin membranous; anal tube minute, cylindrical, sclerotized.



*Data*.—Described from unmounted specimens (paratypes) and the following mounted material: Eight females and five larvae on *Attalea cohune*, Culebra, Canal Zone, H. Pittier, November 1911, U. S. N. H., paratypes; two females and two larvae on *Attalea cohune*, old site of Gorgona, Canal Zone, W. R. Maxon, June 6, 1923, U. S. N. H., holotype and paratypes; five females and seven larvae on *Attalea gomphococca*, Puerto Armuelles, Chiriqui, Panama, G. F. Ferris, August 1938, paratypes.

This species resembles *sabalis* and *urichi*, but differs from *sabalis* in having the atrium of the spiracle enlarged and containing trilocular pores, and from *urichi* in not having setae on the anal ring.

### ASTEROLECANIUM GRANDICULUM, new species

(Fig. 28, A-E; pl. 4, E)

*Habit*.—Living on both surfaces of leaves.

*Test of female*.—Practically circular, 1.95–2.5 mm. in diameter; strongly convex, more or less bluntly conical dorsally; flat ventrally; greenish yellow, transparent, smooth, shiny; marginal filaments whitish, slightly shorter at posterior end than elsewhere; numerous dorsal filaments also whitish, a tuft in center at least twice length of marginal, others shorter than marginal; elliptical larval exit in margin.

*Adult female*.—Practically circular, approximately 1.5–1.9 mm. in diameter, posterior end sometimes slightly produced.

Margin: 8-shaped pores in a double (rarely triple) row terminating two to three times the length of a posterior pore from bases of apical setae, posterior pores 12  $\mu$  long and 8 wide, anterior pores 16  $\mu$  long and 9 wide, the others around 14  $\mu$  long and 8 wide; interspaces between pores varying from the width to nearly twice the length of a pore, the 2 rows around a pore's width apart; 8–20 quinquelocular pores where each spiracular pore band meets margin, the row usually interrupted between anterior and posterior pore bands, usually 1 pore near each 8-shaped pore of nearer row; disk pores dorsad of 8-shaped pores terminating between the posterior pair of 8-shaped pores and apical setae, and somewhat less numerous than 8-shaped pores.

Dorsal surface: 8-shaped pores tending toward arrangement in circles paralleling the margin in submarginal area, and in slightly curved longitudinal rows in median area, some pores 12  $\mu$  long and 8 wide but the majority around 16  $\mu$  long and 9–10 wide, while those in median area are 18–20  $\mu$  long and 12 wide; minute 8-shaped pores sparse; disk pores fairly numerous; tubular ducts 36  $\mu$  long.

Ventral surface: Antenna circular, sunken in derm, with 3 setae nearly as long as diameter of antenna, and 1 longer; beak with 2 pairs of setae; spiracular bar expanded at inner end, more or less triangular; 11–28 quinquelocular pores extending from spiracle to margin in a single, double, or rarely triple row; multifolocular pores, totaling 75–105 and with 9–12 loculi, arranged in 5 complete and 4 interrupted rows, the anterior row anterior to posterior spiracles, posterior row with around 20 pores, each of next 2 rows with 12–24, next with 11–17, next with 6 or 7, and each of interrupted rows with 2–6; 1–4 dark-rimmed 8-shaped pores each side of mouth parts, a few scattered anterior to mouth parts, and a few arranged in 4 transverse rows posterior to mouth parts; submarginal 8-shaped pores mostly in a single row, but sometimes in an irregularly double row for a short distance, and terminating near the posterior row of multifolocular pores, not quite so numerous as marginal 8-shaped pores; submarginal setae in a complete row terminating opposite the posterior pair of marginal 8-shaped pores; 2 pairs of setae in the posterior row of multifolocular pores, 1 pair in each of the next 2 rows.

Apex of abdomen: Notch present; lobes indicated; setae, apical 80–108  $\mu$  long, interapical 17–20  $\mu$  long, dorsal 12  $\mu$  long, inner ventral 8–9  $\mu$  long, outer ventral 10.8–12.6  $\mu$  long; anal ring with 6 setae 28–32  $\mu$  long and an inner row of 6 and an outer one of 14 pores; ventral surface of apex slightly sclerotized and rugose.

*Second stage*.—Resembling adult, but smaller; margin with 8-shaped pores in a single row, without quinquelocular pores; dorsal surface with 8-shaped pores less numerous than in adult, minute 8-shaped and disk pores not observed; ventral surface with 4–6 pores in each spiracular row, submarginal 8-shaped pores in a single row; apex of abdomen as in adult, but all setae 2–4  $\mu$  shorter.

*Larva*.—Nearly elongate elliptical, posterior end narrowed.

Margin: With 28 8-shaped pores, the posterior pores very slightly smaller than the others, axes of the posterior 6 pairs of pores transverse, of the others longitudinal; a pair of minute setae close to each of the posterior 3 pairs of pores; 2 pairs of setae anteriorly.

Dorsal surface: 8-shaped pores, totaling 42-44, in a submedian row of 11 and a lateral row of 10 or 11, on each half of body, the anterior pores slightly larger than posterior ones and practically same size as marginal pores of same segments, the posterior pores usually slightly larger than the marginal pores of the segments on which they occur; a disk pore near each of posterior and penultimate marginal 8-shaped pores and near anterior 8-shaped pore of lateral row.

Ventral surface: Antennal setae, I, 2; IV, 1; V, 0; VI, 2 long, 3 fairly stout, 2 slender; antennal bases one-fourth length of antenna apart; beak setae, 2 pairs apical, 1 pair basal; spiracle with 2 trilocular pores; leg setae, coxa 4, femur 1 on inner margin near base and 1 each on inner and outer margins near center, tarsus 2 on inner and 1 on outer margin; tibia one-half as long as tarsus; 6 pairs of submarginal 8-shaped pores, none between antennae; apparently 10 pairs of submarginal minute setae, on abdomen and thorax, 2 pairs of submarginal larger setae at anterior end; 1 pair of setae between antennae and mouth parts.

Apex of abdomen: Notch present; lobes indicated; setae, apical  $108\ \mu$  long, interapical  $12\ \mu$  long, dorsal  $3\ \mu$  long, inner ventral  $3.4\ \mu$  long, outer ventral  $3.6\ \mu$  long; anal ring with 6 setae, each around  $23\ \mu$  long, and an inner row of 6 and an outer one of 12 or 14 pores; ventral surface of apex sclerotized in dentate rows, or rugose.

*Data*.—Described from unmounted material and the following mounted specimens: One female on *Yucca* sp., Phoenix, Ariz., A. E. Frazier collector, February 5, 1935, loaned by G. F. Ferris; 3 females and 10 larvae on *Agave* sp., Phoenix, Ariz., C. D. Lebert, July 24, 1935, including holotype; 7 females, 5 second-stage specimens, and 5 larvae on *Yucca* sp., Phoenix, Ariz., C. D. Lebert, January 6, 1936; 2 females and 14 larvae on *Idria columnaris*, Mexico, intercepted at San Ysidro, Calif., C. L. Ritchie, September 24, 1936; 11 females and 2 poor larvae on Cactaceae, New Mexico, intercepted at Blythe Quarantine Station, Calif., December 23, 1937 (1 loaned by G. F. Ferris).

Closely related to *viridulum*, but with fewer marginal quinquelocular pores, with median dorsal 8-shaped pores larger than the majority of the marginal 8-shaped pores, and with all setae in the anal area, except the ring setae, much longer than in *viridulum*.

### ASTEROLECANIUM GUTTA Green

(Fig. 28, F-M; fig. 29, A-F; pl. 3, G)

Described in 1922 (*ibid.*, pp. 1035-1036).

*Habit*.—"On young branches of *Calophyllum walkeri*: Pattipola."

*Test of female*.—Nearly circular, or slightly longer than wide, posterior end slightly produced; around 3 mm. in diameter, or 2.5-3.5 mm. long, 2-3 wide; strongly convex or hemispherical dorsally, flat or slightly concave ventrally; greenish or clear yellow, opaque owing to a waxy secretion inside test and with a honeycombed appearance resulting from position of eggs in waxy secretion, smooth, shiny; marginal filaments rubbed off; larval exit circular, in dorsal surface of produced area.

*Adult female*.—Nearly circular or broadly ovoid, posterior end slightly produced; 2-3 mm. in diameter.

Margin: 8-shaped pores in an irregularly double row terminating around twice length of apical seta from bases of setae, spaces between pores usually about equal to the length of a pore but sometimes less or much more, pores in the double row mostly alternating, but when opposite, less than a pore's length apart, of unusual shape, 12-15  $\mu$  long and wide and their halves closely appressed; pores with 5-9 loculi in a single row (sometimes crowded and appearing double for short spaces), interrupted posterior to the last pair of 8-shaped pores



but continued beyond and present between apical setae, at least one and a half times as numerous as 8-shaped pores of nearer row; disk pores among the small multilocular pores and nearly or quite as numerous as those, present between apical setae and also around anal opening.

Dorsal surface: Minute 8-shaped and disk pores fairly numerous; tubular ducts  $40\ \mu$  long.

Ventral surface: Antenna oblong, with 2 very short setae and 2 longer than diameter of antenna; beak with 2 pairs of setae; spiracle with bar fairly broad, derm outside opening slightly sunken, and containing a group of 9-14 small multilocular pores, an irregularly double row of similar pores extending from spiracle to body margin, a total of 45-55 in group and row combined, the majority of these pores distinctly smaller than the marginal multilocular pores; multilocular pores on abdomen totaling approximately 368 and having 10-14 loculi, their arrangement unusual, the posterior ones in a longitudinal median group, the others in 5 transverse, semicircular bands in lateral area and a few sometimes in median area, posterior group apparently with 62 pores, next with about 71, next with 75, next with 69, next with 56, and anterior group with 35; 10-13 dark-rimmed 8-shaped pores each side of mouth parts, rather numerous on anterior half, less numerous near posterior end, and these arranged in transverse rows; submarginal 8-shaped pores in a single row, sometimes rather crowded near posterior end, terminating near the posterior group of multilocular pores, nearly as numerous as marginal 8-shaped pores; submarginal setae in a complete row terminating near the fourth posteriormost pair of marginal 8-shaped pores; 4 setae in the posterior row of multilocular pores, 3 or 4 in the penultimate row, and none to 2 in the first row anterior to penultimate.

Apex of abdomen: Notch present; lobes indicated; setae, apical 30-36  $\mu$  long, interapical (present on only 1 half of body in 1 of specimens examined) 7.2  $\mu$  long, inner and outer ventral each about 12.6  $\mu$  long; anal opening and tube not definitely differentiated from surrounding derm, apex invaginated; anal ring at base of invagination, wide and filled with pores, also provided with 6 setae, apparently around 55  $\mu$  long.

Larva.—Elongate ovoid.

Margin: With 22 8-shaped pores which are very slightly longer than wide, their halves closely appressed, the anterior 3 or 4 pores on each side of body larger than the others, which are uniform or only slightly variable in size, axes of pores diagonal or transverse; 4 pairs of setae at anterior end.

Dorsal surface: 8-shaped pores in a submedian row of 5 or 6 on each half of body, the anterior pores slightly larger than the posterior ones and very slightly smaller than marginal pores of same segments; disk pores in lateral area, a few near anterior marginal 8-shaped pores and others near anterior submedian 8-shaped pores.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 1; VI, 2 long, 2 stout, 3 fairly stout, 2 slender; antennal bases one-half length of antenna apart; beak setae, 2 pairs apical, 1 pair median; spiracle with 1 trilobular and 1 apparently quinquelobular pore; leg setae, coxa 4, femur 1 on inner margin near base and 1 each on inner and outer margins near center, tarsus 1 each on inner and outer margins; tibia about one-third as long as tarsus; 9 pairs of submarginal 8-shaped pores; 9 pairs of submarginal minute setae, on abdomen, thorax, and head, 1 pair of submarginal larger setae at anterior end; 2 pairs of setae between antennae and mouth parts.

Apex of abdomen: Notch shallow; setae, apical around 72  $\mu$  long, interapical 14  $\mu$  long, inner ventral 5.4  $\mu$  long, outer ventral 7.2  $\mu$  long; anal opening not definitely differentiated from surrounding derm, apex invaginated, and ring at base of invagination; anal ring with 6 setae apparently 12.6  $\mu$  long and without pores.

Data.—Redescribed from unmounted material, 1 intact mounted female, and half of another, and 15 mounted larvae, all on *Calophyllum walkeri*, Pattipola, Ceylon, from E. E. Green, March 27, 1912, type.

The marginal 8-shaped pores are unusual in shape, being practically as wide as long, a condition found in no other known species of the genus except *phoenicis*. The multilocular marginal and spiracular pores are also unusual though similar ones are sometimes found in other species, and the undifferentiation of an anal opening and tube from the surrounding derm is in definite contrast to the condition



found in other species having 6 setae on the anal ring. Among the larvae of species having 6 setae on the anal ring, that of *gutta* is the only one known with less than 26 marginal 8-shaped pores. Like the adult, the larva is unusual in not having an anal opening and tube definitely differentiated from the surrounding derm.

### ASTEROLECANIUM HAKEAE Fuller

(Fig. 29, G-J; pl. 8, Q)

Listed by Fuller in 1897 (36, p. 1345) as *Planchonia hakeae* but described by him in 1899 (37, p. 456) as *Asterolecanium hakeae*.

*Habit.*—Living on bark in shallow pits.

*Test of female.*—Nearly circular, 1–1.35 mm. in diameter; slightly convex dorsally, with or without faint transverse striations, convex ventrally; greenish yellow, transparent, smooth or slightly rough, shiny; marginal filaments whitish, fragmentary in available specimens; elliptical larval exit in margin.

*Adult female.*—Nearly circular, 0.9–1.25 mm. in diameter, posterior end sometimes slightly produced.

*Margin:* 8-shaped pores in an irregularly double row on anterior five-sixths of body or less, and in a single row on at least posterior sixth, terminating around the length of apical seta from bases of setae, individual pores measuring 10–12  $\mu$  long and 7 wide, usually around a pore's length apart, pores of the 2 rows alternate or opposite, in the latter case less than a pore's width apart; quinquelocular pores in a single row terminating near the penultimate or posterior pair of 8-shaped pores and as numerous as those; disk pores ventrad of quinquelocular pores, terminating near the posterior pair of marginal 8-shaped pores and less numerous than those pores.

*Dorsal surface:* Minute 8-shaped and disk pores fairly numerous; tubular ducts 26  $\mu$  long.

*Ventral surface:* Antenna bluntly conical, with 1 seta shorter and 1 slightly longer than diameter of antenna; 4–6 quinquelocular pores between antenna and margin; beak apparently with 1 pair of setae; spiracular bar rather broad; 10–16 quinquelocular pores extending from spiracle to body margin in a single row; multifolocular pores, totaling 101–116 and with 9 or 10 loculi, arranged in 5 complete and 5 interrupted rows, the anterior row anterior to posterior spiracles, posterior row with 8–12 pores, penultimate with 11–18, each of next 3 with 16–24, each of next 3 with 6–8, each of next 2 with 3–6; dark-rimmed 8-shaped pores rather sparse, a few scattered on anterior end and others tending toward arrangement in 2 or 3 transverse rows on abdomen; submarginal 8-shaped pores in an irregularly double row terminating near the penultimate row of multifolocular pores, about half as numerous as marginal 8-shaped pores; submarginal setae in a complete row terminating between the posterior pair of marginal 8-shaped pores and apical setae; 3 or 4 setae in posterior row of multifolocular pores, 2 in penultimate row, and 1 or 2 in first row anterior to penultimate.

*Apex of abdomen:* Notch present; setae, apical 47  $\mu$  long, interapical 9  $\mu$  long, inner ventral 3.6–5  $\mu$  long, outer ventral 7.2  $\mu$  long; anal ring with 6 setae around 30  $\mu$  long and an inner row of 6 and an outer one of 16 pores, divided on dorsal and ventral sides; ventral surface of apex lightly sclerotized and lined.

*Data.*—Redescribed from unmounted material and the following mounted specimens: Four females on *Hakea ilicifolia*, Swan River, West Australia, 1891, type material; eight females on *Banksia* sp., Swan River, Australia, G. Compere, Compere No. 940; six females on *Acacia* sp., Melbourne, Australia, G. Compere, Compere No. 344; one female on *Acacia* sp., Australia, C. French collector, from E. E. Green, received in 1934.

Closely related to *ventruosum* but differing in having the marginal row of 8-shaped pores irregularly double in spots instead of definitely double around most of margin, in having fewer marginal quinquelocular pores, and in lacking a row of disk pores dorsad of the marginal 8-shaped pores.

## ASTEROLECANIUM HEMISPHAERICUM Kuwana

(Fig. 29, K-O; fig. 30, A-E; pl. 2, B)

Described in 1916 (55, pp. 147-148) on stems and branches of bamboo in Japan.

*Habit*.—Living on stems, often near nodes.

*Test of female*.—Elongate ovoid, 2.5-3 mm. long, 1.5-2 wide; strongly convex dorsally, particularly near anterior end, from where it falls abruptly to anterior margin but slopes gradually to posterior margin; slightly concave ventrally; pale greenish yellow, transparent, smooth, shiny; marginal filaments whitish, fragmentary; larval exit elliptical, in margin.

*Adult female*.—Elongate ovoid, 2 mm. long, 1.5 wide.

Margin: 8-shaped pores mostly in a double row but in a single row near posterior end of body, terminating about one-half length of apical seta from bases of setae, 12-13  $\mu$  long and 8 wide, usually separated by about the length of a pore, the 2 rows usually separated by less than the width of a pore; quinquelocular pores in a row mostly 4 pores wide but sometimes 6 pores wide at 1 or 2 points, 3 pores wide before terminating point, and only 1 pore wide at end, which is 10-20 8-shaped pores from the last pair of pores in that row; disk pores along dorsal row of 8-shaped pores, terminating nearer to bases of apical setae than to the posterior pair of marginal 8-shaped pores, usually as numerous as 8-shaped pores of dorsal row.

Dorsal surface: Minute 8-shaped and disk pores numerous; tubular ducts scattered except near posterior end, 16  $\mu$  long; dorsal tuberos present.

Ventral surface: Antenna circular, slightly raised, with 1 seta shorter and 2 longer than diameter of antenna; 15-20 quinquelocular pores in a triple or quadruple row between antenna and margin; beak apparently without setae; spiracle with bar subcircular, with atrium expanded, shallow, and filled with quinquelocular pores which continue over edge of opening and extend to body margin in a row 3-8 pores wide, 125-140 in atrium and row combined; multilocular pores, totaling 98-117 and having 6-11 loculi, arranged in 2 complete and 6 interrupted rows, the penultimate row interrupted but the first row anterior to it complete, posterior row with 13 pores, penultimate with 7-10, next with 8-12, next with 11-15, next with 15-18, next with 14-18, next with 17-20, and anterior row with 13-15; genital opening obscure in 1 of specimens studied, not at all apparent in others; a loose group of 10-15 dark-rimmed 8-shaped pores each side of mouth parts, some scattered on anterior end, and others tending toward arrangement in 6 transverse rows posterior to mouth parts; submarginal 8-shaped pores in a double row terminating near first row anterior to penultimate row of multilocular pores, about one-half as numerous as marginal 8-shaped pores of the adjacent row; 7 pairs of submarginal setae on abdomen, the posterior pair near the sixth posteriormost pair of marginal 8-shaped pores; 4 setae in posterior row of multilocular pores, 2 in penultimate row, and 1 in first row anterior to penultimate.

Apex of abdomen: Notch present; setae, apical 35  $\mu$  long, interapical 10.8  $\mu$  long, inner ventral 5.4  $\mu$  long, outer ventral 9  $\mu$  long; anal ring with 6 setae 36  $\mu$  long and an inner row of 6 and an outer row of 16 or 18 pores, tending toward division on dorsal side; ventral surface of apex slightly sclerotized and lined.

*Larva*.—Elliptical.

Margin: With 28 8-shaped pores, the posterior pair and the anterior 4 pairs slightly larger than the others, axes of all longitudinal; 3 pairs of setae anteriorly.

Dorsal surface: 8-shaped pores in a submedian row of 10 or 11 on each half of body, the anterior 2 pores larger than the others, all practically same size as marginal pores of the corresponding segments; disk pores closer to marginal than to submedian 8-shaped pores.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 0; VI, 2 long, 2 stout, 3 fairly stout, 2 slender; antennal bases one-fourth length of antenna apart; beak setae, 2 pairs apical, 1 pair median; spiracle with 1 trilocular and 1 quinquelocular pore; leg setae, coxa 4, femur 1 on inner margin near base and 1 each on inner and outer margins near center, tarsus 2 on inner and 1 on outer margin; tibia one-half as long as tarsus; 9 pairs of submarginal 8-shaped pores; apparently 8 pairs of submarginal minute setae, on abdomen and thorax, 3 pairs of submarginal larger setae at anterior end; 1 pair of setae between antennae.

Apex of abdomen: Notch present; setae, apical  $81\ \mu$  long, interapical  $12.6\ \mu$  long, inner ventral  $5.4\ \mu$  long, outer ventral  $3.6\ \mu$  long; anal ring with 6 setae about  $12.6\ \mu$  long and an inner row of 6 and an outer of apparently 8 pores, divided on dorsal and ventral sides.

*Data*.—Redescribed from the following material identified on the basis of Kuwana's original description: Unmounted specimens, two mounted females, and six mounted larvae on *Bambusa metake*, Riverton, N. J., H. B. Weiss, May 1916; one mounted female on *Phyllostachys* sp., Lung T'au Shan, Ping Shan Hang, K'uk Kong district, Kwangtung, China, F. A. McClure, January 10, 1926; one test and one mounted female on *Arundinaria chino*, Sendai, Japan, E. Iishiba, May 16, 1926, N. Y. B. G.

This is the only known species on bamboo in which the marginal 8-shaped pores are in a double row.

### ASTEROLECANIUM HILLI Green

(Fig. 30, F-M; pl. 5, I)

Described in 1916 (*45*, pp. 63-64).

*Habit*.—Living on the lower surface of leaves.

*Test of female*.—Elongate elliptical, 2.25 mm. long and 0.95 wide, posterior end narrowed; nearly flat to slightly convex dorsally, flat ventrally; clear yellow, transparent, thin, punctate; marginal filaments whitish, fragmentary; circular larval exit in dorsal surface at the margin.

*Adult female*.—Nearly elongate elliptical, 2 mm. long, 0.75 wide, posterior end narrowed and slightly constricted.

Margin: 8-shaped pores in a single row terminating near constriction in body, or about twice length of apical seta from bases of setae,  $9\ \mu$  long and 4 wide, the pores normally about a pore's length apart; trilocular pores in a single row between spiracular pore bands and extending about 15 pores outside them, 1 or 2 near each 8-shaped pore.

Dorsal surface: Minute 8-shaped pores not observed; disk pores sparse; tubular ducts  $28\ \mu$  long.

Ventral surface: Antenna short, apparently with 2 setae slightly longer than diameter of antenna; beak with 2 pairs of setae; spiracle with bar expanded at inner end, opening broad, atrium somewhat enlarged and containing 2 trilocular or quinquelocular pores, approximately 15 trilocular pores extending from spiracle to body margin in a single row; multilocular pores, having 6-10 loculi (usually 10), arranged in 3 complete rows, posterior row with 30 pores, middle row with 20, and anterior row with 10; 2 dark-rimmed 8-shaped pores each side of beak, 4 on anterior end, and 4 near posterior end; submarginal 8-shaped pores at least as numerous as marginal 8-shaped pores, in a double row terminating near anal opening, inner pores larger and usually less numerous than outer ones; apparently 6 pairs of submarginal setae, observed only posterior to spiracles, the posterior pair about two-thirds the length of an apical seta from bases of apical setae; 2 pairs of setae in posterior row of multilocular pores and 1 pair in each of the other rows.

Apex of abdomen: Setae, apical (on ventral surface near margin)  $60\ \mu$  long, interapical (also on ventral surface)  $3.6\ \mu$  long, outer ventral  $3\ \mu$  long; anal opening ventral, anterior to bases of apical setae, circular, its margin faintly sclerotized.

*Larva*.—Elongate elliptical.

Margin: With 28 elongate, slender 8-shaped pores, which gradually increase in size from posterior end of row, axes of all longitudinal; a pair of minute setae close to each of the posterior 3 pairs of pores; 3 pairs of setae anteriorly.

Dorsal surface: 8-shaped pores in a lateral row of 9 on each half of body, shorter than the width of a posterior marginal pore; disk pores between lateral and marginal 8-shaped pores.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 1; VI, 2 long, 2 stout, 3 fairly stout, 1 slender; antennal bases one-half length of antenna apart; beak setae, 1



pair apical, 1 pair median, 1 pair basal; spiracle with 2 trilocular pores or with 1 trilocular and 1 quinquelocular pore; leg setae, coxa 3, femur 0, tarsus 1 each on inner and outer margins; tibia one-third as long as tarsus; 5 pairs of submarginal 8-shaped pores of which 1 pair is between the antennae; 10 pairs of minute submarginal setae, on abdomen, thorax, and head; 2 pairs of setae near antennae.

Apex of abdomen: Setae, apical about  $36 \mu$  long, interapical  $9 \mu$  long, one  $1 \mu$  long mesad of interapical, outer ventral  $0.5 \mu$  long; anal opening an elongate incision in ventral surface close to margin; anal tube short bulbous, heavily sclerotized; anal ring a constriction at inner end of tube.

*Data.*—Redescribed from three unmounted specimens, one mounted female, and three mounted larvae on *Livistona humilis*, Stapleton, Northern Territory, Australia, from E. E. Green, received in 1933, type.

Green stated (*45*, p. 64), "After examination of many preparations, I have been unable to locate the position of the anal orifice." In the well stained specimen examined by the writer the anal orifice is clearly defined.

This species is most closely related to *unicum*.

### ASTEROLECANIUM HORISHAE, new species

(Fig. 31, A-G; pl. 9, Y)

Discussed under the name *Asterolecanium japonicum* Cockerell in 1934 (*95*, p. 4) by Takahashi, who indicated, however, that he was not sure of his identification.

*Habit.*—Living on both surfaces of leaves.

*Test of female.*—Slightly longer than wide, measuring 0.8–1 mm. long and 0.75 wide, posterior end produced; flat or slightly convex dorsally, with a faint longitudinal median carina and transverse striations in median area, flat ventrally; pale greenish yellow, transparent, punctate; marginal filaments pale golden yellow; dorsal filaments absent or arranged in 2–7 groups, pale golden, slightly shorter than marginal filaments; larval exit elliptical, in dorsal surface at margin.

*Adult female.*—Slightly longer than wide, measuring 0.8–1 mm. long and 0.7 wide, or circular, 0.75–0.9 mm. in diameter.

Margin: 8-shaped pores in a single row terminating two to three times a pore's length from bases of apical setae, each pore with a short, sclerotized, tongue-shaped projection on dorsal edge, posterior pores  $7 \mu$  long and 4 wide, the others  $8 \mu$  long and 5 wide, distance between pores ranging from width to length of a pore; usually 3–39 quinquelocular pores near point where each spiracular pore band meets margin.

Dorsal surface: 8-shaped pores sometimes absent but often in 7–10 groups of 2–11 pores each, the groups following the margin but well removed from it, and apparently not at uniform distances from each other, not observed near posterior end, the individual pores usually around  $5\text{--}6 \mu$  long and 4–5 wide, but the posterior pores sometimes  $3\text{--}4 \mu$  long and 2 wide; minute 8-shaped pores numerous; disk pores fairly numerous; tubular ducts  $20 \mu$  long.

Ventral surface: Antenna circular, flat, usually with 2 setae slightly longer than diameter of antenna; beak with 2 pairs of setae; spiracular bar slightly expanded at inner end; 3–15 (usually 6–8) quinquelocular pores extending from spiracle to body margin in a single row; multilocular pores, totaling 29–36 and having 10 loculi, arranged in 4 complete rows of 6–10 each; 1 or 2 dark-rimmed 8-shaped pores each side of beak and 3 or 4 on anterior end; submarginal 8-shaped pores in a single row terminating near the posterior pair of marginal 8-shaped pores and usually nearly as numerous as those pores; 7 pairs of submarginal setae posterior to posterior spiracles, the posterior pair fairly near the posterior pair of marginal 8-shaped pores; 2 pairs of setae in the posterior row, 1 pair in each of the other rows of multilocular pores.

Apex of abdomen: Lobes barely indicated; setae, apical  $48 \mu$  long, interapical  $3.5 \mu$  long, outer ventral  $2 \mu$  long; anal opening ventral, close to margin, circular, its margin membranous, usually without, but occasionally with, 1 seta  $1 \mu$  long.

*Larva*.—Elliptical.

Margin: With 28 8-shaped pores, axes of all longitudinal; 2 pairs of setae at anterior end.

Dorsal surface: 8-shaped pores in a submedian and a lateral row of 8 or 9 each, on each half of body, the submedian pores usually varying in size, some being nearly or quite as large as the marginal pores, others, like the lateral pores, only about as long as the marginal pores are wide; a few disk pores posteriorly.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 0; VI, 2 long, 2 stout, 2 fairly stout, 2 slender; antennal bases nearly two-thirds length of antenna apart; beak setae, 2 pairs apical; anterior spiracle with 1 trilocular and 1 quinquelocular pore, posterior spiracle with 1 trilocular pore; leg setae, coxa 3, femur 1 on inner margin near base, tarsus 1 each on inner and outer margins; tibia one-fourth as long as tarsus; 9 pairs of submarginal 8-shaped pores; apparently 7 pairs of submarginal minute setae posterior to posterior spiracles. 1 pair of submarginal larger setae at anterior end; 3 pairs of setae between antennae and mouth parts.

Apex of abdomen: Slightly concave, lobes barely indicated; setae, apical 32  $\mu$  long, interapical 3.6  $\mu$  long, outer ventral 2  $\mu$  long; anal opening in margin, circular; anal tube short, bulbous, sclerotized; anal ring heavily sclerotized, with 2 setae 1-2  $\mu$  long either on ring or in tube close to ring.

*Data*.—Described from the following material: One test, 2 mounted females, and 2 mounted larvae on *Pasania brevicaudata*, Horisha, Nanto province, Taiwan (Formosa), E. H. Wilson, March 9, 1918, U. S. N. H., holotype and paratypes; unmounted material, 25 mounted females, and 33 mounted larvae on *Lithocarpus* sp., Suisha, Taiwan (Formosa), R. Takahashi, June 11, 1933, paratypes; unmounted material, 7 mounted females, and 10 larvae on *Lithocarpus* sp., Shinten, Taiwan (Formosa), R. Takahashi, March 21, 1938, paratypes.

This species has an unusually large variation in the number of marginal quinquelocular pores. There is a tendency for insects removed from the dorsal surface of leaves to have many marginal quinquelocular pores and no dorsal 8-shaped pores, and for those from the lower surface to have few or no marginal quinquelocular pores and some dorsal 8-shaped pores. So much variation occurs with respect to each of these characters, however, that it seems unwise to segregate the two forms on a specific or varietal basis. Larvae of *horishae* are unusual in having the dorsal 8-shaped pores differing conspicuously in size in different specimens; this seems to be typical of the species, however, because specimens with all the pores small, or some small and some large, have been removed from a single test.

## ASTEROLECANIUM ILICICOLA Targioni-Tozzetti

(Fig. 31, H-N; pl. 1, F)

Described in 1888 (97, pp. 422-424), and discussed further by Targioni-Tozzetti in 1892 (98, pp. 285-295, 311-312).

*Asterolecanium ilicis*, described by Newstead in 1897 (75, p. 100) as *Planchonia ilicis* on "scrub" from Constantine, Algeria, was listed as a synonym of *variolosum* by Lindinger in 1912 (61, pp. 280, 360), but has been accepted as a valid species by some authors, including Balachowsky (2, p. xxiv). Newstead stated that *ilicis* was closely related to *ilicicola*, but that the two could be differentiated by the absence of a marginal fringe from the tests of the former and the presence of such a fringe on those of the latter. This is not satisfactory for separating the two forms. Newstead did not compare the morphological characters of these species, and type material of *ilicis* has not been available to the writer. Specimens on *Quercus* from Constantine, Algeria, have been studied, however, and have been found

specifically identical with specimens of *ilicicola* from Europe. Since there is no information in the original description to warrant the retention of *ilicis* as a valid species, and since specimens from its type host and locality belong to *ilicicola*, *ilicis* is here synonymized with *ilicicola*.

*Habit*.—Living on both surfaces of leaves.

*Test of female*.—Ovoid or nearly circular, posterior end sometimes slightly produced; 1.5–2.25 mm. long and 1.25–2 wide, or around 1.9 mm. in diameter; convex dorsally, sometimes with very faint transverse striations ending in minute tubercles in lateral area; flat ventrally; greenish, brownish, or rather clear yellow, transparent, smooth, shiny; marginal filaments same color as test; larval exit narrow, elongate, in dorsal surface at margin.

*Adult female*.—Similar to test in shape, 1.10–2 mm. in diameter.

*Margin*: 8-shaped pores in a single row terminating around a pore's length from bases of apical setae, around 10  $\mu$  long and 6 wide, usually a pore's length apart; 10–30 quinquelocular pores near point where each spiracular pore band meets margin, the groups not meeting between anterior and posterior spiracular pore bands, the pores as numerous as the 8-shaped pores at ends of row, usually at least twice as numerous in the center of each group.

*Dorsal surface*: Minute 8-shaped pores sparse; disk pores numerous; tubular ducts 28  $\mu$  long.

*Ventral surface*: Antenna conical, with 2 setae as long as diameter of antenna; beak with 2 pairs of setae; spiracular bar rather broad; 25–50 quinquelocular pores extending from spiracle to body margin in an irregularly double row; multilocular pores, with 10 loculi, arranged in 4 complete rows, posterior row with 11–18, each of next 2 rows with 6–14, and anterior row with 2–10, a total of 29–55; 4–8 dark-rimmed 8-shaped pores in a transverse row posterior to beak; submarginal 8-shaped pores mostly in a single row, but usually double at posterior end, terminating near the posterior row of multilocular pores, usually as numerous as marginal 8-shaped pores where row is single, and sometimes twice as numerous where it is double; submarginal setae in a complete row terminating near the fourth to eleventh posteriormost 8-shaped pore; 2 pairs of setae in posterior row, 1 pair in each of the other rows, and 1 pair anterior to multilocular pores.

*Apex of abdomen*: Lobes barely indicated; setae, apical 64–72  $\mu$  long, interapical 8–14  $\mu$  long, outer ventral 8  $\mu$  long; anal opening ventral, its margin sclerotized, normally with 2 setae about 3.6  $\mu$  long on anterior edge.

*Second stage*.—Resembling adult female, but smaller; margin with 2 or 3 quinquelocular pores at each spiracular pore band; ventral surface with 8 or 9 quinquelocular pores in each spiracular pore band, submarginal 8-shaped pores and submarginal setae very sparse; apex of abdomen as in adult but all setae broken off at base.

*Larva*.—Ovoid.

*Margin*: Without 8-shaped pores; 2 pairs of setae anteriorly.

*Dorsal surface*: 8-shaped pores usually lacking, but present in larvae from Corsica collected in 1913, where they are arranged in a submedian row of 1–5 and a lateral row of 1–3, on each half of body; disk pores in lateral area.

*Ventral surface*: Antennal setae, I, 1; IV, 1; V, 0; VI, 2 long, 2 stout, 2 fairly stout, 2 slender; antennal bases one-half length of antenna apart; beak setae, 2 pairs at tip; anterior spiracle with 1 trilocular and 1 quinquelocular pore, posterior spiracle without pores; leg setae, coxa 3, femur 1 on inner margin near base, tarsus 1 each on inner and outer margins; tibia one-fourth as long as tarsus; 8 pairs of submarginal 8-shaped pores, none between antennae; apparently 7 pairs of submarginal minute setae posterior to posterior spiracles, apparently 1 pair of submarginal larger setae at anterior end; 2 pairs of setae between antennae and mouth parts.

*Apex of abdomen*: Lobes sometimes indicated; setae, apical 58–72  $\mu$  long, interapical 9–12  $\mu$  long, outer ventral about 5  $\mu$  long; anal opening a narrow incision in ventral surface and margin; anal tube very short, slightly sclerotized, somewhat bulbous; anal ring slightly sclerotized, with 2 setae 6–8  $\mu$  long.

*Test of male*.—Elliptical, 1.25 mm. long, 0.75 wide; dorsally slightly convex at anterior end, almost flat at posterior end, with faint transverse striations and with a weak median carina extending from convex area to posterior end, occasional specimens also with inconspicuous curved lateral carinae extending from anterior



to posterior ends of median carina; flat ventrally; pale greenish yellow, transparent, very thin; marginal filaments pale yellow to whitish.

*Adult male*.—1 mm. long.

Head: Antenna 10-segmented, formula (longest to shortest), III, IV, V, VI, VII, VIII, IX, X, II, I; antennal setae, I, 1; II, 7; III-X, 12-18 and X also with 4 very long setae and 1 that is stout; basal bars diagonal; approximately 15 setae anterior to ventral eyespots, 1 or 2 on dorsal surface.

Thorax: Bar between wing bases rectangular, four times as long as wide, with a faint median longitudinal fold; tibia one-sixth longer than tarsus.

Abdomen: Five segments each with a pair of setae dorsally on lateral margin, 4 or 5 segments each with a pair of setae in ventral lateral area; lobes indicated, each with 1 long and 2 short setae; penis sheath with 2 setae dorsally at base, 6 or 7 setae ventrally at base, and 4 or 5 setae on each side of ventral opening.

*Data*.—Redescribed from unmounted material and the following mounted specimens collected on *Quercus*: One female, 35 larvae, and 1 male on *Q. ilex*, Nice, France, determined as *quercicola* by Signoret, and used as the basis for the erection of *Asterodiaspis*, loaned by M. Beier; 2 females and 6 larvae on *Q. ilex*, Montpellier, France, determined as *quercicola* by Signoret, loaned by M. Beier; 1 female, Europe, Maskell Collection No. 65, labeled *quercicola* Bouché; 1 female on *Q. ilex*, Portici, Italy, Chermotheca Italica, Fasc. II, No. 47, Berlese and Leonardi, 1895; 8 females, 52 larvae, and 2 males on *Q. ilex*, near Ajaccio, Corsica, O. Jaap, February 25, 1913, Jaap Collection No. 122b; 5 females and 4 larvae on *Q. ilex*, El Guerrah, Constantine, Algeria, A. Balachowsky, November 15, 1926; 3 females on *Q. coccifera*, Alger, Algeria, A. Balachowsky, January 1927; 4 females on *Q. ilex*, Constantine, Algeria, A. Balachowsky, from E. E. Green, received June 3, 1927; 4 females and 10 larvae on *Q. ilex*, Agay, Var, France, A. Balachowsky, April 23, 1930; 2 females and 1 second-stage specimen on *Q. ilex*, Ajaccio, Corsica, A. Balachowsky, November 4, 1930; 2 females on *Q. suber*, Spain, intercepted at Philadelphia, Pa., W. J. Ehinger, December 28, 1932; 2 females on *Q. ilex*, Portici, Italy, from F. Silvestri, received May 1934.

This species, placed as a synonym of *variolosum* by Lindinger in 1912 (61, pp. 280, 360), is valid as considered by Leonardi (57, pp. 256-258) and other writers. It is closely related to *quercicola* and *variolosum*, but differs from them in habit as well as in structural details. It is found on both surfaces of the leaves and does not produce pits, whereas *quercicola* and *variolosum* occur on the bark and do cause the formation of pits. Several characters of the adult females of the three species differ in degree. Specimens of *ilicicola* are consistently larger than specimens of *quercicola* and have fewer marginal quinquelocular pores than either *quercicola* or *variolosum*. In *ilicicola* there are very few minute dorsal 8-shaped pores and also few dark-rimmed 8-shaped pores, whereas in *quercicola* and *variolosum* the minute dorsal 8-shaped pores are numerous and the dark-rimmed 8-shaped pores are usually numerous around the beak and spiracular areas.

In the larvae the absence of marginal 8-shaped pores in *ilicicola* is in striking contrast to the presence of 28 such pores in *quercicola* and *variolosum*. The occurrence of dorsal 8-shaped pores in the larvae of *ilicicola* from Corsica is unusual, there being no indication of such pores in the other larvae studied. In other characters, however, the larvae from Corsica agree with those from other lots, and the adult seems the same as the adults from other sources that are considered to be *ilicicola*.

## ASTEROLECANIUM INCONSPICUUM, new species

(Fig. 31, O-T; fig. 32, A, B; pl. 4, K)

*Habit.*—Living on the lower surface of leaves, in shallow pits.*Test of female.*—Nearly circular, 0.95–1.2 mm. in diameter, posterior end slightly produced; flat dorsally, with or without a faint longitudinal median carina; slightly convex ventrally; yellow, transparent, fairly thin, somewhat punctate; marginal and dorsal filaments whitish, the latter very numerous, slightly longer than marginal; larval exit elliptical, in ventral surface at margin.*Adult female.*—Similar to test in shape, 0.85–1 mm. in diameter.Margin: 8-shaped pores in a single row terminating about one-half length of apical seta from setal bases, 12  $\mu$  long and 8 wide, less than the width of a pore apart; 4–6 quinquelocular pores where each spiracular pore band meets margin; disk pores ventrad of 8-shaped pores (as nearly submarginal as marginal), terminating between the posterior pair of 8-shaped pores and apical setae, less numerous than 8-shaped pores.Dorsal surface: 8-shaped pores arranged in around 13 fairly definite transverse rows, absent on posterior end and close to margin, 12–13  $\mu$  long and 9 wide; minute 8-shaped pores rather sparse, disk pores numerous; tubular ducts 24  $\mu$  long.

Ventral surface: Antenna thimble-shaped, ending in a sharp conical spine, with 2 setae longer than diameter of antenna and apparently sometimes 1 shorter; beak with 2 pairs of setae; spiracle with bar subcircular, derm around opening somewhat sunken and containing 3–5 quinquelocular pores, 8 or 10 similar pores (sometimes with 3 or 6 loculi) extending from spiracle to body margin in an irregularly single row, a total of 11–13 pores in group and row combined; multilocular pores, with 6–9 loculi, in 5 complete and 3 interrupted rows, the posterior row with 6 pores, each of next 2 rows with 9, next with 8, next with 6, next with 5, next with 3, and anterior row with 4, a total of 50 in the single available specimen in which they can be counted accurately, apparently less than 50 in other specimens; dark-rimmed 8-shaped pores very sparse; submarginal 8-shaped pores in a single row terminating near the posterior row of multilocular pores, nearly as numerous as marginal 8-shaped pores; submarginal setae in a complete row terminating near the posterior pair of marginal 8-shaped pores; 2 or 3 setae in the posterior row and 2 in each of the other complete rows of multilocular pores.

Apex of abdomen: Notch shallow; lobes indicated; setae, apical 88  $\mu$  long, interapical 5.4  $\mu$  long, dorsal 2  $\mu$  long, inner and outer ventral each about 5.4  $\mu$  long; anal ring with 2 setae 20  $\mu$  and four 12.6–14.4  $\mu$  long, divided on dorsal and ventral sides; ventral surface of apex slightly sclerotized in dentate rows.*Larva.*—Too poor for outline to be determined or to be described completely.

Margin: Apparently with 28 8-shaped pores, position with respect to margin indeterminate; apparently 3 pairs of setae anteriorly.

Dorsal surface: 8-shaped pores present but number and arrangement indeterminate, apparently slightly smaller than marginal pores; disk pores present but position indeterminate.

Ventral surface: Antennal setae, I, 2; IV, 1; V, 1; VI, 2 long, 2 stout, 3 fairly stout, 2 slender; beak setae, 2 pairs apical, 1 pair basal; spiracle apparently with 1 pore; leg setae, coxa 4, femur 1 on inner margin near base and 1 on outer margin near center, tarsus 1 each on inner and outer margins; tibia about one-third as long as tarsus; apparently 9 pairs of submarginal 8-shaped pores; submarginal setae, and setae near antennae, present, but their number indeterminate.

Apex of abdomen: Setae, apical 72  $\mu$  long, interapical 10.8  $\mu$  long, dorsal 2  $\mu$  long, inner ventral 3.6  $\mu$  long, outer ventral apparently 2  $\mu$  long; anal ring with 6 setae each about 12.6  $\mu$  long and with 6 pores, apparently not divided.*Data.*—Described from unmounted material, three mounted females, and one poor mounted larva on an unknown host, Brisbane, Australia, G. Compere, Compere Collection No. 1161, holotype and paratypes.*Asterolecanium inconspicuum* is the only known species, among those having six setae on the anal ring and not found on bamboo, in which there are no pores in the anal ring of the adult female.

*ASTEROLECANIUM* *INGAE*, new species

(Fig. 32, C-H; pl. 3, F)

Listed by Wolcott in 1936 (100, p. 122), as *Asterolecanium* sp. nov.*Habit.*—Living on bark.*Test of female.*—Broad ovoid, posterior end strongly narrowed, produced, and sometimes slightly elevated; 1.25–1.5 mm. long, 1–1.25 wide; slightly convex dorsally, without or with a faint, broad, longitudinal median carina; flat ventrally; greenish, pale yellow, or nearly colorless, transparent, thin, slightly punctate; marginal and dorsal filaments pale to deep pinkish, sometimes nearly rust, the latter dense along median line and in lateral and submarginal areas, less numerous in submedian area, ranging from at least as long to twice as long as marginal filaments; circular larval exit in margin.*Adult female.*—Similar to test in shape, 1–1.25 mm. long, 0.9–1.10 wide.*Margin:* 8-shaped pores in a single row terminating around three times the length of an apical seta from setal bases, posterior pores 9–10  $\mu$  long and 6–8 wide, the others 12  $\mu$  long and 8 wide, usually slightly more than a pore's width apart at posterior end, and from a pore's width to a pore's length apart elsewhere; quinquelocular pores in a single row, usually absent between antennae and usually terminating at about the eighth (sometimes as much as the seven-teenth) posteriormost pair of 8-shaped pores, at least as numerous as 8-shaped pores near posterior end, elsewhere usually one and a half times and occasionally twice as numerous as corresponding 8-shaped pores; disk pores ventrad of quinquelocular pores and as near to submarginal as to marginal 8-shaped pores, terminating around length of an apical seta from setal bases, nearly or actually as numerous as marginal 8-shaped pores.*Dorsal surface:* 8-shaped pores along median line and scattered elsewhere though sparse, and sometimes absent in a narrow submedian area on posterior half, some pores 9–10  $\mu$  long and 6–7 wide, the majority 12  $\mu$  long and 8 wide, and some 18–20  $\mu$  long and 13 wide, the largest pores along median line in a fairly regular single row, and smaller pores in an irregularly single or double row on each side, largest pores also occurring in 3 fairly definite rows paralleling body margin and at fairly uniform intervals from it, with surrounding area covered with smaller pores; minute 8-shaped pores numerous; disk pores fairly sparse; tubular ducts 40  $\mu$  long.*Ventral surface:* Antenna dome-shaped, sunken in derm, with 2 setae longer and 1 or 2 shorter than diameter of antenna; beak with 2 pairs of setae; spiracle with bar broad, atrium slightly enlarged, very shallow, 8–11 quinquelocular pores in atrium and on edge of opening and 11–24 similar pores extending from spiracle to body margin in an irregularly single row, 22–35 in group and row combined; multilocular pores, totaling 72–88 and with 10 loculi, arranged in 5 complete and 3 interrupted rows, the posterior row with 9–16 pores, penultimate row with 7–14, next with 10–18, each of next 2 with 14–20, next with 2–5, and each of next two rows with 2 or 3; 5–10 dark-rimmed 8-shaped pores each side of beak, some scattered on anterior end and others tending toward arrangement in 5 or 6 transverse rows posterior to mouth parts; submarginal 8-shaped pores in an irregularly single and double row terminating nearly twice length of apical seta from bases of setae, usually as numerous as corresponding marginal 8-shaped pores, the row single posterior to marginal 8-shaped pores; submarginal setae in a complete row terminating near the fourth to sixth posteriormost pair of marginal 8-shaped pores; 2 pairs of setae in the posterior row of multilocular pores and 1 pair in each of the next 2 rows.*Apex of abdomen:* Notch present; lobes indicated; setae, apical apparently 45 (certainly not more than 50)  $\mu$  long, interapical 14.4–16.2  $\mu$  long, dorsal 7.2  $\mu$  long, intermediate ventral 2.8–3.6  $\mu$  long, outer ventral 5.4  $\mu$  long; anal ring with 6 setae 36–41  $\mu$  long, with an inner row of 6 and an outer one of 15 or 16 pores, divided on dorsal side and tending toward division on ventral; ventral surface of apex sclerotized and rugose, or sclerotized in dentate rows.*Larva.*—Rather elongate elliptical, but the ends somewhat narrowed.*Margin:* 8-shaped pores probably 28 in number, but posterior pair more nearly on dorsal surface than on margin and appearing to belong with dorsal lateral pores rather than with marginal pores, the posterior pair slightly larger than the 5 pairs anterior to it, the next 7 pairs slightly larger than the 5 behind them, slightly smaller than the anterior pair, and of the same size as the posterior pair,



axes of the posterior 6 pairs transverse, of the others longitudinal; a pair of minute setae close to each of the posterior 3 pairs of pores; 3 pairs of setae at anterior end.

Dorsal surface: 8-shaped pores in a submedian row of 10 and a lateral row of 13, on each half of body. lateral pores placed irregularly on thorax and suggesting a submarginal row, the posterior 4 or 5 submedian pores slightly smaller than the anterior 5 or 6 and practically equal in size to marginal pores of same segments, the anterior 3 or 4 lateral pores slightly larger than the posterior pore and slightly larger than marginal pores of same segments; a few disk pores rather close to lateral 8-shaped pores; a pair of minute setae anterior to anterior pair of submedian 8-shaped pores.

Ventral surface: Antennal setae, I, 2; IV, 1; V, 0; VI, 2 long, 2 stout, 3 fairly stout, 2 slender; articulation between fifth and sixth antennal segments rather indefinite; antennal bases one-third length of antenna apart; beak setae, 2 pairs apical, 1 pair basal; spiracle with 1 trilocular and 1 quinquelocular pore or with 2 trilocular pores; leg setae, coxa 4, femur 1 on inner margin near base and 1 each on inner and outer margins near center; tarsus 1 each on inner and outer margins; tibia about one-half as long as tarsus; 9 pairs of submarginal 8-shaped pores; apparently 16 disk pores, submarginal in position, nearly in line with submarginal 8-shaped pores, occurring on head, thorax, and abdomen, and terminating on penultimate segment of body; apparently 7 pairs of submarginal minute setae, on head, thorax, and abdomen, the posterior pair on the fifth segment from posterior end of body, 2 pairs of submarginal larger setae at anterior end; 1 pair of setae anterior to antennae and 2 pairs between antennae and mouth parts.

Apex of abdomen: Notch present; setae, apical 48  $\mu$  long, interapical 5.4  $\mu$  long, dorsal 1.8  $\mu$  long, intermediate ventral 2  $\mu$  long, fairly close to median line, outer ventral 3.6  $\mu$  long; anal ring with 6 setae each 21  $\mu$  long and with an inner row of 6 and an outer one of 12 pores, divided on dorsal and ventral sides; ventral surface of apex slightly sclerotized and rugose close to margin.

*Data.*—Described from unmounted material, 9 mounted females, and 15 mounted larvae on *Inga vera*, Utuado, Puerto Rico, V. Medina, March 18, 1935, from G. N. Wolcott, holotype and paratypes.

Although *ingae* is most closely related to various Neotropical species, it superficially resembles the Ethiopian species *coffea*, from which it may, however, be readily distinguished in both the adult and larva by the absence of a sclerotized elongate bar extending anteriorly from the base of each interapical seta.

### ASTEROLECANIUM INLABEFACIUM, new species

(Fig. 33, A-F; pl. 9, X)

*Habit.*—Living on bark and on the lower surface of leaves.

*Test of female.*—Elongate, 1-1.35 mm. long and 0.4-0.5 wide, the posterior third or half slightly narrowed, each end usually truncate, but sometimes slightly rounded; convex dorsally, flat ventrally; pale greenish yellow, transparent, dull or shiny, punctate; marginal filaments very pale greenish yellow, longest across posterior end, dorsal filaments rubbed off; elliptical larval exit in dorsal surface at the margin.

*Adult female.*—Similar to test in shape, 0.9-1.25 mm. long, 0.3-0.4 wide.

Margin: 8-shaped pores in a single row which is continued between the apical setae, the posterior 4 pores slightly farther apart than the others, which are about a pore's width apart, the pores on anterior half of body and the posterior 5 or 6 pores around 8  $\mu$  long and 5 wide, the others around 7  $\mu$  long and 4 wide; trilocular pores in a single row, which is either complete or interrupted toward anterior end, and which terminates slightly nearer to the apical setae than to the posterior spiracular pore bands, 1 trilocular pore opposite every 2 or 3 8-shaped pores near end of row, and usually 1 or 2 near each 8-shaped pore elsewhere.

Dorsal surface: 8-shaped pores 9  $\mu$  long and 5 wide, in 2 groups of 9-15 each in lateral area at anterior end; pores measuring only 5  $\mu$  long and 3 wide occurring posterior to the large pores, extending across body and numerous in transverse median area but sparse on posterior third; minute 8-shaped and disk pores very sparse; tubular ducts 24  $\mu$  long.

Ventral surface: Antenna sclerotized, roughly circular, flat, sunken in derm, with 2 setae slightly longer than diameter of antenna; beak with 1 pair of setae; spiracle with bar fairly wide and slightly expanded at inner end, atrium enlarged, bag-shaped, and containing 6-9 quinquelocular pores, 5-12 similar pores extending from spiracle to body margin in a single row; multilocular pores with 6-10 loculi and arranged in 2 complete and apparently 2-5 interrupted rows, each of complete rows with 6-9 pores and each of interrupted rows with 2; 2-4 dark-rimmed 8-shaped pores each side of beak, a few scattered in lateral area of abdomen, and 4 or 5 tending toward arrangement in a transverse row anterior to multilocular pores; submarginal 8-shaped pores in a single row terminating near the posterior row of multilocular pores, approximately one-third as numerous as marginal 8-shaped pores; submarginal setae in a complete row usually terminating 3 8-shaped pores from the posterior pair of marginal 8-shaped pores; 2 pairs of setae in the posterior row of multilocular pores, 1 pair in the anterior complete row, 1 pair in the posterior interrupted row, and sometimes 1 pair in the next interrupted row.

Apex of abdomen: Notch minute; lobes indicated, on ventral surface close to margin; setae, apical  $52 \mu$  long, outer ventral about  $4 \mu$  long; anal opening ventral, close to body margin, circular, its margin membranous.

*Larva*.—E'lliptical.

Margin: With 28 8-shaped pores, axes of all longitudinal; a pair of minute setae close to each of the posterior 3 pairs of pores; 3 pairs of setae at anterior end.

Dorsal surface: One 8-shaped pore on median line, and 3 in a lateral row on each half of body, the median pore as large as, or slightly larger than, lateral pores, all about two-thirds the size of marginal pores; disk pores in lateral area.

Ventral surface: Antennal setae, I, 1; IV, 1; V, apparently 0; VI, 3 long, 2 stout, 2 fairly stout; antennal bases two-thirds length of antenna apart; beak setae, at least 1 pair near tip, and 1 pair near base; spiracle with 1 trilocular and 1 quinquelocular pore; leg setae, coxa apparently 2, femur 1 on inner margin near base, tarsus apparently 1 each on inner and outer margins; tibia one-half as long as tarsus; 9 pairs of submarginal 8-shaped pores; 9 pairs of submarginal minute setae, on abdomen, thorax, and head; 2 pairs of setae between antennae and mouth parts.

Apex of abdomen: Notch present; lobes indicated; setae, apical  $36 \mu$  long, interapical apparently  $1.8 \mu$  long, outer ventral  $2 \mu$  long; anal opening in margin, circular, its margin slightly sclerotized.

*Data*.—Described from unmounted material, five mounted females, and six larvae on *Palmae* (*Chamaedorea* sp.?), Cordoba, Mexico, O. F. Cook, U. S. N. H., holotype and paratypes.

This species can be separated from other species on palm by the uninterrupted row of marginal 8-shaped pores which extends across the apex of the abdomen, by the presence of two groups of large 8-shaped pores near the anterior end of the body, and by the even distribution of many smaller 8-shaped pores posterior to the large pores.

### ASTEROLECANIUM INUSITATUM, new species

(Fig. 33, G-M; fig. 34, A, B; pl. 8, L)

*Habit*.—Living on the upper surface of leaves.

*Test of female*.—Elongate ovoid, 1.4 mm. long, 0.75 wide, posterior third strongly tapered; mostly convex dorsally but posterior tip nearly flat, with a faint longitudinal median carina; slightly convex ventrally; clear yellow, transparent, shiny, punctate; marginal filaments rubbed off; dorsal filaments clear yellow, scattered, varying in length; circular larval exit in dorsal surface at margin.

*Adult female*.—Elongate ovoid, posterior end strongly tapered; 1.2 mm. long, 0.5 wide.

Margin: 8-shaped pores in a single row terminating about twice length of apical seta from setal bases, posterior pores  $8 \mu$  long and 4 wide, others  $9 \mu$  long and 4 wide, twice a pore's length apart at posterior end of row, a pore's width to length apart elsewhere; quinquelocular pores in a single row termi-

nating about 8 8-shaped pores from the posterior pair of 8-shaped pores, nearly as numerous as 8-shaped pores toward posterior end of row, usually one and one-half times as numerous elsewhere.

Dorsal surface: 8-shaped pores scattered except at posterior end, 10-16  $\mu$  long and 7-12 wide, the majority 12-16  $\mu$  long and 10-12 wide; minute 8-shaped pores numerous; disk pores fairly sparse; tubular ducts 24  $\mu$  long.

Ventral surface: Antenna a circular, raised area with 2 setae as long as, and 2 longer than, diameter of antenna; beak broken, presence or absence of setae indeterminable; spiracle with bar triangular, atrium enlarged and containing 4 or 5 quinquelocular pores, 7-9 similar pores extending to body margin in a single row; multilocular pores, with 7-10 loculi, arranged in 2 complete and 1 interrupted row, the posterior complete row with 11 and the other with 19 pores, the interrupted row with 2; 4 dark-rimmed 8-shaped pores each side of beak, a few in lateral area of abdomen, and a few tending toward arrangement in a transverse row anterior to multilocular pores; submarginal 8-shaped pores in a single row terminating near the posterior row of multilocular pores, nearly as numerous as marginal 8-shaped pores; submarginal setae in a complete row terminating about one-half length of apical seta from bases of apical setae; 7 setae in posterior complete row of multilocular pores, 2 in anterior complete row, and 2 anterior to those but posterior to interrupted row of pores.

Apex of abdomen: Notch minute; lobes indicated, apparently on ventral surface; setae, apical 60-64  $\mu$  long, interapical 7.2  $\mu$  long, a pair 1  $\mu$  long entad of interapical on dorsal margin, intermediate and outer ventral (both nearly anterior to apical) each 3.6  $\mu$  long; anal opening ventral, very close to margin in a slight indentation between lobes, circular, its margin membranous.

Larva.—Nearly elliptical, posterior end narrowed.

Margin: With 28 8-shaped pores, anterior pores slightly larger than the others, axes of all longitudinal; a minute seta close to each pore of the posterior 3 pairs; 3 pairs of setae at anterior end.

Dorsal surface: 8-shaped pores in a submedian row of 4-8 and a lateral row of 9, on each half of body, with a total of 26-33, posterior pores of each row the smallest, submedian pores about one-fourth larger than lateral and slightly or distinctly smaller than marginal pores of same segments; 2 disk pores between lateral and marginal 8-shaped pores.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 1; VI, 3 long, 2 stout, 3 fairly stout; antennal bases one-half length of antenna apart; beak setae, 2 pairs apical, 1 pair basal; spiracle with 1 trilocular and 1 quinquelocular pore; leg setae, coxa 3, femur 1 on inner margin near base, tarsus 1 each on inner and outer margins; tibia one-fourth as long as tarsus; apparently 9 pairs of submarginal 8-shaped pores; apparently 9 pairs of submarginal minute setae, on abdomen, thorax, and head; 3 pairs of setae between antennae and mouth parts.

Apex of abdomen: Lobes sometimes indicated; setae, apical 54  $\mu$  long, interapical 5.4  $\mu$  long, a pair 1  $\mu$  long entad of interapical, intermediate and outer ventral (both nearly anterior to apical) each 1  $\mu$  long; anal opening in margin, circular, its margin sclerotized.

Data.—Described from one unmounted specimen, one mounted female, and six mounted larvae on *Caryota* sp., Cerro del Galipan, north of Caracas, Venezuela, August 15, 1891, U. S. N. H., holotype and paratypes.

In general appearance this species resembles *boliviae* and *palmae*, but the absence of anal ring setae sets it off from these species immediately. It can be segregated from any other known species infesting palm by the presence of numerous 8-shaped pores scattered over the dorsal surface.

### ASTEROLECANIUM JAPONICUM Cockerell

(Fig. 34, C-K; pl. 7, M)

Described by Cockerell in 1900 (22, p. 71) as a variety of *Asterolecanium variolosum*, and raised to specific rank by Takahashi in 1934 (95, p. 4). Although Takahashi based his action on a misidentification of specimens (those he placed as this species belonging



to *horishae*), he was, in the writer's opinion, correct in elevating the name to specific rank.

*Habit*.—Living on bark, in shallow pits.

*Test of female*.—Circular, 0.8–1.10 mm. in diameter, posterior end slightly produced; slightly convex dorsally, sometimes with faint transverse striations, strongly convex ventrally; greenish or brownish yellow, semitransparent, shiny; marginal filaments pale pinkish; elliptical larval exit in margin.

*Adult female*.—Nearly circular, 0.75–1 mm. in diameter, posterior end slightly produced and rounded or truncate.

Margin: 8-shaped pores in a single row terminating about one-half length of apical seta from setal bases, posterior pores 6–7  $\mu$  long and 4 wide, the others 8–9  $\mu$  long and 6 wide, a pore's width to length apart; quinquelocular pores in a row which is continued across apex of abdomen between apical setae, the row single on posterior third, double elsewhere, as numerous as the 8-shaped pores where the row is single, elsewhere at least twice as numerous.

Dorsal surface: Minute 8-shaped pores numerous; disk pores scattered, mostly in lateral area, not numerous; tubular ducts 24  $\mu$  long.

Ventral surface: Antenna conical, with 2 setae as long as diameter of antenna; beak with 2 pairs of setae; spiracle with bar expanded at inner end, and with 5 or 6 quinquelocular pores in a semicircular group outside opening, 20–25 similar pores extending from group to body margin in an irregular single or double row; multilocular pores, with 10 loculi, arranged in 4 complete rows, posterior row with 10 pores, each of the others with 6 or 8; 25–30 dark-rimmed 8-shaped pores surrounding mouth parts, and a few posterior to beak in rather indefinite transverse rows; submarginal 8-shaped pores in a single row terminating near the posterior row of multilocular pores, about one-half as numerous as marginal 8-shaped pores; submarginal setae in a complete row terminating near the posterior pair of marginal 8-shaped pores; 2 pairs of setae in the posterior row, and 1 pair in each of the other rows of multilocular pores.

Apex of abdomen: Setae, apical around 64  $\mu$  long, interapical 5  $\mu$  long, outer ventral 4  $\mu$  long; anal opening ventral, fairly close to body margin, nearly circular, its margin sclerotized and with 2 setae, each around 3  $\mu$  long, on anterior edge.

*Larva*.—Ovoid elliptical.

Margin: With 28 8-shaped pores, anterior pores slightly larger than posterior, axes of all longitudinal; 2 pairs of setae at anterior end.

Dorsal surface: 8-shaped pores in a submedian and a lateral row of 4–8 each, on each half of body, the total number usually ranging from 22–28, the anterior pore of each row tending to be larger than the posterior pore and about the size of the posterior marginal pore; disk pores between submedian and lateral 8-shaped pores; a pair of minute setae near anterior submedian pair of pores.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 0; VI, 2 long, 2 stout, 2 fairly stout, 2 slender; antennal bases two-thirds length of antenna apart; beak setae, 2 pairs apical, 1 pair median; spiracle with 1 trilocular and 1 quinquelocular pore; leg setae, coxa 3, femur 1 on inner margin near base, tarsus 1 each on inner and outer margins; tibia one-fourth as long as tarsus; 9 pairs of submarginal 8-shaped pores; 7 pairs of submarginal minute setae on abdomen, 1 pair of submarginal larger setae at anterior end; 2 pairs of setae between antennae and mouth parts.

Apex of abdomen: Lobes indicated; setae, apical about 65  $\mu$  long, interapical 10.8–12  $\mu$  long, sometimes an additional seta 3.6–5.4  $\mu$  long mesad of interapical on 1 side of body, rarely such a seta on each side, outer ventral 7  $\mu$  long; anal opening ventral; anal tube very short, membranous; anal ring lightly sclerotized, with 2 setae about 5.2  $\mu$  long.

*Data*.—Redescribed from unmounted material and the following mounted specimens: Two females on *Quercus glandulifera*, Japan, received in 1900, from type series; 2 females on *Quercus* sp., Koshiu, Chosen, S. Nakayama, March 9, 1929; 7 females and 16 larvae on *Quercus glandulifera*, Chosen, Tabashi and Nakayama collectors, March 10, 1929.

## ASTEROLECANIUM JAVAЕ, new species

(Fig. 34, L-O; fig. 35, A-C; pl. 9, E)

*Habit.*—Living on stems.

*Test of female.*—Nearly circular, 1.25 mm. in diameter, posterior end slightly produced; slightly raised dorsally, with a faint longitudinal median carina not extending to margin, with faint curved lateral carinae not extending to margins or to median carina, and with faint transverse striations; flat ventrally; brownish yellow, transparent, fairly thin, slightly punctate; marginal filaments whitish, fragmentary; dorsal filaments rubbed off, presumably occurring over most of test in unrubbed specimens; circular larval exit in ventral surface at margin.

*Adult female.*—Similar to test in shape, 1 mm. in diameter.

*Margin:* 8-shaped pores in a single row terminating about two-thirds length of apical seta from setal bases, posterior pores 10  $\mu$  long and 7 wide, others 13  $\mu$  long and 9 wide, less than a pore's width apart; quinquelocular pores in a single row terminating at the posterior pair of 8-shaped pores, at least one and one-half times as numerous as 8-shaped pores.

*Dorsal surface:* 8-shaped pores fairly numerous along median line and in submarginal and lateral areas, anterior median and a few lateral pores 13-16  $\mu$  long and 9-10 wide, majority of lateral pores 12  $\mu$  long and 8 wide, a few 10  $\mu$  long and 7 wide; minute 8-shaped pores very numerous; disk pores fairly numerous; tubular ducts 26  $\mu$  long.

*Ventral surface:* Antenna dome-shaped, with 2 setae longer and 2 or 3 much shorter than diameter of antenna; 3 quinquelocular pores between antenna and margin; beak with 2 pairs of setae; spiracle with bar subcircular and 32  $\mu$  wide, with area around opening slightly raised and containing 15-20 quinquelocular pores, and with 10-13 similar pores extending to body margin in a single row, 25-30 in group and row combined; multilocular pores with 10 loculi, apparently arranged in 4 complete and certainly in 5 interrupted rows, the anterior row anterior to posterior spiracles, posterior row with 12 pores, penultimate with 16, next with 19, next with 12, and each of interrupted rows with 2-6; 3 or 4 dark-rimmed 8-shaped pores each side of mouth parts, many scattered elsewhere; submarginal 8-shaped pores in a single row, apparently terminating near the posterior pair of marginal 8-shaped pores and about as numerous as those pores; disk pores in a submarginal row among submarginal 8-shaped pores, terminating about halfway between the posterior pair of marginal 8-shaped pores and bases of apical setae, less numerous than marginal 8-shaped pores; submarginal setae in a complete row terminating slightly nearer to the posterior pair of marginal 8-shaped pores than to bases of apical setae; apparently 2 pairs of setae in posterior row, and possibly 1 pair in penultimate row of multilocular pores.

*Apex of abdomen:* Notch present; lobes indicated; setae, apical 80  $\mu$  long, interapical 9  $\mu$  long, dorsal 12.6  $\mu$  long, inner ventral 3.6  $\mu$  long, intermediate ventral 3.6  $\mu$  long, outer ventral 7.2  $\mu$  long; anal ring with 6 setae 32-34  $\mu$  long and with an inner row of 6 and an outer one of apparently 14 pores, divided on dorsal side and tending toward division on ventral; ventral surface of apex heavily sclerotized in a roughly rectangular area extending anteriorly from interapical setae.

*Larva.*—Elongate ovoid.

*Margin:* With 28 8-shaped pores, posterior and anterior pairs slightly larger than others, axes of the posterior 6 pairs transverse, of the others longitudinal; apparently 3 pairs of setae at anterior end.

*Dorsal surface:* 8-shaped pores in a submedian row of 7 or 8 and a lateral row of 9, on each half of body, the posterior pores of each row slightly smaller than anterior ones, posterior submedian pores slightly smaller than, anterior ones same size as, marginal pores of same segments; lateral pores slightly larger than marginal pores of same segments; disk pores between submedian and lateral 8-shaped pores and a few between lateral and marginal 8-shaped pores; a pair of minute setae anterior to the anterior pair of pores of the submedian row.

*Ventral surface:* Antennal setae, I, 1; IV, 0; V, 1; VI, 2 long, 2 stout, 3 fairly stout; antennal bases about one-half length of antenna apart; beak setae, 2 pairs apical, 1 pair basal; spiracle with 1 trilocular pore; leg setae, coxa 4, femur 1 on inner margin near base and 1 on outer margin near center, tarsus 2 on inner and 1 on outer margin; tibia about one-half as long as tarsus; 10 pairs of submarginal 8-shaped pores; disk pores in a submarginal row near submarginal 8-shaped pores, apparently as numerous as 8-shaped pores; 7 pairs of

submarginal minute setae on abdomen, 3 pairs of submarginal larger setae at anterior end; 2 pairs of setae between antennae and mouth parts.

Apex of abdomen: Notch present; setae, apical  $35\ \mu$  long, interapical  $2\ \mu$  long, dorsal  $2\ \mu$  long, inner ventral  $6\ \mu$  long, intermediate ventral  $3.6\ \mu$  long, outer ventral  $2.8\ \mu$  long; anal ring with 6 setae, each  $25\ \mu$  long, and an inner row of 6 and an outer one of 12 pores, divided on dorsal and ventral sides; ventral surface of apex sclerotized in dentate rows.

*Data*.—Described from two tests (one empty), one mounted female, and two mounted larvae, on *Calophyllum spectabile* var. *ceramicum*, cultivated in Botanic Garden, Java, 1901, U. S. N. H., holotype and paratypes.

Closely related to *corallinum* and *psychotriae*, but differing in lacking claws.

### ASTEROLECANIUM LACRIMULA, new species

(Fig. 35, D-M; pl. 5, A)

*Habit*.—Living on the upper surface of leaves, in shallow pits.

*Test of female*.—Pyriform, 1.5–2 mm. long, 1.25–1.5 wide; strongly convex dorsally, with posterior end of dorsal surface slightly swollen, produced, and hooked downward, produced area not touching host, but extending posteriorly to the margin that rests on host; slightly convex ventrally; bright brownish yellow, transparent, fairly thin, shiny or dull; marginal filaments whitish; larval exit semicircular, in ventral surface of produced part.

*Adult female*.—More or less pyriform, longer than wide, posterior end slightly produced; 1.10–1.5 mm. long, 1–1.25 wide.

Margin: 8-shaped pores in a single row terminating once or twice a pore's length from bases of apical setae, posterior pores  $11\ \mu$  long and 8 wide, others 12–13  $\mu$  long and 8 wide, about a pore's length apart; quinquelocular pores (several quinquelocular pores replaced by pores with 3, or with 6–9, loculi) in a single row, nearly submarginal in position, which is interrupted for 10–20 8-shaped pores at anterior end, and terminates 5–20 8-shaped pores from the posterior pair of 8-shaped pores, less numerous than 8-shaped pores near posterior end of row, as numerous as the latter elsewhere.

Dorsal surface: Minute 8-shaped and disk pores rather sparse; tubular ducts  $18\ \mu$  long.

Ventral surface: Antenna very short, with 1 seta longer than diameter of antenna; beak with 1 pair of setae; spiracle with bar expanded at inner end, club-shaped; a group of 3–6 quinquelocular pores outside spiracular opening, 6–9 similar pores extending from spiracle to body margin in a single or double row, 9–15 pores in group and row combined; legs represented by 3 pairs of sclerotized circular areas, each with an elongate conical, slightly curved claw; very large quinquelocular (some trilocular) pores replacing multilocular pores and arranged in 8 complete rows and 1 interrupted row, the anterior row anterior to posterior spiracles, posterior row with 7 pores, penultimate with 8 or 9, each of next 3 with 15–19, each of next 2 with 21–25, next with 30–34, and anterior row with 2 or 3; dark-rimmed 8-shaped pores fairly numerous between spiracular pore bands, rather sparse elsewhere, a few arranged in 3 or 4 transverse rows among the large quinquelocular pores; submarginal 8-shaped pores in a single row terminating near the posterior marginal quinquelocular pores, about half as numerous as marginal 8-shaped pores; submarginal setae in a complete row terminating near the penultimate pair of marginal 8-shaped pores; 1 pair of setae in each of the posterior 5 rows of large quinquelocular pores.

Apex of abdomen: Lobes barely indicated, on ventral surface close to margin; setae, apical  $80\ \mu$  long, interapical  $12.6$ – $14.4\ \mu$  long, inner ventral  $9\ \mu$  long, outer ventral  $10.8$ – $12.6\ \mu$  long; anal ring with 6 setae  $36$ – $40\ \mu$  long, and apparently with an inner row of 6 and an outer one of 16 pores, tending toward division on dorsal and ventral sides.

*Larva*.—Elliptical.

Margin: With 28 8-shaped pores, axes of all longitudinal; 3 pairs of setae anteriorly.

Dorsal surface: 8-shaped pores apparently in a submedian row of 3 or 5 and a lateral row of 5, on each half of body, posterior pores of each row smaller than



anterior ones, all practically same size as marginal pores of same segments; disk pores between submedian and lateral, and between lateral and marginal, 8-shaped pores.

Ventral surface: Antennal setae, I, apparently 1; IV, 1; V, 1; VI, all broken, but at least 7 of good size; antennal bases apparently length of antenna apart; beak setae, 2 pairs apical, 1 pair basal; spiracle with 2 quinquelocular pores; leg setae, coxa apparently 3, femur 1 on inner margin near base and 1 on outer margin near center, tarsus 1 each on inner and outer margins; tibia one-third as long as tarsus; apparently 9 pairs of submarginal 8-shaped pores; at least 8 pairs of submarginal setae, possibly more, the exact number not ascertainable from the available material; larger setae present at anterior end, but number and position indeterminable.

Apex of abdomen: Distorted, apparently with a shallow notch; lobes barely indented; setae, apical broken, interapical broken, inner ventral  $5.4 \mu$  long, outer ventral apparently  $5 \mu$  long; anal ring with 6 setae apparently  $4 \mu$  long.

*Data.*—Described from unmounted material, two mounted females, and one mounted larva on an unknown host, Darling River, Bourke, New South Wales, from W. W. Froggatt, received in 1910, Froggatt No. 40, holotype and paratypes.

This species is unusual in having the marginal quinquelocular pores well removed from the 8-shaped pores, and in having large quinquelocular pores replacing the multilocular pores on the abdomen. It appears most closely related to *multiporum*, *stypheiae*, and *ungulatum*.

#### ASTEROLECANIUM LARGUM, new species

(Fig. 36, F-N)

*Habit.*—Unknown.

*Test of female.*—Nearly elongate elliptical, posterior end somewhat pointed; 4 mm. long, 1.75–2 wide; presumably nearly flat or very slightly convex dorsally, flat ventrally; yellow, transparent, fairly thin; marginal and dorsal filaments broken off; larval exit possibly elliptical, in margin.

*Adult female.*—In shape similar to test, 3.8 mm. long, 1.75–1.9 wide.

Margin: 8-shaped pores in a single row terminating about one and a half times the length of apical seta from setal bases, 16–20  $\mu$  long and 8–10 wide, usually around a pore's width apart; quinquelocular pores in a crowded single or irregularly double row terminating at the third or fourth 8-shaped pore from end of row, usually two and one-half times as numerous as 8-shaped pores; disk pores dorsad of, and much less numerous than, 8-shaped pores, terminating near posterior quinquelocular pores.

Dorsal surface: 8-shaped pores in 9 groups along median line, anterior group with 28 and 38, respectively, in the 2 available specimens, next with 28 and 38, next with 31, next with 24 and 39, next with 21 and 37, next with 8 and 32, next with 19 and 31, next with 18 and 22, next with 16 and 20, or a total of 203 and 292, the 2 anterior groups somewhat longitudinal, the others rather transverse, individual pores measuring 16–20  $\mu$  long and 8–14 wide, the majority 18–19  $\mu$  long and 12–13 wide; minute 8-shaped pores not observed; disk pores numerous; tubular ducts numerous except in groups of 8-shaped pores, 40  $\mu$  long; dorsal tubes present.

Ventral surface: Antenna very short, with 2 setae longer than diameter of antenna and 1 or 2 very short; 5 or 6 quinquelocular pores between antenna and margin; beak mutilated, presence or absence of setae indeterminable; spiracular bar nearly subcircular; 40–60 quinquelocular pores extending from spiracle to body margin in a row 2–5 pores wide; multilocular pores, with 8–12 loculi, probably arranged in at least 3 or 4 complete, and certainly in 4 and possibly in 5 interrupted rows, with a total of 162 pores observed, probably not more than 200 in perfect specimens; 5 or 6 dark-rimmed 8-shaped pores each side of beak, some in inner submarginal and lateral areas arranged in 3 or 4 rather indefinite longitudinal rows, others in at least 2 transverse rows on abdomen; submarginal 8-shaped pores in an irregularly double row apparently terminating near the seventh from the posterior pair of marginal 8-shaped pores, at least as numerous as marginal 8-shaped pores; submarginal setae in an interrupted row, but number and terminating point indeterminable; 6 setae observed among multilocular pores, their arrangement indeterminable.

Apex of abdomen: Apparently with a very shallow notch; setae, apical  $40\ \mu$  long, interapical  $10-12\ \mu$  long, outer ventral  $8\ \mu$  long; anal ring with 6 setae, each about  $44\ \mu$  long, and with an inner row of 6 and an outer row of 20 pores.

*Data*.—Described from the following material: One mounted female on bamboo, China, intercepted at San Francisco, Calif., A. C. Dennett, November 25, 1936, paratype; one test preserved in balsam and one mounted female on bamboo, China, intercepted at New York, S. D. Whitlock, June 8, 1937, holotype.

The paratype specimen of this species is partially covered with fungus, and the holotype specimen is somewhat torn and mutilated on the abdomen, consequently it is impossible to determine the exact position and number of multilocular pores and a few other details. This species differs strongly from most other species on bamboo in size, and is the longest species known, the observed test being 4 mm. long, or 0.5 mm. longer than any observed tests of *bambusicola*. It resembles *masuii* most closely but differs from it in having a large number of dorsal 8-shaped pores, as well as in many less conspicuous characters.

### ASTEROLECANIUM LAUNEA, new species

(Fig. 37, A-G; pl. 1, E)

*Habit*.—Living on stems, in shallow depressions.

*Test of female*.—Usually slightly longer than wide, sometimes nearly circular or slightly wider than long, posterior end very slightly produced and sometimes slightly elevated; usually 2 mm. long, 1.5 wide, but a few specimens 2 mm. long, 2-2.5 wide; slightly to rather strongly convex dorsally, nearly flat to somewhat convex ventrally; yellow, translucent, rather thick, smooth, sometimes shiny; marginal and dorsal filaments whitish, or nearly colorless and glassy, a few broken dorsal filaments in 2 or 3 tufts on median line in center of test and a few scattered elsewhere in some specimens; elliptical larval exit in margin.

*Adult female*.—Similar to test in shape, 1.5-2 mm. long, 1.10-1.5 wide.

*Margin*: 8-shaped pores in an irregularly double row terminating twice to three times a pore's length from bases of apical setae, the row single on part of margin, but distinctly double either in spots or along most of margin, individual pores measuring 13-14  $\mu$  long and 8 wide, usually around a pore's length apart, the 2 rows less than a pore's width apart; quinquelocular pores usually in a single row between and outside spiracular pore bands, usually not more than 4 pores anterior to anterior spiracular pore band and 10 posterior to posterior spiracular pore band, the row sometimes interrupted between the pore bands, and the pores usually no more numerous than 8-shaped pores of nearer row; disk pores irregularly spaced, dorsad of 8-shaped pores and around one-third as numerous as these, terminating near the posterior pair of 8-shaped pores; disk pores also ventrad of quinquelocular pores, terminating near the posterior pair of 8-shaped pores, very irregularly spaced and much less numerous than 8-shaped pores.

*Dorsal surface*: 8-shaped pores usually in 3 or 4 groups in median area, each group usually with 2-6 pores, the total number being about 20, but sometimes with pores strewn sparsely over entire surface, median pores 13-14  $\mu$  long and 8 wide, the other pores, which have a tendency toward arrangement in indefinite transverse rows, usually 11-12  $\mu$  long and 7 wide, but a few 14  $\mu$  long and 8 wide, or 8  $\mu$  long and 7 wide; minute 8-shaped pores fairly numerous; disk pores numerous; tubular ducts 44  $\mu$  long.

*Ventral surface*: Antenna a roughly circular area with 2 setae longer and 3-6 shorter than diameter of antenna; beak with 2 pairs of setae; spiracle with bar broad, often subcircular, with a sclerotized band extending around opening, sclerotized area with 3-6 quinquelocular pores and with similar pores extending to body margin in an irregularly double or triple row, 25-48 pores in group and row combined; multilocular pores, with 7-10 loculi, in 3 complete rows, or in 2 complete rows and 1 interrupted row, the posterior row with 5-13, middle row with 7-14, anterior row with 2-6, the total ranging from 14-29; 0-2 dark-rimmed 8-shaped pores each side of beak, a few scattered on anterior end, and others arranged in 5 or 6 transverse rows on abdomen; submarginal 8-shaped pores in

a row 2-4 pores wide, terminating near anterior row of multilocular pores, the rows broken up into groups so that there are 2-4 pores opposite some marginal 8-shaped pores and none opposite others; 2 disk pores each in posterior and penultimate rows of multilocular pores; submarginal setae in a complete row terminating 2 or 3 8-shaped pores from the posterior pair of marginal 8-shaped pores; 1 pair of setae in each row of multilocular pores and 1 pair anterior to these pores.

Apex of abdomen: Notch shallow; setae, apical  $80\ \mu$  long, interapical  $36-40\ \mu$  long, dorsal  $24\ \mu$  long, inner ventral  $8\ \mu$  long, intermediate ventral  $6-9\ \mu$  long, outer ventral  $12-16\ \mu$  long; anal ring with 6 setae  $64-72\ \mu$  long, and with an inner row of 8 and an outer one of 22 pores, tending toward division on dorsal side; ventral surface of apex rather heavily sclerotized around inner ventral setae, surrounding area sclerotized in dentate rows.

*Larva*.—Nearly elliptical, both ends slightly narrowed.

Margin: With 28 8-shaped pores, the posterior 6 pairs slightly smaller than the next 7, the anterior pair a little larger than any others, axes of the posterior 6 pairs transverse, of the others longitudinal; a pair of minute setae close to each of the posterior 4 pairs of pores; 4 pairs of setae anteriorly.

Dorsal surface: Disk pores in submarginal and lateral areas; 1 pair of setae in submedian area anteriorly.

Ventral surface: Antennal setae, I, 2; IV, 1; V, 1; VI, 2 long, 2 stout, 3 fairly stout, 2 slender (unusually short); antennal bases about one-fifth length of antenna apart; beak setae, 2 pairs apical, 1 pair basal; spiracle with 1 quinquelocular pore; leg setae, coxa 4, femur 1 on inner margin near base and 1 each on inner and outer margins near center, tarsus 2 on inner and 1 on outer margin; tibia one-half as long as tarsus; 7 pairs of submarginal 8-shaped pores, none between antennae; 7 pairs of submarginal minute setae on abdomen, 4 pairs of submarginal larger setae at anterior end; 3 pairs of setae between antennae and mouth parts.

Apex of abdomen: Notch shallow; setae, apical  $120\ \mu$  long, interapical  $32\ \mu$  long, dorsal  $8\ \mu$  long, inner ventral  $6-8\ \mu$  long, intermediate ventral  $12\ \mu$  long, outer ventral  $16\ \mu$  long; anal ring with 6 setae  $28-32\ \mu$  long and with an inner row of 6 and an outer one of 14 pores.

*Data*.—Described from the following material collected by Ch. Rungs and received from A. Balachowsky; unmounted specimens, 4 mounted females, and 45 mounted larvae on *Launea arborescens*, "Tagoud, Valley of the old Draa, Sahara Morocco," February 1934, No. 750, holotype and paratypes; unmounted specimens, 3 mounted females, and 3 mounted larvae on *Launea arborescens*, "Oasis de Ferkla, Sahara Morocco," May 10, 1934, paratypes.

This species is closely related to *arabidis*, *fimbriatum*, *nevadense*, and *stentae*.

### ASTEROLECANIUM LITSEAE Kuwana

(Fig. 38, A-E; pl. 9, C)

Described in 1916 (55, p. 149) on *Litsea glauca* from Matsudo in Chiba-Ken, Japan.

*Habit*.—Living on the lower surface of leaves.

*Test of female*.—Longer than wide, 1.2-1.5 mm. long, 0.9-1 wide, posterior end slightly produced; flat dorsally, or very slightly convex, with a faint longitudinal median carina, flat ventrally; very pale yellow, transparent, very thin, shiny, punctate; marginal and dorsal filaments very pale yellow, whitish, or slightly pinkish, the latter scattered, and same length to nearly twice length of marginal; elliptical larval exit in margin.

*Adult female*.—Similar to test in shape, 0.8-1.2 mm. long, 0.75 wide.

Margin: 8-shaped pores in a single row terminating twice a pore's length from bases of apical setae, posterior pores  $9\ \mu$  long and 6 wide, the others  $10\ \mu$  long and 8 wide, a pore's width to length apart; quinquelocular pores in a single row terminating near the posterior pair of 8-shaped pores, and slightly more numerous than 8-shaped pores.

Dorsal surface: 8-shaped pores in median, submedian, and submarginal groups, 11-14 submarginal and 3-5 submedian groups on each half of body, each with 1-4 pores, median group divided into 7-9 fairly definite, transverse rows,



each usually with 2 pores which are 12-13  $\mu$  long and 8 wide; pores of submedian groups 10-12  $\mu$  long and 8 wide, outer submarginal pores 16  $\mu$  long and 12 wide, inner ones 13-14  $\mu$  long and 9-10 wide; minute 8-shaped pores numerous; disk pores sparse; tubular ducts 22  $\mu$  long.

Ventral surface: Antenna bluntly conical, sunken in derm, with 2 setae slightly longer and 1 shorter than diameter of antenna; beak with 2 pairs of setae; spiracle with bar broad, nearly subcircular, with shallow furrows extending around opening, and with 1 or 2 quinquelocular pores in a group at opening, 3-9 similar pores extending to body margin in a single row, a total of 4-10 in group and row combined; legs represented by 3 pairs of slightly curved, rather slender claws; multilocular pores, with 9 or 10 loculi, in 5 complete and 4 interrupted rows, the anterior row anterior to the posterior spiracles, posterior row with 5-7, penultimate with 9-17, each of next 3 with 6-15, each of next 2 with 4-8, and each of next 2 with 2-4, the total ranging from 55-70; 2-4 dark-rimmed 8-shaped pores each side of beak, a few scattered on anterior end, and others tending toward arrangement in 5-7 transverse rows posterior to beak; submarginal 8-shaped pores in a single row terminating near the posterior pair of marginal 8-shaped pores, nearly as numerous as marginal 8-shaped pores; disk pores in a submarginal row entad of submarginal 8-shaped pores, terminating nearly directly anterior to apical setae, about one-third as numerous as marginal 8-shaped pores; submarginal setae in a complete row terminating near the posterior pair of marginal 8-shaped pores; 2 pairs of setae in posterior row of multilocular pores and 1 pair in penultimate row.

Apex of abdomen: Notch present; lobes strongly developed; setae, apical 99  $\mu$  long, interapical 7.2  $\mu$  long, intermediate ventral 5.4  $\mu$  long, outer ventral 7.2  $\mu$  long; anal ring with 2 setae 33-36  $\mu$  long and four setae 28-30  $\mu$  long, and with an inner row of 6 and an outer row of 16 pores, divided on dorsal and ventral sides; ventral surface with a rather elongate sclerotized area extending anteriorly from intermediate ventral or interapical setae, area between bars faintly sclerotized in dentate rows.

*Data.*—Redescribed from the following material: Unmounted material and three mounted females on *Litsea caulocarpa*, Sandakan, British North Borneo, September-December 1920, N. Y. B. G.; one mounted female on *Psychotria arborescens*, Catanduanes Island, Philippine Islands, Ramos and Edano, July-September 1928, N. Y. B. G.; unmounted material and one mounted female on *Litsea luzonica*, Mt. Madooy, Luzon, Philippine Islands, G. Edano, November 1928, N. Y. B. G.; unmounted material and one mounted female on *Litsea* sp., Upper Rejang River, Sarawak, Borneo, J. & M. S. Clemens, 1929, N. Y. B. G.; one mounted female on *Vanda sanderiana*, Philippine Islands, intercepted at California, R. D. Clemens, July 17, 1937.

Specimens used in preparing this description have been placed as *litscae* on the basis of Kuwana's original description and figure.

### ASTEROLECANIUM LONGULUM, new species

(Fig. 38, F-L; pl. 9, G)

*Habit.*—Unknown.

*Test of female.*—Elongate, sides parallel, 2.5 mm. long, 0.5 wide; slightly convex dorsally, flat ventrally; clear yellow, transparent, thin, shiny, slightly punctate in submarginal area; marginal filaments pale yellow to pinkish, much longer at anterior end than elsewhere; larval exit a slit in margin.

*Adult female.*—Elongate, 2-2.25 mm. long, 0.5 wide.

Margin: 8-shaped pores in a single row, usually terminating three or four times the length of an apical seta from bases of setae, about 15 pores at anterior end measuring 12  $\mu$  long and 6 wide, others measuring 10  $\mu$  long and 5 wide, nearly contiguous at ends of body, usually a pore's width apart elsewhere; quinquelocular pores in a single row extending from opposite or slightly anterior to antennae to near posterior fourth of body, usually about one-half as numerous as 8-shaped pores at each end of row and at least as numerous as 8-shaped pores elsewhere; disk pores dorsad of 8-shaped pores and approximately one-third as numerous as 8-shaped pores, terminating with 1 or 2 posterior to the last pair of 8-shaped pores.

Dorsal surface: Minute 8-shaped and disk pores fairly sparse; tubular ducts  $30\ \mu$  long; dorsal tubes present.

Ventral surface: Antenna short, with 2 setae longer than diameter of antenna; usually 2 quinquelocular pores between antenna and margin; beak without setae; spiracle with bar fairly broad, and with atrium slightly enlarged and containing 3-5 quinquelocular pores, a total of 10-19 pores in atrium and in the row extending to body margin from spiracle, this row usually single near spiracle but 3 or 4 pores wide at margin; 2 or 3 dark-rimmed 8-shaped pores each side of beak, a few scattered on anterior end and in lateral area posterior to mouth parts, others arranged in 4 or 5 transverse rows near posterior end of abdomen; submarginal 8-shaped pores usually in a double row, the inner row well removed from the outer, terminating near genital opening, usually 2 pores opposite every other marginal 8-shaped pore; 7 pairs of submarginal setae posterior to anterior spiracles, the posterior pair nearer to the posterior pair of marginal 8-shaped pores than to the apical setae; 1 pair of setae posterior to genital opening, 1 pair anterior to opening, and 1 pair anterior to the latter.

Apex of abdomen: Slightly concave; setae, apical  $18-20\ \mu$  long, interapical  $8-9\ \mu$  long, inner ventral  $5.4\ \mu$  long, outer ventral  $7.2\ \mu$  long; anal ring with 6 setae  $24$  and  $27\ \mu$  long, and with an inner row of 6 and an outer row of 12 pores, divided on dorsal side and tending toward division on ventral.

*Larva*.—Elongate, posterior end narrowed.

Margin: With 26 8-shaped pores (a pair missing immediately anterior to anterior spiracles), the posterior pair a little larger than the penultimate pair, the latter slightly larger than the next 4, the next 6 about the same size as the penultimate, and the anterior pair the largest of all, axes of all pores longitudinal; 3 pairs of setae anteriorly.

Dorsal surface: 8-shaped pores in a submedian row of 4-6 on each half of body, the anterior pore in each row the largest, all very slightly smaller than marginal pores of same segments; disk pores present in submarginal area and a few in lateral area.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 0; VI, 2 long, 2 stout, 3 fairly stout, 1 slender; antennal bases one-third length of antenna apart; beak setae, 2 pairs apical, 1 pair basal; spiracle with 1 trilocular and 1 quinquelocular pore; leg setae, coxa 4, femur 1 on inner margin near base and 1 each on inner and outer margins near center, tarsus 2 on inner and 1 on outer margin; tibia nearly one-half as long as tarsus; 9 pairs of submarginal 8-shaped pores; 8 pairs of submarginal minute setae posterior to anterior spiracles, 2 pairs of submarginal larger setae at anterior end; 1 pair of setae between antennae and mouth parts.

Apex of abdomen: Notch narrow; setae, apical  $52\ \mu$  long, interapical  $12\ \mu$  long, inner ventral  $2\ \mu$  long, outer ventral  $3.6\ \mu$  long; anal ring with 6 setae  $3.6\ \mu$  long.

*Data*.—Described from unmounted material, five mounted females, and five mounted larvae on *Arundinaria sinica*, Hong Kong, China, A. S. Hitchcock, November 5, 1921, U. S. N. H., holotype and paratypes.

This species is closely related to *oblongum*.

### ASTEROLECANIUM LONGUM (Green)

(Fig. 36, A-E; pl. 3, B)

Described in 1896 (40, p. 5) as *Planchonia miliaris longa*. Re-described by Green in 1909 (42, pp. 336-337) as *Asterolecanium lineare*. In 1909 (42, in a note inserted in the volume) Green proposed the name *lancoelatum* in place of *lineare*, which was preoccupied by *lineare* Lindinger. Although Green stated in 1909 (42, pp. 336, 339) that the variety described in 1896 contained a distinct species and variety, all specimens described as *miliaris longa* in 1896 apparently belonged to the species later designated as *lineare* and *lancoelatum*. Since *longum* is the older name, it is the valid name of the species, and *lineare* Green and *lancoelatum* are synonyms of it.

The variety treated by Green as *miliaris longum* in 1909 (*42*, p. 339) on *Bambusa oliveriana* from Peradeniya, Ceylon, can now be known as *miliaris robustum* (see page 130).

*Habit*.—Living on both surfaces of leaves.

*Test of female*.—Elongate, tapering to each end, 1.75–2.5 mm. long, 0.4–0.5 wide; fairly convex dorsally, with a faint longitudinal median carina, usually with more distinct curved lateral carinae meeting median carina and with a shallow furrow between median and lateral carinae; flat ventrally; brownish yellow, transparent, thin, shiny, finely punctate; marginal filaments not observed; circular larval exit in margin.

*Adult female*.—Elongate, 1.5–2.25 mm. long, 0.4 wide.

Margin: 8-shaped pores 1–11 in number, 6–8  $\mu$  long and 4–5 wide, usually situated opposite spiracles or on median section of lateral margin.

Dorsal surface: Minute 8-shaped and disk pores rather sparse; tubular ducts 32  $\mu$  long; dorsal tubes present.

Ventral surface: Antenna a circular area slightly sunken in derm, with 2 setae slightly longer than diameter of antenna; beak without setae; spiracular bar fairly slender; 2–5 quinquelocular pores between spiracle and body margin (3 or 4 usually in a group fairly close to spiracle); 1 or 2 dark-rimmed 8-shaped pores each side of mouth parts, a few scattered anterior to mouth parts, a few arranged in a single longitudinal lateral row, and a few in 2 or 3 transverse rows near posterior end of abdomen; submarginal 8-shaped pores in a single row terminating about two-thirds length of apical seta from setal bases, fairly numerous; apparently 3 pairs of submarginal setae near posterior end of abdomen, the posterior pair about two-thirds length of apical seta from bases of apical setae; 1 pair of setae posterior, and 1 pair anterior, to genital opening.

Apex of abdomen: Notch present; lobes sometimes indicated; setae, apical 56  $\mu$  long, interapical 12  $\mu$  long, inner and outer ventral 4–5.4  $\mu$  long; anal ring with 6 setae, each about 28  $\mu$  long, and with an inner row of 6 and an outer one of 14 pores, divided on dorsal side.

*Second stage*.—Resembling adult female but much smaller and not tapering so strongly; margin with 36 8-shaped pores varying from a pore's width to six times (usually three times) its length apart; ventral surface with 1 quinquelocular pore near each spiracle, 1 pair of setae observed in median area; apex of abdomen as in adult but setae one-third or one-fourth shorter.

*Larva*.—Nearly elongate elliptical.

Margin: With 28 8-shaped pores, the posterior 6 pairs slightly smaller than the others, the anterior pair about one-fourth larger than the adjacent pair and one-third larger than posterior pair, axes of all longitudinal; 3 pairs of setae anteriorly.

Dorsal surface: Disk pores in lateral area.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 1; VI, 2 long, 2 stout, 3 fairly stout, 1 slender; antennal bases nearly one-third length of antenna apart; beak setae, 2 pairs apical, 1 pair median; anterior spiracle with 1 trilocular pore, posterior spiracle with 1 trilocular and 1 quinquelocular pore; leg setae, coxa 4, femur 1 on inner margin near base and 1 each on inner and outer margins near center, tarsus 2 on inner and 1 on outer margin; tibia one-half as long as tarsus; 9 pairs of submarginal 8-shaped pores; 6 pairs of submarginal minute setae on abdomen, 2 pairs of submarginal larger setae at anterior end; 1 pair of setae between antennae and mouth parts.

Apex of abdomen: Notch present; setae, apical 36  $\mu$  long, interapical 9  $\mu$  long, inner ventral 4–5  $\mu$  long, outer ventral 4  $\mu$  long; anal ring with 6 setae 14–16  $\mu$  long, and with an inner row of 6 and an outer one of 12 pores, divided on dorsal side.

*Test of male*.—Elongate, posterior end rather pointed; 1–1.10 mm. long, 0.3–0.4 wide; convex dorsally, with a faint longitudinal median carina; flat ventrally; brownish yellow, transparent, thin, shiny, punctate; marginal filaments whitish, sparse.

*Adult male*.—1 mm. long.

Head: Antenna 10-segmented; formula (longest to shortest), (IV), (III), (VI, VII), (V, VIII, IX, X), (I), (II); antennal setae, I–III, 10–12; IV–IX, 18–20; X, 8 of usual size, 2 slightly stouter than the others, and 3 very long; basal bars diagonal; 19 setae between ventral eyespots and antennae.

Thorax: Bar between wing bases rectangular, three times as long as wide; tibia five-sixths length of tarsus.



Abdomen: Four segments each with a pair of setae dorsally on lateral margin, 2 segments each with a pair of setae in ventral lateral area; each lobe area with 1 long and 2 short setae; penis sheath with 2 pairs of setae dorsally near base, and 5 or 6 setae on each side of ventral opening.

*Male nymph.*—Distinguishing characters similar to those of adult male.

*Third-stage male.*—Resembling second stage in shape; margin with 8-shaped pores more numerous and more regularly spaced than in second stage, usually once or twice (sometimes as much as six times) a pore's length apart; ventral surface with 3 pairs of legs represented by circular sclerotized areas apparently without claws, but with minute clear areas suggesting setal bases, 2 pairs of setae in median abdominal area; apex of abdomen as in second stage.

*Data.*—Redescribed from unmounted material and the following mounted specimens: Eight females and 6 larvae on *Arundinaria* sp., Pundaluoya, Ceylon, E. E. Green, received March 12, 1910, and September 11, 1911, type material; 2 females, Ceylon, Maskell Collection No. 354; 1 female, Ceylon, E. E. Green, Cockerell Collection; 7 females, 1 second-stage specimen, 3 larvae, 3 adult males, 3 male nymphs, and 1 third-stage male on *Arundinaria* sp., Pundaluoya, Ceylon; 3 females and 6 larvae on *Bambusa arundinacea*, Ambagamuwa, Ceylon, July 1885, U. S. N. H.; 5 females, 10 larvae, 3 adult males, and 3 male nymphs on *Arundinaria* sp., Eton, Ceylon, March 18, 1895; 1 female on *Bambusa spinosa*, Hué, Annam, Indo-China, A. S. Hitchcock, September 26, 1921, U. S. N. H.

Although the marginal 8-shaped pores are reduced in number, those present are well defined. Green (42, p. 336) expressed uncertainty as to whether there was a complete marginal series. In stained specimens at hand the marginal row of 28 8-shaped pores is apparent in larvae inside adults, as well as in those removed from the leaves. Green did not mention these pores in the early larvae, although he did note their presence in the later larvae (42, p. 337).

*Asterolecanium longum* is closely related to *miliaris* and *caudatum*, but can be separated from these by its small number of marginal 8-shaped pores.

### ASTEROLECANIUM LUTEOLUM, new species

(Fig. 39, A-K; pl. 7, B)

*Habit.*—Living on the lower surface of leaves in slight depressions, in crevices of rough bark, or in pits in smooth bark.

*Test of female.*—Ovoid, 0.65–0.85 mm. long, 0.5 wide; convex dorsally, sloping to posterior end, flat at tip, with a faint longitudinal median carina and lateral carinae meeting near anterior end and with distinct transverse striations; slightly convex ventrally; deep yellow, transparent, thin, shiny; marginal filaments whitish, shorter near posterior end than elsewhere; dorsal filaments also whitish, shorter than marginal, located in lateral and submarginal area; semicircular larval exit in margin.

*Adult female.*—Ovoid to nearly circular, posterior end slightly produced; 0.6–0.8 mm. long, 0.5 wide.

Margin: 8-shaped pores in a single row terminating twice a pore's length from bases of apical setae, the posterior pores 6  $\mu$  long and 4 wide, the others 8  $\mu$  long and 5 wide, usually about a pore's width apart; quinquelocular pores in a single row terminating within 8 pores from end of row of 8-shaped pores, as numerous as 8-shaped pores near posterior end, at least one and one-half times as numerous as those pores anterior to posterior spiracular pore bands.

Dorsal surface: 8-shaped pores scattered in lateral and submarginal area except at posterior end, fairly numerous, the majority 4  $\mu$  long and 3 wide, but some 5  $\mu$  long and 4 wide; minute 8-shaped pores numerous in median area, sparse in submarginal area; disk pores sparse; tubular ducts 24  $\mu$  long.

Ventral surface: Antenna conical, with 2 setae longer than diameter of antenna; beak with 2 pairs of setae; spiracular bar slightly expanded at inner

end; 10-23 (usually around 16) quinquelocular pores extending from spiracle to body margin in an irregularly single or double row; multilocular pores, totaling 26-33 and having 10 loculi, arranged in 4 complete and 2 or 3 interrupted rows, each of the posterior 3 rows with 5-9 pores, anterior complete row with 4-6, and each of interrupted rows with 2; approximately 20 dark-rimmed 8-shaped pores in a loose row surrounding mouth parts, and 8 or 10 posterior to beak in rather indefinite transverse rows; submarginal 8-shaped pores in a single row terminating near the posterior row of multilocular pores, nearly as numerous as marginal 8-shaped pores; submarginal setae in a complete row terminating near the penultimate pair of marginal 8-shaped pores; 2 pairs of setae in the posterior row of multilocular pores, 1 pair in each of the other complete rows, and 2 in posterior interrupted row.

Apex of abdomen: Lobes indicated on ventral surface close to margin; setae, apical  $48\ \mu$  long, interapical  $4-5\ \mu$  long, outer ventral  $4-5\ \mu$  long; anal opening ventral, fairly well removed from body margin, nearly circular, its margin sclerotized, 2 setae  $2.5-3\ \mu$  long on anterior edge.

Second stage.—Much smaller than adult and elliptical in outline; margin apparently with 5 or 6 quinquelocular pores; dorsal surface with a few very large 8-shaped pores; ventral surface with 2 or 3 pores in each spiracular row, with 4 dark-rimmed 8-shaped pores, and with 2 setae in median abdominal area; apex of abdomen apparently as in adult, but with shorter setae.

Larva.—Somewhat ovoid, posterior end rather pointed.

Margin: With 28 8-shaped pores, the posterior ones slightly smaller than others, axes of all longitudinal; 2 pairs of setae anteriorly.

Dorsal surface: 8-shaped pores, totaling 29-39, in a submedian row of 5-10 and a lateral row of 9-11, on each half of body, the anterior pores of each row usually slightly larger than posterior ones, submedian pores slightly smaller, and lateral pores slightly larger, than marginal pores of same segments; disk pores between submedian and lateral, and between lateral and marginal, 8-shaped pores.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 0; VI, 2 long, 2 stout, 2 fairly stout, 2 slender; antennal bases one-half length of antenna apart; beak with 2 pairs of setae at tip; spiracle with 1 trilocular and 1 quinquelocular pore; leg setae, coxa 3, femur 1 on inner margin near base, tarsus 1 each on inner and outer margins; tibia one-third as long as tarsus; 9 pairs of submarginal 8-shaped pores; 7 pairs of submarginal minute setae on abdomen, 1 pair of submarginal larger setae at anterior end; 2 pairs of setae between antennae and mouth parts.

Apex of abdomen: Notch minute; lobes indicated; setae, apical  $50\ \mu$  long, interapical  $5\ \mu$  long, outer ventral  $3\ \mu$  long; anal opening in margin; anal tube very short, sclerotized; anal ring a sclerotized band almost on surface, with 2 setae, each about  $3\ \mu$  long.

Data.—Described from the following material: Empty tests and 5 mounted females on *Quercus serrata*, Japan, 1893, U. S. N. H., holotype and paratypes; unmounted material, 10 mounted females, 2 mounted second-stage specimens, and 5 mounted larvae on *Quercus* sp., Chestnut Hill, Philadelphia, Pa., R. G. Pierce, November 1915, paratypes.

Although this species resembles *adjunctum*, it differs from that species in several respects, the most conspicuous of which are its shape, the absence of a sclerotized tongue-shaped projection from each marginal 8-shaped pore, and the size and arrangement of the dorsal 8-shaped pores.

### ASTEROLECANIUM MACHILI, new species

(Fig. 39, L-R; pl. 7, H)

Habit.—Living on bark, in pits.

Test of female.—Longer than wide or nearly circular, 1.6-1.9 mm. long and 1.3-1.5 wide, or about 1.5 mm. in diameter; slightly convex dorsally, with faint transverse striations; convex ventrally; greenish yellow, transparent, thin, fairly shiny, punctate; marginal filaments whitish; elliptical larval exit in margin.

*Adult female*.—Similar to test in shape, about 1.3 mm. long and 1.10 wide, or 1.10 mm. in diameter.

Margin: 8-shaped pores in a single row terminating around a pore's length from bases of apical setae, posterior pores  $10\ \mu$  long and 6 wide, the others  $12\text{--}13\ \mu$  long and 8-9 wide, a pore's width apart at anterior end, usually less than that elsewhere; quinquelocular pores in a single row terminating at the posterior pair of 8-shaped pores, usually about as numerous as 8-shaped pores near posterior end of row, more numerous elsewhere.

Dorsal surface: Minute 8-shaped pores very numerous; disk pores fairly numerous; tubular ducts  $30\ \mu$  long.

Ventral surface: Antenna rough, irregular, sharply conical, sunken in derm, apparently with 4 (possibly more) setae shorter, and 2 slightly longer, than diameter of antenna; 3-10 quinquelocular pores between antenna and margin; beak with 2 pairs of setae; spiracular bar subcircular; derm outside spiracular opening faintly sclerotized and containing 13-24 quinquelocular pores, 23-32 additional pores extending to body margin in an irregularly single to triple row, a total of 37-49 pores in group and row combined; multilocular pores, totaling 137-153 and having 8-10 loculi, apparently arranged in 6 complete and 3 interrupted rows, the anterior row anterior to posterior spiracles, posterior and penultimate rows each with 12-16 pores, next row with 22-26, each of next 2 with 23-33, next with 9-16, posterior 2 interrupted rows each with 7-12, and anterior interrupted row with 4; 2-5 dark-rimmed 8-shaped pores each side of beak, a few scattered on anterior end, some arranged in rather indefinite longitudinal rows in lateral area, and others tending toward arrangement in 5 or 6 transverse rows posterior to mouth parts; submarginal 8-shaped pores usually in an irregular single row terminating near the penultimate or posterior pair of marginal 8-shaped pores, nearly as numerous as marginal 8-shaped pores; submarginal disk pores in a single row interspersed with submarginal 8-shaped pores and terminating nearly directly anterior to apical setae; submarginal setae in a complete row terminating near the posterior pair of marginal 8-shaped pores; 5 setae in the posterior row of multilocular pores and 2 in the penultimate row.

Apex of abdomen: Notch present; lobes indicated; setae, apical  $72\ \mu$  long, interapical  $9\ \mu$  long, dorsal  $7.2\ \mu$  long, inner ventral  $3.6\ \mu$  long, intermediate ventral  $4\ \mu$  long, outer ventral  $7.2\ \mu$  long; anal ring with 6 setae  $28\ \mu$  long and with an inner row of 6 and an outer one of apparently 12 pores; tending toward division on dorsal and ventral sides; ventral surface of apex strongly sclerotized in an irregularly rectangular area extending anteriorly from margin through inner lobes, surrounding area slightly sclerotized and rugose.

*Data*.—Described from unmounted material and four mounted females on *Machilus* sp., Sozan, Taiwan (Formosa), R. Takahashi, March 27, 1932, holotype and paratypes.

This species is closely related to *corallinum*, but differs from it in lacking large dorsal 8-shaped pores and claws, and in having usually a larger number of spiracular quinquelocular and multilocular pores.

### ASTEROLECANIUM MASUII Kuwana

(Fig. 40, A-F; pl. 4, A)

Described in 1916 (*55*, p. 148), on leaves of bamboo from Tokyo and Nagasaki, Japan.

*Habit*.—Living on the lower surface of leaves.

*Test of female*.—Nearly elongate elliptical, posterior end slightly narrowed; 3 mm. long, 1.10 wide; slightly convex dorsally, with a faint longitudinal median carina having minute tubercles; flat ventrally; clear yellow, transparent, thin, shiny, finely punctate; marginal filaments whitish with a very faint yellowish cast, slightly longer at anterior end than elsewhere; elliptical larval exit in margin.

*Adult female*.—In shape similar to test, 2.75 mm. long, 1 wide.

Margin: 8-shaped pores in a single row terminating about twice a pore's length from bases of apical setae, posterior pores about  $12.6\ \mu$  long and 7 wide, the others about  $14.4\ \mu$  long and 8 wide, usually less than a pore's width apart; quinquelocular pores in a single row terminating at the penultimate pair of 8-shaped pores, slightly more numerous than 8-shaped pores; disk pores nearly



as numerous as 8-shaped pores, situated dorsad of them and terminating near the posterior pair.

Dorsal surface: Minute 8-shaped and disk pores numerous; tubular ducts  $36\ \mu$  long; dorsal tubes present.

Ventral surface: Antenna rough, dome-shaped, with 2 setae longer and 2 shorter than diameter of antenna; beak without setae; spiracle with bar broad and with wrinkles in derm around opening; 12-25 quinquelocular pores extending from spiracle to body margin in an irregularly double or triple row; multilocular pores in 8 rows, 5 or 6 of which are complete and 2 or 3 interrupted, posterior row with 14 pores in each of the 2 available specimens, penultimate 18 and 25, respectively, next 15 and 18, next 9 and 11, next 5 and 8, next 2 and 8, next 2 and 4, and anterior row with 2, the individual pores with 8-10 loculi; 1 or 2 dark-rimmed 8-shaped pores each side of beak, a few scattered on anterior end, some arranged roughly in a single longitudinal lateral row and in 4 transverse rows among multilocular pores; submarginal 8-shaped pores in a single row terminating near the posterior row of multilocular pores, usually about half as numerous as marginal 8-shaped pores; 6 pairs of submarginal setae on abdomen, the posterior pair near the third posteriormost pair of marginal 8-shaped pores; 1 pair of setae in each of the posterior 4 rows of multilocular pores.

Apex of abdomen: Notch present; setae, apical 28-30  $\mu$  long, interapical 7.2 and 12.6  $\mu$  long, respectively, in the 2 specimens studied, outer ventral 5.4 and 9  $\mu$  long; anal ring with 6 setae 30-34  $\mu$  long and with an inner row of 6 and an outer one of an indeterminate number of pores, divided on dorsal side and tending toward division on ventral.

*Larva*.—Elliptical.

Margin: With 28 8-shaped pores, the posterior pair slightly larger than next 5 pairs and about the same size as the sixth, which is slightly larger than the next 6 pairs, anterior pair slightly larger than the posterior pair; axes of the posterior 6 pairs longitudinal or slightly diagonal, of the others longitudinal; 2 pairs of setae anteriorly.

Dorsal surface: 8-shaped pores in a submedian row of 8 on each half of body, about three-fourths the size of marginal pores of same segments; disk pores in submarginal area and a few in lateral area.

Ventral surface: Antenna indistinctly 6-segmented; antennal setae, I, 1; IV, 1; V, 0; VI, 2 long, 2 stout, 3 fairly stout, 1 slender; antennal bases one-third length of antenna apart; beak setae, 2 pairs apical, 1 pair median; spiracle with 1 quinquelocular pore; leg setae, coxa 4, femur 1 on inner margin at base and 1 each on inner and outer margins near center, tarsus 2 on inner and 1 on outer margin; tibia one-half as long as tarsus; 9 pairs of submarginal 8-shaped pores; 6 pairs of submarginal minute setae on abdomen, 3 pairs of submarginal larger setae at anterior end; 1 pair of setae between antennae and mouth parts.

Apex of abdomen: Notch present; setae, apical 40  $\mu$  long, interapical 12.6  $\mu$  long, outer ventral 3.6  $\mu$  long; anal ring with 6 setae apparently 4  $\mu$  long, apparently without pores.

*Male nymph*.—Antenna 10-segmented; 5 segments of abdomen each with a seta dorsally on lateral margin; each lobe area with 1 short and 2 very short setae; other characters indeterminate.

*Data*.—Redescribed from one mounted female and one male nymph on *Arundinaria* sp., Naam Kwan Shan, Sheung Ping, Lung Moon district, Kwangtung, China, F. A. McClure, April 28, 1931, and one test, one mounted female, and one mounted larva on bamboo, Nagasaki, Japan, I. Kuwana collector, from E. E. Green, possibly type.

The specimen from China is slightly smaller, and has fewer quinquelocular and multilocular pores and shorter interapical and ventral setae than the specimen from Japan. The specimen from Japan is doubtless from the type material, though it is not so labeled.

### ASTEROLECANIUM MEDIUM, new species

(Fig. 40, G-M; fig. 41, A; pl. S, J)

*Habit*.—Living on bark.

*Test of female*.—Broad elliptical, 1.5-1.75 mm. long, 1.25-1.5 wide; convex dorsally, with a longitudinal median and a submarginal carina, usually with transverse striations crossing carinae; flat ventrally; light brownish, transparent.

fairly thin; marginal filaments whitish, very short; elliptical larval exit in ventral surface at margin.

*Adult female*.—Longer than wide, posterior end slightly produced; 1.5 mm. long, 1.15–1.25 wide.

Margin: 8-shaped pores in a single row terminating one and a half to two times the length of an apical seta from bases of setae, posterior pores  $9\ \mu$  long and 5 wide, the others 10–12  $\mu$  long and 7 wide, usually a pore's length apart.

Dorsal surface: Minute 8-shaped pores numerous; disk pores sparse; tubular ducts 18  $\mu$  long.

Ventral surface: Antenna bluntly conical, with 1 seta nearly as long as, and 2 much shorter than, diameter of antenna; beak with 2 pairs of setae; spiracle with bar broad, and with both bar and atrium heavily sclerotized; 55–65 quinquelocular pores extending from inner end of spiracular bar to body margin, in a row which is usually 3 or 4 pores wide but occasionally 6 or 8 pores wide at some point between spiracle and margin; multilocular pores, having 5–7 loculi, in a longitudinal row of 5–7 at each end of genital opening; 5 or 6 dark-rimmed 8-shaped pores each side of beak, a few between spiracles, some scattered in lateral area, and others arranged in 2–4 transverse rows posterior to beak; submarginal 8-shaped pores in a single row apparently terminating near the posterior pair of marginal 8-shaped pores, about one-third as numerous as marginal 8-shaped pores; submarginal setae in a complete row terminating about halfway between the posterior pair of marginal 8-shaped pores and bases of apical setae; 2 setae near each end of each row of multilocular pores, and 3 groups, each with 2 or 3 setae, anterior to each of those rows and spaced at uniform intervals.

Apex of abdomen: Setae, apical 56–64  $\mu$  long, interapical 12  $\mu$  long, one 5.4  $\mu$  long usually entad of interapical on 1 side of body only, inner ventral 6–8  $\mu$  long, outer ventral 8–10  $\mu$  long; anal opening in ventral surface well removed from margin; anal tube short and membranous or not apparent; anal ring nearly or actually, on the surface, a sclerotized band with 4 setae apparently 1  $\mu$  long.

*Second stage*.—Resembling adult in shape, but much smaller; margin with 8-shaped pores terminating a pore's length from bases of apical setae; ventral surface with bar and atrium of spiracle slightly sclerotized, 10–12 quinquelocular pores between spiracle and body margin; apex of abdomen as in adult but without a seta entad of interapical seta.

*Larva*.—Elongate ovoid.

Margin: With 28 8-shaped pores, axes of all longitudinal; a minute seta close to each pore of the posterior 3 pairs; 2 pairs of setae at anterior end.

Dorsal surface: 8-shaped pores arranged in a submedian, a lateral, and a submarginal row of 9–14 each, on each half of body, with a total of 66–76, slightly variable in size and slightly smaller than marginal pores; 2 or 3 disk pores observed.

Ventral surface: Antennal setae, I, 2; IV, 1; V, 1; VI, 2 long, 3 stout, 2 fairly stout, 1 slender; antennal bases one-fourth length of antenna apart; beak setae, 2 pairs apical, 1 pair basal; spiracle with 1 trilocular and 1 quinquelocular pore; leg setae, coxa 4, femur 1 on inner margin near base, tarsus 1 each on inner and outer margins; tibia about one-half length of tarsus; 8 pairs of submarginal 8-shaped pores of which 1 pair is between the antennae; apparently 11 pairs of submarginal minute setae, on abdomen, thorax, and head; 1 pair of setae between antennae and mouth parts.

Apex of abdomen: Lobes sometimes indicated; setae, apical 54  $\mu$  long, interapical 10.8  $\mu$  long, a pair 2  $\mu$  long entad of interapical, inner and outer ventral each about 3.6  $\mu$  long; anal opening in margin; anal tube short, membranous; anal ring sclerotized, with 4 setae, each apparently 1  $\mu$  long, or setae not recognizable but their bases distinct, apparently with 2 pores, divided on dorsal and ventral sides.

*Data*.—Described from unmounted material, 14 mounted females (some very poor), 2 mounted second-stage specimens, and 15 mounted larvae on *Agonis* sp., Coolgardie, West Australia, G. Compere, Compere No. 1010, holotype and paratypes.

This is the only known species in which all the multilocular pores are arranged in a longitudinal row at each end of the genital opening. It is apparently rather closely related to *victoriae*.

## ASTEROLECANIUM MILIARIS variety MILIARIS (Boisduval)

(Fig. 41, B-G; pl. 5, E)

Described in 1869 (9, pp. 261-262) as *Chermes miliaris* on *Bambusa distorta* from the garden of Hamma, Alger, Algeria.

*Habit.*—Living on stems, and both surfaces of leaves.

*Test of female.*—Longer than wide but differing in proportions of length to width, anterior end rounded, sides often parallel, posterior end slightly narrowed and produced; 1-1.6 mm. long, 0.4-0.9 wide; nearly flat to very slightly convex dorsally, usually with a faint longitudinal median carina and sometimes with very faint transverse striations; flat ventrally; greenish, brownish, or clear pale yellow, transparent, thin, shiny, slightly punctate; marginal filaments whitish to pale pinkish; circular larval exit in ventral surface at margin.

*Adult female.*—In shape similar to test, 1-1.4 mm. long, 0.3-0.7 wide.

Margin: 8-shaped pores in a single row, terminating around one-half length of apical seta from setal bases, around  $8\ \mu$  long and 4.5 wide, slightly more than a pore's length apart near posterior end, usually around a pore's width apart elsewhere; quinquelocular pores in a single row, starting on anterior margin approximately halfway between median line and anterior spiracular pore bands, and ending halfway between posterior spiracular pore bands and the posterior pair of 8-shaped pores, at least as numerous as corresponding 8-shaped pores.

Dorsal surface: Minute 8-shaped pores fairly numerous; disk pores rather sparse; tubular ducts  $24\ \mu$  long; dorsal tubes present.

Ventral surface: Antenna circular, flat, with 2 setae slightly longer than diameter of antenna; beak without setae; spiracular bar nearly linear; 10-18 quinquelocular pores extending from spiracle to body margin in an irregularly single row; 2-4 dark-rimmed 8-shaped pores each side of beak, a few on anterior end, and a few on abdomen tending toward arrangement in 6 transverse rows with most of pores in lateral area; submarginal 8-shaped pores in a single row terminating near the penultimate pair of marginal 8-shaped pores, about one-third as numerous as marginal 8-shaped pores; 6 pairs of submarginal setae on abdomen, the posterior pair near the penultimate or posterior pair of marginal 8-shaped pores: 1 pair of setae posterior to genital opening, 1 pair anterior to opening, and 1 pair anterior to the latter.

Apex of abdomen: Notch present; lobes indicated; setae, apical 56-60  $\mu$  long, interapical 9-12  $\mu$  long, inner ventral 6-8  $\mu$  long, outer ventral 8-10  $\mu$  long; anal ring with 6 setae, each 32  $\mu$  long and with an inner row of 6 and an outer one of 14 pores, divided on dorsal side.

*Second stage.*—Resembling adult female but much smaller; margin without quinquelocular pores; ventral surface with 4 or 5 quinquelocular pores in each spiracular row, with 1 pair of setae in median abdominal area; apex of abdomen as in adult but all setae around one-fourth shorter.

*Larva.*—Elliptical.

Margin: 8-shaped pores normally 28 in number, but a few specimens with only 25 or 26, the posterior pair very slightly larger than the next 5 pairs, and about same size as the 7 anterior to those, anterior pair slightly the largest, axes of all longitudinal; 3 pairs of setae at anterior end.

Dorsal surface: 8-shaped pores in a submedian row of 4-8 on each half of body, with a total of 11-16, anterior pore slightly the largest, all about two-thirds size of marginal pores of same segments; disk pores in lateral area and a few in submarginal area.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 1; VI, 2 long, 2 stout, 3 fairly stout, 1 slender; antennal bases one-fourth length of antenna apart; beak setae, 2 pairs apical, 1 pair median; anterior spiracle with 1 trilocular, posterior spiracle with 1 trilocular and 1 quinquelocular pore; leg setae, coxa 4, femur 1 on inner margin near base and 1 on inner and outer margins near center, tarsus 2 on inner and 1 on outer margin; tibia two-thirds length of tarsus; 9 pairs of submarginal 8-shaped pores; 6 pairs of submarginal minute setae on abdomen, 2 pairs of submarginal larger setae at anterior end; 1 pair of setae between antennae and mouth parts.

Apex of abdomen: Notch present; lobes indicated; setae, apical 27-29  $\mu$  long, interapical 7.2  $\mu$  long, inner ventral 5.4  $\mu$  long, outer ventral 3.6-5.4  $\mu$  long; anal ring with 6 setae 12.6  $\mu$  long and with an inner row of 6 and an outer row of 10 or 12 pores, divided on dorsal and ventral sides.



*Data.*—Redescribed from unmounted material, 2 mounted females, and 12 mounted larvae on *Bambusa* sp., Algeria, loaned by M. Beier, presumably type material; a mass of unmounted material, approximately 100 mounted females, several mounted second-stage specimens, and several mounted larvae, on *Bambusa argentea*, *B. balcooa*, *B. spinosa*, *B. vulgaris*, *B. vulgaris* var. *aurea-striata*, and unknown genera of Bambuseae; from Illinois (in greenhouses), Florida, Bermuda, Cuba, Jamaica, Puerto Rico, Culebra Island, Montserrat, St. Kitts, Canal Zone, Trinidad, British Guiana; Kauai and Honolulu, Hawaii; Luzon, Philippine Islands; Kwangsi, China; Lahore, India; Peradeniya, Ceylon; and Brisbane, Australia.

#### ASTEROLECANIUM MILIARIS variety ROBUSTUM Green

(Fig. 41, H; pl. 5, F)

Described in 1908 (41, p. 19) on bamboo from Pusa, India. The form erroneously treated by Green in 1909 (42, p. 339) under the name *Asterolecanium miliaris longum* is identical with *miliaris robustum*. (see discussion on p. 122).

The marginal quinquelocular pores furnish an adequate basis for distinguishing *miliaris miliaris* and *miliaris robustum*. In the typical form these pores start between the antenna and anterior spiracular pore band and end approximately halfway between the posterior spiracular pore band and the last marginal 8-shaped pore. In *miliaris robustum*, however, the quinquelocular pores are either absent or occur in a group of 2 to 15 (usually less than 6) where each spiracular pore band meets the body margin. Other characters, including the shape of the specimens and the distance between the marginal 8-shaped pores mentioned by Green (41, p. 19; 42, p. 339), have not been found sufficiently constant for differentiating the two varieties.

*Data.*—Redescribed from unmounted material, three mounted females, and four mounted larvae on *Bambusa oliveriana*, Peradeniya, Ceylon, E. E. Green, December 1898; unmounted material and three mounted females on *Bambusa* sp., Pusa, India, April 1906, from E. E. Green, type; a mass of unmounted material, hundreds of mounted females, many mounted second-stage specimens, and many mounted larvae, on *Bambusa arundinacea*, *B. nana*, *B. pallescens*, *B. spinosa*, *B. tulda*, *B. vulgaris*, *B. vulgaris* var. *aureo-variegata* and var. *vulgaris*, and *Bambusa* sp., *Dendrocalamus strictus* and *D. thourarii*, *Oxytenanthera abyssinica*, *Phyllostachys* sp., and unknown genera of Bambuseae, from Malanje, Angola; Amani, Tanganyika; Mauritius; Assam, Bangalore, and Lahore, India; Ceylon; Moulmein, Lower Burma; Kwangsi and Kwangtung, China; Nisui, Taiwan (Formosa); Philippine Islands; Tongatabu, Tonga Islands; Fiji Islands; Bahia and Rio de Janeiro, Brazil; British Guiana; near Caracas, Venezuela; Trinidad; Canal Zone; West Indies; Florida; and Bermuda.

#### ASTEROLECANIUM MIMICUM, new species

(Fig. 41, I-N; fig. 42, A; pl. 7, S)

*Habit.*—Living on stems, and on the lower surface of leaves.

*Test of female.*—Elongate, 1 mm. long, 0.3–0.4 wide, posterior end narrowed; strongly convex dorsally, sloping sharply from median line to margin; flat ventrally; greenish yellow, transparent, thin, smooth, shiny; marginal filaments

whitish; dorsal filaments either absent or 1-10 on median line, whitish; elliptical larval exit in margin.

*Adult female.*—In shape similar to test, 0.7-0.9 mm. long, 0.3 wide.

Margin: 8-shaped pores in a single row terminating two and a half times the length of apical seta from setal bases, posterior pores 6-7  $\mu$  long and 4 wide, others 8  $\mu$  long and 4.5 wide, usually a pore's length apart; quinquelocular pores as numerous as corresponding 8-shaped pores and arranged in a single row extending from slightly anterior to anterior spiracular pore bands to a point beyond posterior spiracular pore bands, which is nearer to the posterior spiracular pore bands than to the posterior pair of 8-shaped pores.

Dorsal surface: 8-shaped pores absent, or 1-10 such pores on median line, these 10-12  $\mu$  long and 6-8 wide; minute 8-shaped pores fairly numerous; disk pores sparse; tubular ducts 24  $\mu$  long; dorsal tubes present.

Ventral surface: Antenna short, with 2 setae longer than diameter of antenna; beak without setae; spiracle with bar very short, and atrium slightly enlarged and containing 1 or 2 quinquelocular pores, 4 or 5 similar pores extending to body margin in a single row; 2 dark-rimmed 8-shaped pores each side of beak, 1 or 2 anterior to mouth parts, and 2-4 in each of 2 transverse rows anterior to genital opening; submarginal 8-shaped pores in a single row terminating near the posterior pair of marginal 8-shaped pores, nearly as numerous as marginal 8-shaped pores; 6 pairs of submarginal setae on abdomen, the posterior pair the length of apical seta from bases of apical setae; 1 pair of setae posterior to genital opening and 1 pair anterior.

Apex of abdomen: Notch present; lobes indicated; setae, apical 40  $\mu$  long, interapical 8  $\mu$  long, inner ventral 5.2  $\mu$  long, outer ventral 6  $\mu$  long; anal ring with 6 setae 28-30  $\mu$  long and an inner row of 6 and an outer row of 12 pores, divided on dorsal side and tending toward division on ventral.

*Larva.*—Elliptical.

Margin: With 23 8-shaped pores, the posterior 6 pairs slightly smaller than next 7, anterior pair slightly the largest, axes of the posterior 6 pairs slightly diagonal, of the others longitudinal; 3 pairs of setae at anterior end.

Dorsal surface: 8-shaped pores in a submedian row of 11 on each half of body, gradually increasing in size from posterior to anterior end of row, all distinctly larger than marginal pores of same segments; disk pores in lateral area.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 1; VI, 2 long, 2 stout, 3 fairly stout, 1 slender; antennal bases one-third length of antenna apart; beak setae, 2 pairs apical, 1 pair median; anterior spiracle with 1 trilobular pore, posterior spiracle with 1 trilobular and 1 quinquelocular pore; leg setae, coxa 3, femur 1 on inner margin near base and 1 on outer margin near center, tarsus 2 on inner and 1 on outer margin; tibia one-half as long as tarsus; 9 pairs of submarginal 8-shaped pores; 6 pairs of submarginal minute setae on abdomen, 1 pair of submarginal larger setae anteriorly; 2 pairs of setae between antennae and mouth parts.

Apex of abdomen: Notch present; setae, apical 27  $\mu$  long, interapical 7.2  $\mu$  long, inner ventral 3  $\mu$  long, outer ventral 3.6  $\mu$  long; anal ring with 6 setae 9  $\mu$  long and with an inner row of 6 and an outer row of 6-8 pores, divided on dorsal side and tending toward division on ventral.

*Data.*—Described from unmounted material and the following mounted specimens: Four females and 4 larvae on bamboo, Hong Kong, China, G. Compere, Compere No. 242; 19 females and 17 larvae on bamboo, Hong Kong, China, C. W. Howard, April 26 and August 11, 1930, Nos. 176 and 191; 1 female, Tung Heung near Kwong Ning, Kwangtung, April 25, 1925, and 4 females and 3 larvae, Au Tsai, Foo Chiu Haang, Kwangsi, November 5, 1928 (including holotype), collected by F. A. McClure in China on *Bambusa*.

Similar to *pseudolanceolatum*, but differing in being smaller, in not having two quinquelocular pores posterior to the genital opening, and in its shorter apical setae. Furthermore, the larva has only three setae on each coxa whereas there are four in *pseudolanceolatum*.

Specimens from stems either have no dorsal 8-shaped pores or only one to three, whereas specimens from leaves have at least five and usually nine such pores.

## ASTEROLECANIUM MINUS Lindinger

(Fig. 37, II-0; pl. 7, A)

The name *Asterolecanium variolosum minor* was applied by Leonardi to specimens on *Quercus* sp. from Italy in 1909.<sup>11</sup> Leonardi's entire notation concerning the variety was as follows: "Vive su parecchie specie di *Quercus*. Gli esemplari furono raccolti in varie località dell'Italia meridionale." In 1911 (85, p. 63) Sassocer listed the name, stating that it had been published by Leonardi without a description. In 1912 (61, p. 360) Lindinger placed *A. variolosum minor* Leonardi, 1909, as a synonym of *variolosum*, thereby validating the name, and in so doing became the author of the variety. Study of type material shows that *minus* is neither a variety nor a synonym of *variolosum* but is a valid species, and it is therefore accorded that standing. The species here described as *minus* Lindinger is unquestionably the species discussed by Leonardi in 1920 (57, pp. 250-253) as *variolosum* Ratzeburg.

*Habit.*—Living on bark, in pits.

*Test of female.*—Slightly longer than wide or nearly circular, posterior end slightly produced; 0.95-1.5 mm. long, 0.85-1.5 wide, usually 1-1.25 in diameter; flat to slightly convex dorsally, with broad, flat, median, and semicircular lateral carinae meeting at anterior end, and with transverse striations extending to punctate area, the space on a lateral carina between any two transverse striations often having the appearance of a small, blunt tubercle; flat to convex ventrally; greenish yellow, fairly clear yellow, or rarely brownish yellow, transparent to translucent, shiny, strongly punctate near margin; marginal filaments whitish; circular larval exit in margin.

*Adult female.*—Slightly longer than wide, or circular, 0.85-1.10 mm. long, 0.75-1 wide, usually around 0.95 mm. in diameter.

Margin: 8-shaped pores in a single row terminating around a pore's length from bases of apical setae, posterior pores 8  $\mu$  long and 5 wide, others 9  $\mu$  long and 6 wide, a pore's width to length apart; quincelocular pores in a single row, interrupted for 2-20 8-shaped pores at anterior end and terminating 8-25 (usually about 20) pores from the posterior pair of 8-shaped pores, slightly more numerous than the 8-shaped pores opposite them.

Dorsal surface: Minute 8-shaped pores numerous; disk pores fairly numerous; tubular ducts about 24  $\mu$  long.

Ventral surface: Antenna globular, with 2 setae as long as diameter of antenna; beak with 3 pairs of setae; spiracular bar expanded at inner end; 4-6 quincelocular pores in a rather indefinite group outside spiracular opening and about 25-50 similar pores extending to body margin in a single, double, or triple row; pores with 4 or 5 loculi, replacing the multilocular pores, arranged in 3 complete or interrupted rows, the posterior row usually with 3 or 4 pores, median row with 2-4, and anterior row with 1 or 2, the total ranging from 4-13 (usually 6-8); a loose group of 4-8 dark-rimmed 8-shaped pores each side of beak, a few scattered in spiracular area, and 15-20 others on abdomen either in indefinite arrangement or roughly in transverse rows; submarginal 8-shaped pores in a single row terminating near the posterior row of multilocular pores, sometimes somewhat crowded near posterior end and appearing irregularly double, around one-half as numerous as 8-shaped pores; submarginal setae in a complete row terminating near the penultimate pair of marginal 8-shaped pores; 2 pairs of setae in the posterior row of multilocular pores, 1 pair each in median and anterior rows, 1 pair anterior to those, and 1 pair still farther anteriorly.

Apex of abdomen: Setae, apical 28-32  $\mu$  long, interapical around 4  $\mu$  long, outer ventral 3-4  $\mu$  long; anal opening in ventral surface well removed from margin, circular, its margin slightly sclerotized, with 2 setae not more than 4  $\mu$  long on anterior edge.

*Larva.*—Elongate ovoid.

Margin: With 28 8-shaped pores, axes of all longitudinal; 2 pairs of setae anteriorly.

<sup>11</sup> LEONARDI, G. CHERMOTHECA ITALICA [EXSICCATI]. Fascicolo 5, No. 107. 1909.



Dorsal surface: 8-shaped pores normally in a submedian row of 4 or 5 and a lateral row of 6-9 (usually 9), on each half of body, with the total ranging from 20-30, these pores slightly larger than marginal pores; disk pores near posterior end.

Ventral surface: Antenna apparently 6-segmented; antennal setae, I, 1; IV, 1; V, 0; VI, 2 long, 2 stout, 2 fairly stout, 2 slender; antennal bases one-third length of antenna apart; beak setae, 3 pairs apical; anterior spiracle with 1 trilocular and 1 quinquelocular pore, posterior spiracle with 1 apparently trilocular pore; leg setae, coxa 3, femur 1 on inner margin near base, tarsus 1 each on inner and outer margins; tibia one-fourth as long as tarsus; 9 pairs of submarginal 8-shaped pores; 7 pairs of submarginal minute setae on abdomen, 1 pair of submarginal larger setae at anterior end; 2 pairs of setae between antennae and mouth parts.

Apex of abdomen: Lobes sometimes indicated; setae, apical  $54 \mu$  long, interapical  $5.4 \mu$  long, outer ventral  $4.6 \mu$  long; anal opening in ventral surface and margin, circular; anal tube very short; anal ring close to surface, sclerotized, with 2 setae about  $5.7 \mu$  long.

*Data.*—Described from unmounted material and the following mounted specimens collected on *Quercus*: Two females and 1 larva on *Quercus* sp., Italy, type; 5 females and 6 larvae, Fairmount Park, Philadelphia, Pa., O. Paul, August 22, 1908; 2 females, Pencoyd, Pa., J. L. Means, received August 30, 1912; 7 females and 8 larvae on *Q. lanuginosa*, near Sestri Levante in Liguria, Italy, O. Jaap, March 16, 1913, O. Jaap Collection No. 169; 5 females, Ardmore, Pa., from Peters, Byrne and Co., received May 22, 1915; 5 females on white oak, Foxburg, Pa., Hannah Fox, November 3, 1918; 7 females and 3 larvae on white oak, Philadelphia, Pa., C. F. Jenkins, June 1, 1921; 4 females, Philadelphia, Pa., H. W. Tradell, March 29, 1922; 3 females on chestnut oak, Philadelphia, Pa., H. Skinner, September 20, 1922; 7 females, from Davey Tree Expert Co., Philadelphia, Pa., November 12, 1925; 2 females and 10 larvae on *Q. cerris*, Vallombrosa, Italy, from F. Silvestri, received May 1934; 1 female, Berlin, Germany, intercepted at Washington, D. C., W. B. Wood, January 26, 1937; 6 females and 4 larvae, Norristown, Pa., from M. C. Van Horn, July 15, 1937; 2 females on *Q. pedunculata*, Warsaw, Poland, intercepted at Washington, D. C., D. P. Limber, March 17, 1938; 5 females on *Q. montana*, Glen Lyon, Pa., S. Mesavage, August 31, 1938; 2 females, Germany, intercepted at Washington, D. C., W. B. Wood, December 29, 1938.

This species is closely related to both *quercicola* and *variolosum*, but differs most conspicuously in having less than 14 multilocular pores with 4 or 5 loculi, instead of at least 23 multilocular pores with 6 to 10 loculi, in having 25 to 50, instead of 35 to 85, quinquelocular pores in each spiracular pore band, and in averaging 0.95 mm. in diameter instead of at least 1.25 mm.

### ASTEROLECANIUM MINUSCULUM, new species

(Fig. 42, B-E; pl. 7, P)

*Habit.*—Living on the lower surface of leaves.

*Test of female.*—Nearly circular or slightly longer than wide, sometimes indented by growth against hairs on leaf, posterior end strongly produced and usually turned up against dorsal surface; 0.5-0.75 mm. in diameter, or 0.6-0.9 mm. long, 0.5-0.75 wide; strongly convex dorsally, the sides nearly vertical, sloping somewhat near posterior end, but posterior tip recurved and practically as high as anterior end, a faint, broad, median carina in central third, also usually with faint transverse striations; flat ventrally; pale greenish yellow, transparent, thin, shiny; marginal filaments pale greenish yellow, not observed on posterior half; broken dorsal filaments same color as marginal, placed at uniform intervals in submarginal area and 1 or 2 usually present in lateral area; elliptical larval exit at end of produced area on dorsal surface.

*Adult female*.—In shape similar to test, 0.4–0.7 mm. in diameter, or 0.6–0.75 mm. long, 0.5 wide.

Margin: 8-shaped pores in a single row terminating around six times the length of an apical seta from bases of setae (usually only 2 or 3 posterior to posterior spiracular pore bands), 6–7.2  $\mu$  long and 3 G wide, the intervals between them one to five times (normally apparently around twice) the length of a pore, sometimes absent along anterior margin; quinquelocular pores in a single row terminating at the posterior pair of 8-shaped pores or slightly beyond, normally at least as numerous as 8-shaped pores.

Dorsal surface: 8-shaped pores 8–17 in number (usually at least 12), posterior pore 9  $\mu$  long and 7.2 wide, in submarginal area near posterior end, others placed at fairly regular intervals in submarginal area, and usually 2 in submedian or lateral area near beak, the majority 9  $\mu$  long and 7.2 wide, but sometimes 1 or 2 slightly smaller; minute 8-shaped pores not observed; disk pores fairly sparse; tubular ducts 27  $\mu$  long; dorsal tubes present.

Ventral surface: Antenna circular, flat, sometimes slightly sunken in derm, with 2 setae longer than diameter of antenna; beak without setae; spiracular bar rather slender; 8–14 quinquelocular pores extending from spiracle to body margin in a single row, except near margin, where it is 3 or 4 pores wide; 2 or 3 dark-rimmed 8-shaped pores each side of beak, a very few on anterior end, a few in lateral area of abdomen, and in 1 or 2 transverse rows in genital area; submarginal 8-shaped pores in a single row terminating around length of apical seta from bases of setae, 1 opposite each marginal 8-shaped pore when the latter are twice a pore's length apart, and at the same intervals where 8-shaped pores are absent; apparently at least 4 pairs of submarginal setae near posterior end of abdomen, the posterior pair around length of apical seta from bases of apical setae; 1 pair of setae posterior to genital opening (so near posterior end that in slightly folded specimens they almost appear to belong with those of apex of abdomen), 1 pair anterior to opening, and 1 pair anterior to these.

Apex of abdomen: Notch present; setae, apical 52–56  $\mu$  long, interapical 5.4  $\mu$  long, inner and outer ventral about 3.6  $\mu$  long; anal ring with 2 setae 24  $\mu$  long, and four 26–30  $\mu$  long, and with an inner row of 6 and an outer row of 12 pores; ventral surface of apex sometimes slightly rugose.

*Larva*.—Practically elliptical.

Margin: With 28 8-shaped pores, the anterior pair slightly larger than any others, axes of the posterior 6 pairs transverse or diagonal, of the others longitudinal; 3 pairs of setae anteriorly.

Dorsal surface: Two submedian 8-shaped pores on each half of body, anterior pore slightly smaller than posterior, both slightly wider than marginal pores of same segments; disk pores in submarginal and lateral areas.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 1; VI, 2 long, 2 stout, 3 fairly stout, 1 slender; antennal bases about one-half length of antenna apart; beak setae, 2 pairs apical, 1 pair median; spiracle with 1 trilocular pore; leg setae, coxa 4, femur 1 on inner margin near base and 1 each on inner and outer margins near center, tarsus 2 on inner and 1 on outer margin; tibia one-half as long as tarsus; 9 pairs of submarginal 8-shaped pores; apparently 6 pairs of submarginal minute setae on abdomen, 3 pairs of submarginal larger setae at anterior end; 1 pair of setae between antennae and mouth parts.

Apex of abdomen: Notch present; setae, apical 33  $\mu$  long, interapical 7.2  $\mu$  long, inner ventral 5.4  $\mu$  long, outer ventral 3.6  $\mu$  long; anal ring with 6 setae around 5.4  $\mu$  long.

*Data*.—Described from unmounted material, 28 mounted females, and 47 mounted larvae removed from host material collected by F. A. McClure in Kwangtung, China, unless otherwise indicated. The following lots are represented: *Bambusa spinosa*, Hué, Annam, Indo-China, A. S. Hitchcock, September 26, 1921, U. S. N. H.; *Bambusa arundinacea*, Hainan Island, China, A. S. Hitchcock, October 10–15, 1921, U. S. N. H.; *Bambusa* sp., Lung T'au Shan, K'uk Kong district, January 7, 1925; *Bambusa* sp., Leng T'seng village, April 15, 1925; *Bambusa* sp., Ahwat village near Chun Wong Shan, Ts'ing Uen district, April 20, 1925; *Bambusa* sp., near Wan T'ong, Ts'ing Uen district, April 21, 1925; *Bambusa* sp.?, Kwong Ning, April 24, 1925; *Bambusa* sp., near Tung Heung, Kwong Ning district, April 25, 1925;

*Bambusa* sp., Tin Ha village, Honam Island, May 5, 1925; *Bambusa nana*, Philippine Islands, September 1925; 2 females on *Bambusa* sp., Chung Chou, Kwangsi, September 21, 1925, holotype and paratype; *Bambusa* sp., Bamboo Garden, Lingnan University, September 2, 1926; *Bambusa* sp., Hak Ts'uen, Honam Island, April 4, 1929; *Arundinaria* sp., Lingnan University, P'oon Ue district, September 9, 1931; *Bambusa* sp., Lingnan University, P'oon Ue district, October 2, 1931; *Bambusa* sp., P'oh T'au T'suen, Mau Ming district, December 27, 1931.

This species is so similar to *minutum* that in the adult stage it is sometimes difficult to differentiate the two although in the larval stage they are easily separated. In the adult females of *minusculum* there are 8 to 17 (usually at least 12) dorsal 8-shaped pores and in those of *minutum* 4 to 8; there are 8 to 14 quinquelocular pores in each spiracular pore band in *minusculum* and 6 to 10 in *minutum*; furthermore, in *minusculum* the apical setae are 52 to 56  $\mu$  long and the ring setae 24 to 30  $\mu$  long, while in *minutum* the apical setae are 44 to 50  $\mu$  long and the ring setae 20  $\mu$  long. The larvae of *minusculum* have 4 dorsal 8-shaped pores which are slightly larger than the marginal, while those of *minutum* have at least 7, the largest of which is smaller than the marginal pore of the same segment; also in *minusculum* there is 1 trilocular pore near each spiracle, but in *minutum* 1 trilocular pore near the anterior spiracle and 2 near the posterior spiracle.

#### ASTEROLECANIUM MINUTUM Takahashi

(Fig. 42, F-J; fig. 43, A; pl. 7, C)

Described in 1930 (93, pp. 10-11) from specimens on *Bambusa stenostachya* from Taihoku, Nisui, Suisha, and Naze, Taiwan (Formosa).

*Habit*.—Living on the lower surface of leaves.

*Test of female*.—Broadly ovoid, sometimes indented by growth against hairs on leaf; 0.5-0.75 mm. long, 0.4-0.6 wide; strongly convex dorsally, sides often nearly vertical, top slightly rounded, most strongly convex at anterior end, sloping from anterior end to posterior third, tip of test produced and elevated, with transverse striations which are most conspicuous between most strongly convex area and produced portion; flat ventrally; pale greenish yellow, transparent, thin, shiny; marginal filaments pale greenish yellow to slightly whitish, not observed at posterior end; dorsal filaments also pale greenish yellow, much longer than marginal, 4-8 located at intervals in submarginal or lateral area; circular larval exit at tip of produced part.

*Adult female*.—In shape similar to test, 0.4-0.75 mm. long, 0.3-0.6 wide.

Margin: 8-shaped pores in a single row terminating three to four times the length of an apical seta from bases of setae, posterior pores usually 6  $\mu$  long and 4 wide, others 7-8  $\mu$  long and 4.5 wide, posterior pores sometimes eight or ten times a pore's length from the penultimate pores, all pores usually a pore's length apart, but sometimes less and often more, sometimes dropping out for varying distances, or reduced in size, due to growth against hairs on leaf; quinquelocular pores in a single row terminating near the posterior pair of 8-shaped pores or with 3 or 4 pores beyond this point, usually in the proportion of 1 to each 8-shaped pore and 1 opposite each interval between the 8-shaped pores that are around a pore's length apart, either persisting or dropping out where 8-shaped pores have dropped out and sometimes dropping out at a point where specimen has grown against a hair, even if corresponding 8-shaped pore has persisted.

Dorsal surface: 8-shaped pores 4-8 in number; on each half of body, 1 near posterior end in submarginal area, and 1 or 2 anteriorly in submarginal area, sometimes 1 also present in lateral area, posterior pore 12  $\mu$  long and 8 wide,



others 10-12  $\mu$  long and 7-8 wide; minute 8-shaped and disk pores fairly sparse; tubular ducts 24  $\mu$  long; dorsal tubes present.

Ventral surface: Antenna roughly dome-shaped, with 2 setae slightly longer than diameter of antenna; beak without setae; spiracular bar fairly broad, somewhat expanded at inner end; normally with 6-10 quinquelocular pores extending from spiracle to body margin in a single or double row; 2 or 3 dark-rimmed 8-shaped pores each side of beak, a few in lateral area of abdomen, and others arranged in 2 or 3 transverse rows on abdomen; submarginal 8-shaped pores in a single row terminating about halfway between genital opening and the posterior marginal quinquelocular pores, usually 1 opposite each marginal 8-shaped pore when the latter are slightly more than a pore's length apart; apparently at least 4 pairs of submarginal setae on abdomen, the posterior pair nearly the length of an apical seta from bases of apical setae; 1 pair of setae posterior to genital opening, 1 pair anterior to it, and 1 pair anterior to those.

Apex of abdomen: Setae, apical 44-50  $\mu$  long, interapical 6-7.2  $\mu$  long, inner ventral 3.6  $\mu$  long, outer ventral 4-5  $\mu$  long; anal ring with 6 setae 20  $\mu$  long and with an inner row of 6 and an outer row of 12 pores, tending toward division on dorsal side; ventral surface of apex rugose.

*Larva*.—Broadly elliptical.

Margin: With 28 8-shaped pores, the posterior, penultimate, fifth from posterior, and anterior pairs very slightly larger than the others, axes of the posterior 6 pairs transverse, of the others longitudinal; 3 pairs of setae anteriorly.

Dorsal surface: 8 shaped pores in a submedian row of 2-5 on each half of body, the total number ranging from 7-10, anterior pore largest and about one-sixth smaller than marginal pores of same segment, the others, except the second from anterior pore which is sometimes distinctly larger, one-half to three-fourths size of marginal pores of same segments; disk pores in lateral area and a few in submarginal area.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 1; VI, 2 long, 2 stout, 3 fairly stout, 1 slender; antennal bases one-half length of antenna apart; beak setae, 2 pairs apical, 1 pair median; anterior spiracle with 1 trilocular pore, posterior spiracle with 2; leg setae, coxa 4, femur 1 on inner margin near base and 1 each on inner and outer margins near center, tarsus 2 on inner and 1 on outer margin; tibia two-thirds as long as tarsus; 9 pairs of submarginal 8-shaped pores; 6 pairs of submarginal minute setae on abdomen, 2 pairs of submarginal larger setae at anterior end; 1 pair of setae between antennae and mouth parts.

Apex of abdomen: Notch present; setae, apical 28  $\mu$  long, interapical 5  $\mu$  long, inner ventral 2.7  $\mu$  long, outer ventral 3  $\mu$  long; anal ring with 6 setae 7.2  $\mu$  long, divided on dorsal side.

*Data*.—Redescribed from unmounted material and the following mounted specimens: Two females and 2 larvae on *Dendrocalamus* sp., Kwangtung, China, F. A. McClure; 1 female and 2 larvae on *Arundinaria glaucescens*, Calcutta, India, R. A. Young, 1862, U. S. N. H.; 5 females and 2 larvae on *Bambusa tulda*, India, May 1888, U. S. N. H.; 3 females and 1 larva on *Bambusa* sp., Hanoi, Indo-China, A. S. Hitchcock, October 5, 1921, U. S. N. H.; 1 female and 3 larvae on *Bambusa* sp., Koo Long Ue, Sz Ming district, Fukien, China, F. A. McClure, July 26, 1930; 7 females and 5 larvae on *Bambusa* sp., Lingnan University, P'oon Ue district, Kwangtung, China, F. A. McClure, September 9 and 17 and October 13, 1931; 1 female on *Bambusa* sp., Sing Kok T'sai, Yeung Kong district, Kwangtung, China, F. A. McClure, December 1, 1931; 2 females and 2 larvae on *Bambusa* sp., Chan T'au Ling, Mau Ming district, Kwangtung, China, F. A. McClure, December 27, 1931; 6 females and 13 larvae on *Bambusa stenostachya*, Taihoku, Taiwan (Formosa), R. Takahashi collector, from E. E. Green, received in 1934, probably type.

This species resembles most closely *minusculum* and *parvum*, and is rather similar to *brunetae* and *circulare*.

## ASTEROLECANIUM MULTIPORUM Green

(Fig. 43, B-M; pl. 6, M)

Described in 1915 (44, p. 48) as a variety of *stypheiae*; it is here raised to specific rank.

*Habit.*—Living on stems.

*Test of female.*—Longer than wide, measuring 2.25 by 1.45 mm., posterior end slightly produced; convex dorsally, with very faint transverse striations; concave ventrally; lemon yellow, transparent, fairly thin, fairly shiny; fragmentary marginal filaments whitish; larval exit a slit in margin.

*Adult female.*—Elongate ovoid, posterior end slightly produced, about 1.75 mm. long, 1.25 wide.

Margin: 8-shaped pores in a single row terminating about three times a posterior pore's length from bases of apical setae, posterior pores 10  $\mu$  long and 6 wide, the others 12  $\mu$  long and 8 wide, about a pore's width apart; quinquelocular pores in a row that is triple at anterior end, double and occasionally triple in lateral areas, and then double posteriorly, sometimes single for 3 or 4 pores at posterior end, terminating at the third posteriormost pair of 8-shaped pores, as numerous as 8-shaped pores at posterior end, two or three times as numerous elsewhere.

Dorsal surface: Minute 8-shaped and disk pores rather sparse; tubular ducts 32  $\mu$  long.

Ventral surface: Antenna short, with 3 setae shorter and 2 longer than diameter of antenna; 3 quinquelocular pores between antenna and margin; beak with 2 pairs of setae; spiracle with bar fairly broad and expanded at inner end, atrium enlarged and containing 7-11 quinquelocular pores, 3-10 similar pores extending from spiracle to body margin in an irregularly single or double row, a total of 12-17 in atrium and row combined; multilocular pores, having 8-12 loculi, arranged in 6 complete and 4 interrupted rows, posterior and penultimate rows each with 18-21, next 14-30, next 20-24, next 15-18, next 13, each of next 3 with 4-6, and anterior with 2 or 3, the total ranging from 116-140; 3-6 dark-rimmed 8-shaped pores each side of beak and a few scattered elsewhere; submarginal 8-shaped pores in a single row terminating near the penultimate row of multilocular pores, nearly as numerous as marginal 8-shaped pores; submarginal setae in a complete row terminating near the penultimate pair of marginal 8-shaped pores; 2 pairs of setae in the posterior row of multilocular pores and 1 pair in each of the next 3 rows.

Apex of abdomen: Notch present; lobes barely indicated; setae, apical 70  $\mu$  long, interapical 7.2-9  $\mu$  long, inner ventral apparently 7.2  $\mu$  long, outer ventral 9  $\mu$  long; anal ring with 6 setae apparently 27  $\mu$  long and apparently with an inner row of 6 and an outer row of 10 or 12 pores, divided on dorsal side and tending toward division on ventral; ventral surface with a heavily sclerotized, elongate area extending anteriorly from near base of each apical seta, slightly sclerotized in dentate rows between heavily sclerotized areas.

*Larva.*—Nearly elliptical, posterior end narrowed.

Margin: 8-shaped pores normally 28 in number, missing near posterior end of body when less than 28 occur, posterior pores smallest, gradually increasing in size to the anterior pore; if 28 are present, the axes of the posterior 6 pairs are diagonal or transverse, and of the others longitudinal; normally a minute seta close to each pore of the posterior 3 pairs; 3 pairs of setae anteriorly.

Dorsal surface: 8-shaped pores in a rather irregular lateral row, normally 7-9 on each half of body, posterior pores smaller than anterior pores and about two-thirds the size of marginal pores of same segments; disk pores on posterior 3 or 4 segments.

Ventral surface: Antennal setae, I, 2; IV, 1; V, 1; VI, 2 long, 2 stout, 3 fairly stout, 2 slender; antennal bases nearly one-half length of antenna apart; beak setae, 2 pairs apical, 1 pair basal; spiracle with 1 trilocular or quadrilocular and 1 quinquelocular pore; leg setae, coxa 4, femur 1 on inner margin near base and 1 on outer margin near center, tarsus 1 each on inner and outer margins; tibia about one-half as long as tarsus; 9 pairs of submarginal 8-shaped pores; 10 pairs of submarginal minute setae, on abdomen, thorax, and head, 3 pairs of submarginal larger setae at anterior end; 1 pair of setae between antennae and mouth parts.

Apex of abdomen: Notch present; setae, apical  $65\ \mu$  long, interapical usually  $6\ \mu$  long, dorsal  $2\ \mu$  long, inner ventral  $5.4\ \mu$  long, outer ventral  $5.4\ \mu$  long; anal ring with 6 setae  $16.2\ \mu$  long and with an inner row of 6 and an outer one of apparently 12 pores, divided on dorsal side and tending toward division on ventral side; ventral surface with a sclerotized, irregularly elongate area anterior to base of each apical seta, median area faintly sclerotized in dentate rows.

*Data*.—Redescribed from two tests, two mounted females (apex of abdomen missing in one), and seven mounted larvae on *Samolus repens*, Warrnambool, Victoria, Australia, November 1914, from E. E. Green, type.

Closely resembling *stypheleiae*, but with many more marginal quinquelocular pores, with the tubular ducts 32 instead of  $28\ \mu$  long, with 7 to 11 pores in the atrium of each spiracle, and with 116 multilocular pores. The larvae of the two species exhibit only minor differences.

### ASTEROLECANIUM NEVADENSE Balachowsky

(Fig. 44, A-F; pl. 4, D)

Described in 1935 (3, pp. 239-242).

*Habit*.—Living on stems, leaf petioles, and leaves.

*Test of female*.—About 2 mm. long and 1.5 wide; posterior end produced and turned straight up, or hooked with tip nearly reaching dorsum of test; strongly convex dorsally, flat or concave ventrally; pale whitish yellow, transparent to translucent, rather thick, smooth, shiny; marginal and dorsal filaments whitish, the latter in an inconspicuous tuft along median line and scattered to margin, the median filaments same length as marginal filaments, the others shorter; larval exit narrow elliptical, in margin.

*Adult female*.—Somewhat ovoid, posterior end slightly produced; 1.7-1.9 mm. long, 1-1.3 wide.

Margin: 8-shaped pores in an irregularly double and single row terminating around twice length of pore from bases of apical setae, irregularly or regularly double from anterior end to slightly beyond posterior spiracular pore bands and usually single from there to end of row, the pores usually alternate rather than opposite when row is double, the intervals between them varying from the width to the length of a pore, and the space between the rows about equal to the width of a pore, individual pores measuring around  $12\ \mu$  long and 8 wide; quinquelocular pores in a single row interrupted for 40-50 8-shaped pores at anterior end and terminating at about the twentieth pore from the ends of the row of 8-shaped pores, about 1 quinquelocular pore to 1 8-shaped pore of nearer row; disk pores dorsad of 8-shaped and ventrad of quinquelocular pores, each row terminating near apical setae, the pores irregularly spaced, for the most part about half as numerous as corresponding 8-shaped pores.

Dorsal surface: 8-shaped pores in 5 or 6 groups in median area and distributed from these groups to margin, the median groups arranged transversely, the other pores tending toward arrangement in transverse rows, the pores varying in size, those of the posterior 2 groups usually  $10\ \mu$  long and 7 wide, the majority of pores making up the other groups  $12\ \mu$  long and 8 wide, most of the scattered pores  $9-10\ \mu$  long and 6 wide; minute 8-shaped pores absent; disk pores numerous; tubular ducts  $40\ \mu$  long.

Ventral surface: Antenna a roughly circular area, with 2 setae slightly longer and 3-6 usually much shorter than diameter of antenna; beak with 2 pairs of setae; spiracle with bar very broad, with a sclerotized subcircular area around opening, 4-6 quinquelocular pores in sclerotized area and 20-30 (usually 20-25) extending to body margin in an irregularly double or triple row; multilocular pores in 3 complete rows near genital opening and 1 interrupted row anterior to posterior spiracles, the posterior row with 8-12 pores, penultimate with 14-19, anterior complete with 7-11, interrupted row with 3-8, or a total of 41-43., majority of pores of complete rows with 8-11 loculi, those near spiracles occasionally with only 5 loculi; 5-10 dark-rimmed 8-shaped pores each side of beak, a few scattered anterior to mouth parts, and a few posterior to beak in median area arranged roughly in 4-6 transverse rows; submarginal 8-shaped pores in an irregularly single to triple or rarely quadruple row terminating near a transverse line drawn through the twenty-fifth from the posterior pair of marginal



8-shaped pores, usually irregularly double but sometimes single or triple for a few pores, interrupted at each antenna but continued between them, usually arranged in groups placed at short intervals from one another, so that there are 1-4 opposite some marginal 8-shaped pores and none opposite others; 1 or 2 disk pores in 1, or in each, spiracular row of quinquelocular pores, 1-5 in each complete row of multilocular pores, 3-8 in a transverse row anterior to anterior complete row of multilocular pores, and sometimes 2 or 3 in a second transverse row farther anteriorly; submarginal setae in a complete row terminating near the penultimate pair of marginal 8-shaped pores; 1 pair of setae in each complete row of multilocular pores.

Apex of abdomen: Lobes sometimes barely indicated; setae, apical 76  $\mu$  long, interapical 32  $\mu$  long, dorsal 24  $\mu$  long, inner ventral 6  $\mu$  long, intermediate ventral 7-8  $\mu$  long, outer ventral 9-10  $\mu$  long; anal ring with 6 setae 72  $\mu$  long and apparently with around 30 pores; ventral surface heavily sclerotized near inner ventral setae, surrounding area slightly sclerotized in dentate rows.

*Larva*.—Somewhat ovoid.

Margin: With 28 8-shaped pores, the posterior 6 pairs usually slightly smaller than the others and with their axes transverse, axes of the others longitudinal; a minute seta close to each pore of the posterior 3 pairs (sometimes only 2 setae on 1 side of body); 4 pairs of setae anteriorly.

Dorsal surface: 8-shaped pores usually in a submedian row of 10 on each half of body, as large as, or very slightly larger than, marginal pores of same segments; disk pores fairly close to marginal 8-shaped pores and 1-3 rather near dorsal 8-shaped pores; a pair of small setae close to anterior pair of 8-shaped pores.

Ventral surface: Antennal setae, I, 2; IV, 1; V, 1; VI, 2 long, 2 stout, 3 fairly stout, 2 slender; antennal bases about one-third length of antenna apart; beak setae, 2 pairs apical, 1 pair basal; spiracle usually with 1 trilocular but sometimes with 1 quinquelocular pore; leg setae, coxa 4, femur 1 on inner margin near base and 1 each on inner and outer margins near center; tarsus 2 on inner and 1 on outer margin; tibia around one-half as long as tarsus; usually 6 but sometimes only 5 pairs of submarginal 8-shaped pores, none between antennae; 11 pairs of minute submarginal setae, on abdomen, thorax, and head, anterior setae slightly but not conspicuously longer than the others; 3 pairs of setae between antennae and mouth parts.

Apex of abdomen: Setae, apical apparently 100-108  $\mu$  long, interapical 23.4-27  $\mu$  long, dorsal 5.4  $\mu$  long, inner ventral 5.4-7.2  $\mu$  long, intermediate ventral 9  $\mu$  long, outer ventral 9-12.6  $\mu$  long; anal ring with 6 setae 28-32  $\mu$  long and with an inner row of 6 and an outer one of 14 pores; ventral surface of apex faintly sclerotized on margin.

*Data*.—Redescribed from unmounted material, 4 mounted females, and 29 mounted larvae on *Thymus hirtus*, Mulhacen, Sierra Nevada, Andalusia, Spain, A. Balachowsky, August 10, 1934, type.

Closely resembling *arabidis* and *stentae*, but differing from those in having fewer marginal and spiracular quinquelocular pores and also fewer submarginal 8-shaped pores. It differs further from *arabidis* in having fewer multilocular and dark-rimmed 8-shaped pores and shorter apical setae, and from *stentae* in having multilocular pores anterior to the posterior spiracles. Larvae of *nevadense* differ from those of *arabidis* and *stentae* in having 1, instead of 2, pores near each spiracle, and 10 or 12, instead of 14, submarginal 8-shaped pores. The occurrence of either 10 or 12 submarginal 8-shaped pores is most unusual, but there can be no doubt about the variation, all specimens being in excellent condition for critical study.

### ASTEROLECANIUM NITIDUM, new species

(Fig. 44, G-P; pl. 6, P)

*Habit*.—Living on the lower surface of leaves.

*Test of female*.—Somewhat ovoid, 1.6-2 mm. long, 1.25-1.5 wide; practically flat dorsally, with a small longitudinal median carina; flat ventrally; pale greenish yellow, transparent, thin, shiny, punctate; marginal filaments rubbed off; circular larval exit in dorsal surface at margin.

*Adult female*.—Somewhat elongate ovoid, 1.25–1.6 mm. long, 1.10–1.25 wide.

*Margin*: 8-shaped pores in a single row terminating about one-half length of an apical seta from setal bases, each pore with a small, sclerotized, tongue-shaped projection on dorsal edge, posterior pores about  $8\ \mu$  long and 5 wide, others 9–10  $\mu$  long and 5–6 wide, usually slightly more than a pore's length apart; quinquelocular pores in a single row at each spiracular pore band, 15–19 at the anterior band and 29–33 at the posterior one, the row interrupted between the spiracular pore bands, 1 quinquelocular pore opposite each 8-shaped pore at ends of each group and 2 opposite each 8-shaped pore elsewhere.

*Dorsal surface*: Minute 8-shaped pores rather sparse; disk pores numerous; tubular ducts 22–24  $\mu$  long.

*Ventral surface*: Antenna thimble-shaped, with 2 setae longer than diameter of antenna; beak with 2 pairs of setae; spiracular bar fairly broad; 15–24 quinquelocular pores extending from spiracle to body margin in an irregularly single or double row; multilocular pores, with 6–12 (usually 10) loculi, in 4 complete and 4 interrupted rows, posterior and penultimate rows each with 10 or 11 pores, each of next 2 with 3–8, each of the interrupted rows with 2, the total number 30–42; 2 or 3 dark-rimmed 8-shaped pores each side of beak, a few scattered on anterior end, and a few in lateral area of abdomen; submarginal 8-shaped pores in a single row terminating at median line slightly anterior to anal opening, as numerous as marginal 8-shaped pores; submarginal setae in a complete row terminating near the posterior pair of marginal 8-shaped pores; 2 pairs of setae in the posterior row of multilocular pores and 1 pair in each of the other complete rows.

*Apex of abdomen*: Lobes faintly indicated; setae, apical 48  $\mu$  long, interapical 5.4  $\mu$  long, outer ventral 3  $\mu$  long; anal opening in ventral surface well removed from margin, nearly circular, its margin slightly sclerotized or membranous.

*Larva*.—Elongate ovoid.

*Margin*: With 28 8-shaped pores, the anterior pair slightly the largest, axes of all longitudinal; 2 pairs of setae at anterior end.

*Dorsal surface*: 8-shaped pores in a submedian row of apparently 10 or 11 and a lateral row of apparently 9, on each half of body, the total number 38–40, individual pores about as long as the width of marginal pores; disk pores between submedian and lateral 8-shaped pores and a few between lateral and marginal.

*Ventral surface*: Antennal setae, I, 1; IV, 1; V, 0; VI, 2 long, 2 stout, 2 fairly stout, 2 slender; antennal bases nearly one-half length of antenna apart; beak setae, 3 pairs at tip; anterior spiracle with 1 trilocular and 1 quinquelocular pore, posterior spiracle without pores; leg setae, coxa 3, femur 1 on inner margin near base, tarsus 1 each on inner and outer margins; tibia one-fifth as long as tarsus; 9 pairs of submarginal 8-shaped pores; 7 pairs of submarginal minute setae on abdomen, 1 pair of submarginal larger setae at anterior end; 3 pairs of setae on antennae and mouth parts.

*Apex of abdomen*: Setae, apical 45  $\mu$  long, interapical 7.2  $\mu$  long, outer ventral 2.5  $\mu$  long; anal opening in margin, circular; anal tube very short and heavily sclerotized; anal ring a sclerotized band with ventral edge almost on ventral surface and with 2 setae 3.6–5  $\mu$  long.

*Data*.—Described from unmounted material, six mounted females, and four mounted larvae on *Pasania* sp., and two mounted females on *Quercus* (*Lithocarpus*) sp., Tientai Shan, Chekiang, China, R. C. Ching, May 5–18, 1934, U. S. N. H., holotype and paratypes.

Closely related to *pasaniae*, but separable from it in the adult stage by its small number of marginal quinquelocular pores, and in the larval stage by the absence of a pore near the posterior spiracle and the presence of two setae on the anal ring.

### ASTEROLECANIUM NOTABILE, new species

(Fig. 45, A–G; pl. 5, B)

*Habit*.—Living on both surfaces of leaves.

*Test of female*.—Elongate elliptical, 2.5–3 mm. long, 1.5–1.8 wide; slightly convex dorsally, with a faint longitudinal median carina; flat ventrally; unparasitized tests greenish yellow, parasitized test deep pink, transparent, fairly thin, finely punctate; marginal filaments pale yellow on greenish-yellow tests, deep

pink on pink test, slightly longer at ends than elsewhere; larval exit a slit in margin.

*Adult female*.—Elongate elliptical, 2.5 mm. long, 1.4 wide.

Margin: 8-shaped pores in a single row usually terminating less than a posterior pore's width from bases of apical setae, the posterior pair of pores 14–15  $\mu$  long and 7.2 wide, next 10–15 pairs 15–16  $\mu$  long and 8 wide, the remainder 16.2–18  $\mu$  long and 9 wide, all nearly contiguous; quinquelocular pores mostly in a single row but sometimes crowded so as to make the row double here and there, terminating at or near the posterior pair of 8-shaped pores, 1 opposite each 8-shaped pore near end of row, more numerous elsewhere, there being usually 2, and sometimes 3 or 4, opposite each 8-shaped pore from a point slightly posterior to posterior spiracular pore bands to near antennae, and usually 2 opposite each 8-shaped pore at anterior end; disk pores dorsal of, and somewhat less numerous than, 8-shaped pores, terminating near the posterior or penultimate pair of those pores.

Dorsal surface: Minute 8-shaped pores fairly numerous; disk pores numerous; tubular ducts 44  $\mu$  long; dorsal tubes present.

Ventral surface: Antenna dome-shaped, with 2 setae slightly longer and 2 much shorter than diameter of antenna; 1–8 quinquelocular pores between antenna and margin; beak without setae; spiracle with bar rather broad, a sclerotized area extending around opening and 2–8 quinquelocular pores on edge of opening, 39–75 similar pores extending from spiracle to body margin in a row 2–6 pores wide; multilocular pores having 5–10 loculi (usually at least 6) in 2 rows, each with 3–6 pores; 1–4 dark-rimmed 8-shaped pores each side of beak, some scattered in a wide, irregularly double row entad of submarginal area (except near posterior end), and others arranged in 2 or 3 sparse, transverse rows near posterior end of abdomen; submarginal 8-shaped pores in an irregularly single row terminating near posterior row of multilocular pores, nearly as numerous as marginal 8-shaped pores; 7 pairs of submarginal setae on abdomen, the posterior pair near the fourth posteriormost pair of marginal 8-shaped pores; 1 pair of setae in posterior row of multilocular pores, 1 pair in anterior row, 1 pair anterior to these, and a pair sometimes anterior to the last.

Apex of abdomen: Notch small; setae, apical 23.4–27  $\mu$  long, interapical 9  $\mu$  long, inner ventral 4–6  $\mu$  long, outer ventral 7.2–9  $\mu$  long (actually anterior to posterior marginal 8-shaped pore); anal ring with 6 setae 32.4–36  $\mu$  long, and with an inner row of 6 and an outer row of apparently 14 pores, apparently tending toward division on dorsal side; ventral surface of apex sclerotized on margin.

*Larva*.—Nearly elongate elliptical, posterior end narrowed.

Margin: With 28 8-shaped pores, anterior pair distinctly the largest, the next pair smaller than anterior pair but slightly larger than the others, axes of all longitudinal; 3 pairs of setae anteriorly.

Dorsal surface: Disk pores in submarginal and lateral areas.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 0; VI, 2 long, 2 stout, 3 fairly stout, 1 slender; antennal bases one-third length of antenna apart; beak setae, 2 pairs apical, 1 pair basal; spiracle with 1 trilocular pore; leg setae, coxa 4, femur 1 on inner margin near base and 1 each on inner and outer margins near center, tarsus 2 on inner and 1 on outer margin; tibia one-half as long as tarsus; 9 pairs of submarginal 8-shaped pores; 7 pairs of submarginal minute setae on abdomen, 2 pairs of submarginal larger setae at anterior end; 1 pair of setae between antennae and mouth parts.

Apex of abdomen: Notch minute; setae, apical 72  $\mu$  long, interapical 18  $\mu$  long, inner ventral 2  $\mu$  long, outer ventral 5.4  $\mu$  long; anal ring with 2 setae apparently 2.5  $\mu$  long, and four 5.4  $\mu$  long.

*Data*.—Described from the following material: One mounted female on *Arundinaria amabilis*, Koo Shui, Kwong Ning district, Kwangtung, China, F. A. McClure, March 24, 1929, paratype; three unmounted specimens, three mounted females, and eight mounted larvae on bamboo, China, intercepted at Seattle, Wash., E. I. Smith, May 26, 1937, holotype and paratypes.

This species is rather similar to *subdolum*.



## ASTEROLECANIUM OBLONGUM, new species

(Fig. 45, H-M; pl. 9, H)

*Habit.*—Living on the lower surface of leaves.

*Test of female.*—Elongate, about 2 mm. long and 0.5 wide; slightly convex dorsally, flat ventrally; yellow, transparent, fairly thin, shiny; marginal filaments broken off; larval exit apparently a slit in margin.

*Adult female.*—Elongate, about 1.75 mm. long, 0.5 wide.

*Margin:* 8-shaped pores in a single row terminating two to three times the length of an apical seta from bases of setae, about 15 pores at anterior end 12.6  $\mu$  long and 7.2 wide, the others 10.8  $\mu$  long and 5.4 wide, usually a pore's width apart near spiracular pore bands and nearly contiguous elsewhere; quinquelocular pores in a single row from near antennae to a point usually much nearer to posterior spiracular pore bands than to the posterior pair of 8-shaped pores, usually about half as numerous as corresponding 8-shaped pores near ends of row, and about as numerous as those pores elsewhere; disk pores dorsad of 8-shaped pores and much less numerous than the latter, although the row extends slightly beyond the ends of the row of 8-shaped pores.

*Dorsal surface:* Minute 8-shaped and disk pores fairly numerous; tubular ducts 28  $\mu$  long; dorsal tubes present.

*Ventral surface:* Antenna short, with 2 setae longer and 2 shorter than diameter of antenna; beak without setae; spiracle with bar fairly broad and with atrium slightly enlarged and containing 3-5 quinquelocular pores, 8-12 similar pores extending from spiracle to body margin in an irregularly single, double, or triple row; 2-4 dark-rimmed 8-shaped pores each side of mouth parts, 1 or 2 anterior to mouth parts, and a few on abdomen arranged in 3 or 4 transverse rows; submarginal 8-shaped pores in a single row terminating near genital opening, usually about half as numerous as marginal 8-shaped pores; 8 pairs of submarginal setae, all posterior to anterior spiracular pore bands, the posterior pair slightly anterior to the posterior pair of marginal 8-shaped pores; 1 pair of setae posterior to genital opening, 1 pair anterior to opening, and 1 pair anterior to those.

*Apex of abdomen:* Slightly concave; setae, apical 16-20  $\mu$  long, interapical 7.2  $\mu$  long, inner ventral 3.6  $\mu$  long and slightly nearer to median line than to apical seta, outer ventral 5.4-7.2  $\mu$  long; anal ring with 6 setae 27-29  $\mu$  long, and with an inner row of 6 and an outer row of 12 pores, tending toward division on dorsal and ventral sides.

*Larva.*—Elongate elliptical.

*Margin:* With 28 8-shaped pores, the posterior pair larger than next 5 pairs, which, together with the anterior pair, are slightly larger than the remaining 7 pairs, axes of all longitudinal; 3 pairs of setae at anterior end.

*Dorsal surface:* 8-shaped pores in a submedian row of 7 on each half of body, the posterior pores slightly smaller than the anterior ones, which are around two-thirds the size of marginal pores of same segments; disk pores in lateral area and possibly in submarginal area.

*Ventral surface:* Antennal setae, I, 1; IV, 1; V, 0; VI, 2 long, 2 stout, 3 fairly stout, 1 slender; antennal bases around one-third length of antenna apart; beak setae, 2 pairs apical, 1 pair basal; spiracle with 1 trilocular pore; leg setae, coxa 4, femur 1 on inner margin near base and 1 each on inner and outer margins near center, tarsus 2 on inner and 1 on outer margin; tibia about one-third as long as tarsus; 9 pairs of submarginal 8-shaped pores; apparently 8 pairs of submarginal minute setae posterior to anterior spiracles, 2 pairs of submarginal larger setae at anterior end; 1 pair of setae between antennae and mouth parts.

*Apex of abdomen:* Setae, apical 54  $\mu$  long, interapical 12.6-14.4  $\mu$  long, inner ventral apparently 2  $\mu$  long, outer ventral 3.6  $\mu$  long; anal ring with 6 setae, each about 5.4  $\mu$  long, and possibly with 2 pores.

*Data.*—Described from the following material: Unmounted specimens, two mounted females, and one poor mounted larva, on *Gigantochloa tessellata*, Chekiang, China, F. N. Myer, July 12, 1915, U. S. N. H., paratypes; two mounted females and eight mounted larvae on bamboo, China, intercepted at New York, S. D. Whitlock, one female on June 8, 1937, the other specimens on June 18, 1937, holotype and paratypes.

Closely resembling *longulum*, but with a single, instead of a double, row of submarginal 8-shaped pores and with two short, as well as two long, setae on the antenna. The larva is distinguished from that of *longulum* by having 28, instead of 26, marginal 8-shaped pores, and only 1 pore near each spiracle.

### ASTEROLECANIUM ORANIAE, new species

(Fig. 46, A-F; pl. 9, J)

*Habit.*—Living on the lower surface of leaves.

*Test of female.*—Elongate ovoid, around 1.4 mm. long, 0.65 wide; truncate at anterior end, nearly uniform in width on anterior third, tapering gradually to posterior end; dorsally convex at anterior end, sloping gradually to posterior end; flat ventrally; brownish yellow, transparent, rather thick; marginal filaments apparently whitish, fragmentary; larval exit not observed.

*Adult female.*—Elongate, around 1.25 mm. long, 0.5 wide.

Margin: 8-shaped pores in a single row terminating twice or three times length of an apical seta from bases of setae, the posterior pores 7  $\mu$  long and 4 wide, the others 8 or 9  $\mu$  long and 5 wide, a pore's length apart at anterior end, two to six times that distance apart near posterior end; trilocular pores (with some quinquelocular pores intermixed) in a single row from slightly anterior to anterior spiracular pore bands to halfway between posterior spiracular pore bands and the posterior pair of 8-shaped pores, less numerous than 8-shaped pores at ends of rows, one and a half times as numerous elsewhere.

Dorsal surface: Two and 6 8-shaped pores observed in different specimens of the meager available material, these fairly close to anterior margin and 12  $\mu$  long and 8 wide; minute 8-shaped pores numerous on anterior third of specimen, sparse elsewhere; disk pores sparse; tubular ducts 24  $\mu$  long.

Ventral surface: Antenna circular, slightly raised, with 2 setae slightly longer than diameter of antenna; beak with 2 pairs of setae; spiracle with bar expanded at inner end and with atrium enlarged, bag-shaped, and containing 5 or 6 quinquelocular pores, 4-6 similar pores extending from spiracle to body margin in a single row; multilocular pores, with 9 or 10 loculi, in 2 complete rows of 11-16 each, 1 interrupted row of 8 or 10, and 5 interrupted rows each with 2-4, or a total of 47-49; 2 or 3 dark-rimmed 8-shaped pores each side of beak, a few scattered on anterior end, and a few on posterior half of body tending toward arrangement in transverse rows mostly in lateral areas (some in median area close to mouth parts); submarginal 8-shaped pores apparently in a single row, terminating near the penultimate row of multilocular pores; submarginal setae in a complete row terminating halfway between the posterior pair of marginal 8-shaped pores and bases of apical setae; 2 pairs of setae in the posterior row of multilocular pores and 1 pair in each of the next 3 rows.

Apex of abdomen: Setae, apical 20  $\mu$  long, interapical 1-2  $\mu$  long, outer ventral 4  $\mu$  long; anal opening not clearly differentiated, apparently in margin; anal tube very short or absent; anal ring not clearly differentiated, apparently a somewhat elliptical plate which is sclerotized on ventral side and has 2 setae 16  $\mu$  long apparently arising from very short, inconspicuous collars, and a clear area suggestive of a pore between base of seta and rim of collar.

*Larva.*—Elliptical.

Margin: With 28 8-shaped pores varying slightly in size, the anterior pair as large as any of the others, axes of all practically longitudinal; a minute seta close to each pore of the posterior 3 pairs; 3 pairs of setae at anterior end.

Dorsal surface: 8-shaped pores, totaling 40-42, in a submedian row of 9-11 and a lateral row of 10-12, on each half of body, varying slightly in size, anterior pores of each row usually larger than the others, and nearly as large as marginal pores of same segments; disk pores near some of the lateral 8-shaped pores.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 1; VI, 2 long, 2 stout, 3 fairly stout; antennal bases about one-half length of antenna apart; beak setae, 2 pairs apical, 1 pair median; spiracle with 1 trilocular and 1 quinquelocular pore or with 2 quinquelocular pores; leg setae, coxa 3, femur 0, tarsus apparently 1 each on inner and outer margins; tibia one-third as long as tarsus; 9 pairs of submarginal 8-shaped pores; apparently 7 pairs of submarginal minute setae, on abdomen and thorax, 1 pair of slightly larger submarginal setae at anterior end; 3 pairs of setae near antennae and mouth parts.

Apex of abdomen: Setae, apical  $38\ \mu$  long, interapical  $5\ \mu$  long, a pair  $1\ \mu$  long entad of interapical, outer ventral  $2.2\ \mu$  long; anal opening apparently a narrow incision in dorsal surface at margin; anal tube short, sclerotized; anal ring with 2 setae apparently less than  $1\ \mu$  long.

*Third-stage male.*—Resembling adult female in shape, but smaller; margin with 8-shaped pores terminating a posterior pore's length from bases of apical setae, 1 or 2 trilocular pores where anterior spiracular pore band meets margin, others present between that point and the posterior pair of 8-shaped pores, about as numerous as 8-shaped pores, but 2 or 3 trilocular pores near each pore of the posterior pair of 8-shaped pores; dorsal surface without large 8-shaped pores; ventral surface with atrium of spiracle not enlarged and not containing pores, and with only 2 or 3 trilocular pores in each spiracular row, legs represented by 3 pairs of circular, faintly sclerotized areas; apex of abdomen with lobes indicated, apical setae  $48\ \mu$  long, interapical setae  $2\ \mu$  long, outer ventral setae  $2\ \mu$  long; anal opening in body margin, circular, its margin membranous, anal tube, anal ring, and anal setae absent.

*Data.*—Described from one test, three mounted females, nine mounted larvae, and one mounted third-stage male on *Orania philippinensis*, Mt. Giting-giting, Magallanes, Sibuyan, Philippine Islands, A. D. E. Elmer, April 1910, U. S. N. H., holotype and paratypes.

Closely resembling *pinangae*, but differing from it in having marginal 8-shaped pores terminating well before the apical setae, in having nearly 50 multilocular pores instead of about 20, and in having apical setae which are only  $20\ \mu$  long.

#### ASTEROLECANIUM ORDINARIUM, new species

(Fig. 46, G-O; pl. 3, C)

*Habit.*—Living on the lower surface of leaves.

*Test of female.*—Elongate, widest on anterior third, tapering to posterior end, margin sometimes indented by growth against hairs on leaf; 1.5–1.6 mm. long, 0.4–0.5 wide; convex dorsally, flat ventrally; pale greenish yellow or pale clear yellow, transparent, thin; marginal filaments very pale yellow, almost whitish, or very pale pinkish, not observed at posterior end, apparently slightly longer at anterior end than elsewhere; dorsal filaments whitish, fairly numerous, mostly slightly longer than marginal; larval exit apparently circular or elliptical, in ventral surface at margin.

*Adult female.*—In shape similar to test, 1.10–1.4 mm. long, 0.35–0.5 wide.

Margin: 8-shaped pores in a single row terminating around length of an apical seta from bases of setae, the anterior pores around  $10.8\ \mu$  long and 7.2 wide, the others  $7.2$ – $9\ \mu$  long and  $4.5$ – $5.4$  wide, normally around a pore's length apart; quinquelocular pores in a single row terminating within 10 8-shaped pores from ends of that row, about as numerous as 8-shaped pores posteriorly, at least twice as numerous elsewhere; disk pores dorsad of, and less numerous than, 8-shaped pores, terminating with 1 or 2 beyond the posterior pair of 8-shaped pores.

Dorsal surface: 8-shaped pores fairly numerous, some  $7$ – $8\ \mu$  long and 6 wide but the majority  $10.8$ – $12\ \mu$  long and 7.2 wide; minute 8-shaped pores not observed; disk pores fairly numerous; tubular ducts  $28.8\ \mu$  long; dorsal tubes present.

Ventral surface: Antenna circular, short, with 2 setae longer, and 2 slightly shorter, than diameter of antenna; beak without setae; spiracle with bar fairly slender, slightly expanded at inner end, atrium slightly enlarged and containing 2–5 quinquelocular pores, 3–5 similar pores extending from spiracle to body margin; 1 dark-rimmed 8-shaped pore each side of beak, a few scattered on anterior end, and a few arranged in 3 transverse rows on abdomen; submarginal 8-shaped pores in a single row terminating near genital opening, usually 1 opposite each marginal 8-shaped pore, when they are around a pore's length apart; 6 pairs of submarginal setae on abdomen, the posterior pair near terminating point of marginal 8-shaped pores; 1 pair of setae posterior to genital opening, 1 pair anterior to it, and 1 pair anterior to those.

Apex of abdomen: Slightly concave; setae, apical  $30.6\ \mu$  long, interapical  $10.8\ \mu$  long, inner ventral  $5.4\ \mu$  long, outer ventral  $7.2$ – $9\ \mu$  long; anal ring with 6 setae  $27$ – $30\ \mu$  long, and with an inner row of 6 and an outer row of apparently 12 pores, divided on dorsal side.



*Second stage.*—Resembling adult, but smaller; margin with 8-shaped pores terminating about a pore's length from bases of apical setae, without quinquelocular and disk pores; dorsal surface with 8-shaped and disk pores less numerous than in adult; ventral surface without pores in atrium of spiracle and with 2 in each spiracular row; apex of abdomen as in adult but all setae approximately one-third shorter.

*Larva.*—Elliptical.

Margin: With 28 8-shaped pores, the anterior pair slightly larger than the others, axes of the posterior 6 pairs transverse, of the others longitudinal; 3 pairs of setae anteriorly.

Dorsal surface: 8-shaped pores in a submedian row of 3-6 on each half of body, the total ranging from 8-11, anterior pore slightly larger than the others, all practically same size as, or slightly larger than, marginal pores of same segments; disk pores in submarginal area and a few in lateral area.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 0; VI, 2 long, 2 stout, 3 fairly stout, 1 slender; antennal bases about two-fifths length of antenna apart; beak setae, 2 pairs apical, 1 pair rather near base; anterior spiracle with 1 trilocular and 1 quinquelocular pore or with 2 trilocular pores, posterior spiracle with 2 trilocular pores; leg setae, coxa 4, femur 1 on inner margin near base and 1 each on inner and outer margins near center, tarsus 2 on inner and 1 on outer margin; tibia one-half as long as tarsus; 9 pairs of submarginal 8-shaped pores; apparently 7 pairs of submarginal minute setae on abdomen, 2 pairs of submarginal larger setae at anterior end; 1 pair of setae between antennae and mouth parts.

Apex of abdomen: Notch minute; setae, apical  $50 \mu$  long, interapical  $10.8 \mu$  long, inner ventral  $2.5 \mu$  long, outer ventral  $3.6 \mu$  long; anal ring with 6 setae  $5.4-7.2 \mu$  long.

*Test of male.*—Elongate, 1.10 mm. long, 0.4 wide; convex dorsally, flat ventrally; transparent, very thin; marginal filaments paler yellow than test, longest at anterior end; dorsal filaments very pale yellow, fairly numerous, slightly longer than marginal ones.

*Third-stage male.*—Resembling adult female but smaller; margin with 8-shaped pores terminating about a pore's length from bases of apical setae, quinquelocular pores terminating around 20 8-shaped pores from the posterior pair of 8-shaped pores, usually 1 near each 8-shaped pore, disk pores apparently absent; ventral surface with atrium of spiracle not enlarged, 2 or 3 quinquelocular pores in each spiracular row, legs represented by 3 pairs of circular, sclerotized, slightly raised areas, each with a very small, straight, clawlike spine in center; apex of abdomen as in adult female but apical seta broken and other setae around one-fourth shorter.

*Data.*—Described from unmounted specimens (paratypes) and the following mounted material: Six females, 1 second-stage specimen, 10 larvae, and 2 third-stage males on bamboo, China, intercepted at New York, Fitzgerald and Garrett, March 25, 1932, holotype and paratypes; 1 female on bamboo, China, intercepted at Seattle, Wash., E. I. Smith, May 28, 1937, paratype.

Allied to *longulum* and *oblongum*.

### ASTEROLECANIUM PALLIDUM, new species

(Fig. 47, A-G; pl. 9, Q)

*Habit.*—Living on both surfaces of leaves.

*Test of female.*—Longer than wide, anterior margin curved, tapering slightly at posterior end; around 1.85 mm. long, 0.75 wide; dorsally strongly convex at anterior end, not so high at posterior end; flat ventrally; pale greenish yellow, transparent, very thin, glassy; marginal filaments fragmentary, paler in color than test, almost whitish; circular larval exit in dorsal surface at margin.

*Adult female.*—In shape similar to test, around 1.75 mm. long, 0.65 wide.

Margin: 8-shaped pores in a single row terminating slightly more than length of an apical seta from setal bases, posterior pores  $7 \mu$  long and 4 wide, the others  $9 \mu$  long and 4 wide, posterior 4 or 5 pores from a pore's width to three times a pore's length apart, the others usually less than a pore's length apart;

trilocular pores in a single row terminating 2-11 8-shaped pores from end of row, about half as numerous as 8-shaped pores near ends of body (sometimes absent opposite about 20 8-shaped pores at anterior end) and about as numerous as corresponding 8-shaped pores elsewhere.

Dorsal surface: Minute 8-shaped and disk pores sparse; tubular ducts  $24 \mu$  long.

Ventral surface: Antenna very short, with 2 setae longer and 1 much shorter than diameter of antenna; beak with 2 pairs of setae; spiracle with bar expanded at inner end, atrium enlarged and containing 4-6 quinquelocular pores, 9-12 similar pores extending from spiracle to body margin in a single row; multilocular pores, with 10 loculi, in 2 complete rows, each with 11-13; a group of 9-13 dark-rimmed 8-shaped pores each side of beak and a few apparently in 3 transverse rows on abdomen; submarginal 8-shaped pores in a single row terminating near median line, usually as numerous as corresponding marginal 8-shaped pores; submarginal setae in a complete row terminating about one-third length of apical seta from bases of apical setae; 1 pair of setae in each row of multilocular pores.

Apex of abdomen: Notch present; lobes indicated; setae, apical  $60 \mu$  long, interapical  $14-16 \mu$  long, a pair  $4 \mu$  long entad of interapical very close to margin on ventral surface, outer ventral  $3.6 \mu$  long; anal opening ventral, inconspicuous; anal tube membranous, inconspicuous; anal ring consisting of 2 sclerotized elliptical plates, which are nearly contiguous, and each of which has a seta  $27-29 \mu$  long at each end and a large clear area in center; a circular opening between the 2 plates.

*Data.*—Described from unmounted material and three mounted females on *Attalea* sp., Colon Province, Panama, H. Pittier, July-August 1911, U. S. N. H., holotype and paratypes; one empty test and one mounted female on *Attalea cohune*, Culebra, Canal Zone, H. Pittier, November 1911, U. S. N. H., paratype.

Resembling *bondari* and *truncatum*, but differing from each in having four pairs of setae on the apex of the abdomen.

#### ASTEROLECANIUM PALMAE Cockerell

(Fig. 47, H-M; pl. 6, H)

First referred to by Cockerell in 1892 (*14*, p. 333) as follows: "(16) *Fiorinia camelliae* Comst. on Coconut, near Montego Bay. (Coll. by Dr. Sinclair). On the same leaves I find a curious yellow creature, with a fringe all round, and some pink filaments at each end, so is it possibly the young form of *Fiorinia*?" Later in 1892 (*15*, p. 142) Cockerell commented on this insect as follows: "The 'curious yellow creature' has nothing to do with *Fiorinia*, but is a new species of *Asterolecanium*, or a closely allied genus." In April 1893 (*16*, p. 255) he listed the species as *Asterolecanium palmae*, n. sp., and described it in papers, published in April 1893 (*17*, p. 77), in 1894 (*18*, p. 308), and in 1896 (*19*, p. 9). The species was erroneously recorded by Fernald in 1903 (*32*, p. 52) as having been described in the Journal of the Institute of Jamaica, volume 1, 1892, page 76.

The original description of *Asterolecanium lineare* Lindinger was contained in an article published by Brick in 1909 (*13*, pp. 449-450), and the species was listed as *Asterolecanium lineare*, n. sp., in an article by Lindinger immediately following the one by Brick (*60*, p. 464). The description is inadequate to separate the species from many others found on palm. In 1936, however, Lindinger stated that *lineare* was a synonym of *palmae* (*64*, p. 153). Although there is a possibility that he erred in the assignment, the synonymy is accepted by the writer, who has not had authentic specimens of *lineare* for comparison.

*Habit.*—Living on both surfaces of leaves.

*Test of female.*—Elongate, tapering from center to posterior end; 1.45–2 mm. long, 0.5–0.6 wide; convex dorsally, with a weak longitudinal median carina; fat ventrally; bright brownish or clear yellow, transparent, punctate; marginal filaments pale golden brown, slightly longer at anterior end than elsewhere; dorsal filaments rubbed off; elliptical larval exit in dorsal surface at margin.

*Adult female.*—In shape similar to test, 1–1.75 mm. long, 0.4–0.5 wide.

Margin: 8-shaped pores in a single row terminating four to six times the length of an apical seta from setal bases, posterior pores 7 or 8  $\mu$  long and 4 wide, others 9  $\mu$  long and 5 wide, usually about a pore's width apart at anterior end, and from the width to the length of a pore apart near posterior end; trilocular pores in a single row (occasionally containing a quinquelocular pore and rarely nearly as many quadrilocular or quinquelocular as trilocular pores) usually terminating within 15 8-shaped pores from end of row, about as numerous as corresponding 8-shaped pores near posterior end, about one and a half times as numerous as these pores elsewhere.

Dorsal surface: 8-shaped pores along median line and sometimes a few in lateral area, a total of 10–60 (usually 30–40), 11–16  $\mu$  long and 4–12 wide; minute 8-shaped and disk pores numerous; tubular ducts 28  $\mu$  long.

Ventral surface: Antenna globular, with 2 setae as long as, and 2 longer than, diameter of antenna, 4 or 5 quinquelocular pores between antenna and margin; beak with 2 pairs of setae; spiracular bar expanded at inner end, opening large, atrium enlarged but shallow and containing 5–8 quinquelocular pores, 8–11 similar pores extending from spiracle to body margin in a single row; multilocular pores, with 10 loculi, in 3 complete and 5 interrupted rows, posterior and median complete rows each with 14–20 pores, anterior complete with 6–10, each interrupted row with 2, the total 43–51; a group of 6–12 dark-rimmed 8-shaped pores each side of beak, a few tending toward arrangement in 2 or 3 transverse rows in median area near posterior end; submarginal 8-shaped pores in a single row terminating near the posterior row of multilocular pores, one-third as numerous as corresponding marginal 8-shaped pores; submarginal setae in a complete row terminating around length of an apical seta from bases of apical setae; 2 pairs of setae in posterior row of multilocular pores and 1 pair in each of next 3 rows.

Apex of abdomen: Lobes sometimes indicated; setae, apical around 20  $\mu$  long, interapical 1  $\mu$  long, outer ventral 2  $\mu$  long; anal opening apical; anal tube absent or so short as to be indeterminate; anal ring practically or actually at the surface, apparently consisting of an elliptical, weakly sclerotized plate with a seta 18–24  $\mu$  long arising from each end, and with 3 or 4 minute pores on the outer edge of each setal base, a more heavily sclerotized line outside pores, and an opening in center of plate.

*Second stage.*—Resembling adult in shape but smaller; margin with 8-shaped pores terminating length of an apical seta from bases of setae, 5 trilocular pores where each spiracular pore band meets margin; dorsal surface with 1 large 8-shaped pore; ventral surface with atrium of spiracle enlarged and containing 1 quinquelocular pore, 2 or 3 similar pores between opening and body margin, 1 pair of setae in median abdominal area; apex of abdomen with anal lobes indicated, apical setae 50  $\mu$  long, interapical setae 1.8  $\mu$  long, outer ventral setae 1.8  $\mu$  long; anal opening in body margin, circular, its margin sclerotized; without ring or setae.

*Larva.*—Nearly elliptical, posterior end narrowed.

Margin: With 28 8-shaped pores, posterior pairs slightly smaller than anterior ones, axes of all longitudinal; a pair of minute setae close to each of the posterior 2 pairs; 3 pairs of setae at anterior end.

Dorsal surface: 8-shaped pores in a submedian and a lateral row of 9 each, on each half of body, anterior pore of each row slightly larger than posterior one, submedian pores practically same size as marginal pores, lateral pores about one-half size of submedian; disk pores occurring between lateral and marginal 8-shaped pores at posterior end.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 1; VI, 3 long, 2 stout, 2 fairly stout; antennal bases one-third length of antenna apart; beak setae, 2 pairs apical, 1 pair median; spiracle with 1 trilocular and 1 quinquelocular pore; leg setae, coxa 3, femur 1 on inner margin near base, tarsus 1 each on inner and outer margins; tibia one-half as long as tarsus; 9 pairs of submarginal 8-shaped pores; apparently 10 pairs of submarginal minute setae, on abdomen, thorax, and head; 4 pairs of setae near antennae.



Apex of abdomen: Lobes barely indicated; setae, apical  $37\ \mu$  long, interapical  $3.6\ \mu$  long, a pair  $1\ \mu$  long entad of interapical, outer ventral  $1\ \mu$  long; anal opening apical, circular, its margin sclerotized.

*Data.*—Redescribed from unmounted specimens and the following mounted material: One female on coconut, Catherine Hall, Jamaica, Dr. Sinclair, type; two females on *Attalea cohune*, Puerto Sierra, Honduras, Percy Wilson, February 18, 1903, U. S. N. H.; three females on *Cocos nucifera*, Puerto Sierra, Honduras, Percy Wilson, February 18, 1903, N. Y. B. G.; one female on Palmae, Limon, Costa Rica, Cook and Doyle, May 1903, U. S. N. H.; one female on *Martinezia aiphanes*, Miranda, Venezuela, H. Pittier, April 6, 1917, U. S. N. H.; two females on *Elaeis melanococca*, near Panama City, Panama, W. R. Maxon, June 3, 1923, U. S. N. H.; one female on coconut palm, San Andreas Island, Colombia, J. Zetek, April 29, 1931; three females on *Elaeis melanococca*, between Matias Hernandez and Juan Dias, Panama Province, Panama, P. C. Standley, January 21, 1934, U. S. N. H.; four females, two second-stage specimens, and three larvae on coconut palm, Honduras, intercepted at New Orleans, La., A. K. Pettit, March 19, 1934; four females and four larvae on *Guilielma* sp. and one female on Palmae (*Elaeis?*), Armuelles, Chiriqui Province, Panama, G. F. Ferris, August 1938.

#### ASTEROLECANIUM PARVUM, new species

(Fig. 48, A-G; pl. 9, BB)

*Habit.*—Living on the lower surface of leaves.

*Test of female.*—Virtually circular, 0.6 mm. in diameter; strongly convex dorsally, sides nearly vertical, top nearly flat, with a low, fairly wide longitudinal median carina, a curved submarginal carina, a slight furrow between the carinae, and with faint transverse striations across median carina; flat ventrally; greenish yellow, transparent, thin, shiny; marginal filaments fragmentary, apparently same color as test, dorsal filaments broken off, apparently around 17 in number placed at fairly uniform intervals in submarginal area, and 1 or 2 in submedian or lateral area; elliptical larval exit in dorsal surface at margin.

*Adult female.*—Nearly circular, 0.5 mm. in diameter, posterior end produced.

Margin: 8-shaped pores in a single row terminating slightly more than length of an apical seta from bases of setae,  $5.4\text{--}6\ \mu$  long and  $3.6\ \mu$  wide, usually two to four (sometimes as much as eight) times a pore's length apart; quinquelocular pores in a single row terminating at the posterior pair of 8-shaped pores, or with 1 beyond, usually 1 near each 8-shaped pore when the latter are twice a pore's length apart, and at about the same intervals where 8-shaped pores are farther apart.

Dorsal surface: 8-shaped pores placed at fairly uniform intervals in submarginal area and a few in lateral area, the total being approximately 19, most of the pores  $9\ \mu$  long and  $7.2\ \mu$  wide, with only 1 or 2 slightly smaller than that; minute 8-shaped and disk pores fairly sparse; tubular ducts  $12\ \mu$  long; dorsal tubes present.

Ventral surface: Antenna a circular disk, with 2 setae slightly longer than diameter of antenna; beak without setae; spiracular bar rather slender; a single row of 5–10 quinquelocular pores extending from spiracle to body margin; 2 or 3 dark-rimmed 8-shaped pores each side of beak, a few in a single row in lateral area, and a few in 2 transverse rows anterior to genital opening; submarginal 8-shaped pores in a single row terminating near the posterior pair of marginal 8-shaped pores, the intervals between them twice the length of a marginal 8-shaped pore; 5 pairs of submarginal setae on abdomen, the posterior pair at base of produced part of abdomen; 1 pair of setae posterior to genital opening, 1 pair anterior to opening, and 1 pair anterior to those.

Apex of abdomen: Setae, apical  $56\ \mu$  long, interapical  $7.2\ \mu$  long, inner ventral  $3.6\ \mu$  long, outer ventral  $4.5\ \mu$  long; anal ring with 6 setae  $23.4\text{--}26\ \mu$  long and with an inner row of 6 and an outer one of 12 pores; ventral surface of apex sclerotized and rugose.

*Larva*.—Nearly elliptical, posterior end slightly narrowed.

Margin: With 28 8-shaped pores, the penultimate and anterior pairs slightly larger than the others, axes of the posterior 2 or 3 pairs transverse, of the next 2 or 3 pairs somewhat diagonal, and of the others longitudinal; 3 pairs of setae at anterior end.

Dorsal surface: 8-shaped pores in a submedian row of 4 or 5 on each half of body, the anterior pore and the second from it one-third or one-fourth larger than the others, the largest pores slightly larger than marginal pores of same segments, the others smaller; disk pores in lateral area.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 1; VI, 2 long, 2 stout, 3 fairly stout, 1 slender; antennal bases one-third length of antenna apart; beak setae, 2 pairs apical, 1 pair median; spiracle with 1 trilocular pore; leg setae, coxa 4, femur 1 on inner margin near base and 1 each on inner and outer margins near center, tarsus 2 on inner and 1 on outer margin; tibia one-half as long as tarsus; 9 pairs of submarginal 8-shaped pores; 6 pairs of submarginal minute setae on abdomen, 3 pairs of submarginal larger setae at anterior end; 1 pair of setae between antennae and mouth parts.

Apex of abdomen: Notch present; setae, apical  $27\ \mu$  long, interapical  $5.4\ \mu$  long, inner and outer ventral each  $3.6\ \mu$  long; anal ring with 6 setae  $3.6\ \mu$  long.

*Data*.—Described from one parasitized test, two mounted females, and two mounted larvae on *Bambusa* sp., Kachek, Hainan Island, China, A. S. Hitchcock, October 13, 1921, U. S. N. H., holotype and paratypes.

Closely resembling *minutum* and *minusculum*, but differing from them in having the marginal row of 8-shaped and quinquelocular pores terminating the length of an apical seta from bases of setae, instead of three to six times that distance, and in the tubular ducts being only  $12\ \mu$  long. Larvae of *parvum* have one trilocular pore near each spiracle instead of two near the posterior spiracle as in *minutum*, and nine dorsal 8-shaped pores instead of four as in *minusculum*.

### ASTEROLECANIUM PASANIAE Kuwana and Cockerell

(Fig. 48, H-0; pl. 9, D)

Described by Kuwana and Cockerell in an article published by Kuwana in 1909 (*54*, p. 152).

*Habit*.—Living on the lower surface of leaves.

*Test of female*.—Elongate ovoid, 1.6 mm. long, 1 wide; slightly convex dorsally, with a longitudinal median carina and faint transverse striations; flat ventrally; bright yellow, transparent, shiny, slightly punctate; marginal filaments pale salmon; circular larval exit in margin.

*Adult female*.—Elongate ovoid, 1.10 mm. long, 0.85 wide.

Margin: 8-shaped pores in a single row terminating one-third length of an apical seta from bases of setae, each pore with a short, sclerotized, tongue-shaped projection on dorsal edge, posterior pores  $8\ \mu$  long and 5 wide, others  $9\ \mu$  long and 5 wide, usually around a pore's length apart near anterior end and a pore's width apart near posterior end; quinquelocular pores in a single row terminating within 20 8-shaped pores from end of row, usually at least as numerous as corresponding 8-shaped pores, but sometimes the row interrupted anteriorly.

Dorsal surface: Minute 8-shaped pores numerous; disk pores fairly numerous; tubular ducts  $24\ \mu$  long.

Ventral surface: Antenna short, with 2 setae as long as diameter of antenna; beak apparently with 2 pairs of setae; spiracular bar fairly broad; a group of 3 or 4 quinquelocular pores sometimes at spiracular opening, but in any case with 2-30 quinquelocular pores extending from opening to body margin in an irregularly single row; multilocular pores, with 10 loculi, in 4 complete and 4 interrupted rows, the posterior row with 10-12 pores, each of the other complete rows with 4-9, and each of the interrupted rows with 4 or 5, the total being approximately 36; 2 or 3 dark-rimmed 8-shaped pores each side of mouth

parts; submarginal 8-shaped pores in a single row terminating near posterior pair of marginal 8-shaped pores and about one-half as numerous as those pores; submarginal setae in a complete row terminating near the posterior pair of marginal 8-shaped pores; 2 pairs of setae in posterior row of multilocular pores and 1 pair in each of the other complete rows.

Apex of abdomen: Setae, apical  $56\ \mu$  long, interapical  $8\ \mu$  long, outer ventral  $8\ \mu$  long; anal opening ventral, fairly well removed from body margin, small, nearly circular, its margin faintly sclerotized.

*Larva*.—Elliptical.

Margin: With 28 8-shaped pores, the anterior pores slightly smaller than the others, axes of all longitudinal; 2 pairs of setae at anterior end.

Dorsal surface: 8-shaped pores in a submedian row of 10–12 and a lateral row of 8 or 9, on each half of body, varying slightly in size with the largest about one-half the size of a posterior marginal pore; disk pores between submedian and lateral 8-shaped pores.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 0; VI, 2 long, 2 stout, 2 fairly stout, 2 slender; antennal bases one-half length of antenna apart; beak setae, certainly 2 pairs, and possibly 3 pairs, all at tip; anterior spiracle with 1 trilocular and 1 quinquelocular pore, posterior spiracle with 1 trilocular pore; leg setae, coxa 3, femur 1 on inner margin near base, tarsus 1 each on inner and outer margins; tibia one-fifth as long as tarsus; 9 pairs of submarginal 8-shaped pores; 7 pairs of minute submarginal setae on abdomen, 1 pair of submarginal larger setae at anterior end; 2 pairs of setae near antennae.

Apex of abdomen: Setae, apical  $42\ \mu$  long, interapical  $9\ \mu$  long, outer ventral  $7.8\ \mu$  long; anal opening an incision in margin, anal tube very short, slightly sclerotized; anal ring with ventral edge almost at opening.

*Data*.—Redescribed from one test, two poor, mounted females, and three mounted larvae on *Pasania cuspidata*, Hachijo Shima, Japan, 1905, received from Cockerell, type material.

The characters considered here differ from those mentioned and illustrated by Kuwana (54, p. 152) in the presence of two setae on the antenna instead of one, and in the presence of marginal 8-shaped pores at the anterior end of the body.

### ASTEROLECANIUM PENICILLATUM, new species

(Fig. 49, A–L; pl. 8, N)

*Habit*.—Living on both surfaces of leaves.

*Test of female*.—Elongate, 1.6–2 mm. long, 0.25–0.3 wide, sides parallel, or indented by growth against hairs on leaf, posterior end narrowed and sometimes slightly upturned; strongly convex dorsally, flat or convex ventrally; greenish yellow, transparent, thin, shiny, slightly punctate near margin; marginal filaments whitish, observed only on lateral margins; dorsal filaments not observed; circular larval exit in ventral surface at margin.

*Adult female*.—Elongate, posterior end slightly narrowed; 1.5–1.9 mm. long, 0.25 wide.

Margin: 8-shaped pores in a single row starting slightly nearer to anterior spiracular pore bands than to median line at anterior end and terminating a little nearer to posterior spiracular pore bands than to bases of apical setae, none to 3 at anterior end, the individual pores  $7.2$ – $8\ \mu$  long and  $3.6$ – $4$  wide, once to twice a pore's length apart at ends of row and slightly less than a pore's length apart elsewhere; quinquelocular pores in a single row beginning at, or slightly posterior to, the anterior pair of 8-shaped pores, and terminating near the third to ninth 8-shaped pore from end of row, as numerous as corresponding 8-shaped pores at ends of row, about one and a half times as numerous elsewhere.

Dorsal surface: One 8-shaped pore  $12.6\ \mu$  long and  $7.2$  wide at anterior end; minute 8-shaped and disk pores sparse; tubular ducts  $24\ \mu$  long; dorsal tubes present.

Ventral surface: Antenna short, with 2 setae slightly longer than diameter of antenna; beak without setae; spiracle with bar slender, sometimes expanded at inner end, atrium very slightly enlarged and containing 1 or 2 quinquelocular pores, 1–3 similar pores between spiracle and body margin; 2 quinquelocular pores posterior to genital opening; 1–3 dark-rimmed 8-shaped pores each side



of mouth parts, 2 or 3 anterior to mouth parts, and a few in 2 transverse rows near posterior end of abdomen: submarginal 8-shaped pores in a single row terminating slightly nearer to bases of apical setae than to the posterior pair of marginal 8-shaped pores, nearly as numerous as corresponding marginal 8-shaped pores where the latter are present, and similarly spaced at anterior end where they are absent; 6 pairs of submarginal setae on abdomen, the posterior pair around length of an apical seta from bases of those setae; 1 pair of setae posterior to genital opening and 1 pair anterior to it.

Apex of abdomen: Slightly concave; lobes indicated; setae, apical 44-50  $\mu$  long, interapical 7.2-9  $\mu$  long, inner ventral 5.4  $\mu$  long, outer ventral 5.4-7  $\mu$  long; anal ring with 6 setae 28-30  $\mu$  long and with an inner row of 6 and an outer row of 14 pores, apparently divided on dorsal side; ventral surface of apex slightly sclerotized in dentate rows.

*Larva*.—Elongate.

Margin: With 28 8-shaped pores, the anterior pair largest, first pair anterior to penultimate pair smallest, the others gradually increasing in size anteriorly, next to anterior pair as large as posterior and penultimate pairs, axes of the posterior 6 pairs diagonal, of the others longitudinal; 3 pairs of setae at anterior end.

Dorsal surface: 8-shaped pores in a submedian row of 8-10 on each half of body, the posterior and the anterior pores distinctly larger than the others, of the remainder those toward posterior end of row the smallest, all slightly larger than marginal pores of same segments; disk pores in lateral area.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 1; VI, 2 long, 2 stout, 3 fairly stout, 1 slender; distance between antennal bases one-half length of antenna; beak setae, 2 pairs apical, 1 pair median; anterior spiracle with 1 trilocular pore, posterior spiracle with 1 trilocular and 1 quinquelocular pore; leg setae, coxa 4, femur 1 on inner margin near base and 1 on outer margin near center, tarsus 2 on inner and 1 on outer margin; tibia one-half as long as tarsus; 9 pairs of submarginal 8-shaped pores; 6 pairs of submarginal minute setae on abdomen, 1 pair of submarginal larger setae at anterior end; 2 pairs of setae between antennae and mouth parts.

Apex of abdomen: Notch present; lobes indicated; setae, apical 27  $\mu$  long, interapical 5.4-7.2  $\mu$  long, inner ventral 2  $\mu$  long, outer ventral 3.6  $\mu$  long; anal ring with 6 setae 10.8  $\mu$  long, and with an inner row of 6 and an outer row of 10 pores, divided on dorsal side.

*Data*.—Described from unmounted specimens (paratypes), 12 mounted females, and 10 mounted larvae collected on *Bambusa* sp. unless otherwise indicated; all host material collected by F. A. McClure in China. The source of the material is as follows: Bamboo Garden, Lingnan University, Kwangtung, September 3, 1926; Au Tsai, Kwangsi, November 5, 1928; Hak Ts'uen, Honam Island, Kwangtung, April 4, 1929; P'oon Ue district, Kwangtung, August 23, 1931, holotype and paratypes; Lingnan University, P'oon Ue district, Kwangtung, September 8, 1931; on *Dendrocalamus* sp., Sing Kok Tsaai, Yeung Kong district, Kwangtung, December 18, 1931; Shek Kwat, She Ts'uen, Mau Ming district, Kwangtung, December 22, 1931; Lingnan University, P'oon Ue district, Kwangtung, February 22, 1932.

This species is closely related to *pseudolanceolatum* and *solenophoroides* but is longer and more slender than these, and has a different arrangement of marginal 8-shaped pores.

### ASTEROLECANIUM PERPLEXUM, new species

(Fig. 49, M-W; fig. 50, A, B; fig. 51, A-E; pl. 4, L)

*Habit*.—Living on both surfaces of leaves.

*Test of female*.—Somewhat ovoid, 1.4-1.6 mm. long, 1-1.4 wide; nearly flat dorsally, sometimes with a very faint longitudinal median carina; flat ventrally; pale greenish yellow, transparent, very thin, shiny, punctate; marginal filaments light brownish yellow; larval exit apparently a slit in margin.

*Adult female*.—Longer than wide, posterior end sometimes slightly produced; 1-1.4 mm. long, 0.85-1 wide.

Margin: 8-shaped pores in a single row terminating about twice a pore's length from bases of apical setae, posterior pores  $9\ \mu$  long and 7 wide, the others 11–12  $\mu$  long and 8 wide, a pore's width apart at anterior end, less widely separated posteriorly; quinquelocular pores in a single row terminating at end of the row of 8-shaped pores or extending 1 or 2 pores beyond this point, as numerous as corresponding 8-shaped pores near posterior end, usually one and a half times as numerous as that elsewhere, sometimes twice as numerous as corresponding 8-shaped pores near spiracular pore bands.

Dorsal surface: Minute 8-shaped pores numerous; disk pores fairly numerous; tubular ducts  $24\ \mu$  long.

Ventral surface: Antenna conical, with 2 setae longer and 1 slightly shorter than diameter of antenna; beak with 2 pairs of setae; spiracular bar fairly slender, expanded at inner end; 12–21 quinquelocular pores extending from spiracle to body margin in an irregularly single or double row; multilocular pores, with 10 loculi, in 4 complete and 4 or 5 interrupted rows, posterior and penultimate rows each with 8–11 pores, next with 7 or 8, anterior complete row with 8 or 9, posterior interrupted row usually with 3, each of other interrupted rows with 2, the total ranging from 39–46; 2 or 3 dark-rimmed 8-shaped pores each side of beak; submarginal 8-shaped pores in a single row terminating near median line nearly directly anterior to bases of apical setae, nearly as numerous as marginal 8-shaped pores; submarginal setae in a complete row terminating near the posterior or penultimate pair of marginal 8-shaped pores; 2 pairs of setae in the posterior row of multilocular pores and 1 pair in each of the other complete rows.

Apex of abdomen: Lobes sometimes indicated; setae, apical  $64\ \mu$  long, interapical  $3.6\ \mu$  long, outer ventral  $5.2\ \mu$  long; anal opening ventral, twice its own diameter from body margin, circular, its margin sclerotized; 2 setae 3–5  $\mu$  long on anterior edge.

*Larva*.—Elongate elliptical.

Margin: With 28 8-shaped pores, axes of all longitudinal; 2 pairs of setae anteriorly.

Dorsal surface: 8-shaped pores in a submedian row of 4–9 and a lateral row of 9, on each half of body, the total number in the specimens studied 27–36, around one-fifth smaller than marginal pores; disk pores between submedian and lateral, and a few between lateral and marginal, 8-shaped pores.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 0; VI, 2 long, 2 stout, 2 fairly stout, 2 slender; antennal bases about one-half length of antenna apart; beak setae, 2 pairs apical; anterior spiracle with 1 trilocular and 1 quinquelocular pore, posterior spiracle with 1 trilocular pore; leg setae, coxa 3, femur 1 on inner margin near base, tarsus 1 each on inner and outer margins; tibia one-fifth as long as tarsus; 9 pairs of submarginal 8-shaped pores; 7 pairs of minute submarginal setae on the abdomen, 1 pair of submarginal larger setae at anterior end; 2 pairs of setae between antennae and mouth parts.

Apex of abdomen: Notch small; lobes sometimes indicated; setae, apical  $72\ \mu$  long, interapical  $5.2\ \mu$  long, outer ventral  $3.6\ \mu$  long; anal opening ventral, close to margin, nearly circular; anal tube short, rather bulbous, sclerotized; anal ring not conspicuously differentiated from tube, with 2 setae, each  $3.6\ \mu$  long.

*Test of male*.—Elongate elliptical, 1 mm. long, 0.5 wide; dorsally convex at anterior end, sloping to posterior end; flat ventrally; very pale yellow, transparent, very thin, shiny, punctate; marginal filaments very light brownish yellow.

*Adult male*.—Broken, apparently 0.75 mm long.

Head: Antenna 10-segmented, comparative length of segments indeterminate; antennal setae, I, 1 or 2; II, 7; III–X, more than 7 but exact number indeterminate; basal bars indeterminate; approximately 25 setae ventrally anterior to eyespots and near bases of antennae; 8 or 9 setae dorsally near bases of antennae.

Thorax: Bar between wing bases nearly rectangular, three and a half times as long as wide; tibia apparently about as long as tarsus.

Abdomen: Five segments each with a pair of setae dorsally on margin, apparently 3 each with a pair of setae in ventral lateral area; lobes indicated, each with 1 long and 2 short setae; penis sheath with 1 pair of setae dorsally near base, apparently with 2 pairs of setae ventrally near base, and with 3 or 4 setae on each side of ventral opening.

*Male nymph*.—Distinguishing characters similar to those of adult male.

*Data.*—Described from specimens (7 females, 11 larvae, 1 adult male, and 2 male nymphs, mounted), on *Quercus phillyraeoides*, Japan, from I. Kuwana, letter of December 5, 1932, No. 85, holotype and paratypes.

This species is closely related to *pasaniae* and *variabile*. It is distinguished from the former, however, in lacking the sclerotized tongue-shaped projections of the marginal 8-shaped pores and in having setae on the margin of the anal opening. In *perplexum* the marginal 8-shaped pores are distinctly larger than in *variabile*, the marginal quinquelocular pores terminate nearer the apical setae, and the latter are 64  $\mu$  long instead of 48 to 52  $\mu$  long as in *variabile*. Larvae of *perplexum* have only one pore near the posterior spiracle while those of *variabile* have two.

### ASTEROLECANIUM PETROPHILAE (Fuller)

(Fig. 52, A-F; pl. 9, F)

Briefly described by Fuller as *Planchonia petrophilae* in 1897 (36, p. 1345) from specimens on *Petrophila linearis* collected at Swan River, West Australia; in 1899 (37, pp. 456-457) the species was more fully characterized by the same author and transferred to the genus *Asterolecanium*.

*Habit.*—Living on both surfaces of leaves, in pits.

*Test of female.*—Broadly ovoid or nearly circular, 1.6 mm. long and 1.10 wide, or 1.10-1.6 mm. in diameter; flat or slightly convex dorsally and ventrally; pale yellow, transparent, glassy; marginal filaments rubbed off; larval exit a slit in margin.

*Adult female.*—Usually nearly circular, 0.75-1.5 mm. in diameter.

Margin: 8-shaped pores in a single row terminating about one-half length of an apical seta from bases of setae, about 9 or 10  $\mu$  long and 5 or 6 wide, the intervals between them ranging from the width to the length of a pore, the axes of the pores transverse, diagonal, or longitudinal; quinquelocular pores in a single row terminating 5-10 8-shaped pores from end of row, nearly as numerous as corresponding 8-shaped pores.

Dorsal surface: Minute 8-shaped pores and disk pores sparse, only a few of the former observed on posterior half of body, and a few of the latter on anterior half; tubular ducts 26-28  $\mu$  long.

Ventral surface: Antenna globular, with 3 setae slightly longer than diameter of antenna; beak apparently with 2 pairs of setae; spiracle with bar expanded at inner end, atrium slightly enlarged, shallow, and containing 3-5 quinquelocular pores close to edge, 12-20 similar pores extending from spiracle to body margin in an irregularly single row; submarginal 8-shaped pores in a single row terminating near the posterior pair of marginal 8-shaped pores and about half as numerous as corresponding marginal 8-shaped pores; submarginal setae in a complete row terminating near the posterior pair of marginal 8-shaped pores; 3-5 pairs of setae in genital area, the posterior pair close to anal ring, the other pairs anterior to genital opening and uniformly spaced.

Apex of abdomen: Setae, apical 48-56  $\mu$  long, interapical 8-10  $\mu$  long, intermediate and outer ventral each 6-7  $\mu$  long (1 sometimes lacking on 1 side of body); anal opening ventral, between interapical setae, semicircular to elliptical; anal tube fairly short, a little larger at inner than at outer end, rather heavily sclerotized; anal ring a sclerotized semicircular or circular band with 2 setae 20-28  $\mu$  long.

*Second stage.*—Resembling adult, but smaller and nearly ovoid; axes of majority of marginal 8-shaped pores longitudinal with body margin, marginal quinquelocular pores lacking; dorsal surface with minute 8-shaped and disk pores more numerous than in adult; ventral surface with atrium of spiracle not enlarged, 2 quinquelocular pores outside spiracular opening and 6-10 similar



pores extending to body margin, no submarginal 8-shaped pores observed, and no setae in median abdominal area; apex of abdomen as in adult but all setae usually slightly shorter.

*Larva*.—Ovoid.

Margin: Without 8-shaped pores; a minute seta on lateral margin of each of the 3 segments anterior to the last; 2 pairs of setae at anterior end.

Dorsal surface: Without pores.

Ventral surface: Antenna indistinctly segmented, only 5 segments plainly indicated; antennal setae, I, 0; IV, 1; V, 2 long, 2 stout, 2 fairly stout, 2 slender; distance between antennal bases about one-half length of antenna; beak setae, 2 pairs apical, 1 pair median, 1 pair basal; anterior spiracle with 1 trilocular and 1 quinquelocular pore, posterior spiracle with none; anterior coxa with only 2 minute setae, the others with only 1, but all with 3 long setae, femur with 1 seta on inner margin near base and 1 on inner margin near center, tarsus with 1 each on inner and outer margins; tibia one-third as long as tarsus; the single pair of submarginal 8-shaped pores situated between the antennae; apparently 9 pairs of submarginal minute setae, on abdomen, thorax, and head, 1 pair of submarginal larger setae at anterior end; 3 pairs of setae between antennae and mouth parts.

Apex of abdomen: Lobes barely indicated; setae, apical 55–60  $\mu$  long, interapical 9–12  $\mu$  long, a pair 1  $\mu$  long entad of interapical, intermediate and outer ventral each about 4  $\mu$  long; anal opening in ventral surface and margin, elongate; anal tube short, bulbous, sclerotized; anal ring a semicircular or circular sclerotized band, with 2 setae, each 5  $\mu$  long.

*Test of male*.—Elongate ovoid, 1 mm. long, 0.5 wide; flat dorsally and ventrally; pale greenish yellow, transparent, thin, punctate; marginal filaments colorless, glassy.

*Adult male*.—0.85 mm. long.

Head: Antenna 9-segmented; formula (longest to shortest), (III), (IV), (V, VI), (VII, IX), (VIII), (I), (II); antennal setae; I, 0; II, 10; III–IX, 6–10, IX also with 4 very long setae; basal bars not apparent; 6 or 8 setae ventrally between eyespots and antennae; a minute sclerotized tubercle on posterior lateral margin.

Thorax: Bar between wing bases curved on anterior margin, slightly more than twice as long as wide; tibia as long as tarsus.

Abdomen: Five segments each with a seta dorsally on lateral margin, apparently 4 or 5 segments each with a seta in ventral lateral area; each lobe area with 1 long and 3 short setae; penis sheath with 1 pair of setae dorsally at base, 2 pairs ventrally at base, and 8 setae on each side of ventral opening.

*Male nymph*.—Distinguishing characters similar to those of adult male.

*Third-stage male*.—Similar to second stage but with legs represented by 3 pairs of faintly sclerotized, raised areas.

*Data*.—Redescribed from unmounted specimens and the following mounted material collected by G. Compere: Three females, 5 second-stage specimens, 4 poor larvae, 5 males, 1 male nymph, and 5 third-stage males, on *Petrophila linearis*, Perth, West Australia, Compere No. 874; 15 females and 1 poor larva on *Hake* sp., Australia, March 1, 1902, Compere No. 874.

The larvae are unusual in not having marginal 8-shaped pores, in apparently having only two ventral submarginal 8-shaped pores, and in having only two minute setae on the anterior coxa, and only one on each of the median and posterior coxae.

## ASTEROLECANIUM PHOENICIS Ramachandra Rao

(Fig. 52, G–R; pl. 7, K)

Described briefly by Ramachandra Rao in 1922 (78, p. 11), illustrated by Dutt in 1922 (30, p. 13), and described in detail by Green in 1923 (47, pp. 469–470).

*Habit*.—"On the leaf stalks, leaves and fruits of the date palm (*Phoenix dactylifera*)" according to Green (47, p. 470); observed by the writer only on the lower surface of leaves.

*Test of female*.—Somewhat elongate, 1.5–1.95 mm. long and 0.75–0.95 wide, widest at anterior third, tapering from there to anterior end and to constriction near posterior end, wider and rounded at posterior end, appearing slipper-shaped on ventral surface; convex dorsally, sloping strongly to margin, somewhat constricted at posterior sixth with posterior end enlarged and sloping to margin; ventrally concave at posterior end, flat elsewhere; pale greenish yellow or fairly clear pale yellow, transparent, thin, smooth, shiny; marginal filaments whitish; larval exit a semicircular slit in ventral surface at margin.

*Adult female*.—Constricted near posterior end and slipper-shaped, or not constricted and elongate elliptical; 1.4–1.75 mm. long, 0.65–0.85 wide.

Margin: 8-shaped pores in a single row terminating around three times the length of an apical seta from setal bases, 9  $\mu$  long and 8 wide, usually a pore's width apart but sometimes spaced at intervals equal to the length of a pore, and the posterior 2 or 3 pores occasionally three times a pore's length apart; quinquelocular pores in a single row of 8–16 at points where each spiracular pore band meets body margin, the rows not meeting between the spiracular pore bands, the spacing of these pores the same as for the corresponding 8-shaped pores.

Dorsal surface: A total of 20–25 8-shaped, somewhat tubular pores in submarginal area, 1 or 2 sometimes in median area anterior to mouth parts, 5–6  $\mu$  long and 4–5 wide, the tube wider than a tubular duct and slightly more than one-half as long, very slightly wider at outer end than at inner end; minute 8-shaped pores numerous; disk pores fairly numerous; tubular ducts in scattered groups, 28  $\mu$  long.

Ventral surface: Antenna very short, with 2 setae as long as, or slightly longer than, diameter of antenna; beak with 3 pairs of setae: spiracular bar expanded at inner end; approximately 12 quinquelocular pores extending from spiracle to body margin in an irregularly single and double row, the 2 or 4 pores nearest opening situated in a furrow which flattens out near body margin; 2 dark-rimmed 8-shaped pores each side of beak, 1 anterior to mouth parts, and a few tending toward arrangement in 3 or 4 transverse rows on abdomen; submarginal 8-shaped pores in a single row apparently terminating at the fifth from the posterior pair of marginal 8-shaped pores, about one-third as numerous as corresponding marginal 8-shaped pores; submarginal setae in a complete row terminating about length of an apical seta from bases of apical setae; 10, 12, or 14 setae posterior to genital opening, arranged in 4 transverse rows of 3 each when 12 are present, occasionally 2 setae between anterior row and genital opening.

Apex of abdomen: Setae, apical 76  $\mu$  long, interapical 10  $\mu$  long, outer ventral 5  $\mu$  long; anal opening ventral, circular, its margin sometimes faintly sclerotized.

*Larva*.—Elongate elliptical.

Margin: With 28 8-shaped pores, axes of all longitudinal; a pair of minute setae close to each of the posterior 3 pairs; 1 pair of setae at anterior end.

Dorsal surface: 8-shaped pores in a submedian row of 5 or 6 on each half of body, about one-half the size of marginal pores; 2–4 disk pores between lateral and marginal 8-shaped pores.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 1; VI, 3 long, 2 stout, 2 fairly stout; antennal bases nearly one-half length of antenna apart; beak setae, 3 pairs apical, 1 pair basal; each spiracle with 2 trilocular pores or posterior spiracle with 1 trilocular and 1 quinquelocular pore; leg setae, coxa 3, femur 1 on inner margin near base, tarsus 1 each on inner and outer margins; tibia one-half as long as tarsus; 9 pairs of submarginal 8-shaped pores; apparently 10 pairs of submarginal setae, on abdomen, thorax, and head; 5 setae near antennae.

Apex of abdomen: Setae, apical 48–55  $\mu$  long, interapical 7.2  $\mu$  long, a pair 1  $\mu$  long entad of interapical, outer ventral 3.6  $\mu$  long; anal opening ventral, circular, its margin sometimes slightly sclerotized; anal tube very short; anal ring poorly differentiated.

*Data*.—Redescribed from the following material: One unmounted specimen, two mounted females, and two mounted larvae on *Phoenix dactylifera*, Iraq, from W. Horn, May 11, 1928; unmounted specimens, three mounted females, and one mounted larva, Margil, Basra, Iraq, from A. Dutt, January 19, 1929.

Distinguishable from all other known species on palm by the presence of dorsal tubular 8-shaped pores and the shape of the marginal and dorsal 8-shaped pores. Although Green stated, "No supplementary paired pores on the dorsum" (47, p. 470), they are fairly distinct in all specimens examined.

### ASTEROLECANIUM PINANGAE, new species

(Fig. 53, A-E; pl. 9, 0)

*Habit.*—Living on both surfaces of leaves, and on bark.

*Test of female.*—Elongate, nearly elliptical, 1-1.5 mm. long, 0.5-1 wide; flat dorsally and ventrally, with a faint longitudinal median carina dorsally; greenish or clear yellow, transparent, punctate; marginal filaments very pale salmon; larval exit ovoid, in dorsal surface at margin.

*Adult female.*—Nearly elliptical, posterior end narrowed; 0.9-1.25 mm. long, 0.3-0.6 wide.

Margin: 8-shaped pores in a single row terminating approximately a pore's length from bases of apical setae, 9  $\mu$  long and 4 wide, less than a pore's length apart; quinquelocular (sometimes nearly as many trilocular as quinquelocular) pores in a single row, starting 6-20 8-shaped pores anterior to anterior spiracular pore bands and ending the same distance posterior to posterior spiracular pore bands (the row sometimes narrowly interrupted between pore bands), the pores as numerous as corresponding 8-shaped pores at ends of row, somewhat more numerous elsewhere.

Dorsal surface: Minute 8-shaped pores fairly numerous; disk pores sparse; tubular ducts 28  $\mu$  long.

Ventral surface: Antenna a slightly raised, irregular area, with 2 setae as long as diameter of antenna; beak apparently with 2 pairs of setae; spiracle with bar slender, atrium enlarged, bag-shaped, and containing 3-6 quinquelocular pores, 5-12 similar pores extending from spiracle to body margin in a single row; multilocular pores, with 10 loculi, in 7 interrupted rows, the posterior row with 2 or 3 pores, penultimate row with 6 or 8, and each of the other rows with 1-4, the total ranging from 18-24; 2-4 dark-rimmed 8-shaped pores each side of beak and a few in an irregular row on abdomen; submarginal 8-shaped pores in a single row terminating near the posterior row of multilocular pores, about one-half as numerous as corresponding marginal 8-shaped pores; submarginal setae in a complete row terminating near the penultimate pair of marginal 8-shaped pores; 2 pairs of setae in posterior row of multilocular pores and 1 pair in each of the next 3 rows.

Apex of abdomen: Lobes sometimes indicated; setae, apical 36-44  $\mu$  long, interapical about 2.7  $\mu$  long, outer ventral 3  $\mu$  long; anal opening apical; anal tube very short, often indeterminate; anal ring somewhat elliptical, consisting of a sclerotized band surrounding 2 short, sclerotized collars, each collar with a seta 16  $\mu$  long and a minute pore; a membranous opening contiguous to ventral sides of collars; ventral surface of apex slightly sclerotized directly anterior to apical setae.

*Larva.*—Nearly elliptical, posterior end slightly narrowed.

Margin: With 28 8-shaped pores, posterior pores slightly smaller than the others, axes of all longitudinal; a minute seta close to each pore of the posterior 3 pairs; 3 pairs of setae at anterior end.

Dorsal surface: 8-shaped pores in a submedian row of 2-9 and a lateral row of 9-11, on each half of body, majority of lateral pores as long as width of marginal pores, but 1 or 2 near anterior end at least as large as marginal; the posterior pore and 1 or 2 anterior pores of the submedian row virtually as large as marginal pores, the others distinctly smaller, submedian pores occurring near posterior end of body and usually at the anterior end but the row often interrupted medially; disk pores between lateral and marginal 8-shaped pores.

Ventral surface: Antennal setae, I, 0; IV, 1; V, 1; VI, 3 long, 2 stout, 2 fairly stout; antennal bases three-fifths length of antenna apart; beak apparently with 3 pairs of setae at tip; anterior spiracle with 2 trilocular or quinquelocular pores, posterior spiracle with apparently 2 quinquelocular pores; leg setae, coxa 3, femur 0, tarsus 1 each on inner and outer margins; tibia one-fourth as long as tarsus, articulation between tibia and tarsus very indefinite; 9 pairs of submarginal 8-shaped pores; 10 pairs of submarginal minute setae, on abdomen, thorax, and head; 4 pairs of setae near antenna; and mouth parts.



Apex of abdomen: Notch small; lobes sometimes indicated; setae, apical  $40\ \mu$  long, interapical  $10\ \mu$  long, a pair  $1\ \mu$  long entad of interapical, outer ventral  $2\ \mu$  long; anal opening apical; anal tube very short, faintly sclerotized; anal ring a sclerotized band, with 2 setae apparently  $2\ \mu$  long.

*Third-stage male.*—Resembling adult female, but smaller; margin with trilocular or quinquelocular pores missing opposite only 2 or 3 of the anterior 8-shaped pores, or on entire margin anterior to anterior spiracular pore bands, present elsewhere and terminating between the posterior pair of marginal 8-shaped pores and apical setae, approximately twice as numerous as corresponding 8-shaped pores; ventral surface having atrium of spiracle slightly enlarged but without pores, 2 or 3 pores between spiracle and body margin, legs represented by 3 pairs of small, circular, sclerotized areas, each with a distinct claw; apex of abdomen with lobes indicated, apical setae  $35\ \mu$  long, interapical setae  $1.5\ \mu$  long, outer ventral setae  $3\ \mu$  long; anal opening apical, circular, its margin slightly sclerotized; no anal tube or anal ring but 2 setae  $3\ \mu$  long on edge of opening.

*Data.*—Described from specimens (34 females, 2 second-stage specimens, and 44 larvae, mounted) that were removed from U. S. N. H. material of *Pinanga* from the Philippine Islands. The following lots of host material were involved: *P. barnesii*, Morong, Luzon, A. Loher; *P. philippinensis*, Lamao River, Mt. Mariveles, Batan Province, Luzon, R. S. Williams, January 3, 1903; *P. insignis*, Bongabon River, Mindoro, H. Whitford, June 1906; *P. modesta*, Lake Lanao, Mindanao, M. S. Clemens, April 1907; *P. barnesii*, Lucban, Tayabas Province, Luzon, A. D. E. Elmer, May 1907; *P. pedicellata*, Camiguin, E. Fenix, June–July 1907; *P. barnesii*, Polillo, C. B. Robinson, August 1909; *Pinanga* sp., Butuan, Mindanao, E. D. Merrill, October 1910; *P. copelandii*, Butuan, Mindanao, C. M. Weber, March–July 1911; *Pinanga* sp., near Dupax, Nueva Vizcaya Province, Luzon, R. C. McGregor, March–April 1912; *P. barnesii*, Laguna Province, Luzon, R. C. McGregor, June–August 1915; *P. insignis* and *P. urosperma*, Apayao, Luzon, E. Fenix, May 1917; *P. barnesii*, Catanduanes, M. Ramos, November 14–December 11, 1917; 6 females and 3 larvae on *Pinanga* sp., Catanduanes, M. Ramos, December 11, 1917, holotype and paratypes; *P. negrosensis*, Dinagat Island, Ramos and Pascasis, May 1919; *P. woodeana*, Mt. Tokduanbanoy, Rizal Province, Luzon, Ramos and Edano, November 1926.

Most closely allied to *oraniae*.

#### ASTEROLECANIUM PROBOSCIDIS, new species

(Fig. 53, F–N; pl. 9, A4)

*Habit.*—Living on the lower surface of leaves.

*Test of female.*—Nearly circular, 0.7 mm. long, 0.6 wide (this test broken, rubbed, and in poor condition, probably unusually small); very slightly convex dorsally, flat ventrally; pale greenish yellow, transparent, very thin; marginal filaments fragmentary, apparently same color as test; larval exit not apparent.

*Adult female.*—Slightly longer than wide or circular, around 0.9 mm. long and 0.75 wide, or around 0.95 mm. in diameter.

Margin: 8-shaped pores in a single row terminating at posterior fifth of body,  $12\ \mu$  long and 8 wide, around a pore's width apart; row of quinquelocular pores interrupted for a space equal to that occupied by 10–20 8-shaped pores at anterior end, and terminating slightly before the posterior 8-shaped pores, the row single anteriorly and posteriorly but double between spiracular pore bands and for 5 or 6 8-shaped pores outside of them, 1 or 2 opposite each 8-shaped pore where the row is single, 2–4 opposite each 8-shaped pore where it is double; disk pores dorsad of 8-shaped pores and continued beyond them posteriorly, terminating near apical setae, 1 near each 8-shaped pore when the latter are present, and spaced at the same intervals posterior to 8-shaped

pores, disk pores also occurring ventrad of quinquelocular pores, the row terminating near posterior pair of submarginal setae, slightly less numerous than those dorsad of 8-shaped pores.

Dorsal surface: Minute 8-shaped pores fairly numerous; disk pores rather sparse; tubular ducts 30-32  $\mu$  long; dorsal tubes present.

Ventral surface: Antenna globular, apparently with 2 or 3 setae of nearly the same length as diameter of antenna; beak without setae; spiracle with bar expanded at inner end, atrium enlarged, bag-shaped, and containing 5-7 quinquelocular pores, 14-20 similar pores extending from near inner end of bar to body margin in a fan-shaped row; 3 or 4 dark-rimmed 8-shaped pores each side of beak, 2 or 4 on anterior end near antennae, and a few sometimes on abdomen; submarginal 8-shaped pores in a single row terminating fairly near genital opening, nearly as numerous as marginal 8-shaped pores anteriorly, about one-half as numerous as those pores elsewhere; apparently 5 pairs of submarginal setae on abdomen, the posterior pair nearer to bases of apical setae than to the posterior pair of marginal 8-shaped pores; 2 pairs of setae posterior to genital opening, 1 pair anterior to opening, and 1 pair anterior to those.

Apex of abdomen: Slightly concave; setae, apical 5.2  $\mu$  long, intermediate and outer ventral (both anterior to apical) each 3.6  $\mu$  long; anal opening apparently apical, circular; anal tube a sclerotized, pouchlike sack; anal ring not clearly differentiated, apparently membranous, on the ventral surface of the tube.

*Larva*.—Nearly elliptical.

Margin: With 28 8-shaped pores, the posterior and anterior pairs slightly larger than the others, the penultimate pair smallest, the others gradually increasing in size from penultimate pair anteriorly, axes of all virtually longitudinal; a pair of minute setae close to each of the posterior 3 pairs of pores; 4 pairs of setae anteriorly.

Dorsal surface: 8-shaped pores in a submedian row of 7 or 8 and a lateral row of 9, on each half of body, anterior pores of each row slightly larger than posterior ones, posterior submedian pores slightly larger than those of posterior lateral row, all slightly larger than marginal pores of same segments; disk pores between lateral and marginal 8-shaped pores and a few between lateral and submedian rows.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 1; VI, 2 long, 2 stout, 3 fairly stout, 1 slender; distance between antennal bases one-third length of antenna; beak unusually long and pointed, wide on basal half and narrow on distal half, proboscislike, with 1 pair of setae at tip, 1 pair in median area, and 1 pair at base; spiracle with 1 trilocular and 1 quinquelocular pore; leg setae, coxa 4, femur 1 on inner margin at base and 1 each on inner and outer margins near center, tarsus 2 on inner and 1 on outer margin; tibia one-half as long as tarsus; 7 pairs of submarginal 8-shaped pores, none present between antennae; apparently 10 pairs of submarginal setae, on abdomen, thorax, and head; apparently 3 pairs of setae between antennae and mouth parts.

Apex of abdomen: Lobes indicated; setae, apical apparently at least 36  $\mu$  long, interapical 3.2  $\mu$  long, a pair 1  $\mu$  long entad of, and anterior to, interapical on dorsal surface, intermediate and outer ventral each 1  $\mu$  long; anal opening apical, longitudinally elliptical, its margin sclerotized; anal tube sclerotized, small, apparently larger at inner than at outer end; anal ring a sclerotized band, 2 setal bases on ventral side of tube close to ring.

*Data*.—Described from 1 poor test, 4 mounted females, and 11 mounted larvae on *Bambusa* sp., Antipolo, Luzon, Philippine Islands, A. S. Hitchcock, June 9, 1921, U. S. N. H., holotype and paratypes.

The larva of this species is unusual in having a long, proboscislike beak.

#### ASTEROLECANIUM PSEUDOLANCEOLATUM Takahashi

(Fig. 54, A-G; pl. 7, Q)

Takahashi described this species in 1933 (94, pp. 34-35) but stated that it was part of the material he had listed as *lanceolatum* Green in 1930 (93, p. 11).

*Habit.*—Living on stems.

*Test of female.*—Elongate, posterior third tapering, posterior end sometimes slightly upturned; 1.25–1.5 mm. long, 0.4 wide; convex dorsally, without or with faint transverse striations, flat ventrally; greenish or very pale yellow transparent, thin, shiny; marginal filaments very pale pinkish, not observed near posterior end, slightly longer at anterior end than elsewhere; dorsal filaments not observed; elliptical larval exit in ventral surface at margin.

*Adult female.*—In shape similar to test, 1–1.25 mm. long, 0.3 wide.

Margin: 8-shaped pores in a single row terminating near posterior fourth of body (around three times the length of an apical seta from setal bases), the posterior pores 5–6  $\mu$  long and 3 wide, the others 7–8  $\mu$  long and 4.5 wide, usually about a pore's length apart; quinquelocular pores in a single row beginning closer to antennae than to anterior spiracles and extending to a point 6–12 8-shaped pores from the posterior pair of those pores, as numerous as corresponding 8-shaped pores near ends of row, usually one and a half times as numerous as that elsewhere.

Dorsal surface: 8-shaped pores absent or 1–3 present along median line usually, but rarely slightly more numerous, the pores 10–14  $\mu$  long and 6–8 wide; minute 8-shaped pores fairly numerous; disk pores rather sparse; tubular ducts 28  $\mu$  long; dorsal tubes present.

Ventral surface: Antenna short, with 2 setae longer than diameter of antenna; beak without setae; spiracular bar rather short and wide, only fairly well defined; 6–9 quinquelocular pores extending from spiracle to body margin in a single row; 2 quinquelocular pores posterior to genital opening; 2 or 3 dark-rimmed 8-shaped pores each side of beak, 1 or 2 on anterior end, and a few arranged in 2 or 3 transverse rows near posterior end of abdomen; submarginal 8-shaped pores in a single row terminating near genital opening, half as numerous as marginal 8-shaped pores; 5 pairs of submarginal setae on abdomen, the posterior pair about length of an apical seta from bases of apical setae; 1 pair of setae posterior, and 1 pair anterior, to genital opening.

Apex of abdomen: Notch present; lobes barely indicated; setae, apical 52  $\mu$  long, interapical 8  $\mu$  long, inner and outer ventral each 52  $\mu$  long; anal ring with 6 setae 28–32  $\mu$  long, with an inner row of 6 and an outer row of apparently 12 or 14 pores, tending toward division on dorsal side; ventral surface of apex lightly sclerotized and rugose.

*Second stage.*—Resembling adult female, but smaller; margin without 8-shaped or quinquelocular pores; dorsal surface with 1 or 2 large median 8-shaped pores at one or each end of body; ventral surface with 2 or 3 quinquelocular pores near each spiracle; apex of abdomen as in adult but all setae around one-sixth shorter.

*Larva.*—Elongate elliptical.

Margin: With 28 8-shaped pores, the posterior pair slightly larger than penultimate and penultimate pair slightly larger than first pair anterior to it, the next 3 pairs about as large as penultimate, the next 7 about same size as posterior pair, which are a little smaller than anterior pair; axes of the posterior 6 pairs diagonal, of the others longitudinal; 2 pairs of setae anteriorly.

Dorsal surface: 8-shaped pores in a submedian row of 11 on each half of body, the anterior 2 pores slightly larger than the others, all about one-sixth larger than marginal pores of same segments; disk pores in lateral area.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 1; VI, 2 long, 2 stout, 3 fairly stout, 1 slender; antennal bases one-half length of antenna apart; beak setae, 2 pairs apical, 1 pair median; anterior spiracle with 1 trilocular pore, posterior spiracle with 1 trilocular and 1 quinquelocular pore; leg setae, coxa 4, femur 1 on inner margin near base and 1 on outer margin near center, tarsus 2 on inner and 1 on outer margin; tibia two-thirds as long as tarsus; 9 pairs of submarginal 8-shaped pores; 6 pairs of submarginal minute setae on abdomen, 1 pair of submarginal larger setae at anterior end; 2 pairs of setae between antennae and mouth parts.

Apex of abdomen: Setae, apical 27  $\mu$  long, interapical 7.2  $\mu$  long, inner and outer ventral each 3.6  $\mu$  long; anal ring with 6 setae, each 10  $\mu$  long and with 4 pores in specimens in which these can be counted accurately, but apparently sometimes with 2 in an inner row and 6 in an outer row, divided on dorsal side.

*Test of male.*—Elongate, slightly narrowed at posterior end, a notch in posterior margin; 0.9–1.10 mm. long, 0.3–0.4 wide; strongly convex dorsally, with a faint longitudinal median carina and usually with a few faint transverse striations near posterior end; flat ventrally; pale greenish yellow, transparent, thin, smooth; marginal filaments whitish, slightly longer at anterior end than elsewhere.

*Adult male.*—1 mm. long.



Head: Antenna 10-segmented; formula (longest to shortest), (X), (IV), (V), (VI, IX), (III, VII, VIII), (I), (II); antennal setae, I, 2-4; II, 14; III, 10; IV-VII, 18-22; VIII, 16; IX, 23; X, 19 and also 3 very long and 2 rather stout; basal bars transverse; 23 setae anterior to ventral eyespots.

Thorax: Bar between wing bases rectangular, three times as long as wide, an oblong area in center less heavily sclerotized than the rest; tibia three-fifths length of tarsus.

Abdomen: Five segments each with a pair of setae dorsally on lateral margins; apparently 2 segments each with a pair of setae in ventral lateral area; each lobe area with 1 long and 2 short setae; penis sheath with 2 or 3 short setae dorsally near base and apparently with 5 setae on each side of ventral opening.

*Male nymph.*—Distinguishing characters similar to those of adult male.

*Third-stage male.*—Resembling adult female, but not so strongly narrowed at posterior end, nearly elliptical, smaller than mature female; margin with 8-shaped pores terminating about one-half length of an apical seta from bases of setae; quinquelocular pores in a complete row terminating closer to apical setae than to marginal 8-shaped pores; dorsal surface with 1 8-shaped pore on median line near posterior end and 5 larger pores in submarginal area at anterior end, these pores larger than posterior marginal pores; ventral surface with 2 or 3 quinquelocular pores near each spiracle, legs represented by 3 pairs of circular, sclerotized, slightly raised areas, each with or without a small, straight claw: apex of abdomen as in adult female, but interapical and ventral setae about one-sixth shorter.

*Da'a.*—Redescribed from the following material: One mounted female, 2 mounted larvae on *Bambusa* sp., Chun Wong Mt., Ts'ing Uen district, Kwangtung, China, F. A. McClure, April 21, 1925: specimens (10 females, 5 second-stage specimens, 11 larvae, 3 adult males, 1 male nymph, and 1 third-stage male, mounted) on *Bambusa* sp., Taihoku, Taiwan (Formosa). R. Takahashi, April 20, 1929 (part of original collection from which the species was described).

Closely resembling *solenophoroides*, but differing from it conspicuously in shape, and in having a well defined marginal row of quinquelocular pores; also related to *penicillatum*.

Although Takahashi stated that there were no dorsal 8-shaped pores in this species, one or two have been noted in several of the specimens examined.

#### ASTEROLECANIUM PSEUDOMILIARIS Green

(Fig. 54, H-S; pl. 7, R)

Described in 1922 (46, pp. 1036-1037) from specimens on *Bambusa* sp. collected at Peradeniya, Ceylon.

The dorsal 8-shaped pores of this species vary much more than was indicated in the original description, and on this account it is necessary to synonymize *charmoyi* with *pseudomiliaris*. Green described *charmoyi* in 1924 (48, pp. 45-46) on *Bambusa* sp. from Mauritius. The dorsal 8-shaped pores, said by Green to be less numerous and smaller in *charmoyi* than in *pseudomiliaris*, vary greatly in number and slightly in size, and do not furnish a basis for separating the two forms. Moreover, the marginal 8-shaped pores, which were stated to be closer together in *charmoyi* than in *pseudomiliaris*, are practically the same distance apart in all specimens.

With the synonymizing of *charmoyi*, *pseudomiliaris bambusifoliae* also becomes a synonym of *pseudomiliaris*. Takahashi described this variety in 1930 (93, p. 11) on *Bambusa* sp. from Nisui, Taiwan (Formosa), and in 1933 (94, p. 35) indicated that it was a synonym of *charmoyi*. Specimens bearing the collection data of the type specimens of this variety, and studied by the writer, are the same as specimens described as *charmoyi* and *pseudomiliaris*.

*Habit.*—Living on the lower surface of leaves.

*Test of female.*—Elongate, anterior half widest, tapering sharply near posterior end, often indented by growth against hairs on leaf, 0.9–1.25 mm. long, 0.4–0.5 wide; slightly convex dorsally, without or with a faint longitudinal median carina; flat ventrally; greenish, very pale yellow, or nearly colorless, transparent, very thin, finely punctate; marginal filaments whitish or colorless, slightly longer at anterior end of test than elsewhere; dorsal filaments whitish, in a submarginal row of 10–25, none to 10 in a median row, and occasionally 1–4 in lateral area, usually not more than 10 in submarginal and 8 in median row, about twice length of marginal filaments; larval exit irregular, in margin.

*Adult female.*—In shape similar to test, 0.7–1.2 mm. long and 0.3–0.4 wide.

Margin: 8-shaped pores, 7–8  $\mu$  long and 4 wide, in a single row terminating one-half length to nearly the length of an apical seta from setal bases, the intervals between pores ranging from the width of a pore to twice its length; 2–13 quinquelocular pores near point where each spiracular pore band reaches margin, the rows not meeting between anterior and posterior spiracular pore bands; disk pores dorsad of 8-shaped pores and much less numerous, terminating at or near the posterior pair of 8-shaped pores, irregularly spaced.

Dorsal surface: 8-shaped pores in a submarginal row of 10–28, none to 10 in a median row, and occasionally 1–4 in lateral area, 9–11  $\mu$  long and 6–7 wide; minute 8-shaped and disk pores fairly numerous; tubular ducts 26  $\mu$  long; dorsal tubes present.

Ventral surface: Antenna a circular disk having 2 setae slightly longer than its diameter; beak without setae; spiracular bar fairly slender, sometimes slightly expanded at inner end; 8–14 quinquelocular pores extending from spiracle to body margin in an irregularly single row; 1–3 dark-rimmed 8-shaped pores each side of beak, a few scattered on anterior end, a few arranged in a longitudinal row in lateral area, and others in 3 transverse rows of 2–4 pores each in genital area; submarginal 8-shaped pores in a single row terminating near posterior pair of marginal 8-shaped pores or slightly anterior to that point, one-half as numerous as marginal 8-shaped pores; 6 pairs of submarginal setae on abdomen, the posterior pair near the posterior or penultimate pair of marginal 8-shaped pores; 1 pair of setae posterior to genital opening, 1 pair anterior to opening, and 1 pair anterior to those.

Apex of abdomen: Notch present; lobes sometimes indicated; setae, apical 48–56  $\mu$  long, interapical 9–12  $\mu$  long, inner ventral 4–6  $\mu$  long, outer ventral 8  $\mu$  long; anal ring with 6 setae 28  $\mu$  long and with an inner row of 6 and an outer row of 14 pores, divided on dorsal and ventral sides.

*Second stage.*—Resembling adult but smaller and more slender, sides nearly parallel, tapering near posterior end; margin with 8-shaped pores closer together than in adult, without quinquelocular pores; dorsal surface with 1 8-shaped pore on median line at posterior end and occasionally with 1 at anterior end also; ventral surface with 1 or 2 quinquelocular pores between each spiracle and body margin; apex of abdomen as in adult, but all setae one-third or one-fourth shorter.

*Larva.*—Elliptical.

Margin: With 28 8-shaped pores, anterior pair slightly larger than the others, axes of all longitudinal, or axes of the posterior 4 or 5 pairs slightly diagonal; 3 pairs of setae at anterior end.

Dorsal surface: 8-shaped pores in a submedian row of 5–8 on each half of body, and a total of 12–16, anterior pore larger than the others and about one-fourth smaller than a marginal pore; disk pores in lateral area.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 1; VI, 2 long, 2 stout, 3 fairly stout, 1 slender; distance between antennal bases about one-half length of antenna; beak setae, 2 pairs apical, 1 pair median; anterior spiracle with 1 trilocular pore, posterior spiracle with 1 trilocular and 1 quinquelocular pore; leg setae, coxa 4, femur 1 on inner margin near base and 1 each on inner and outer margins near center, tarsus 2 on inner and 1 on outer margin; tibia five-sixths as long as tarsus; 9 pairs of submarginal 8-shaped pores; 6 pairs of submarginal minute setae on abdomen, 2 pairs of submarginal larger setae at anterior end; 1 pair of setae between antennae and mouth parts.

Apex of abdomen: Notch present; setae, apical 27–30  $\mu$  long, interapical 7.2  $\mu$  long, inner ventral 2.8–3.6  $\mu$  long, outer ventral 3.6  $\mu$  long; anal ring with 6 setae 12.6  $\mu$  long and with an inner row of 6 and an outer one of 10 pores, divided on dorsal side and tending toward division on ventral.

*Data*.—Redescribed from the following material: Unmounted material and 12 mounted females on bamboo, Royal Botanic Gardens, Peradeniya, Ceylon, R. S. Woglum collector, October 1910. Unmounted material, 7 mounted females, 3 mounted second-stage specimens, and 5 mounted larvae on *Bambusa* sp., Mauritius, De Charmoy collector, from E. E. Green, type material of *charmoyi*. Unmounted material, 15 mounted females, and 8 mounted larvae on *Bambusa* sp., Nisui, Taiwan (Formosa), R. Takahashi collector, April 19, 1929, same collection data as type material of *pseudomiliaris* var. *bambusifoliae*. A mass of unmounted material, 125 mounted females, and 20 mounted larvae on *Arundinaria glaucescens*, *Arundinaria* sp., *Bambusa arundinacea*, *B. balcooa*, *B. nana*, *B. pallescens*, *B. spinosa*, *B. tulda*, *B. tuldoidea*, *B. vulgaris*, *B. vulgaris* var. *aureo-variegata*, *Bambusa* sp., and *Dendrocalamus strictus*, the localities involved being Chicago, Ill. (in greenhouse); San Salvador, El Salvador; Cuba; Jamaica; Puerto Rico; Grenada; Tobago; Antigua; St. Kitts; Trinidad; British Guiana; near Caracas, Venezuela; States of Minas Geraes and Rio de Janeiro, Brazil; Alger, Algeria; Amani, Tanganyika; Assam and Calcutta, India; Peradeniya, Ceylon; Kwangtung, Kwangsi, and Fukien, China; and Japan.

Allied to *caudatum* and *miliaris*. The ventral simple pores mentioned and illustrated by Green (46, pp. 1036-1037) probably are the ventral submarginal 8-shaped pores rather than the marginal quinquelocular pores.

#### ASTEROLECANIUM PSYCHOTRIAE, new species

(Fig. 55, A-E; pl. 4, J)

*Habit*.—Living on the lower surface of leaves.

*Test of female*.—Slightly longer than wide, around 1.75 mm. long and 1.5 wide; flat or slightly convex dorsally; flat ventrally; pale greenish yellow, transparent, thin, punctate; marginal filaments pale greenish yellow to very pale salmon; dorsal filaments whitish, pale greenish yellow, or pale salmon, some longer and some shorter than marginal filaments, occurring along median line and in submedian and submarginal groups; elliptical larval exit in margin.

*Adult female*.—Longer than wide, around 1.3 mm. long, 0.9 wide.

Margin: 8-shaped pores in a single row terminating around twice a pore's length from bases of apical setae, posterior pores around  $12\ \mu$  long and 8 wide, others about  $14\ \mu$  long and 8 wide, less than a pore's width apart; quinquelocular pores in a single row terminating with 2 pores posterior to the posterior pair of 8-shaped pores, as numerous as corresponding 8-shaped pores toward posterior end of row, somewhat more numerous elsewhere.

Dorsal surface: 8-shaped pores arranged roughly in median, submedian, and submarginal groups, with submedian and submarginal groups sometimes merging; median group divided into 9 or 10 transverse groups, of which the posterior one has 1 or 2 pores, the penultimate one 3 (where 10 groups occur), and each of the others 5-9; 3 definite submarginal groups and 3-6 fairly definite submedian groups on each half of body, 3-11 pores in each of submarginal groups, and 1-7 in each of submedian; the total number of pores on dorsal surface ranging from 122-144 in the specimens examined; majority of median and some of submedian and submarginal pores  $14\ \mu$  long and 9 wide, a few median and the majority of submedian pores  $12\ \mu$  long and 8 wide, 1 or 2 outer pores of submarginal groups usually  $20\ \mu$  long and 12 wide; minute 8-shaped pores fairly numerous; disk pores rather sparse; tubular ducts  $24\ \mu$  long.

Ventral surface: Antenna conical, sunken in derm, with 1 (possibly 2) seta shorter than, and 2 about same length as, diameter of antenna; 3 or 4 quinquelocular pores between antenna and margin; beak with 2 pairs of setae; spiracular bar subcircular,  $24\ \mu$  wide; shallow furrows around spiracular opening containing 2 or 3 quinquelocular pores and 10-17 similar pores extending to body margin in a single or double row; legs represented by a single pair of small, rather in-



conspicuous claws in the position occupied by the posterior claws when 3 pairs are present; multilocular pores, with 9 or 10 loculi, in 5 or 6 complete and 3 or 4 interrupted rows, apparently with 9 rows in all, the anterior interrupted row anterior to posterior spiracles, posterior row with 4 or 5 pores, penultimate row with 6-13, each of next 4 with 13-22, and each of next 3 with 4-11, the total observed being 108-110; 1-4 dark-rimmed 8-shaped pores each side of beak, some scattered on anterior end, and others arranged in 4-7 transverse rows among multilocular pores; submarginal 8-shaped pores in a single row terminating near posterior row of multilocular pores, nearly as numerous as corresponding marginal 8-shaped pores; disk pores in a single submarginal row entad of submarginal 8-shaped pores, terminating nearly directly anterior to apical setae, about one-half as numerous as marginal 8-shaped pores; submarginal setae in a complete row terminating near the posterior pair of marginal 8-shaped pores; 4 setae in posterior row of multilocular pores, 2 or 3 in penultimate row, and 2 in each of next 2 rows.

Apex of abdomen: Notch present; lobes strongly developed; setae, apical  $100\ \mu$  long, interapical  $7.2\ \mu$  long, dorsal  $5.4\ \mu$  long, inner ventral  $4\ \mu$  long, intermediate ventral  $5.4\ \mu$  long, outer ventral  $10.8\ \mu$  long; anal ring with 2 setae  $32.4\ \mu$  long and 4 setae  $28.8\ \mu$  long, and with an inner row of 6 and an outer one of 18 or 19 pores, divided on dorsal and ventral sides; ventral surface of apex strongly sclerotized in a roughly linear area extending anteriorly from inner lobes, surrounding area very weakly sclerotized and wrinkled.

*Data*.—Described from unmounted material and three mounted females occurring on *Psychotria* sp., Urai, Taiwan (Formosa), R. Takahashi collector, December 27, 1931, holotype and paratypes.

Similar to *corallinum javae*, and *litseae*. It differs from *corallinum* in having some dorsal 8-shaped pores much larger than the marginal ones, in having only 1 pair of claws, in having 13 to 19 spiracular quinquelocular pores instead of 23 to 37, and in having 2 linear sclerotized areas instead of 1 rectangular sclerotized area on the ventral surface of the apex of the abdomen. From *jvae* and *litseae* it may be distinguished by having 1 pair of claws instead of none or 3, and from the latter it differs further in having a pair of dorsal setae and 3 pairs of ventral setae.

### ASTEROLECANIUM PUSILLUM, new species

(Fig. 55, F-N; pl. 7, O)

*Habit*.—Living on the lower surface of leaves.

*Test of female*.—Circular, 0.6-0.7 mm. in diameter; convex dorsally, with a low, fairly broad, longitudinal median carina not reaching margins, very low submarginal carinae, and a shallow furrow between carinae, also with faint transverse striations; flat ventrally; greenish or fairly clear pale yellow, transparent, thin, shiny; marginal filaments usually clear pale yellow, sometimes pinkish, not observed at posterior end; fragmentary dorsal filaments in a small transverse group on median line near anterior end and in 1-3 smaller groups in lateral area near posterior end; elliptical larval exit in dorsal surface fairly near margin.

*Adult female*.—Nearly circular, 0.6-0.7 mm. in diameter, posterior end produced.

Margin: 8-shaped pores in a single row terminating near produced part of abdomen, posterior pores 7-8  $\mu$  long and 5 wide, others 9  $\mu$  long and 6 wide, usually a pore's width apart; quinquelocular pores in a single row terminating near the twelfth posteriormost 8-shaped pore, usually half as numerous as corresponding 8-shaped pores toward posterior end, and about as numerous as the latter elsewhere.

Dorsal surface: 8-shaped pores in a transverse group of 13 anterior to mouth parts, and in 1-3 lateral groups, on each side of posterior half of body, consisting of 1-4 pores each, the individual pores measuring 9  $\mu$  long and 5 wide; minute 8-shaped and disk pores rather sparse; tubular ducts arranged roughly in 6 longitudinal rows, none on median line posterior to mouth parts or close to margin, 27  $\mu$  long; dorsal tubes present.

Ventral surface: Antenna circular, flattish, with 1 seta longer than diameter of antenna; beak without setae; spiracular bar fairly broad: 2-5 quinque-

locular pores in a group outside spiracular opening and 4 or 5 similar pores extending to body margin in a single row, 6-10 in group and row combined; slightly enlarged quinquelocular pores replacing multilocular pores on abdomen, arranged in 4 complete and 2 or 3 interrupted rows, each of complete rows with 4-7 pores and each of interrupted rows with 1-4, the total being 25-32; 1-4 dark-rimmed 8-shaped pores each side of beak, a very few scattered near spiracles, a few arranged in a rather indefinite longitudinal row in lateral area, and a few tending toward arrangement in 3 or 4 transverse rows in median area posterior to mouth parts; 2 disk pores between apical setae and quinquelocular pores and 1 at each end of posterior and penultimate rows of quinquelocular pores; submarginal 8-shaped pores in a single row terminating near the posterior pair of marginal 8-shaped pores, as numerous as marginal 8-shaped pores; 4 pairs of submarginal setae on abdomen, the posterior pair at end of the posterior row of quinquelocular pores and 1 pair of setae in each of the posterior 3 rows of quinquelocular pores.

Apex of abdomen: Setae, apical  $3.4 \mu$  long; anal opening apical; anal tube heavily sclerotized on outer half, largest in center, slightly larger at ring than at opening; anal ring with 6 setae, each  $5.4 \mu$  long; ventral surface of apex sometimes finely wrinkled.

*Larva*.—Somewhat ovoid, posterior end almost pointed.

Margin: With 28 8-shaped pores, axes of all longitudinal; 3 pairs of setae at anterior end.

Dorsal surface: 8-shaped pores in a submedian row of 10 and a lateral row of 6, on each half of body, posterior pore of submedian row smallest, the next 4 gradually increasing in size but all 5 slightly smaller than the rest, the posterior 2 submedian pores practically same size as marginal pores, the others slightly larger, the posterior 5 pores of lateral row around two-thirds as large as the anterior pore, which is the same size as the anterior pore of submedian row; disk pores between lateral and marginal, and between lateral and submedian, 8-shaped pores.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 1; VI, 2 long, 2 stout, 3 fairly stout, 1 slender; antennal bases one-half length of antenna apart; beak setae, 2 pairs apical, 1 pair median; each spiracle with 2 trilocular pores; leg setae, coxa 4, femur 1 on inner margin near base and 1 on inner margin near center, tarsus 1 each on inner and outer margins; tibia one-half as long as tarsus; 9 pairs of submarginal 8-shaped pores; apparently 6 pairs of submarginal minute setae on abdomen, 1 pair of submarginal larger setae at anterior end; 1 pair of setae between antennae and mouth parts.

Apex of abdomen: Notch very small; setae, apical  $28 \mu$  long, interapical  $3.6 \mu$  long, outer ventral  $2.5 \mu$  long; anal opening apical, anal tube uniformly sclerotized throughout, rather short, largest at center; anal ring with 6 setae  $2 \mu$  long.

*Test of male*.—Nearly elliptical, posterior end slightly pointed, a notch at tip; 0.85 mm. long, 0.5 wide; slightly convex dorsally, sloping to posterior end, with a broad longitudinal median carina and faint transverse striations; flat ventrally; yellow, transparent, thin, shiny; marginal filaments yellowish or pale orange, apparently slightly shorter at posterior end than elsewhere; dorsal filaments yellowish or orange, brighter than marginal and slightly longer, apparently in 10 transverse groups along longitudinal median line.

*Adult male*.—Only available specimen enclosed in nymphal stage and most characters indeterminable; 1 mm. long; antenna apparently 10-segmented; setae present on abdomen and penis sheath but number and position indeterminable.

*Male nymph*.—Characters indeterminable beyond those listed for adult male, except for the presence of 1 short seta and 2 minute setae in lobe areas of abdomen.

*Third-stage male*.—Nearly elliptical, posterior end narrowed; margin with 8-shaped pores terminating a pore's length from bases of apical setae, posterior pores slightly smaller than the rest, quinquelocular pores present from a point near antennae to the posterior pair of 8-shaped pores, usually 1 opposite each 8-shaped pore; dorsal surface with 8-shaped pores in 10 transverse groups along median line, posterior group with 2 pores, penultimate with 8, each of next 3 with 9, next with 10, next with 11, next with 13, next with 12, and anterior with 15, the pores variable in size, but all larger than marginal; ventral surface with 2 pairs of setae on beak, 1-3 pores in each spiracular row, legs represented by 3 pairs of circular, slightly sclerotized, raised areas each with a small, straight, sharp claw, 1 pair of setae observed in median abdominal area; apex of abdomen with apical setae  $4.4 \mu$  long, outer ventral setae  $2 \mu$  long, anal opening much larger than in adult female, anal tube, sclerotized in a



narrow band at opening, not distinctly enlarged in middle as in female, very slightly smaller at ring than at opening, nearly cylindrical, anal ring with 6 setae  $20\ \mu$  long and with an indeterminate number of pores, apparently not divided, ventral surface of apex apparently not rugose.

*Data*.—Described from unmounted specimens (paratypes) and the following mounted specimens from Hainan Island, Kwangtung, China: Four females, five larvae, one adult male, one male nymph, and one third-stage male from *Bambusa* sp., Kachek, A. S. Hitchcock, October 13, 1921, U. S. N. H., holotype and paratypes; one female from *Schizostachyum* sp., Hau Laan, F. A. McClure, 1929, paratype; one female from *Schizostachyum* sp., Faan Maan Ts'uen, Ling Shui district, F. A. McClure, May 8, 1932, paratype.

*Asterolecanium pusillum* is unusual in having one pair of setae on the apex of the abdomen in the adult female, two pairs in the third-stage male, and three pairs in the larva. It is more closely allied to *æviqum*, *rubrocomatum*, and *udagamæ* than to other known species.

### ASTEROLECANIUM PUSTULANS (Cockerell)

(Fig. 56, A-E; pl. 4, F)

Described by Cockerell in 1892 (15, pp. 142-143) as *Asterodiaspis pustulans* and redescribed by him in 1893 (17, pp. 77-78) as *Planchonia pustulans*.

*Asterolecanium pustulans sambuci*, described by Cockerell in 1903 (26, p. 112), from material on *Sambucus* sp. from Cairo, Egypt, is here synonymized with *pustulans*. No varietal differences have been found between the two, the characters considered by Cockerell (26, p. 112) and Hall (50, pp. 4-5) fitting typical *pustulans* as well as specimens named *pustulans sambuci*. *A. pustulans seychellarum* also is here placed as a synonym of *pustulans*. Green described this variety on *Hevea brasiliensis* from the Seychelle Islands in 1910 (43, pp. 3-5) and stated, "The variety under consideration differs from the type merely in superficial characters of the secretory covering." In the writer's opinion neither the tests nor the morphological structures of type specimens of *pustulans seychellarum* exhibit differences, as compared with typical specimens of *pustulans*, that justify varietal distinction.

*Habit*.—Living on bark, leaves, and fruit, on smooth surfaces or in shallow or deep pits.

*Test of female*.—Practically circular to ovoid, posterior end sometimes slightly produced; 1-1.85 mm. in diameter, or 1.25-2 mm. long and 1-1.65 wide; nearly flat to fairly convex dorsally, usually with a faint longitudinal median carina and faint transverse striations; flat to convex ventrally; brownish or greenish yellow, transparent, punctate; marginal and dorsal filaments whitish to pinkish, some dorsal filaments longer and others shorter than marginal ones; elliptical larval exit in margin.

*Adult female*.—Nearly circular or ovoid, posterior end slightly produced; 0.9-1.6 mm. in diameter, or 1-1.75 mm. long, and 0.9-1.5 wide.

Margin: 8-shaped pores in a single row terminating one-third to two-thirds length of an apical seta from bases of setae, often somewhat crowded near anterior end and some pores out of alignment, posterior pores 11-12  $\mu$  long and 7 wide, others 12  $\mu$  long and 8 wide, usually about a pore's width apart; quinquelocular pores in a single row terminating near the posterior or penultimate pair of 8-shaped pores, or with 1 pore beyond the end of the row of those pores, 1 quinquelocular to each 8-shaped pore near posterior end of row and often nearly to posterior spiracular pore bands, elsewhere usually 1 quinquelocular to each 8-shaped pore and 1 opposite each interval; disk pores ventrad of quinquelocular pores, termi-



nating at the posterior or penultimate pair of 8-shaped pores, usually about as numerous as 8-shaped pores.

Dorsal surface: 8-shaped pores scattered, usually without apparent arrangement, but sometimes with a tendency toward arrangement in transverse rows, often most numerous in median area, and with a narrow submedian area at posterior end with few or no pores, pores varying considerably in number, sometimes crowded and sometimes only fairly numerous, 12-16  $\mu$  long and 8-12 wide, the majority near the upper limits of those measurements; minute 8-shaped and disk pores numerous; tubular ducts 34  $\mu$  long.

Ventral surface: Antenna rounded, with 2 setae slightly longer than diameter of antenna; beak with 2 pairs of setae; spiracle with bar fairly broad to very broad, with wrinkles in derm extending from bar around opening and with 3-6 quinquelocular pores in wrinkles, 10-20 (usually 10-15) similar pores extending from spiracle to body margin in an irregularly single row, a total of 13-23 in group and row combined; multilocular pores, with 9-11 loculi, in 6 or 7 complete and 3 or 4 interrupted rows, but with 10 rows in all, the anterior interrupted row anterior to the posterior spiracles, the posterior row with 11-23 pores, penultimate row with 14-20, each of next 3 rows with 17-37, next with 11-18, next with 7-13, and each of anterior 3 rows with 2-10, the total 132-177; 2 or 3 dark-rimmed 8-shaped pores each side of beak, some scattered on anterior end, and others arranged in 5 or 6 transverse rows posterior to mouth parts; submarginal 8-shaped pores in an irregularly double row terminating near posterior row of multilocular pores, usually about as numerous as corresponding marginal 8-shaped pores; 3-6 disk pores in an irregular row caudad of each end of posterior row of multilocular pores, 1-3 near each end of the next 2, or rarely 3, rows of multilocular pores; submarginal setae in a complete row terminating near the posterior pair of marginal 8-shaped pores; 4-7 setae in the posterior row of multilocular pores and 2 in the penultimate row.

Apex of abdomen: Notch present; lobes indicated; setae, apical 75-80  $\mu$  long, interapical 10.8-12.6  $\mu$  long, dorsal 7.2-10  $\mu$  long, inner ventral 5.4  $\mu$  long, intermediate ventral 5.4  $\mu$  long, outer ventral 7  $\mu$  long; anal ring with 6 setae 36-40  $\mu$  long and with an inner row of 6 and an outer row of 14 pores, divided on dorsal and ventral sides; ventral surface heavily sclerotized in a roughly rectangular area extending from margin of inner lobes anteriorly to anal ring, sclerotized area more heavily sclerotized in dentate rows, surrounding derm usually wrinkled.

*Second stage.*—Resembling adult female but smaller; margin with quinquelocular and disk pores not more numerous than corresponding 8-shaped pores; dorsal surface with 8-shaped pores much less numerous than in adult, arranged roughly in 8 longitudinal rows; ventral surface with 3 or 4 quinquelocular pores in each spiracular row, 2 pairs of setae in median abdominal area; apex of abdomen as in adult, but all setae around one-fifth shorter.

*Larva.*—Elongate elliptical.

Margin: With 28 8-shaped pores, the anterior pair slightly larger than the rest, axes of the posterior 6 pairs transverse, of the others longitudinal; 3 pairs of setae at anterior end.

Dorsal surface: 8-shaped pores in a submedian row of 7-10 (usually 8) and a lateral row of 9, on each half of body, lateral pores practically same size as marginal pores, submedian pores slightly smaller than lateral; disk pores between lateral and marginal, and between submedian and lateral, 8-shaped pores.

Ventral surface: Antennal setae, I, 2; IV, 0; V, 1; VI, 2 long, 2 stout, 2 fairly stout, 1 slender; distance between antennal bases equal to about one-half length of antenna; beak setae, 2 pairs apical, 1 pair basal; spiracle usually with 1 trilocular and 1 quinquelocular pore, rarely with a quinquelocular and a small multilocular pore; leg setae, anterior and middle coxae each 4, posterior coxa 3, femur 1 on inner margin near base and 1 each on inner and outer margins near center, tarsus 2 on inner and 1 on outer margin; tibia one-half as long as tarsus; 10 pairs of submarginal 8-shaped pores: 8-10 submarginal disk pores, on abdomen and thorax, often very close to submarginal 8-shaped pores; 7 pairs of submarginal minute setae, on abdomen and thorax, 2 pairs of submarginal larger setae at anterior end; 3 pairs of setae between antennae and mouth parts.

Apex of abdomen: Notch present; lobes sometimes indicated; setae, apical 68  $\mu$  long, interapical 7.2  $\mu$  long, dorsal 2.5  $\mu$  long, inner ventral 3.6  $\mu$  long, intermediate ventral 3.6  $\mu$  long, outer ventral 5.4  $\mu$  long; anal ring with 6 setae 22  $\mu$  long, with an inner row of 6 and an outer row of 12 pores, divided on dorsal and ventral sides; ventral surface of apex slightly sclerotized close to margin.

*Data.*—Redescribed from the following material: Unmounted specimens, 5 mounted females, and 20 mounted larvae on oleander, Kingston, Jamaica. Cockerell Collection, cotypes. Unmounted material, 1 mounted female, and 1 mounted larva on oleander, Kingston, Jamaica, Rouse collector, cotypes. Unmounted material, 2 mounted females, and 2 mounted larvae on *Sambucus* sp., Cairo, Egypt, Cockerell Collection, cotypes of *pustulans sambuci*. Unmounted material, 6 mounted females, and 28 mounted larvae on *Hevea brasiliensis*, Seychelle Islands, R. Dupont, received from E. E. Green, August 14, 1911, type of *pustulans seychellarum*. Unmounted material from more than 100 lots, approximately 300 mounted females, several mounted second-stage specimens, and approximately 100 mounted larvae, from the following hosts and localities: *Acacia* spp. from Florida, Panama, Egypt; *Achras sapota* from Florida, Puerto Rico, Haiti, Jamaica; *Agave* sp. from Puerto Rico; *Annona* spp. from Florida, Cuba, Puerto Rico, Jamaica, Virgin Islands; *Baryxylum africanum* from Florida; *Bauhinia* sp. from Florida, Canal Zone; *Bignonia speciosa*, locality unknown; *Blighia sapida* from Florida, Canal Zone, Trinidad, Jamaica, Barbados; *Boehmeria nivea* and *Bougainvillea* sp. from Seychelle Islands; *Bryophyllum* sp. from Jamaica; *Cajanus* sp. from Montserrat, West Indies; *Calocarpum mammosum* from Puerto Rico; *Casimiroa tetrameria* from Florida; *Cassia* sp. from Florida, Puerto Rico; *Castilleja* spp. from Florida, Puerto Rico, and Nicaragua; *Casuarina equisetifolia* from Puerto Rico; *Cecropia* sp. from Florida; *Ceiba pentandra* from Puerto Rico; *Chrysophyllum caissita* from Trinidad; *Croton* sp. from Bahia, Brazil; *Cupania edulis* from Jamaica; *Cydonia* sp. from Brazil; *Euphorbia* sp. from Florida; *Ficus* spp. from Florida, Louisiana, Mexico (Lower California and other localities), Cuba, Puerto Rico, Dominican Republic, Grenada, St. Croix (Virgin Islands), and Palestine; *Flacourtia ramontchi* from Trinidad, British West Indies, and Guam (Marianne Islands); *Gossypium* sp. from Peru; *Grevillea robusta* from Florida, Isle of Pines, Cuba, Montserrat, Grenada, Puerto Rico, Hawaii, and Portuguese East Africa; *Hevea* sp. from Brazil; *Hibiscus* sp. from Florida and the Canal Zone; *Jacaranda* sp., locality unknown; *Jasminum* sp. from Puerto Rico and Egypt; *Lantana* sp. from Hawaii; *Leucaena glauca* from Grenada; *Magnolia* sp. from Mexico; *Malachra* sp. from Puerto Rico; *Mangifera* sp. from Florida, Honduras, Cuba, Puerto Rico, Guadeloupe, Jamaica, St. Thomas, and Hawaii; *Manihot* sp. from Antigua; *Melocactus* sp. from Cuba; *Momordica balsamina* from Jamaica; *Montezuma speciosissima* from Puerto Rico; *Morus* sp. from Florida; *Nerium* spp. from Florida, Puerto Rico, Costa Rica, Isle of Pines, Cuba, St. Croix, Mexico, Canal Zone, Peru, Brazil, Hawaii, Taiwan (Formosa), and Portuguese East Africa; Orchidaceae from Dominican Republic; *Passiflora* sp. from Florida; *Persea* sp. from Hawaii; *Plumeria* sp. from Mexico; *Poinciana* sp. from Puerto Rico; *Prosopis* sp. from Hawaii; *Prunus* (*Amygdalus*) sp. from Florida, Puerto Rico, and Brazil; *Psidium guajava* from Mexico and Puerto Rico; *Psychotria* sp. from Barbados; *Pyrus* (*Malus*) *malus* from Portuguese East Africa; *Rapanea guianensis* from Puerto Rico; *Russelia juncea* from Cuba; *Sapium* sp. from Hawaii; *Sedum* sp. from Puerto Rico; *Sida antillensis* from Puerto Rico; *Tamarinda* sp. from Puerto Rico and Montserrat; *Taonabo stahlii* from Puerto Rico; *Tephrosia toxicaria* from Dominican Republic; *Vachellia jarnesiana* from Lower California; *Vanda teres* from Jamaica; *Xanthophyllum*



sp. from Canal Zone; *Zizyphus* spp. from Florida and Brazil; unknown hosts from Florida, Cuba, Puerto Rico, St. Thomas, Mexico, Canal Zone, Honduras, Trinidad, Egypt, Palestine, Madagascar, and Hawaii.

*Asterolecanium pustulans* is an interesting species in several respects, but particularly in its tendency to produce pits. This habit, however, apparently is governed primarily by the susceptibility of the host to pit formation because some infested hosts do not show any depressions, while others show gradations from shallow pits to deep cavities. When deep pits are formed there is a tendency for the host tissue to draw together at the opening, thus concealing the insect. In the mounted insects all structures are amazingly constant except the number of dorsal 8-shaped pores. The larva of *pustulans* is the only one known to the writer in which there are different numbers of long setae on the coxae, there being four on the anterior and middle ones but only three on the posterior coxa.

### ASTEROLECANIUM PUTEANUM, new species

(Fig. 56, F-K; pl. 8, H)

Referred to by Felt and Bromley in 1937 (31, p. 20) as *Asterolecanium* sp.

*Habit*.—Living on bark, in shallow or deep pits.

*Test of female*.—Usually ovoid, sometimes nearly circular, 1.2–2 mm. long and 1–1.8 wide, or 1.2–2 mm. in diameter; slightly convex dorsally, with a rather broad, flat, longitudinal median carina, and without or with inconspicuous submarginal carinae; slightly or strongly convex ventrally; greenish yellow, transparent, thin; marginal filaments pale yellowish, sometimes slightly golden; dorsal filaments pale yellowish, usually scattered over entire surface, but sometimes numerous in median and submarginal areas and absent in submedian area near posterior end, about the same length as marginal filaments; elliptical larval exit in ventral margin.

*Adult female*.—Usually ovoid, sometimes nearly circular, posterior end slightly produced; 1–1.75 mm. long and 0.9–1.6 wide, or 1–1.75 mm. in diameter.

Margin: 8-shaped pores in a single row terminating around one-half length of an apical seta from setal bases, posterior pores 10  $\mu$  long and 6 wide, the others 12  $\mu$  long and 8 wide, usually around a pore's width apart, axes of some pores diagonal to body margin; quinquelocular pores in a single row terminating with 1 beyond the end of the row of 8-shaped pores, slightly more numerous than 8-shaped pores.

Dorsal surface: 8-shaped pores scattered over entire surface or present only in median and submarginal areas, submarginal pores in fairly definite transverse groups not reaching median group except near mouth parts, slightly more numerous along median line than elsewhere, 10–12  $\mu$  long and 6–8 wide; minute 8-shaped pores fairly numerous; disk pores rather sparse; tubular ducts 30  $\mu$  long.

Ventral surface: Antenna very short, sunken in derm, with 2 setae shorter and 2 slightly longer than diameter of antenna; 1–4 quinquelocular pores between antenna and margin; beak with 2 pairs of setae; spiracular bar subcircular; 10–20 quinquelocular pores extending from spiracle to body margin in an irregularly single or double row; multilocular pores, with 10–12 loculi, in 6 complete and 3 interrupted rows, the anterior interrupted row anterior to posterior spiracles, posterior row with 6–9 pores, penultimate row with 11–15, each of next 3 with 14–23, next with 11–13, and each of interrupted rows with 2–5, the total ranging from 90–115; 1–3 dark-rimmed 8-shaped pores each side of mouth parts, a few scattered on anterior half of body, and a few arranged in 3 or 4 transverse rows among multilocular pores; submarginal 8-shaped pores in an irregularly single row terminating near the penultimate row of multilocular pores, usually about half as numerous as corresponding marginal 8-shaped pores; submarginal setae in a complete row terminating near the penultimate or posterior pair of marginal 8-shaped pores; 2 pairs of setae in posterior row of multilocular pores, 1 pair in penultimate row, and sometimes 1 seta in the next row.

Apex of abdomen: Notch present; lobes indicated; setae, apical 72–80  $\mu$  long, interapical 14.4–18  $\mu$  long, dorsal 9  $\mu$  long, intermediate ventral 7.2  $\mu$  long, outer



ventral 9-12.6  $\mu$  long; anal ring with 6 setae 28-36  $\mu$  long and with an inner row of 6 and an outer row of 14 pores, divided on dorsal and ventral sides; ventral surface of apex slightly sclerotized in dentate rows.

*Second stage*.—Resembling adult female, but smaller; margin with quinquelocular pores less numerous than in adult; dorsal surface with 8-shaped pores much less numerous than in adult, arranged in a median, and a sparse submedian, row; ventral surface with 2-4 quinquelocular pores in each spiracular row, dark-rimmed 8-shaped pores very sparse, 2 pairs of setae in median abdominal area; apex of abdomen as in adult but all setae about one-fourth shorter.

*Larva*.—Ovoid.

Margin: With 28 8-shaped pores, the posterior pair smallest, next 6 or 7 pairs gradually increasing in size, and slightly smaller than the anterior 4 or 5 pairs, axes of the posterior 6 pairs transverse, of the others longitudinal; 3 pairs of setae at anterior end.

Dorsal surface: 8-shaped pores in a submedian row of 9 and a lateral row of 10 or 11, on each half of body, 2 or 3 pores of lateral row outside a straight line and suggestive of a submarginal row, posterior pores of each row the smallest, the rest gradually larger toward anterior end of row, the anterior 3 pores of each row practically uniform in size, all pores about one-fifth to one-third smaller than marginal pores of same segments; disk pores between submedian and lateral, and between lateral and marginal, 8-shaped pores.

Ventral surface: Antennal setae, I, 2; IV, 1; V, 0; VI, 2 long, 2 stout, 3 fairly stout, 2 slender; antennal bases about one-third length of antenna apart; beak setae, 2 pairs apical, 1 pair basal; spiracle with 1 trilocular and 1 quinquelocular pore; leg setae, coxa 4, femur 1 on inner margin near base and 1 each on inner and outer margins near center, tarsus 2 on inner and 1 on outer margin; tibia one-third as long as tarsus; 9 pairs of submarginal 8-shaped pores; 9 pairs of submarginal minute setae, on abdomen and thorax, 2 pairs of submarginal larger setae at anterior end; 2 pairs of setae between antennae and mouth parts.

Apex of abdomen: Notch present; lobes indicated; setae, apical 50  $\mu$  long, interapical 11  $\mu$  long, dorsal 3.6  $\mu$  long, intermediate and outer ventral 5.4  $\mu$  long; anal ring with 6 setae 20  $\mu$  long and with an inner row of 6 and an outer row of 12 pores, divided on dorsal and ventral sides; ventral surface of apex slightly sclerotized in dentate rows.

*Test of male*.—Nearly elliptical, 1.2 mm. long, 0.75 wide; slightly convex dorsally, with a rather broad, flat, longitudinal median carina, and sometimes with a faint lateral carina; flat ventrally; greenish yellow; marginal filaments very pale golden yellow; dorsal filaments same color as test, most numerous in median and lateral areas, shorter than marginal filaments.

*Adult male*.—1 mm. long.

Head: Antenna broken, only 2 segments remaining; basal bars diagonal; 12 setae between ventral eyespots and antennae; 2 setae on dorsal surface.

Thorax: Bar between wing bases nearly rectangular, three and one-half times as long as wide; tibia about as long as tarsus.

Abdomen: Five segments each with a pair of setae dorsally on lateral margin; 2 segments each with a pair of setae in ventral submedian area; lobes indicated, each with 1 long and 3 short setae; penis sheath with 2 setae dorsally near base, and 9 or 10 on each side of ventral opening.

*Male nymph*.—Distinguishing characters similar to those of adult male.

*Third-stage male*.—Resembling second stage, but nearly elliptical; dorsal surface with 8-shaped pores more numerous than in second stage, arranged in a median and a submarginal row and in a large group at anterior end; ventral surface with legs represented by 3 pairs of sclerotized areas, each with a straight, elongate claw; apex of abdomen as in second stage, but slightly sclerotized on ventral surface and with a short, irregular, sclerotized area anterior to each interapical seta.

*Data*.—Described from unmounted specimens (paratypes) and the following mounted material: Five females on *Bumelia parviflora*, Ft. George, Fla., May 10, 1880, paratypes; five females on *Ilex vomitoria*, Brunswick, Ga., J. C. Bradley, February 16, 1911, holotype and paratypes; two females on *Ilex vomitoria*, Fairhope, Ala., M. K. Chapin, from G. F. Mitchell, June 11, 1925, paratypes; seven females on *Ilex*

sp., Cambridge, Md., J. A. Jordan, February 25, 1927, paratypes; six females on *Ilex* sp., Norfolk, Va., F. W. Poos, March 19 and April 28, 1927, paratypes; five females on *Ilex* sp., Fayetteville, N. C., C. S. Brimley, from R. W. Leiby, August 6, 1932, paratypes; three females, three second-stage specimens, four larvae, one adult male, one male nymph, and one third-stage male on *Ilex* sp., Wilmington, Del., from E. P. Felt, March 12, 1936, paratypes.

Most closely related to *agavis*.

### ASTEROLECANIUM QUADRISSETOSUM, new species

(Fig. 57, A-E; pl. 5, M)

*Habit.*—Living on smooth bark, or in cracks and crevices, margin of test not closely appressed to bark.

*Test of female.*—Longer than wide, 1.25–1.75 mm. long, 0.75–1.25 wide; convex dorsally, occasionally with a faint longitudinal median carina, usually with a low lateral carina, usually with faint transverse striations which give the lateral carinae the appearance of having minute tubercles on them; slightly convex ventrally; brownish or clear yellow, transparent, rather thick; marginal filaments light brownish or whitish, very short; circular larval exit ventral, close to margin.

*Adult female.*—Longer than wide, 1–1.5 mm. long and 0.65 to 1 wide, posterior end sometimes slightly produced.

Margin: 8-shaped pores mostly in a double row but the posterior 4–7 pores in a single row, terminating length of an apical seta from setal bases, the posterior pores 9–10  $\mu$  long and 6 wide, the other 11–12  $\mu$  long and 7 wide, intervals between the pores within a row one to three times a pore's length, distance between the 2 rows equal to at least a pore's length; quinquelocular pores in a single row terminating with the 8-shaped pores, one and one-half times as numerous as 8-shaped pores of nearer row; disk pores occurring along 8-shaped pores of dorsal row, and about one-third as numerous as those, terminating near the posterior or penultimate pair of 8-shaped pores, irregularly spaced; disk pores also among quinquelocular pores and terminating at, or posterior to, the posterior quinquelocular pores, irregularly spaced and less numerous than the quinquelocular pores.

Dorsal surface: Minute 8-shaped pores numerous; 3 or 4 disk pores near posterior end; tubular ducts 36  $\mu$  long.

Ventral surface: Antenna blunt, with 2 setae slightly longer than diameter of antenna; beak with 3 pairs of setae; spiracle with bar expanded at inner end, and with a sclerotized area extending around opening, atrium slightly enlarged and containing 4–8 quinquelocular pores, 4–8 similar pores extending from spiracle to body margin in a single row; multilocular pores having 10 loculi, arranged in 6 or 7 complete and 1 or 2 interrupted rows, posterior and penultimate rows each with 9–12 pores, each of next 3 rows with 11–17, next with 8–14, and the anterior 2 rows each with 3–7, the total number 75–94; dark-rimmed 8-shaped pores scattered loosely each side of beak and arranged in 5–7 transverse rows posterior to beak; submarginal 8-shaped pores in a single row terminating near the fourth posteriormost pair of marginal 8-shaped pores, as numerous as corresponding 8-shaped pores of nearer row; submarginal setae in a complete row terminating near the posterior pair of marginal 8-shaped pores; 2 pairs of setae in the posterior row of multilocular pores and 1 pair in each of next 3 rows.

Apex of abdomen: Notch present or absent; lobes sometimes indicated; setae, apical 40  $\mu$  long, interapical 12  $\mu$  long, intermediate and outer ventral 4–6  $\mu$  long; anal opening apical; anal tube sclerotized in a narrow transverse band on dorsal side and in a wider area on ventral side, inner end membranous and smaller than outer; anal ring with 4 setae 12  $\mu$  long and apparently with 6 pores, divided on ventral side; ventral surface of apex sclerotized, wrinkled.

*Second stage.*—Resembling adult in shape, but smaller; margin with 8-shaped pores in a single row terminating one-half length of an apical seta from setal bases, quinquelocular pores in a row terminating before that of the 8-shaped pores, and present or absent at anterior end, as numerous as corresponding 8-shaped pores; ventral surface with atrium of spiracle slightly enlarged and containing 1 quinquelocular pore, a faintly sclerotized area around opening, 1 quinquelocular pore between opening and body margin; apex of abdomen as in adult but all setae about one-fourth shorter.



*Larva*.—Elliptical.

Margin: With 28 8-shaped pores, the anterior pores slightly larger than the posterior ones, axes of at least the posterior 6 pairs transverse, axes of the others either transverse, diagonal, or longitudinal; 2 pairs of setae at anterior end.

Dorsal surface: 8-shaped pores in a submedian row of 8 or 9 and a lateral row of 10 or 11, on each half of body, the anterior pores of each row slightly larger than the posterior ones, and all slightly smaller than marginal pores; disk pores between submedian and lateral and between lateral and marginal 8-shaped pores.

Ventral surface: Antennal setae, I, 2; IV, 1; V, 1; VI, 2 long, 3 stout, 2 fairly stout, 2 slender; antennal bases one-third length of antenna apart; beak setae, 2 pairs apical, 1 pair basal; anterior spiracle with 1 quinquelocular pore, posterior spiracle with 2; leg setae, coxa 3, femur 1 on inner margin near base and 1 on outer margin near center, tarsus 1 each on inner and outer margins; tibia one-third as long as tarsus; 9 pairs of submarginal 8-shaped pores; apparently 10 pairs of submarginal minute setae, on abdomen, thorax, and head; 1 pair of setae between antennae and mouth parts.

Apex of abdomen: Notch present; setae, apical  $54 \mu$  long, interapical  $10.8 \mu$  long, intermediate ventral (fairly near median line)  $2.5-3.6 \mu$  long, outer ventral  $3.6 \mu$  long; anal opening apical; anal tube sclerotized on outer half and membranous on inner half; anal ring with 4 setae  $5-8 \mu$  long and apparently with 1 or 2 pores.

*Data*.—Described from unmounted specimens (paratypes) and the following mounted material collected by G. Compere in Coolgardie, West Australia: Four females, 3 second-stage specimens, and 1 larva, Compere No. 85, holotype and paratypes; 7 females and 65 larvae on *Melaleuca* sp., Compere No. 1005, paratypes.

This species resembles *ventuosum* as closely as any other known form.

#### ASTEROLECANIUM QUAESITUM, new species

(Fig. 57, F-K; fig. 58, A-E; pl. 4, I)

*Habit*.—Living on bark.

*Test of female*.—Broadly ovoid, posterior end slightly produced; 2.5-3 mm. long and 2-2.5 wide; strongly convex dorsally, nearly flat or slightly convex ventrally; dull greenish yellow, translucent, smooth, shiny; fragmentary marginal filaments apparently pale yellow or whitish, dorsal filaments rubbed off; elliptical larval exit in margin.

*Adult female*.—Nearly circular or slightly ovoid, 2 mm. in diameter.

Margin: 8-shaped pores mostly in an irregularly double row but posterior 10-20 pores, and a few others, in a single row terminating slightly more than length of an apical seta from bases of setae, posterior pores  $9-10 \mu$  long and 6 wide, the others  $12 \mu$  long and 8 wide, the pores one to three times (usually slightly more than once) a pore's length apart, distance between the 2 rows equal to at least a pore's length; quinquelocular pores in a single row from near antenna to a point 5-20 pores from end of row of 8-shaped pores, usually one and one-half times as numerous as corresponding 8-shaped pores of nearer row; disk pores among quinquelocular pores and in a similar position close to 8-shaped pores at anterior end where quinquelocular pores are missing, terminating near posterior quinquelocular pores, not quite so numerous as corresponding 8-shaped pores of nearer row.

Dorsal surface: 8-shaped pores numerous,  $8-9 \mu$  long and 5 wide; minute 8-shaped pores not observed; disk pores fairly sparse; tubular ducts  $36 \mu$  long.

Ventral surface: Antenna thimble-shaped, sunken in derm, with 4 setae nearly as long as, and 2 longer than, diameter of antenna; 4 or 5 quinquelocular pores sometimes present between antenna and margin; beak with 2 pairs of setae; spiracular bar broad, sometimes slightly expanded at inner end; derm around opening or on 1 side of spiracle sunken and filled with quinquelocular pores, a total of 45-55 such pores in that group and in a double to quadruple row extending to margin; multilocular pores in 7 complete rows and 1 interrupted row, the posterior row with 10-12 pores, penultimate row with 21-25, each of next 2 with 23-35, next with 19-24, next with 15, next with 9-10, and interrupted row with 1 or 2, or a total of 132-153 pores, having 5-15 (usually 10) loculi; 5-10 dark-rimmed 8-shaped pores each side of beak, some scattered anterior to



and laterad of mouth parts, and others arranged in 7 or 8 transverse rows posterior to mouth parts; submarginal 8-shaped pores much larger in comparison to the marginal than in other species, 7 or 8  $\mu$  long and 5 wide, arranged in a double row terminating near the first row of multilocular pores anterior to the penultimate row, nearly as numerous as corresponding marginal 8-shaped pores; submarginal setae in a complete row terminating slightly nearer to bases of apical setae than to the posterior pair of marginal 8-shaped pores; 2 setae each in the posterior and penultimate rows of multilocular pores and sometimes 1 in the first row anterior to penultimate.

Apex of abdomen: Notch present; setae, apical 45  $\mu$  long, interapical 9–10.8  $\mu$  long, dorsal (absent from 1 side of 1 specimen examined) 7.2–10.8  $\mu$  long, inner ventral 5.4  $\mu$  long, intermediate ventral 7.2–9  $\mu$  long, outer ventral 10.8–14.4  $\mu$  long, either inner or intermediate ventral seta usually lacking on 1 side of body; anal ring with 6 setae about 54  $\mu$  long, with an inner row of 6 and an outer one of 26 pores, divided on dorsal and ventral sides; ventral surface of apex rugose or reticulate.

*Second stage.*—Resembling adult female but smaller, longer than wide; margin with 8-shaped pores in a single row though somewhat irregular and tending to be double at some points; dorsal surface with 8-shaped pores less numerous than in adult; ventral surface with bar of spiracle narrower than in adult and with 3 or 4 quinquelocular pores between spiracular opening and body margin, submarginal 8-shaped pores much smaller in comparison with marginal pores than in adult and arranged in a single row; apex of abdomen as in adult but all setae approximately one-fifth shorter.

*Larva.*—Elongate ovoid.

Margin: With 28 8-shaped pores, axis of the posterior pair transverse, axes of the next 3 or 4 pairs diagonal or longitudinal, and of the others longitudinal; apparently 2 pairs of setae at anterior end.

Dorsal surface: 8-shaped pores in a submedian row of apparently 5–10 and a lateral row of 10–12, on each half of body, or a total of 34–43, 1 or 2 pores of lateral row inside a straight line through the remaining pores and suggestive of an intermediate row, anterior pores of each row slightly larger than posterior ones, lateral pores slightly larger than submedian, anterior pores of lateral row nearly as large as marginal pores, the posterior ones apparently larger; disk pores between submedian and lateral, and between lateral and marginal, 8-shaped pores.

Ventral surface: Antennal setae, I, apparently 1; IV, 1; V, 1; VI, 4 long, 2 stout, 3 or 4 fairly stout; distance between antennal bases slightly more than one-third length of antenna; beak setae, 2 pairs apical, 1 pair basal; spiracle with 1 trilocular and 1 quinquelocular pore; leg setae, coxa 3, femur 1 on inner margin near base and 1 each on inner and outer margins near center, tarsus 1 each on inner and outer margins; tibia one-third as long as tarsus; apparently 8 pairs of submarginal 8-shaped pores of which 1 pair is between the antennae; 8 pairs of submarginal minute setae on abdomen in a single row except on penultimate segment, where the row is double, apparently 1 pair of submarginal larger setae at anterior end; 3 or 4 setae between antennae and mouth parts.

Apex of abdomen: Notch present; lobes sometimes indicated; setae, apical 95–100  $\mu$  long, interapical 5.4–10.8  $\mu$  long, dorsal (lacking on 1 side in 1 specimen examined) 3.6–5.4  $\mu$  long, inner ventral (lacking on 1 side of 1 specimen examined) 3.6–5.4  $\mu$  long, intermediate ventral 5.4–9  $\mu$  long, outer ventral 7.2  $\mu$  long; anal ring with 6 setae about 25.5  $\mu$  long and with an inner row of 6 and an outer one of 14 pores, divided on dorsal and ventral sides.

*Test of male.*—Elliptical, a notch in posterior margin; 1.5 mm. long, 0.7 wide; dorsally slightly convex at anterior end, sloping to posterior end, with longitudinal median and lateral carinae, and with faint transverse striations; nearly flat ventrally; greenish yellow, transparent, thin; marginal filaments rubbed off; dorsal filaments whitish, very short.

*Adult male.*—1.5 mm. long.

Head: Antenna 10-segmented; formula (longest to shortest), (III), (IV), (V), (VI), (VII), (VIII, IX), (I, II, X); antennal setae, I, 1; II, 9; III, 13; IV apparently with 20; V, VI, VII, 19; VIII, 18; IX, 16; X, 5 very long, 1 stout, and 7 fairly long; basal bars strongly diagonal; 1 seta between ventral eyespots and antennae; 3 minute tubercles dorsally near base of each antenna.

Thorax: Bar between wing bases curved on anterior margin, with a longitudinal fold in center, two and a half times as long as wide; tibia slightly longer than tarsus.

Abdomen: Three segments with a seta dorsally on lateral margin on 1 side of body, and 2 segments with a seta on the other side; 4 segments with a seta in ventral submedian area on 1 half of body, and 3 segments with a seta on the other half; lobes indicated, each with 1 long and 3 short setae, and with 3 setae between lobe and median line on 1 half of body and 2 on the other half; penis sheath with 4 setae dorsally near base, 5 long setae ventrally near base on 1 half and 4 on the other, 9 smaller setae on each side of ventral opening, and several minute clear areas at tip.

*Male nymph*.—Distinguishing characters similar to those of adult male.

*Third-stage male*.—Similar to second stage but more nearly elliptical; dorsal surface with 8-shaped pores slightly more numerous than in second stage; ventral surface with legs represented by 3 pairs of circular sclerotized areas, each with a short, stout, straight claw, and 4-8 clear areas (possibly setal bases); apex of abdomen as in second stage.

*Data*.—Described from specimens (eight females, one second-stage specimen, three larvae, one adult male, one male nymph, and three third-stage males, mounted) from "Tusca" [presumably *Acacia moniliformis*], Cordoba, Argentina, M. Kisliuk, June 20, 1927, holotype and paratypes.

This species is particularly interesting in three respects, namely, the unusually large size of the submarginal 8-shaped pores as compared with the marginal 8-shaped pores in the adult females, the constancy with which one seta is missing on one half of the apex of the abdomen in all stages, and the presence of four submarginal setae on the penultimate segment of the body in the larval stage.

It is rather similar to *viridulum*.

#### ASTEROLECANIUM QUERCICOLA (Bouché)

(Fig. 58, F-K; pl. 8, G)

*Lecanium quercicola* was described by Bouché in 1851 (11, p. 112) as follows, "♀ fast kreisrund, erhaben, rünzlich, dunkelbraun. Länge  $\frac{1}{2}$  Linie. Auf Eichen selten." In 1870 (88, pp. 279-280) Signoret redescribed it and transferred it to *Asterolecanium*. He gave a French translation of Bouché's description, which he followed with this statement: "Telle est la description donnée par Bouché d'un type que l'on trouve sur les chênes et que nous possédons à deux états, dont l'un se rapporte entièrement comme couleur à la description ci-dessus, et l'autre, d'un jaune pâle brillant et transparent, présente à une des extrémités une macule d'un brun foncé, qui n'est que la dépouille repoussée vers ce point." However, while Signoret considered Bouché's *quercicola* to be a species of *Asterolecanium*, Sanders, in 1909 (84, p. 431), believed it to be identical with *Aspidiotus zonatus* Frauent., and in 1912 Lindinger (61, p. 371) assigned it doubtfully to *Kermes quercus* but in 1934 (62, p. 169) listed it as an unknown species.

The original description certainly is inadequate to differentiate this form from many other scale insects, and the identity of the species cannot be determined because the type specimens presumably are no longer in existence. Bouché's *quercicola* may belong to *Asterolecanium*, the specimens treated being either immature or ones in which the adults had not shrivelled in the test, which would account for the dark-brown color. Since there is this possibility, and since Signoret as well as some other writers have adopted this interpretation, it seems best to assume that *quercicola* is the species treated below.

*A. quercicola*, as redescribed by Signoret on oak from Paris, and here accepted as the true *quercicola* (Bouché), is distinct from *variolosum*, with which it was synonymized by Cockerell in 1899 (21, p. 269), by Sanders in 1909 (84, p. 431), and by Lindinger in 1912 (61, p. 360).

*Habit*.—Living on bark, in shallow or deep pits.

*Test of female*.—Nearly circular, 1.25–1.7 mm. long and 1–1.5 wide, usually 1.5 mm. long and 1.4 wide; slightly to distinctly convex dorsally, with posterior tip flattened, usually with faint transverse striations; slightly or distinctly convex ventrally; usually greenish, sometimes brownish yellow, transparent, often shiny, sometimes slightly punctate in lateral areas; marginal filaments same color as test, slightly shorter at posterior end than elsewhere; elliptical larval exit in dorsal surface at margin.

*Adult female*.—Nearly circular, 0.95–1.5 mm. in diameter, posterior end sometimes slightly produced.

*Margin*: 8-shaped pores in a single row terminating one to three (usually one) times the length of a posterior pore from bases of apical setae, the posterior pores 9–10  $\mu$  long and 6 wide, the others 12  $\mu$  long and 6 wide, from the width to the length of a pore apart; quinquelocular pores in a single row terminating at a point 10–28 (usually around 20) pores before the posterior pair of 8-shaped pores, the row complete, or interrupted opposite 1–20 8-shaped pores at anterior end, the quinquelocular pores in the proportion of 1 to each 8-shaped pore anteriorly and 1 to each 8-shaped pore and 1 opposite the interval between every 2 8-shaped pores elsewhere, except sometimes 2 to each 8-shaped pore near spiracular pore bands, in this case the row almost double.

*Dorsal surface*: Minute 8-shaped pores numerous; disk pores fairly numerous; tubular ducts 32  $\mu$  long.

*Ventral surface*: Antenna thimble-shaped, with 2 setae nearly as long as diameter of antenna; beak with 2 pairs of setae; spiracular bar expanded at inner end, roughly triangular; a group of 8–16 quinquelocular pores outside spiracular opening and a double or triple row of similar pores extending from there toward body margin, this row often becoming 5 or 6 pores wide at the margin, usually a total of 45–65 pores in group and row combined; multilocular pores in 4 complete rows, posterior row with 8–13 pores (usually 10 or 11), each of next 2 with 5–10 (usually 7–9), and anterior with 4–7 (usually 5 or 6), or a total of 23–38, the pores with 6–10 loculi; a loose group of 7–10 dark-rimmed 8-shaped pores each side of mouth parts, some scattered on anterior end, others tending toward arrangement in 2 transverse rows posterior to beak; submarginal 8-shaped pores in an irregularly double row terminating near the posterior row of multilocular pores, usually 2 opposite every other marginal 8-shaped pore, but occasionally in a slightly different proportion; submarginal setae in a complete row terminating near the penultimate pair of marginal 8-shaped pores; 2 pairs of setae in posterior row of multilocular pores, 1 pair in each of the other rows, and 1 pair before the anterior row.

*Apex of abdomen*: Setae, apical 32–40  $\mu$  long, interapical 8–10  $\mu$  long, ventral 8–9  $\mu$  long; anal opening ventral, circular, its margin sclerotized, 2 setae, 3  $\mu$  long, on anterior edge.

*Larva*.—Nearly elliptical; posterior end sometimes narrowed.

*Margin*: With 28 8-shaped pores, axes of all longitudinal; 2 pairs of setae at anterior end.

*Dorsal surface*: 8-shaped pores in a submedian row of 1–4 (usually 1 or 2) and a lateral row of 9, on each half of body, or a total of 20–26, practically same size as, or slightly larger than, marginal pores; disk pores near lateral 8-shaped pores.

*Ventral surface*: Antennal setae, I, 1; IV, 1; V, 0; VI, 2 long, 2 stout, 2 fairly stout, 2 slender; antennal bases about one-half length of antenna apart; beak setae, 3 pairs apical; anterior spiracle with 2 quinquelocular pores or with 1 quinquelocular and 1 trilocular pore, posterior spiracle with 1 trilocular or quinquelocular pore; leg setae, coxa 3, femur 1 on inner margin near base, tarsus 1 each on inner and outer margins; tibia one-third as long as tarsus; 9 pairs of submarginal 8-shaped pores; 7 pairs of submarginal minute setae on abdomen, 1 pair of submarginal larger setae at anterior end; 2 pairs of setae between antennae and mouth parts.

*Apex of abdomen*: Setae, apical 66  $\mu$  long, interapical 7–10  $\mu$  long, outer ventral 4–7  $\mu$  long; anal opening apical; anal tube very short, slightly sclerotized; anal ring circular, sclerotized, with 2 setae, each about 7.2–9  $\mu$  long.



*Data*.—Redescribed from unmounted material, approximately 90 mounted females, and many mounted larvae from the following lots (all collected on *Quercus*): On English oak, no other data; Newburg, N. C., Mrs. Rains, Cockerell Collection; on *Q. pedunculata*, Paris, France, determined as *quercicola* by Signoret, loaned by M. Beier; New York, August 30, 1898; on *Q. bicolor*, Breslau, Silesia, Germany, C. Baenitz, November 9, 1899, U.S.N.H.; on *Q. alba*, Yonkers, N. Y., E. P. Felt, September 16, 1901; Johannesburg, South Africa, January 20, 1908, C. W. Howard No. 56; on English oak, Botanic Garden, Washington, D. C., J. G. Sanders, November 1908; New York Zoological Park, N. Y., H. W. Merkel, March 25, 1909; on *Q. robur*, Prignitz, Brandenburg, Germany, O. Jaap, June 2, 1916, No. 251; on *Q. robur*, Christchurch, New Zealand, R. J. Tillyard, letter May 11, 1922; on chestnut oak, Bear Mountain, N. Y., F. M. Schott, September 13, 1925; Eberswalde, Germany, from Walter Horn, letter May 11, 1928; on *Q. robur*, Berlin, Germany, intercepted at Washington, D. C., D. P. Limber, January 27, 1930; Stanford University, Calif., C. T. Paine, received in 1931; on red oak, Ithaca, N. Y., G. W. Herrick, June 27, 1932; on *Q. argenteo-marginata*, Weener, Germany, intercepted at Washington, D. C., D. P. Limber, April 20, 1934; Berlin, Germany, intercepted at Washington, D. C., W. B. Wood, January 26, 1937; on *Q. pontica*, Germany, intercepted at Washington, D. C., D. P. Limber, December 27, 1937; on *Q. sessiliflora laciniata*, Dublin, Ireland, intercepted at Washington, D. C., D. P. Limber, January 7, 1939.

Closely related to *minus* and *variolosum*. In the adult stage it can be distinguished from *minus* by the presence of approximately 23 to 33 multilocular pores instead of about 8, and from *variolosum* by having 23 to 33 such pores instead of approximately 50 to 62. In the larval stage it can be separated from *minus* by the presence of about 21 dorsal 8-shaped pores instead of around 30 and by having apical setae 66 instead of 54  $\mu$  long, and from *variolosum* by the number of dorsal 8-shaped pores, *variolosum* having none or rarely 1 to 4.

### ASTEROLECANIUM RADIATUM, new species

(Fig. 59, A-E; pl. 5, N)

*Habit*.—Living on the lower surface of leaves.

*Test of female*.—Slightly longer than wide, posterior end produced and upturned; 1.4 mm. long, 1.10 wide; slightly convex dorsally, with faint longitudinal median and lateral carinae, and with faint transverse striations that give the longitudinal carinae the appearance of having minute tubercles; flat ventrally; pale yellow, transparent, fairly thin, slightly punctate, very shiny; marginal filaments pale yellow; larval exit elliptical, at tip of produced area.

*Adult female*.—Slightly longer than wide, posterior end produced; 1 mm. long, 0.85 wide.

Margin: 8-shaped pores in a single row terminating nearly length of an apical seta from bases of setae, 8  $\mu$  long and 5 wide, about a pore's width apart; quinquelocular pores absent, or 2-4 where each spiracular pore band meets margin.

Dorsal surface: Minute 8-shaped pores numerous; disk pores rather sparse, a few near margin; tubular ducts 32  $\mu$  long; dorsal tubes present.

Ventral surface: Antenna dome-shaped, with 2 setae much longer than diameter of antenna and possibly 1 much shorter; beak without setae; spiracular bar fairly broad, sometimes expanded at inner end; 10-12 quinquelocular pores (including any that may occur on margin) extending from spiracle to body margin in a single row; 1 dark-rimmed 8-shaped pore each side of beak, a few on anterior end, and a few in 4 transverse rows anterior to genital opening;

submarginal 8-shaped pores in a single row terminating near the posterior marginal 8-shaped pores, half as numerous as the marginal 8-shaped pores; 5 pairs of submarginal setae on abdomen, the posterior pair slightly nearer to the posterior marginal 8-shaped pores than to bases of apical setae; 1 pair of setae posterior to genital opening, 1 pair anterior to it, and 1 pair anterior to those.

Apex of abdomen: Notch present; lobes indicated; setae, apical 60  $\mu$  long, interapical 8  $\mu$  long, inner ventral 3.6  $\mu$  long, outer ventral 5  $\mu$  long; anal ring with 6 setae 34  $\mu$  long and with an inner row of 6 and an outer one of 20 pores, tending toward division on dorsal side; ventral surface of apex rugose.

*Data*.—Described from two tests (one empty) and one mounted female on *Schizostachyum* sp., Tungking, Kwangtung, China, F. A. McClure, January 21, 1932.

Closely related to *circulare* but differing from it in lacking marginal quinquelocular pores.

### ASTEROLECANIUM REPUGNANS, new species

(Fig. 59, F-J; pl. 8, E)

*Habit*.—Living on bark.

*Test of female*.—Somewhat ovoid, posterior end slightly produced; 1.5–1.85 mm. long, 1.4–1.5 wide; strongly convex dorsally, flat or very slightly convex ventrally; brownish yellow, transparent, fairly thin; marginal filaments whitish, fragmentary; dorsal filaments whitish, scattered, matted down but presumably approximately same length as marginal; elliptical larval exit in dorsal surface at margin.

*Adult female*.—Somewhat ovoid, posterior end produced; approximately 1.25 mm. long, 1 wide.

Margin: 8-shaped pores in a single row normally terminating a pore's length from bases of apical setae, posterior pores 12  $\mu$  long and 8 wide, the others 12–13  $\mu$  long and 8–9 wide, usually around a pore's length apart; disk pores dorsad of 8-shaped pores and much less numerous than those, terminating near the penultimate pair of 8-shaped pores.

Dorsal surface: 8-shaped pores scattered, those near posterior end 9  $\mu$  long and 5 wide, most of the remainder 12  $\mu$  long and 8 wide; minute 8-shaped pores absent; disk pores numerous; tubular ducts 36  $\mu$  long.

Ventral surface: Antenna short, with 2 setae as long as diameter of antenna; beak with 3 pairs of setae; spiracular bar expanded at inner end; 40–76 quinquelocular pores extending from spiracle to body margin in a row 3 or 4 pores wide at the center and 8 or 10 pores wide near opening and near body margin; multilocular pores, with 10 loculi, in 4 complete rows, posterior row with 11 or 12 pores, each of next 2 with 9–12, and anterior row with 7–9, or a total of 36–43; an indefinite group of 8 or 10 (possibly more) dark-rimmed 8-shaped pores each side of beak, some scattered anterior to mouth parts, and others arranged in 3 wide, and 1 narrow, transverse row on abdomen; submarginal 8-shaped pores well removed from margin, in an irregularly double row terminating near anterior row of multilocular pores, 1 or 2 opposite each or every other marginal 8-shaped pore; submarginal setae in a complete row terminating nearly directly anterior to the posterior pair of marginal 8-shaped pores, 4 or 5 setae in posterior row of multilocular pores, 2 in each of other rows, and 2 before the anterior row.

Apex of abdomen: Setae, apical 36–40  $\mu$  long, interapical (anterior to and inside or outside apical seta, lacking on 1 side in 2 specimens examined) 6  $\mu$  long, outer ventral (present on 1 side in 2 specimens examined) 6  $\mu$  long; anal opening ventral, well removed from body margin, circular, its margin sclerotized, with 1 or 2 setae 2  $\mu$  long, without any indication of setae, or with a suggestion of 2 setal bases.

*Data*.—Described from the following material: Unmounted specimens and two mounted females from *Quercus ilex*, Cannes, France, determined as *quercicola* by Löw, loaned by M. Beier, holotype and paratypes; empty tests, two mounted females, and fragments of another mounted female from *Quercus lanuginosa*, Corfu, Greece, C. Baenitz, May 30, 1896, U.S.N.H., paratypes.

Allied to *bellum* and *roboris*. Like the latter it shows an unusual amount of variation in the number and position of setae associated with the apical setae and the anal opening.

### ASTEROLECANIUM ROBORIS, new species

(Fig. 60, A-D; pl. 8, F)

*Habit*.—Living on bark.

*Test of female*.—Ovoid, posterior end slightly produced; 1.5–2 mm. long, 1.5–1.75 wide; strongly convex dorsally, sometimes with faint transverse striations; flat ventrally; greenish yellow, transparent, fairly thin; marginal filaments whitish, slightly shorter at posterior end than elsewhere; dorsal filaments whitish, scattered, practically same length as marginal; elliptical larval exit in dorsal surface at margin.

*Adult female*.—Ovoid, posterior end slightly produced; 1.5–1.7 mm. long, 1.2 wide.

Margin: 8-shaped pores in a single row terminating about a pore's length from bases of apical setae, posterior pores 12  $\mu$  long and 8 wide, the others 13–14  $\mu$  long and 9 wide, slightly more than a pore's length apart; quinquelocular pores in an irregularly single and double row between spiracular pore bands and extending to about the eighth 8-shaped pore anteriorly from the anterior band and an approximately equal distance beyond the posterior band, 1 pore near each 8-shaped pore at ends of row, 1–3 near each 8-shaped pore elsewhere; disk pores dorsad of 8-shaped pores and much less numerous than these, terminating near the penultimate pair of 8-shaped pores.

Dorsal surface: 8-shaped pores scattered; the posterior pores 8–9  $\mu$  long and 5 wide, the majority of the others 12–13  $\mu$  long and 8–9 wide; minute 8-shaped pores absent; disk pores fairly numerous; tubular ducts 40  $\mu$  long.

Ventral surface: Antenna thimble-shaped, with 2 setae as long as diameter of antenna; beak with 3 pairs of setae; spiracular bar expanded at inner end; 71–99 quinquelocular pores extending from spiracle to body margin in a row 4–14 pores wide, the row widest toward margin; multilocular pores, with 10 loculi, in 4 complete rows, the posterior row with 11–17 pores, penultimate row with 10–15, next with 10–12, and the anterior row with 6–10, the total being 42–47; around 25 dark-rimmed 8-shaped pores in a loose row surrounding mouth parts, some scattered on anterior end, and others arranged in 4 transverse rows on abdomen, 3 of them wide and 1 narrow; submarginal 8-shaped pores well removed from margin, arranged in an irregularly double row terminating near the second row of multilocular pores, 1 or 2 opposite each or every other marginal 8-shaped pore; submarginal setae in a complete row terminating nearly directly anterior to the penultimate pair of marginal 8-shaped pores; 2 pairs of setae in the posterior row of multilocular pores, 1 pair in each of the other rows, and 1 pair before anterior row.

Apex of abdomen: Setae, apical 40  $\mu$  long, apparently normally with an interapical seta, 1 of the specimens examined with one 3.6  $\mu$  long instead of one apical seta; anal opening ventral, well removed from body margin, circular, its margin sclerotized, apparently with or without setae, holotype with 1 seta 3  $\mu$  long on anterior edge.

*Larva*.—Elongate ovoid.

Margin: With 28 8-shaped pores, the posterior pair slightly larger than others, axes of all longitudinal; 2 pairs of setae at anterior end.

Dorsal surface: 8-shaped pores in a submedian row of 3–6 and a lateral row of 9, on each half of body, the total in specimens examined being 26–30, individual pores one-third larger than marginal pores; a disk pore just posterior to each 8-shaped pore of the lateral row; a pair of minute setae anterior to anterior pair of submedian 8-shaped pores.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 0; VI, 2 long, 2 stout, 2 fairly stout, 2 slender; distance between antennal bases about equal to one-half length of antenna; beak with 3 pairs of setae at tip; anterior spiracle with 2 trilocular pores or with 1 trilocular and 1 quadrilocular or quinquelocular pore, posterior spiracle with 1 trilocular pore; leg setae, coxa 3, femur 1 on inner margin near base, tarsus 1 each on inner and outer margins; tibia one-fourth as long as tarsus; 8 pairs of submarginal 8-shaped pores, of which 1 pair is between



the antennae; 7 pairs of minute submarginal setae on abdomen, 1 pair of submarginal larger setae at anterior end; 2 pairs of setae between antennae and mouth parts.

Apex of abdomen: Setae, apical  $63\ \mu$  long, sometimes one  $1$  or  $2\ \mu$  long inside or outside apical; anal opening in margin, circular; anal tube very short, slightly sclerotized; anal ring a sclerotized band, with 1 or 2 setae  $2-3\ \mu$  long, or with 2 indefinite setal bases.

*Data*.—Described from the following material: One poor mounted female on *Quercus lusitanica*, probably from Spain, U. S. N. H., paratype; unmounted material, 2 mounted females, and 13 mounted larvae on *Quercus pubescens*, Laaerberg, Austria, determined as *quercicola* by Löw, loaned by M. Beier, holotype and paratypes.

Closely related to *repugnans*, but differing from it in having marginal quinquelocular pores.

### ASTEROLECANIUM RUBROCOMATUM Green

(Fig. 60, E-J; pl. 6, I)

Described in 1909 (*42*, p. 316).

*Habit*.—Living on both surfaces of leaves.

*Test of female*.—Nearly elongate elliptical, posterior end either rounded or rather pointed;  $1.5-2$  mm. long,  $0.75$  wide; slightly convex dorsally, flat ventrally; brownish yellow, transparent, thin, shiny, punctate; marginal filaments yellowish to pinkish, slightly longer at anterior end than elsewhere; dorsal filaments rubbed off; larval exit apparently a slit in margin.

*Adult female*.—In shape similar to test,  $1.4-1.8$  mm. long,  $0.6$  wide.

Margin: 8-shaped pores in a single row terminating about the length of an apical seta from setal bases,  $14\ \mu$  long and  $8$  wide at anterior end,  $12\ \mu$  long and  $8$  wide elsewhere, around a pore's width apart; quinquelocular pores mostly in a single row, but in an irregularly double row at a few points, usually terminating at a point near the fourth to the fourteenth 8-shaped pore from end of row, usually around three times as numerous as corresponding 8-shaped pores, but sometimes no more numerous than the latter posteriorly.

Dorsal surface: 8-shaped pores in 6-8 transverse rows in median and submedian area, and in a single or double submarginal row, each of 4 transverse rows with 10-12 pores and each of the others with 2 or 3, the pores in posterior and penultimate rows  $6-7\ \mu$  long and  $4$  wide, the majority of the others  $8-10\ \mu$  long and  $6$  wide but a few  $12\ \mu$  long and  $8$  wide; around 26 submarginal pores spaced at fairly uniform intervals, the posterior pore  $14\ \mu$  long and  $8$  wide, its axis usually transverse, the other submarginal pores  $8-10\ \mu$  long and  $5-6$  wide and their axes usually longitudinal; minute 8-shaped pores numerous; disk pores rather sparse; tubular ducts  $32\ \mu$  long; dorsal tubes present.

Ventral surface: Antenna conical, sometimes slightly sunken in derm, with 2 setae longer than diameter of antenna; beak without setae; spiracle with bar fairly broad, atrium enlarged and containing 8-14 quinquelocular pores, 10-15 similar pores extending from spiracle to body margin in a single or irregularly double row; legs represented by 3 pairs of fairly small to stout claws each in a circular sclerotized area, anterior claws smaller than the others, and middle claw sometimes smaller than posterior one; multilocular pores, with 9 or 10 loculi, in 4 complete and 4 or 5 interrupted rows, the posterior row with 8-13 pores, penultimate row with 16-21, next with 7-11, anterior complete row with 3-8, and each of interrupted rows with 1-3, the total ranging from 45-61; 5 or 6 dark-rimmed 8-shaped pores each side of beak, some scattered anterior to mouth parts, a few in lateral area of abdomen, and others arranged in 3 transverse rows near posterior end of abdomen; submarginal 8-shaped pores mostly in a single row (sometimes irregularly double near posterior end) terminating near the penultimate row of multilocular pores, 1 pore opposite each marginal 8-shaped pore; 8 pairs of submarginal setae posterior to anterior spiracular pore bands, the posterior pair near the posterior or penultimate pair of marginal 8-shaped pores; 1 pair of setae in each of the posterior 3 rows of multilocular pores.

Apex of abdomen: Notch present; lobes indicated; setae, apical  $52-56\ \mu$  long, interapical  $4.2\ \mu$  long, outer ventral  $4\ \mu$  long; anal ring with 2 setae apparently

9  $\mu$  long and four 18  $\mu$  long, apparently with a tendency toward division on dorsal side; ventral surface of apex sclerotized in a narrow transverse band along margin and in a short linear band extending anteriorly from base of each apical seta, area between sclerotized linear bands lightly sclerotized in dentate rows.

*Larva*.—Nearly elongate elliptical, posterior end slightly narrowed.

**Margin:** With 28 8-shaped pores, the posterior and penultimate pairs slightly larger than the next 4 pairs, which are the smallest of the row, the next 5 pairs gradually increasing in size anteriorly, and the anterior of these 5 the largest of the row, the anterior 3 pairs about the same size as the pair behind the largest, axes of the posterior 6 pairs slightly diagonal, axes of others longitudinal; 3 pairs of setae at anterior end.

**Dorsal surface:** 8-shaped pores in a submedian row of 10 and a lateral row of 2, on each half of body, the anterior 3 submedian pores slightly larger than the others of that row, anterior pore of lateral row slightly larger than posterior one and practically same size as anterior submedian pore, all pores about three-fourths the size of marginal pores of same segments; disk pores fairly close to marginal 8-shaped pores.

**Ventral surface:** Antennal setae, I, 2; IV, 1; V, 1; VI, 2 long, 2 stout, 3 fairly stout, 1 slender; antennal bases one-third length of antenna apart; beak setae, 2 pairs apical, 1 pair median; anterior spiracle with 1 trilocular or quinquelocular pore and 1 multilocular pore (having 8 loculi). posterior spiracle with 1 trilocular pore; leg setae, coxa 4, femur 1 on inner margin near base and 1 each on inner and outer margins near center, tarsus 2 on inner and 1 on outer margin; tibia three-eighths as long as tarsus; 9 pairs of submarginal 8-shaped pores; 8 pairs of submarginal minute setae, on abdomen and thorax, 2 pairs of submarginal larger setae at anterior end; 3 pairs of setae between antennae and mouth parts.

**Apex of abdomen:** Setae, apical 25  $\mu$  long, interapical apparently 3.6  $\mu$  long, outer ventral 3.6  $\mu$  long; anal ring with 6 setae apparently 5  $\mu$  long.

*Test of male*.—Elongate elliptical, 1 mm. long, 0.5 wide; dorsal surface slightly convex on anterior third, flat elsewhere, with a longitudinal median carina not reaching anterior margin; flat ventrally; very pale yellow, transparent, thin, slightly punctate; marginal filaments whitish, apparently slightly shorter near posterior end than elsewhere; dorsal filaments dark orange, in a dense group on each side of median line on anterior third, apparently about as long as the anterior marginal filaments.

*Male nymph*.—Antenna apparently 9-segmented; abdomen with a seta dorsally on lateral margin of each of 5 segments and with a seta in ventral lateral area of each of 2 segments; lobes indicated, each with 1 large and 2 small setae.

*Third-stage male*.—Resembling adult female in shape, but smaller; margin with 8-shaped pores terminating about twice, and quinquelocular pores about once, an 8-shaped pore's length from bases of apical setae, the quinquelocular pores about one and a half times as numerous as the 8-shaped pores; dorsal surface with 25-30 8-shaped pores in a curved group (ends of curve toward margin) each side of mouth parts, sometimes with a few in submarginal area posterior to those groups; the pores comprising the group usually as large as anterior marginal 8-shaped pores, submarginal pores about three-fourths as large as the largest dorsal pores; ventral surface with atrium of spiracle slightly enlarged and containing 1 quinquelocular pore, 1-5 similar pores in each spiracular pore band, anterior and middle pairs of claws small, the posterior pair fairly large and sharply pointed; apex of abdomen with setae arranged as in adult female, apical setae broken, interapical and ventral same length as in adult female; anal ring with 6 setae 20  $\mu$  long and with an inner row of probably 6 and an outer one of an indeterminable number of pores, divided on dorsal side.

*Data*.—Redescribed from specimens (six females, two larvae, one male nymph, and three third-stage males, mounted) on bamboo, Yatiyantota, Ceylon, from E. E. Green, letter of March 12, 1910, type.

Attention is here called to three errors contained in the original description of this species (42, p. 316). There are three pairs of claws rather than two, as stated, six setae on the anal ring instead of none, and in the third-stage male, erroneously called second stage by Green, there are three pairs of setae on the apex of the abdomen, rather than



one. In the third-stage male the anal ring has pores even though these are absent in the larvae and adult females.

*Asterolecanium rubrocomatum* is rather closely related to *exiguum* and *udagamae*, but can be separated from these by the presence of claws.

### ASTEROLECANIUM SABALIS, new species

(Fig. 61, A-E; pl. 5, G)

*Habit.*—Living on both surfaces of leaves.

*Test of female.*—Elongate elliptical, posterior end tapering slightly; 1.5–1.75 mm. long, 0.5–0.6 wide; slightly convex dorsally, sometimes with a faint longitudinal median carina; flat ventrally; bright deep yellow, transparent, thin, punctate; marginal filaments cream color; elliptical larval exit in margin.

*Adult female.*—Elongate elliptical, posterior sixth tapering slightly; 1.25–1.5 mm. long, 0.5 wide.

*Margin:* 8-shaped pores in a single row that is briefly interrupted, usually twice, near posterior end, and terminating one and one-half times a pore's length from bases of apical setae, the pores 9  $\mu$  long and 5 wide, less than a pore's width apart on lateral margin, and slightly more than that distance apart anteriorly; trilocular pores in a single row starting near antennae and ending near anterior interruption in row of 8-shaped pores, as numerous as corresponding 8-shaped pores at ends of row, two or three times as numerous as that elsewhere.

*Dorsal surface:* Minute 8-shaped and disk pores sparse; tubular ducts absent along median line, except near anterior margin, scattered elsewhere, 24  $\mu$  long.

*Ventral surface:* Antenna flat, with 3 setae slightly longer than diameter of antenna; beak apparently without setae; spiracular bar expanded at inner end; 15–25 trilocular pores extending from spiracle to body margin in an irregularly single row; multilocular pores, with 10 loculi, in 3 complete and 3 or 4 interrupted rows, the posterior row with 4–6 pores, the other complete rows each with 9–11, and each of the interrupted rows with 2, the total number 32–37; a group of 8–15 dark-rimmed 8-shaped pores each side of mouth parts; submarginal 8-shaped pores in a single row terminating directly anterior to apical setae, about one-third as numerous as marginal 8-shaped pores; apparently 7 pairs of submarginal setae on abdomen, the posterior pair anterior to the penultimate pair of marginal 8-shaped pores; 3 pairs of setae in posterior complete row of multilocular pores, 2 or 3 in median row, and 1 pair in anterior row.

*Apex of abdomen:* Lobes indicated; setae, apical 60  $\mu$  long, inner ventral and outer ventral each about 3  $\mu$  long; anal opening ventral, circular, its margin sometimes faintly sclerotized.

*Larva.*—Nearly elliptical, posterior end narrowed.

*Margin:* With 28 8-shaped pores normally (sometimes only 27), the anterior pair slightly larger than the others, axes of the posterior 8–11 pairs transverse, of the others longitudinal; usually with a minute seta close to each pore of the posterior 3 pairs; 3 pairs of setae at anterior end.

*Dorsal surface:* 8-shaped pores in a submedian row of 4–10 (usually 8 or 9) and a lateral row of 8 or 9, on each half of body, two-thirds as large as posterior marginal pores; disk pores between lateral and marginal, and occasionally 1 between submedian and lateral 8-shaped pores.

*Ventral surface:* Antenna 5-segmented; antennal setae, I, 0; IV, 1; V, 3 long, 2 stout, 2 fairly stout; antennal bases one-half length of antenna apart; beak setae, 2 pairs apical, 1 pair basal; spiracle with 1 trilocular and 1 quinquelocular pore; leg setae, coxa 2, femur 1 on inner margin near base, tarsus 1 each on inner and outer margins; tibia one-half as long as tarsus; 9 pairs of submarginal 8-shaped pores; 10 pairs of submarginal minute setae, on abdomen, thorax, and head; 2 pairs of setae near antennae.

*Apex of abdomen:* Lobes sometimes indicated; setae, apical 45  $\mu$  long, interapical 5.4  $\mu$  long, inner and outer ventral each 1  $\mu$  long; anal opening apical, circular, its margin membranous.

*Test of male.*—Elliptical, 1 mm. long, 0.5 wide; slightly convex dorsally, with a faint longitudinal median carina; flat ventrally; bright yellow, transparent, thin, shiny; marginal filaments rubbed off.

*Adult male.*—0.75 mm. long.



Head: Antenna 10-segmented, formula (longest to shortest), (III, IV, V), (VI), (VII), (VIII), (IX, X), (I), (II); antennal setae, I, 0; II, III, 5 or 6; IV-X, 15-20; X also with 4 very long setae; basal bars diagonal; 6 or 8 setae anterior to ventral eyespots.

Thorax: Bar between wing bases rectangular, five times as long as wide, with a faint median longitudinal fold and a small clear area in center; tibia very slightly longer than tarsus.

Abdomen: Five segments each with a seta dorsally on lateral margin, apparently 3 segments each with a seta in ventral lateral area; lobes sometimes indicated, each with 1 long and 2 short setae; penis sheath with 1 pair of setae dorsally at base, also apparently with 1 pair ventrally at base, and with a few setae on each side of ventral opening.

*Male nymph*.—Distinguishing characters similar to those of adult male.

*Third-stage male*.—Resembling adult female but smaller; margin with 8-shaped pores in a single row continuous between apical setae, trilocular pores terminating slightly before apical setae, slightly more numerous than corresponding 8-shaped pores at posterior end, absent at anterior end; ventral surface with antenna thimble-shaped, 7 trilocular pores between spiracle and body margin, sometimes 1 or 2 dark-rimmed 8-shaped pores near mouth parts, legs represented by 3 pairs of very small sclerotized areas; apex of abdomen with anal opening slightly nearer margin than in female, setae shorter than in female.

*Data*.—Described from specimens (30 females, 7 larvae, 4 adult males, 1 male nymph, and 1 third-stage male, mounted) on *Sabal palmetto*, Cayamas, Cuba. E. A. Schwarz, June 23, 1904, holotype and paratypes.

The specimens of palm examined are very heavily infested.

### ASTEROLECANIUM SANBERNARDENSE Hempel

(Fig. 61, F-J; pl. 4, G)

Described in 1937 (*51*, pp. 18-19).

*Habit*.—Living on the lower surface of leaves, in shallow or fairly deep pits.

*Test of female*.—Usually circular, sometimes slightly longer than wide, 1.5-2 mm. in diameter, or 1.5-2 mm. long and 1.25 wide; flat dorsally, without, or with, a faint longitudinal median carina and transverse striations; slightly to rather strongly convex ventrally; greenish yellow, transparent, very thin, shiny, punctate; marginal filaments pale greenish yellow; elliptical larval exit in margin.

*Adult female*.—Nearly circular or slightly longer than wide, posterior end slightly produced; 1.25-1.75 mm. in diameter or 1.25 mm. long and 1.10 wide.

Margin: 8-shaped pores in a single row terminating length of an apical seta from bases of setae, 12  $\mu$  long and 8 wide, around a pore's length apart; quinquelocular pores in a single row terminating at a point near the fifth to the fourteenth 8-shaped pore from end of row, nearly as numerous as corresponding 8-shaped pores near end of row, usually about one and a half times as numerous as that elsewhere.

Dorsal surface: Minute 8-shaped pores numerous; disk pores fairly sparse; tubular ducts 32  $\mu$  long.

Ventral surface: Antenna an irregular, flat area on derm. with 3 setae longer and 1 slightly shorter than diameter of antenna; 1 or 2 quinquelocular pores between antenna and margin; beak with 2 pairs of setae; spiracular bar greatly expanded at inner end; wrinkles in derm around spiracular opening: 35-55 quinquelocular pores extending from spiracle to body margin in an irregularly double row; multilocular pores, with 10 loculi, in 5 complete and 4 interrupted rows, the posterior row with 12-14 pores, penultimate row with 12-24, next with 16-24, next with 15-18, next with 14-16, next with 10-12, next with 6-12, next with 4-10, and anterior row with 2-4, the total 98-130; sometimes 1 or 2 dark-rimmed 8-shaped pores each side of beak, a few scattered on anterior end, and others arranged in 6 or 7 transverse rows posterior to mouth parts; submarginal 8-shaped pores in an irregularly single row terminating near posterior row of multilocular pores, somewhat less numerous than corresponding marginal 8-shaped pores; submarginal setae in a complete row terminating nearly directly

anterior to the posterior marginal 8-shaped pores; 1 pair of setae in the posterior row of multilocular pores, 2 pairs in each of the next 4 rows, and 1 pair in each of the next 2 rows.

Apex of abdomen: Notch present; lobes indicated; setae, apical  $80\ \mu$  long, interapical  $9\text{--}10.8\ \mu$  long, dorsal  $10.8\ \mu$  long, inner ventral  $6.5\ \mu$  long, outer ventral  $9\ \mu$  long; anal ring with 6 setae  $36\text{--}40\ \mu$  long, apparently with an inner row of 6 and an outer one of 14 pores, apparently divided on dorsal side and tending toward division on ventral side; ventral surface of apex sclerotized in dentate rows.

*Larva*.—Apparently nearly elliptical.

Margin: With 28 8-shaped pores, the posterior 8 pairs slightly smaller than the next 5, and the anterior pair a little larger than any others, axes of the posterior 6 pairs somewhat diagonal, of the others longitudinal; apparently 3 pairs of setae at anterior end.

Dorsal surface: With 9 submedian pores and 1 lateral 8-shaped pore, on each half of body, anterior submedian pore slightly larger than the others, all about three-fourths as large as marginal pores of same segments; disk pores in lateral area and a few in submarginal area; a pair of small setae anterior to anterior submedian 8-shaped pores.

Ventral surface: Antennal setae, I, 2; IV, 1; V, 0; VI, 2 long, 2 stout, 3 fairly stout, 2 slender; antennal bases about one-half length of antenna apart; beak setae, 2 pairs apical, 1 pair basal; spiracle with 1 trilocular and 1 quadrilocular or quinquelocular pore; leg setae, coxa 4, femur 1 on inner margin near base and 1 each on inner and outer margins near center, tarsus 2 on inner and 1 on outer margin; tibia two-thirds length of tarsus; 9 pairs of submarginal 8-shaped pores; submarginal minute setae in a double row of 6 pairs posterior to posterior spiracles and in a single row of 3 pairs anterior to posterior spiracles, 1 pair of submarginal larger setae at anterior end; apparently 3 pairs of setae between antennae and mouth parts.

Apex of abdomen: Notch present; setae, apical apparently at least  $54\ \mu$  long, interapical apparently  $7.2\ \mu$  long, dorsal  $5.4\ \mu$  long, inner ventral apparently  $3.6\ \mu$  long, outer ventral  $6.3\ \mu$  long (exact length of some setae indeterminate owing to position on slide); anal ring with 6 setae  $18\ \mu$  long and with an inner row of 6 and an outer row of 13 pores, apparently divided on dorsal side and tending toward division on ventral; ventral surface of apex apparently slightly sclerotized close to margin.

*Data*.—Redescribed from specimens (three females and two larvae, mounted) on a forest shrub, Sao Bernardo, State of Sao Paulo, Brazil, H. S. Lepage collector, April 13, 1934, from A. Hempel, cotype.

This is the only species examined by the writer in which the larvae have a double row of submarginal setae on the abdomen, although in *quaesitum* there are two pairs of setae on one segment.

### ASTEROLECANIUM SASAE, new species

(Fig. 62, A-D; pl. 7, E)

*Habit*.—Living on the lower surface of leaves.

*Test of female*.—Elongate ovoid, tapering rather sharply to posterior end; often deeply indented by growth against hairs on leaf;  $1.5\text{--}2$  mm. long,  $0.8\text{--}1.10$  wide; moderately convex dorsally, sometimes with a faint longitudinal median carina; flat ventrally; pale lemon yellow, transparent, thin, smooth; marginal filaments whitish, slightly longer at anterior end than elsewhere; dorsal filaments whitish, fragmentary, occurring in a submarginal and a median row; larval exit narrow, in ventral surface at margin.

*Adult female*.—In shape similar to test,  $1.25\text{--}1.85$  mm. long,  $0.75\text{--}1$  wide.

Margin: 8-shaped pores in a single row terminating around length of apical seta from bases of setae, posterior pores around  $10.8\ \mu$  long and 6 wide, others around  $12.6\ \mu$  long and  $7.2$  wide, around a pore's width apart; quinquelocular pores in a single row, terminating at a point  $10\text{--}20$  8-shaped pores before end of row of those pores (missing opposite 23 8-shaped pores at anterior end of 1 specimen examined), about half as numerous as corresponding 8-shaped pores near posterior end, usually at least as numerous as 8-shaped pores elsewhere; disk pores dorsad of 8-shaped pores and much less numerous than these, terminating about halfway between the posterior 8-shaped pores and the posterior quinquelocular pores.

Dorsal surface: 8-shaped pores in a lateral row on each side of body and in a median row, the lateral row usually single but sometimes double for 1 or 2 pores, the median row usually single for posterior 2 or 3 pores, but double anterior to those, and sometimes triple or even quadruple, a total of 23-46 observed (the majority of specimens examined with 28-38), individual pores 16-18  $\mu$  long and 9.5-10.6 wide; minute 8-shaped and disk pores fairly numerous; tubular ducts 36  $\mu$  long; dorsal tubes present.

Ventral surface: Antenna circular, short, with 2 setae longer and 1 or 2 shorter than diameter of antenna; beak without setae; spiracle with bar fairly broad; 9-16 quinquelocular pores extending from spiracle to body margin in an irregularly single or double row, the 3-7 pores nearest spiracle usually in a fairly definite group; multilocular pores, with 10 loculi, in 5 complete and 3 interrupted rows, the posterior row with 10-18 pores, penultimate row with 14-21, next with 15-25, next with 10-19, next with 6-9, and each of interrupted rows with 2-6, the total number 68-97; 1 dark-rimmed 8-shaped pore each side of beak, a few scattered anterior to mouth parts, a few in 2 rather irregular, indefinite longitudinal rows in lateral area of abdomen, and others in 3 transverse rows on abdomen; submarginal 8-shaped pores in a single row terminating near genital opening, at least half as numerous as marginal 8-shaped pores; 3-5 disk pores on each half of body in a submarginal row extending from near posterior row of multilocular pores to near apical setae and 2 or 3 usually in submarginal area near anterior end of body; 6 pairs of submarginal setae on abdomen, the posterior pair fairly near the penultimate pair of marginal 8-shaped pores; 1 pair of setae in each of the posterior 4 rows of multilocular pores.

Apex of abdomen: Slightly concave; setae, apical 27.6-30  $\mu$  long, interapical 9-12.6 long, outer ventral 7.2-9  $\mu$  long; anal ring with 6 setae 27-30.7  $\mu$  long and with an inner row of 6 and an outer row of 14 or 16 pores, divided, or tending toward division, on dorsal side; ventral surface of apex slightly sclerotized in median area near margin.

*Second stage.*—Nearly elongate elliptical, posterior end narrowed; margin with quinquelocular pores much less numerous than in adult; dorsal surface with 5 8-shaped pores in median and submedian areas; ventral surface with 3 or 4 quinquelocular pores in each spiracular row, no setae in median region; apex of abdomen as in adult but all setae about one-half shorter and number of pores in anal ring indeterminate.

*Larva.*—Elongate elliptical.

Margin: With 28 8-shaped pores, the anterior pair distinctly the largest, the next pair and the posterior and penultimate pairs about equal in size and slightly larger than the remainder, axes of the posterior 6 pairs transverse, of the others longitudinal; 3 pairs of setae at anterior end.

Dorsal surface: 8-shaped pores in a submedian row of 10 or 11 and a lateral row of 7 or 8, on each half of body, a total of 35 observed, 1 or 2 pores of each row slightly larger than the rest, all at least slightly smaller than marginal pores of same segments; disk pores between lateral and marginal, and a few between submedian and lateral, 8-shaped pores.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 0; VI, 2 long, 2 stout, 3 fairly stout, 1 slender; distance between antennal bases around one-third length of antenna; beak setae, 2 pairs apical, 1 pair median; spiracle with 1 trilocular pore; leg setae, coxa 4, femur 1 on inner margin near base and 1 each on inner and outer margins near center, tarsus 2 on inner and 1 on outer margin; tibia one-half as long as tarsus; 9 pairs of submarginal 8-shaped pores; 6 pairs of submarginal minute setae on abdomen, 3 pairs of submarginal larger setae at anterior end; 1 pair of setae between antennae and mouth parts.

Apex of abdomen: Setae, apical 45  $\mu$  long, interapical 14.4-16.2  $\mu$  long, outer ventral 3.6  $\mu$  long; anal ring with 6 setae, each 5.4  $\mu$  long, apparently not divided.

*Test of male.*—Elongate elliptical, 1.10-1.4 mm. long, 0.5 wide; dorsally convex at anterior end, sloping to posterior end; flat ventrally; pale yellow, transparent, very thin, slightly punctate; marginal filaments whitish, slightly longer on anterior than on posterior half; dorsal filaments whitish, fragmentary, apparently arranged in a submarginal and a median row.

*Adult male.*—1 mm. long.

Head: Antenna 10-segmented, formula (longest to shortest), (III), (IV, V, VI), (VII, X), (IX), (VIII), (I, II); antennal setae, I, 11; II, 14; III, 12; IV, 17; V, 20; VI, VII, 24; VIII, 20; IX, 21; X, 18 fairly long and 4 very long; basal bars diagonal; 29 setae between ventral eyespots and antennae; 2 setae dorsally near antennae.



Thorax: Bar between wing bases nearly rectangular, nearly three times as long as wide, with a longitudinal fold in center; tibia as long as tarsus.

Abdomen: Five segments each with a seta dorsally on lateral margin; 3 segments each with a seta in ventral lateral area; lobes indicated, each with 1 long and 2 short setae; penis sheath with 2 minute setae dorsally near base, and with 6-9 setae on each side of ventral opening.

*Male nymph.*—Distinguishing characters similar to those of adult male.

*Third-stage male.*—Elongate elliptical; margin with quinquelocular pores slightly less numerous than in adult female; ventral surface with 4 or 7 quinquelocular pores in each spiracular row, submarginal disk pores not observed, legs represented by 3 pairs of circular, slightly sclerotized, slightly raised areas, each with a straight spinelike claw, 2 setae observed in median abdominal area; apex of abdomen as in adult female but all setae around one-fifth shorter.

*Data.*—Described from unmounted specimens (paratypes) and the following mounted material: Two females from *Arundinaria fastuosa*, Kyoto, Japan, A. S. Hitchcock, July 28, 1921, U. S. N. H., paratypes; six females, two second-stage specimens, five larvae, one adult male, one male nymph, and one third-stage male from *Sasa albo-marginata*, Yumoto, Nikko, Japan, S. I. Kuwana collector, July 1925, No. 1256, holotype and paratypes.

Most closely related to *florum* and *masuii*.

### ASTEROLECANIUM SCIRROSIS, new species

(Fig. 62, E-L; pl. 8, M)

*Habit.*—Living at the point of articulation of the blade and sheath of the leaf, the anterior end of the test either pressed tightly between the leaf and stem or resting rather loosely on the leaf petiole, the ventral surface of the test against the upper surface of the leaf, the dorsal surface against the stem.

*Test of female.*—Dorsal and ventral surfaces flat at anterior end if pressed tightly between leaf and stem, with 1 or 2 ridges formed around flattened area, the entire test in this case broadly wedge-shaped; if resting rather loosely on the petiole of the leaf, both surfaces fairly convex and the test roughly ovate or nearly round, in any case the posterior end exposed, rounded, and slightly produced; a distinct margin seldom clearly indicated; 0.75-0.95 mm. long, 0.55-0.75 wide; brownish or greenish yellow, nearly opaque, punctate, varying from very rough and irregular to comparatively smooth; marginal and dorsal filaments not observed; elliptical larval exit in produced area.

*Adult female.*—Nearly circular, ovoid, or elongate ovoid, posterior end produced; 0.65-0.85 mm. long, 0.45-0.65 wide.

Margin: 8-shaped pores in a single row opposite and posterior to spiracles (occasionally 1 pore also close to sclerotized apex), 7-12 on each side of body, 9  $\mu$  long and 6 wide, usually more than a pore's length apart; quinquelocular pores apparently in a single or double row along 8-shaped pores with 5-12 pores beyond each end of row of 8-shaped pores, not clearly differentiated from quinquelocular pores surrounding spiracles; disk pores among quinquelocular pores, extending from near anterior spiracles to sclerotized apex, fairly numerous.

Dorsal surface: 8-shaped pores in a submedian group of 5-8 and a lateral group of 3 or 4, on each half of body, the submedian pores arranged in a double longitudinal row of 2-5 each, the lateral ones in a single longitudinal row, a total of 17-24 observed in these groups, individual pores 8-9  $\mu$  long and 5-6 wide; majority of specimens also with 2-12 8-shaped pores 5  $\mu$  long and 4 wide scattered on anterior end, usually anterior to mouth parts; minute 8-shaped pores absent; disk pores sparse among 8-shaped pores and 2-6 sometimes present on sclerotized apex; tubular ducts, measuring 36  $\mu$  in length, arranged roughly in longitudinal rows; dorsal tubes close to margin in sclerotized apex.

Ventral surface: Antenna short, with 2 setae nearly as long as diameter of antenna; beak without setae; spiracular bar globose; derm outside spiracular opening wrinkled, more or less reticulate, sclerotized, sometimes appearing slightly raised and containing 7-14 quinquelocular pores; spiracles situated close to marginal row of quinquelocular pores and without the usual row of

quinelocular pores extending from opening to body margin; an area without pores completely surrounding spiracle but a double or triple row of quinelocular pores in a circle surrounding clear area except occasionally when the pores extend in a direct line to a point before anterior spiracle instead of curving and completing the circle; 8-shaped pores similar to those on anterior part of dorsal surface usually scattered anterior to beak, and 2-5 rarely posterior to beak; approximately of the same size and number as those on dorsal surface; submarginal row of 8-shaped pores absent; apparently 6 pairs of submarginal setae on abdomen (5 pairs in membranous area and 1 in sclerotized area); 2 setae posterior to genital opening, usually 6 in successive pairs anterior to opening.

Apex of abdomen: Heavily sclerotized; setae, apical  $12\ \mu$  long, others normally absent but sometimes a minute seta close to 1 apical seta; anal opening apical, circular; anal tube sclerotized near opening, membranous on inner half, slightly larger in center than at ends; anal ring a sclerotized band with 2 setae about  $2\ \mu$  long.

*Second stage*.—Ovoid; margin apparently with 12 pores on each side of body, posterior pores largest, gradually decreasing in size anteriorly, quinelocular pores between spiracular pore bands; dorsal surface with 5 or 6 8-shaped pores at posterior end, smaller than anterior marginal 8-shaped pores; ventral surface with bar of spiracle fairly broad, area around spiracular opening membranous, 4 or 5 pores between opening and body margin, a few disk pores in a submarginal row on abdomen, setae indeterminable; apex of abdomen too poor for determination of structures.

*Larva*.—Ovoid.

Margin: With 18 8-shaped pores, situated on abdomen and thorax, posterior pair the largest, the others gradually decreasing in size to anterior pair, which is one-half as large as posterior pair, axes of all practically longitudinal, except sometimes axes of the posterior and the anterior pairs transverse or diagonal; 3 pairs of setae at anterior end.

Dorsal surface: One or 2 8-shaped pores each side of median line on thorax, about the same size as anterior marginal pores; disk pores in lateral area.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 0; VI, 2 long, 2 stout, 3 fairly stout; antennal bases one-half length of antenna apart; beak setae, 2 pairs apical, 1 pair median; spiracle with 1 quinelocular and 1 quadrilocular pore; leg setae, coxa 4, femur 1 each on inner and outer margins near center, tarsus 2 on inner and 1 on outer margin; tibia one-half as long as tarsus; 2 pairs of submarginal 8-shaped pores, 1 pair posterior to antennae and 1 pair posterior to anterior spiracles; 12-16 disk pores in a submarginal row extending from near anterior marginal 8-shaped pores to a point 2 or 3 8-shaped pores before posterior 8-shaped pore; 6 pairs of submarginal minute setae on abdomen, 2 pairs of submarginal larger setae at anterior end; 1 pair of setae between antennae and mouth parts.

Apex of abdomen: Lobes indicated; setae, apical  $40\ \mu$  long, interapical approximately  $3.6\ \mu$  long; anal opening an elongate incision in margin; anal tube short, sclerotized, bulbous; anal ring a sclerotized band with 2 setae around  $4.5\ \mu$  long; derm around opening sclerotized in a small rectangular area.

*Test of male*.—Elliptical, 0.75 mm. long, 0.45 wide; dorsally slightly convex anteriorly and flat posteriorly; flat ventrally; pale brownish yellow, transparent, fairly thin; marginal filaments apparently same color as test, fragmentary.

*Adult male*.—0.75 mm. long.

Head: Antenna 9-segmented, formula (longest to shortest), (IX), (III, V, VI, VIII), (IV), (VII), (II), (I); antennal setae, I, 2; II, 12; III-IX, 10-18; VII and IX also with 1 stout seta, very long setae not observed on ninth segment; basal bars curved; 12 setae anterior to ventral eyespots.

Thorax: Bar between wing bases curved on anterior margin, three times as long as wide, with a faint longitudinal median fold; tibia very slightly longer than tarsus.

Abdomen: Three segments each apparently with a seta dorsally on lateral margin, apparently 2 segments each with a seta in ventral lateral area; each lobe area with 1 rather short seta; penis sheath apparently without setae on dorsal surface, 6 large setae on each side of ventral opening near base, 3 or 4 smaller setae nearer tip.

*Third-stage male*.—Elongate ovoid; margin with 27 8-shaped pores on each side of body, extending from a transverse line drawn through anterior part of mouth parts to within once or twice a pore's length from bases of apical setae, the



posterior 11 pores the largest though slightly variable in size, next 2 the smallest, the rest slightly larger than the latter but smaller than the posterior pores, quinquelocular pores in a single row extending from anterior end of row of 8-shaped pores to the eighth 8-shaped pore from posterior end of row, somewhat more numerous than corresponding 8-shaped pores; dorsal surface with 10 8-shaped pores scattered on anterior end, mostly anterior to mouth parts, one-third as large as posterior marginal pores, disk pores arranged roughly in 3 transverse rows of approximately 4 each; ventral surface with spiracular bar broad, derm outside spiracular opening slightly wrinkled, faintly sclerotized, and containing 5 or 6 quinquelocular pores, 4 similar pores between these and marginal pores, legs represented by 3 pairs of faintly sclerotized circular areas without claws, 8 8-shaped pores similar to those on dorsal surface at anterior end, disk pores occurring posterior to mouth parts and in a submarginal row, submarginal setae present on abdomen but number indeterminable, none observed in median abdominal area; apex of abdomen without setae but possibly with setal bases, anal opening in ventral surface close to margin, apparently nearly circular, anal tube apparently as in adult female, anal ring with 2 minute setae, derm immediately surrounding opening sclerotized, rest of apex membranous.

*Data*.—Described from unmounted specimens (paratypes) and the following mounted material: Seven females, 16 larvae, 1 adult male, and 1 third-stage male from *Bambusa nana*, Bamboo Garden, Lingnan University, Canton, Kwangtung, China, F. A. McClure, December 24, 1929, holotype and paratypes; 4 females, 1 second-stage specimen, and 17 larvae from *Bambusa nana*, Philippine Islands, F. A. McClure, November 1925, paratypes; 2 females and 2 larvae from *Dendrocalamus strictus*, Havana, Cuba, J. M. Estepé, August 15, 1933, from R. A. Young, paratypes; 4 females and 4 larvae from *Bambusa thourisii*, Herradura, Cuba, J. M. Estepé, August 15, 1933, from R. A. Young, paratypes; 2 females and 2 larvae from bamboo, St. Kitts, intercepted at New York, R. W. Woodbury, January 30, 1935, paratypes; 4 females and 2 larvae from bamboo, Botanic Gardens, Rio de Janeiro, Brazil, D. T. Fullaway, November 6, 1935, paratypes; 1 female from bamboo, Trinidad, intercepted at New York, A. G. Lennox, December 4, 1936, paratype; 2 females from bamboo, St. Kitts, intercepted at New York, A. G. Lennox, January 26, 1937, paratypes; 1 female from bamboo, Antigua, intercepted at New York, P. X. Peltier, February 24, 1937, paratype.

This is the only known species of *Asterolecanium* in which the entire apex of the abdomen is heavily sclerotized. It is also unusual in having large 8-shaped pores ventrally and in lacking ventral submarginal 8-shaped pores.

#### ASTEROLECANIUM SEMISEPULTUM, new species

(Fig. 63, A-E; pl. 8, T)

*Habit*.—Living on both surfaces of leaves, and imbedded in the leaf tissue, the dorsal surface of the test on a level with the surface of the leaf, the tissue surrounding the test slightly raised.

*Test of female*.—Nearly circular, posterior end slightly produced; around 0.5 mm. long, 0.45 wide; flat dorsally, with distinct transverse striations, strongly convex ventrally; pale brownish yellow, transparent, shiny; marginal filaments not observed; elliptical larval exit in dorsal surface at margin.

*Adult female*.—Nearly circular, ventral surface so much larger than dorsal surface, because of its greater convexity, that the whole extent of the slide-mounted insect is larger than dorsal surface; 0.5-0.65 mm. in diameter.

Margin: 8-shaped pores in a single row which is probably normally complete and which terminates the length of an apical seta from setal bases and the pores once to twice a pore's length apart, but with considerable variation due to



growth against host, pores normally around  $8\ \mu$  long and 5 wide and the majority of them with a very short, sclerotized, tongue-shaped projection on dorsal edge.

Dorsal surface: Minute 8-shaped pores numerous; disk pores fairly numerous; tubular ducts  $20\ \mu$  long.

Ventral surface: Antenna globular, with 2 setae slightly longer than diameter of antenna; beak apparently without setae; spiracular bar sometimes slightly expanded at inner end, more or less globose; 10-14 quinquelocular pores extending from spiracle to body margin in a single row; multilocular pores, with 6-10 (usually 10) loculi, in 4 complete rows of 6-8 pores each; 1 or 2 dark-rimmed 8-shaped pores each side of beak and a few scattered in submarginal area; submarginal 8-shaped pores in a single row terminating near the penultimate row of multilocular pores, about one-half as numerous as corresponding marginal 8-shaped pores; submarginal setae in a complete row terminating nearer to apical setae than to marginal 8-shaped pores; 2 pairs of setae in posterior row of multilocular pores, 1 pair in each of the other rows, and 1 pair cephalad of the anterior row.

Apex of abdomen: Lobe barely indicated; setae, apical  $36-40\ \mu$  long, interapical  $2\ \mu$  long, outer ventral  $2.2\ \mu$  long; anal opening apical, circular, its margin sclerotized.

Larva.—Short elliptical.

Margin: With 28 8-shaped pores, posterior pores slightly smaller than the anterior ones, axes of all longitudinal; 2 pairs of setae at anterior end.

Dorsal surface: 8-shaped pores in a submedian row of 5 and a lateral row of 9, on each half of body, about one-half the size of marginal pores; disk pores between submedian and lateral, and a few between lateral and marginal, 8-shaped pores.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 0; VI, 2 long, 2 stout, apparently 1 fairly stout, 2 slender; antennal bases nearly one-half length of antenna apart; beak setae, apparently 4 pairs near tip; anterior spiracle with 2 quinquelocular pores, posterior spiracle with none; leg setae, coxa 3, femur 1 on inner margin near base, tarsus 1 each on inner and outer margins; tibia one-fourth as long as tarsus; 9 pairs of submarginal 8-shaped pores; 7 pairs of submarginal minute setae on abdomen, 5 pairs of submarginal larger setae at anterior end; 2 pairs of setae between antennae and mouth parts.

Apex of abdomen: Lobes barely indicated; setae, apical  $36\ \mu$  long, interapical around  $3.6\ \mu$  long, outer ventral  $2\ \mu$  long; anal opening apical; anal tube short, sclerotized, bulbous; anal ring a sclerotized, circular band with 2 setae  $3.6\ \mu$  long.

Data.—Described from one unmounted specimen, two mounted females, and one mounted larva from *Pasania polystachya*, between Takaw and Meh Soi, Chiang Mai Province, Siam, J. F. Rock, January 4, 1922, U. S. N. H., holotype and paratypes.

The chief differentiating character between this species and *castaneae*, the most closely related form, is the absence of marginal quinquelocular pores in *semisepultum* and their presence in *castaneae*.

### ASTEROLECANIUM SIMILE, new species

(Fig. 63, F-O; pl. 8, D)

Habit.—Living on leaves, twigs, and nuts.

Test of female.—Longer than wide, ovoid, or irregular in outline, owing to position on host, posterior end narrowed and produced; specimens on smooth surfaces 1.5-2 mm. long, 1-1.5 wide, specimens on rough surfaces around 1.5 mm. long, 0.5-0.75 wide; flat to slightly convex dorsally, flat ventrally; pale greenish or clear yellow, transparent, thin, smooth, shiny; marginal filaments whitish to slightly pinkish; elliptical larval exit in margin.

Adult female.—Varying in outline like test, 1-1.75 mm. long, 0.5-0.95 wide.

Margin: In normal specimens 8-shaped pores in a single row briefly interrupted at produced area, but 4-10 pores beyond interruption, and terminating one-half to the length of a pore from bases of apical setae, rarely extending between setae, pores anterior to interruption  $7\ \mu$  long and 4 wide, the others  $8-9\ \mu$  long and 5 wide, approximately a pore's length apart; owing to growth against rough places on the host, the row sometimes with short or long inter-

ruptions at various points or the pores reduced in size; trilocular pores in a single row usually extending across interruption in row of 8-shaped pores and around apex of abdomen between apical setae, rarely terminating with the 8-shaped pores, usually as numerous as corresponding 8-shaped pores near posterior end and one and a half times as numerous as that elsewhere, but present or absent, or reduced in number or size where 8-shaped pores are missing or are reduced in size.

Dorsal surface: Minute 8-shaped pores numerous; disk pores sparse; tubular ducts  $24\ \mu$  long.

Ventral surface: Antenna a roughly circular area with 1-3 very small setae, 2 as long as, and 1 slightly shorter than, diameter of antenna; beak with 2 pairs of setae; spiracle with bar very narrow, and atrium enlarged, bag-shaped, and containing 12-16 quinquelocular pores, 10-20 similar pores extending to body margin in a row varying from single to triple; multilocular pores, with 8-10 loculi, in 3 complete rows, the posterior row usually with 4 pores and each of others with 6-12, the total number usually 20-28; a group of 10-25 (usually around 20) dark-rimmed 8-shaped pores each side of beak, and few or many tending toward arrangement in transverse rows posterior to mouth parts; submarginal 8-shaped pores usually in a single row but sometimes crowded so that the row appears more or less double in lateral area, terminating near anterior end of interruption in marginal 8-shaped pores, nearly as numerous as corresponding marginal 8-shaped pores; submarginal setae in a complete row terminating anterior to the penultimate pair of marginal 8-shaped pores; 1 pair of setae in each row of multilocular pores and 1 pair before the anterior row.

Apex of abdomen: Setae, apical 8-10  $\mu$  long, interapical (inside, or rarely outside, apical) 3  $\mu$  long, outer ventral 2.5  $\mu$  long; anal opening very inconspicuous, elliptical, situated on dorsal surface anterior to bases of apical setae, its margin membranous, sometimes an inconspicuous fold in derm extending from end of opening to bases of apical setae; anal tube very short, membranous; anal ring a sclerotized, semicircular band connecting bases of 2 short, sclerotized collars, a seta 7-10  $\mu$  long, and a pore sometimes outside seta, in each collar; a circular opening in curve of band between collars, the margin of this opening appearing somewhat sclerotized in some specimens, hardly discernible in others; ventral surface of apex rugose.

*Larva*.—Nearly elliptical, posterior end narrowed.

Margin: With 28 8-shaped pores, axes of nearly all transverse or diagonal; a pair of minute setae close to each of the posterior 3 pairs; 3 pairs of setae anteriorly.

Dorsal surface: 8-shaped pores in a lateral row of 9 on each half of body, about one-fourth smaller than marginal pores; disk pores slightly nearer marginal than dorsal 8-shaped pores.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 0; VI, 3 long, 2 stout, 3 fairly stout; antennal bases one-half length of antenna apart; beak setae, 2 pairs apical, 1 pair median; spiracle with 2 trilocular pores; leg setae, coxa 2, femur 1 on inner margin near base, tarsus 1 each on inner and outer margins; tibia one-half as long as tarsus; 9 pairs of submarginal 8-shaped pores; apparently 9 pairs of submarginal minute setae, on abdomen and thorax, 1 pair of submarginal larger setae at anterior end; 3 pairs of setae near antennae and mouth parts.

Apex of abdomen: Setae, apical 28-30  $\mu$  long, interapical 7.2  $\mu$  long, rarely 1 minute seta entad of interapical on 1 half of specimen, outer ventral 2  $\mu$  long; anal opening ventral, circular; anal tube very short; anal ring a sclerotized band with 2 minute setae which are usually visible only when the circumference of the ring is visible.

*Test of male*.—Elliptical, 0.75 mm. long, 0.5 wide; slightly convex dorsally, flat ventrally; pale greenish yellow, transparent, thin; marginal filaments whitish to pale pinkish.

*Adult male*.—0.7 mm. long.

Head: Antenna 9-segmented, formula (longest to shortest), III, IV, V, VI, VII, IX, VIII, I, II; antennal setae, I, 1; II, III, IV, 6 or 7; V, VI, 15; VII-IX, around 10, in addition VII and VIII each with 1 stout seta and IX with 2 stout and apparently 3 very long setae; sclerotized bars not observed; approximately 15 setae between ventral eyespots and antennae.

Thorax: Greatly modified; wings absent; internal framework of thorax represented by a T-shaped bar and 2 stout, sclerotized, hornlike processes, without a bar in center; tibia very slightly shorter than tarsus.

Abdomen: Very slender; five segments each with a seta dorsally on lateral margin, 4 segments each with a seta in ventral lateral area; each lobe area with



1 long seta and 1 or 2 short setae; penis sheath very slender, with 1 pair of small setae dorsally near base, 2 pairs of large setae ventrally near base, and 3 short, and a few minute, setae on each side of ventral opening.

*Male nymph.*—Distinguishing characters similar to those of adult male.

*Third-stage male.*—Elliptical; margin with 8-shaped pores in a complete row terminating near median line, the posterior 2 pores separated by twice the length of a pore, the others about a pore's length apart, trilobular pores in a single row terminating near the posterior marginal 8-shaped pores, 1 near each 8-shaped pore; dorsal surface apparently without minute 8-shaped and disk pores; ventral surface with atrium of spiracle somewhat enlarged and containing 1 quinquelocular pore, apparently sometimes with 1 quinquelocular pore also between spiracle and body margin, 1 or 2 dark-rimmed 8-shaped pores each side of beak, number of submarginal 8-shaped pores, submarginal setae, and areas representing legs indeterminable; apex of abdomen with apical setae apparently present but broken, other setae and anal opening not observed.

*Data.*—Described from unmounted specimens and the following mounted material: Six females, 7 larvae, and 1 adult male from *Attalea cohune*, La Ceiba, Honduras, intercepted at New Orleans, La., Benton and Kostal, November 24, 1920, including holotype; 1 female and 1 larva from *Attalea cohune*, Puerto Sierra, Honduras, Percy Wilson, February 18, 1903, U. S. N. H.; 11 females, 19 larvae, 3 adult males, and 1 male nymph from *Attalea cohune*, Honduras, intercepted at Philadelphia, Pa., W. J. Ehinger, April 25, 1928; 1 female and 2 larvae from coconut palm, Honduras, intercepted at New Orleans, La., J. C. Pritchett, June 25, 1934; 7 females, 23 larvae, 2 adult males, and 1 male nymph from *Palmae*, Jamaica, intercepted at Philadelphia, Pa., M. Kisliuk, July 6, 1934; 3 females, 3 larvae, and 2 third-stage males from *Attalea cohune*, Honduras, intercepted at New Orleans, La., U. G. Haddon, June 28, 1935; 3 females and 12 larvae from palm, Honduras, intercepted at Washington, D. C., H. Y. Gouldman, September 11, 1935.

Closely related to *degeneratum*, *difficile*, and *urichi*. Characters distinguishing it from *degeneratum* and *difficile* are discussed in the treatment of those species. It is distinguished from *urichi* by having multilobular pores, and by the length of the apical setae, which are only approximately as long as the ring setae. In no other species of the genus have apterous males been observed.

### ASTEROLECANIUM SIMPLEX, new species

(Fig. 64, A-E; pl. 9, A)

*Habit.*—Living on stems.

*Test of female.*—Elliptical, around 2 mm. long, 0.9 wide; convex dorsally, sometimes with 2 or 3 minute flattened tubercles on median line, posterior end somewhat flattened; slightly concave ventrally; pale brownish yellow, translucent, dull, punctate; marginal filaments fragmentary, apparently whitish; elliptical larval exit in dorsal surface at margin.

*Adult female.*—Elliptical, 1.8 mm. long, 0.9 wide.

*Margin:* 8-shaped pores in a single row terminating about a pore's length from bases of apical setae, posterior pores 8-9  $\mu$  long and 5 wide, the others 10-11  $\mu$  long and 5 wide, about a pore's width apart; quinquelocular pores in a single row terminating with the 8-shaped pores, in the proportion of 1 to each 8-shaped pore and 1 for each interval toward posterior end, 3 or 4 to each 8-shaped pore between spiracular pore bands, and 2 or 3 to each 8-shaped pore elsewhere.

*Dorsal surface:* Minute 8-shaped pores fairly numerous; disk pores rather sparse; tubular ducts 30-32  $\mu$  long; dorsal tubes present.

*Ventral surface:* Antenna jagged, conical, apparently with 2 setae as long as diameter of antenna; beak without setae; spiracle without a bar, the atrium enlarged and containing 6 or 8 quinquelocular pores, 15-20 similar pores extending from spiracle to body margin in a double row; 3 or 4 dark-rimmed 8-shaped pores



each side of beak and a few on abdomen tending toward arrangement in transverse rows; submarginal 8-shaped pores in a double row, the pores of outer row about twice as numerous as those of inner row and about half as numerous as the marginal 8-shaped pores with which they terminate; 5 pairs of submarginal setae on abdomen, the posterior pair about two-thirds length of an apical seta from bases of apical setae, 7 setae arranged in 2 transverse rows posterior to genital opening, 2 setae anterior to opening, 2 anterior to those.

Apex of abdomen: Lobes barely indicated; setae, apical (tips broken)  $52 \mu$  long, interapical  $8 \mu$  long, intermediate ventral  $5 \mu$  long, outer ventral  $6 \mu$  long; anal opening ventral, close to body margin, circular, its margin membranous.

*Larva*.—Elliptical.

Margin: With 28 8-shaped pores, posterior pair smallest, the others gradually larger to the anterior pore, which is twice the size of the posterior one, axes of all longitudinal; 3 pairs of setae anteriorly.

Dorsal surface: 8-shaped pores in a submedian row of 2 (1 near each end of body) and a lateral row of 8, on each half of body, about as long as the width of a posterior marginal pore; a few disk pores between lateral and marginal 8-shaped pores.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 1; VI, 2 long, 2 stout, 2 fairly stout, 1 slender; antennal bases one-third length of antenna apart; beak pointed but not elongate, with 2 pairs of setae at tip and 1 pair in median area; spiracle with bar very small, and with 1 trilocular and 1 quinquelocular pore; leg setae, coxa 4, femur 1 on inner margin near base and 1 each on inner and outer margins near center, tarsus 1 each on inner and outer margins; tibia one-half as long as tarsus; 9 pairs of submarginal 8-shaped pores; apparently 6 pairs of submarginal minute setae on abdomen, 3 pairs of submarginal larger setae at anterior end; 2 pairs of setae near antennae.

Apex of abdomen: Lobes barely indicated; setae, apical  $40 \mu$  long, interapical  $8 \mu$  long, intermediate and outer ventral each  $3 \mu$  long; anal opening a short, narrow incision in margin; anal tube sclerotized, larger at inner than at outer end; anal ring a sclerotized band.

*Data*.—Described from 3 tests, 1 mounted female, and more than 50 mounted larvae on *Schizostachyum* sp., Bikal, Philippine Islands, F. A. McClure, October 25, 1925, holotype and paratypes.

This species is most unusual in lacking a well-defined bar on the spiracle of the adult female.

### ASTEROLECANIUM SINGULARE, new species

(Fig. 64, F-Q; fig. 65, A; pl. 9, B)

*Habit*.—Living on bark.

*Test of female*.—Somewhat elliptical, posterior end slightly narrowed; 1.6-1.75 mm. long, 1.25-1.35 wide; slightly convex dorsally, flat ventrally; pale brownish yellow, transparent, punctate, shiny; marginal filaments fragmentary, apparently same color as test; elliptical larval exit in dorsal surface at margin.

*Adult female*.—Nearly elliptical, posterior end narrowed, produced, and truncate; 1.6 mm. long, 0.95 wide.

Margin: 8-shaped pores in a single row terminating at produced area of abdomen, individual pores measuring 11-12  $\mu$  long and 8 wide, usually a pore's length apart; quinquelocular pores in a single row terminating with the 8-shaped pores, 2-5 (usually at least 3) near each 8-shaped pore.

Dorsal surface: Minute 8-shaped pores numerous; disk pores rather sparse; tubular ducts  $32 \mu$  long.

Ventral surface: Antenna globular, with 2 setae slightly longer, and 3 much shorter, than diameter of antenna; beak with 3 pairs of setae; spiracle with bar fairly slender, slightly expanded at inner end, atrium enlarged, bag-shaped, and containing 11-13 quinquelocular pores, 13-16 similar pores extending from spiracle to body margin in an irregularly double or triple row; multilocular pores, totaling 76, and with 9 or 10 loculi, apparently arranged in 4 complete and 4 interrupted rows, the posterior row with 26, penultimate row with 17, next with 13, anterior complete row with 4, and each of interrupted rows with 4; a group of 10-12 dark-rimmed 8-shaped pores each side of beak, a few scattered on anterior end, and many posterior to beak, some scattered in lateral area and others tending toward arrangement in at least 6 transverse median rows; submarginal 8-shaped

pores in a single row terminating caudad of the posterior row of multilocular pores, nearly as numerous as corresponding marginal 8-shaped pores; submarginal setae in a complete row terminating caudad of posterior row of multilocular pores; 4 or 5 setae in the posterior row of multilocular pores and 2 in each of other complete rows.

Apex of abdomen: Setae, apical (on ventral surface)  $4\ \mu$  long, interapical  $4\ \mu$  long, outer ventral  $4\ \mu$  long; a cluster of 4 or 5 pores, surrounded by a somewhat rectangular sclerotized band, situated between the interapical setae, each of these pores about the same size as the smallest multilocular pores (near genital opening) and apparently with 6 loculi; a circular opening in ventral surface directly anterior to this group of pores, margin of opening sclerotized.

*Larva*.—Nearly elliptical.

Margin: With 28 8-shaped pores, axes of all longitudinal; a pair of minute setae close to each of the posterior 3 pairs; 3 pairs of setae anteriorly.

Dorsal surface: 8-shaped pores in a lateral row of 9 on each half of body, the posterior pores smaller than the anterior ones, the largest about three-fourths the size of a marginal pore; disk pores between lateral and marginal 8-shaped pores.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 1; VI, 2 long, 2 stout, 3 fairly stout, 1 slender; distance between antennal bases equal to one-third length of antenna; beak setae, 1 pair apical, 1 pair median, 1 pair basal; spiracle with 2 quinquelocular pores; leg setae, coxa 3, femur 0, tarsus 1 each on inner and outer margins; tibia one-half as long as tarsus; claw very short; 9 pairs of submarginal 8-shaped pores; apparently 9 pairs of submarginal minute setae, on abdomen and thorax, 1 pair of submarginal larger setae at anterior end; 4 pairs of setae near antennae.

Apex of abdomen: Lobes indicated; setae, apical  $27\ \mu$  long, interapical  $4\ \mu$  long, dorsal  $1\ \mu$  long, outer ventral  $1.8\ \mu$  long; anal opening apical; anal tube very short, bulbous, sclerotized; anal ring a sclerotized band, apparently without setae.

*Data*.—Described from 2 unmounted specimens, 1 intact and 1 fragmentary mounted female, and 15 mounted larvae from *Livistona merrilli*, Paracale, Camarines, Luzon, Philippine Islands, Ramos and Edano, November–December 1918, U. S. N. H., holotype and paratypes.

*Asterolecanium singulare* is unusual in having pores at the apex of the abdomen enclosed in a somewhat rectangular sclerotized area. This pore plate may correspond to the anal ring found in many species.

### ASTEROLECANIUM SKANIANAE, new species

(Fig. 65, B–F; pl. 9, W)

*Habit*.—Living on the lower surface of leaves.

*Test of female*.—Longer than wide to nearly circular, often irregular in outline owing to growth against hairs on leaf, posterior end slightly produced; 1 mm. long and 0.6 wide, or 0.7–1 mm. in diameter; convex dorsally, posterior end flattened, with transverse striations; flat ventrally; pale greenish yellow, translucent, smooth, shiny or rather dull; marginal filaments whitish, fragmentary; elliptical larval exit in dorsal surface at margin.

*Adult female*.—In shape similar to test, 0.6–0.9 mm. long, 0.5 wide.

Margin: 8-shaped pores in a single row terminating about three-fourths length of an apical seta from bases of setae, each pore with a sclerotized tongue-shaped projection on dorsal edge, posterior pores  $8\ \mu$  long and 5 wide, the others  $9\ \mu$  long and 5 wide, usually from the width to the length of a pore apart; quinquelocular pores in a single row continuing around apex of abdomen between apical setae, slightly more numerous than corresponding 8-shaped pores.

Dorsal surface: Minute 8-shaped pores numerous; disk pores fairly numerous; tubular ducts  $24\ \mu$  long.

Ventral surface: Antenna conical, with 1 seta slightly longer than diameter of antenna; beak with 2 pairs of setae; spiracular bar fairly broad; 15–20 quinquelocular pores extending from spiracle to body margin in a single row; multilocular pores, totaling 20–24 and having 7–10 loculi, in 3 complete rows of 5–8 (usually 8) each; a group of 3–6 dark-rimmed 8-shaped pores each side of beak and a few

between spiracular pore bands; submarginal 8-shaped pores in a single row terminating near posterior row of multilocular pores, about one-third as numerous as corresponding marginal 8-shaped pores; submarginal setae observed only behind posterior spiracular pore bands, the posterior pair about halfway between the last pair of marginal 8-shaped pores and apical setae; 2 pairs of setae in posterior row of multilocular pores, 1 pair in each of the other rows, 1 pair anterior to multilocular pores, and 1 pair still farther anteriorly.

Apex of abdomen: Lobes barely indicated; setae, apical (tips broken)  $54 \mu$  long, interapical  $5.4 \mu$  long, outer ventral  $4-5 \mu$  long; anal opening ventral, fairly close to body margin, circular, its margin sclerotized, usually without setae, but sometimes with 1 minute seta; a sclerotized area extending posteriorly from opening nearly to body margin.

*Larva*.—Elliptical.

Margin: With 28 8-shaped pores, axes of all longitudinal; 2 pairs of setae anteriorly.

Dorsal surface: 8-shaped pores, totaling 27-33 (usually 28 or 29), in a submedian row of 5-9 (usually 5-7) and a lateral row of 8 or 9, on each half of body, uniform in size or a few anterior pores in each row slightly larger than the rest, about one-half the size of marginal pores; disk pores between submedian and lateral 8-shaped pores.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 0; VI, 2 long, 2 stout, 2 fairly stout, 2 slender; antennal bases one-third length of antenna apart; beak setae, certainly 1 pair and possibly 2 pairs apical, 1 pair basal; anterior spiracle with 2 quinquelocular pores and posterior spiracle with 1; leg setae, coxa 3, femur 1 on inner margin near base, tarsus 1 each on inner and outer margins; tibia one-fourth as long as tarsus; 9 pairs of submarginal 8-shaped pores; 7 pairs of submarginal minute setae on abdomen, 1 pair of submarginal larger setae at anterior end; 3 pairs of setae near antennae.

Apex of abdomen: Lobes faintly indicated; setae, apical about  $42 \mu$  long, interapical about  $5 \mu$  long, outer ventral  $3-4 \mu$  long; anal opening apical; anal tube very short, sclerotized, bulbous; anal ring a sclerotized, circular band with 2 setae around  $5 \mu$  long.

*Data*.—Described from unmounted specimens, 8 mounted females, and 14 mounted larvae from *Quercus (Pasania) skaniiana*, Tuk Shan, Kweichow, China, Y. Tsing, September 8, 1930, N. Y. B. G., holotype and paratypes.

This species can be separated from all known species on oak from the Orient, except *japonicum*, by the presence of marginal quinquelocular pores across the apex of the abdomen. It differs from *japonicum* in having a sclerotized tongue-shaped projection on each of the marginal 8-shaped pores, the arrangement of the marginal quinquelocular pores in a single, uncrowded row, in having fewer than 20 quinquelocular pores in each spiracular row, and in having only 3 rows of multilocular pores.

### ASTEROLECANIUM SOLENOPHOROIDES (Green)

(Fig. 65, G-L; pl. 5, 0)

Described by Green as *Planchonia solenophoroides* in 1896 (40, p. 6); redescribed by him in 1909 (42, p. 334) and placed in *Asterolecanium*.

*Habit*.—Living on the lower surface of leaves.

*Test of female*.—Elongate, anterior two-thirds swollen, posterior third strongly narrowed, apex sometimes slightly upturned;  $0.75-1.25$  mm. long,  $0.4-0.5$  wide; strongly convex dorsally, often with a faint longitudinal median carina; flat ventrally; brownish yellow, semitransparent; marginal filaments whitish, not observed on posterior third; 0-4 dorsal filaments along median line, whitish, longer than marginal; elliptical larval exit in ventral surface at margin.

*Adult female*.—In shape similar to test,  $0.6-1.4$  mm. long,  $0.4$  wide.

Margin: 8-shaped pores in a single row terminating near posterior fourth (more than twice length of apical seta from setal bases), posterior pores  $5-6 \mu$  long and  $3-4$  wide, the others  $7-8 \mu$  long and  $4$  wide, from the width to the length



of a pore apart; 4-14 (usually 6) quinquelocular pores usually present where each spiracular pore band meets margin.

Dorsal surface: With or without 8-shaped pores, when present 1-4 along median line,  $10\ \mu$  long and 6 wide; minute 8-shaped and disk pores sparse; tubular ducts  $28\ \mu$  long; dorsal tubes present.

Ventral surface: Antenna circular, short, with 2 setae longer than diameter of antenna; beak without setae; spiracle with bar small, sometimes rather inconspicuous, atrium slightly enlarged and containing 1-3 quinquelocular pores, with 4 or 5 similar pores extending from spiracle to body margin in a single row; 2 slightly enlarged quinquelocular pores posterior to genital opening; 2 or 3 dark-rimmed 8-shaped pores each side of beak and 2 or 3 in a transverse row anterior to genital opening; submarginal 8-shaped pores in a single row apparently terminating slightly before the marginal 8-shaped pores and at least one-half as numerous as marginal 8-shaped pores; 6 pairs of submarginal setae on abdomen, the posterior pair around three-fourths length of an apical seta from bases of apical setae; 1 pair of setae posterior, and 1 pair anterior, to genital opening.

Apex of abdomen: Notch present; lobes indicated; setae, apical  $48\ \mu$  long, interapical  $9\ \mu$  long, inner ventral  $5.4-7.2\ \mu$  long, outer ventral  $6.5\ \mu$  long; anal ring with 4 setae 30 and two  $34\ \mu$  long, with an inner row of 6 and an outer one apparently of 12 or 14 pores, tending toward division on dorsal and ventral sides; ventral surface of apex slightly sclerotized and rugose near median line.

*Larva*.—Nearly elliptical.

Margin: With 28 8-shaped pores, axes of the posterior 6 pairs diagonal, of the others longitudinal; normally 3 pairs of setae at anterior end.

Dorsal surface: 8-shaped pores in a submedian row of 8-11 on each half of body, posterior pores smallest, the others gradually larger cephalad, but anterior pore only slightly larger than posterior, these dorsal pores around one-fourth larger than corresponding marginal pores; disk pores in lateral area.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 1; VI, 2 long, 2 stout, 3 fairly stout, 1 slender; antennal bases about one-third length of antenna apart; beak setae, 2 pairs apical, 1 pair median; anterior spiracle with 1 trilocular pore, posterior spiracle with 1 trilocular and 1 quinquelocular pore; leg setae, coxa 4, femur 1 on inner margin near base and 1 on outer margin near center, tarsus 2 on inner and 1 on outer margin; tibia three-fourths as long as tarsus; 9 pairs of submarginal 8-shaped pores; 6 pairs of submarginal minute setae, on abdomen and thorax, 1 pair of submarginal larger setae at anterior end; 2 pairs of setae between antennae and mouth parts.

Apex of abdomen: Notch present; setae, apical  $28\ \mu$  long, interapical  $3.6\ \mu$  long, inner ventral  $3.6\ \mu$  long, outer ventral  $3.6\ \mu$  long; anal ring with 6 setae about  $10.8\ \mu$  long and an inner row of 6 and an outer row of apparently 8 or 10 pores, tending toward division on dorsal side.

*Test of male*.—Elongate, tapering gradually from anterior third to posterior end; 1 mm. long, 0.3 wide; convex dorsally, sometimes with faint transverse striations along median line; flat ventrally; brownish or greenish yellow, transparent, thin, shiny or dull; marginal filaments pale brownish or whitish; dorsal filaments whitish, arranged in a median and in a lateral row, longer than marginal.

*Male nymph*.—Antenna 10-segmented; each lobe area of abdomen apparently with 1 long and 2 short setae; other characters indeterminable.

*Data*.—Redescribed from specimens (10 females, 15 larvae, and 1 male nymph, mounted) on *Arundinaria* sp., Pundaluoya, Ceylon, E. E. Green, January 1907, type.

Allied to *penicillatum* and *pseudolanceolatum*.

### ASTEROLECANIUM SPARUS, new species

(Fig. 66, A-F)

*Habit*.—Unknown.

*Test of female*.—Elongate, posterior end broken off, broken test 3 mm. long, 1 wide; flat dorsally, with a faint longitudinal median carina; flat ventrally; dull yellow, transparent, fairly thin, punctate; marginal filaments salmon, fragmentary.

*Adult female*.—Lanceolate, 3 mm. long, 1 wide.

Margin: 8-shaped pores in a single row interrupted at anterior end for a space equivalent to that occupied by about 5 pores and terminating length of an apical seta from bases of setae, posterior pores  $8\ \mu$  long and 4.5 wide, the others  $12\ \mu$  long and 6 wide, around a pore's width apart; quinquelocular pores in a single row starting slightly posterior to antennae and ending slightly nearer to the posterior pair of 8-shaped pores than to the posterior spiracular pore bands, a little more numerous than corresponding 8-shaped pores.

Dorsal surface: Minute 8-shaped and disk pores sparse; tubular ducts  $12\ \mu$  long; dorsal tubes present.

Ventral surface: Antenna short, craterlike at end, with 2 setae longer than diameter of antenna; beak without setae; spiracle with bar fairly broad, atrium slightly enlarged and containing 3 or 4 quinquelocular pores, 16-21 similar pores extending from spiracle to body margin in an irregularly double row: 1 or 2 dark-rimmed 8-shaped pores each side of mouth parts and a few in lateral area of abdomen; submarginal 8-shaped pores in a single row terminating near the posterior pair of marginal 8-shaped pores, half as numerous as marginal 8-shaped pores; 4 pairs of submarginal setae on abdomen, the posterior pair slightly behind the posterior pair of marginal 8-shaped pores; 1 pair of setae posterior and 1 pair anterior to genital opening.

Apex of abdomen: Notch present; lobes indicated; setae, apical  $54\ \mu$  long, interapical  $5.4\ \mu$  long, intermediate ventral 3-3.6  $\mu$  long, outer ventral  $5.4\ \mu$  long; anal ring with 6 setae  $27\ \mu$  long and with an inner row of 6 and an outer row of 14 pores, apparently not divided.

Larva.—Elongate elliptical.

Margin: With 28 8-shaped pores, the posterior, penultimate, ninth from posterior, next to anterior, and anterior pairs fairly large and nearly uniform in size, the others also uniform in size and as long as the width of the larger pores, axes of the posterior 6 pairs slightly diagonal or longitudinal, of the others longitudinal; 3 pairs of setae anteriorly.

Dorsal surface: A submedian row of 5-8 8-shaped pores and 1 lateral pore, on each half of body, smallest pores slightly larger than smallest marginal pores and largest pores slightly smaller than largest marginal; disk pores in lateral area.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 1; VI, 2 long, 2 stout, 3 fairly stout, 1 slender; antennal bases one-fourth length of antenna apart; beak setae, 2 pairs apical, 1 pair median; spiracle with 1 trilocular and 1 quinquelocular pore; leg setae, coxa 4, femur 1 on inner margin near base and 1 each on inner and outer margins near center, tarsus 2 on inner and 1 on outer margin; tibia one-half as long as tarsus; 9 pairs of submarginal 8-shaped pores; 6 pairs of submarginal minute setae on abdomen, 2 pairs of submarginal larger setae at anterior end; 2 pairs of setae between antennae and mouth parts.

Apex of abdomen: Notch present; setae, apical  $40\ \mu$  long, interapical  $9\ \mu$  long, intermediate ventral  $2\ \mu$  long, outer ventral  $3\ \mu$  long; anal ring with 6 setae  $9\ \mu$  long and apparently with 6 pores.

Data.—Described from 1 test destroyed in mounting, 1 mounted female, and 18 mounted larvae from *Dinochloa* sp., Naam-fung, Hainan, Kwangtung, China, F. A. McClure, 1929, holotype and paratypes.

This species is most closely related to *bambusicola*, but differs from it in having the marginal row of 8-shaped pores terminating the length of an apical seta from the bases of the apical setae, in having 16 to 21 instead of 60 to 100 quinquelocular pores in each spiracular band, and in lacking a group of 10 to 14 setae posterior to the genital opening, as well as in less conspicuous characters.

### ASTEROLECANIUM SPECTABILE Newstead

(Fig. 66, G-P; fig. 67, A; pl. 3, A)

Described by Newstead in 1917 (77, pp. 15-16) from specimens on palm from Mauritius.

Habit.—Living on the upper surface of leaves.

Test of female.—Lanceolate, 1.5-2.5 mm. long, 0.75-1 wide; flat dorsally, with a faint longitudinal median carina; flat or slightly convex ventrally; bright



orange scarlet, transparent, strongly punctate; marginal filaments salmon, absent from anterior and posterior ends; elliptical larval exit in dorsal surface at margin.

*Adult female*.—Lanceolate, sometimes slightly constricted near posterior end; 1–2 mm. long, 0.75 wide.

*Margin*: 8-shaped pores in a single row on lateral margins, absent from both ends of body, terminating about twice length of an apical seta from bases of setae, 7–8  $\mu$  long and 4 wide, mostly a pore's width apart, but a pore's length apart at ends of row; trilocular pores in a single row between spiracular pore bands and opposite about 20 8-shaped pores outside those bands, 1 near each 8-shaped pore at ends of row, 2 near each 8-shaped pore elsewhere.

*Dorsal surface*: Minute 8-shaped pores not observed; disk pores sparse; tubular ducts in lateral area, 7.2  $\mu$  long.

*Ventral surface*: Antenna a faintly sclerotized, minute, irregular area with 2 setae much shorter than diameter of antenna; beak with 3 pairs of setae; spiracle with bar narrow, atrium enlarged and containing approximately 12 pores whose number of loculi is indeterminable; approximately 16 apparently trilocular pores extending from spiracle to body margin in a single row; multilocular pores, totaling 36–46 and with 10 loculi, in 4 complete and 4 interrupted rows, the posterior row with 6 or 7, each of other complete rows with 8–11, and each of interrupted rows with 2; 2–4 dark-rimmed 8-shaped pores each side of beak and a few on abdomen; submarginal 8-shaped pores apparently in a single row terminating anterior to bases of apical setae, about one-third as numerous as marginal 8-shaped pores; submarginal setae apparently in an interrupted row terminating about the length of an apical seta from bases of apical setae; 2 pairs of setae in the posterior row of multilocular pores and 1 pair in each of the other rows.

*Apex of abdomen*: Lobes indicated; setae, apical broken in all specimens at hand except in 1 adult enclosed in an intermediate stage, 52  $\mu$  long in that specimen, outer ventral 1  $\mu$  long; anal opening apical, circular, its margin membranous.

*Second stage*.—Resembling adult but smaller; margin with 8-shaped pores present at anterior end of body and terminating around the length of an apical seta from bases of apical setae, trilocular pores not meeting between spiracular pore bands, present opposite about 16 8-shaped pores at anterior spiracular pore band, and opposite about 25 8-shaped pores at posterior spiracular pore band; dorsal surface without disk pores; ventral surface with atrium of spiracle containing 3 pores, 6 trilocular pores between spiracle and body margin, 1 dark-rimmed 8-shaped pore each side of beak, 4 pairs of setae in median abdominal area; apex of abdomen as in adult.

*Larva*.—Elliptical.

*Margin*: 8-shaped pores absent; a pair of minute setae on lateral margins of each of the first 3 segments before the last; eyespots usually invisible, barely visible in a few of the specimens examined; apparently 1 pair of setae at anterior end.

*Dorsal surface*: Minute 8-shaped pores apparently in a lateral row on each half of body; disk pores in submarginal area.

*Ventral surface*: Antennal setae, I, 1; IV, 1; V, 1; VI, 4 long, 2 stout, 3 fairly stout; antennal bases one-half length of antenna apart; beak setae, 3 pairs apical, 1 pair basal; spiracle with 1 trilocular and 1 quinquelocular pore; leg setae, anterior coxa 4 instead of 3 minute, other coxae apparently 3 instead of 2 minute, all coxae with 4 long, femur 1 on inner margin near base and 1 on outer margin near center, tarsus 1 each on inner and outer margins; tibia one-fifth as long as tarsus; 9 pairs of submarginal 8-shaped pores; a disk pore entad of, and fairly close to, each submarginal 8-shaped pore of the posterior 8 pairs; apparently 22 submarginal setae, on abdomen, thorax, and head; 1 pair of small and 3 pairs of larger setae at anterior end between margin and mouth parts.

*Apex of abdomen*: Setae, apical 40  $\mu$  long, interapical 5.4  $\mu$  long, a pair 1  $\mu$  long nearly anterior to apical on dorsal margin, and a pair 1  $\mu$  long anterior to interapical on dorsal surface close to margin; anal opening apical, an elongate incision, its margin heavily sclerotized except at ventral end; anal tube funnel-shaped, much larger at inner than at outer end, slightly sclerotized; anal ring sclerotized.

*Data*.—Redescribed from specimens (6 females, 2 second-stage specimens, and 24 larvae, mounted) on palm, Mauritius, from E. E. Green.

This is the only known species of *Asterolecanium* which is red, and one of the few whose larvae lack marginal 8-shaped pores.



## ASTEROLECANIUM STENTAE Brain

(Fig. 67, B-J; pl. 1, A)

Described in 1920 (*12*, pp. 114-115).*Habit*.—Living on twigs, in slightly depressed areas or in shallow pits.

*Test of female*.—Practically circular, 2-2.5 mm. in diameter, posterior end produced and sometimes upturned; convex dorsally, with a broad longitudinal median carina, and sometimes with faint transverse striations; nearly flat or slightly convex ventrally; pale yellow, translucent to nearly opaque, rather thick, slightly punctate; marginal filaments whitish, shortest at posterior end; dorsal filaments whitish, arranged in transverse tufts along median line, and in inconspicuous transverse rows elsewhere, tuft filaments broken, but presumably longer than the others, the majority of which are practically the same length as the marginal filaments; larval exit elongate elliptical, in margin.

*Adult female*.—Usually slightly longer than wide, sometimes nearly circular, posterior end slightly produced; 1.5-2.25 mm. long, 1.25-2 wide, or around 2 mm. in diameter.

*Margin*: 8-shaped pores in an irregularly single and double row terminating once or twice a pore's length from bases of apical setae and usually irregularly single around much of margin although distinctly double at some points, sometimes double except near posterior end, the pores 15-16  $\mu$  long and 9 wide, separated by a space varying from the width to the length of a pore, the 2 rows less than a pore's width apart; quinquelocular pores interrupted at anterior end for a space equal to that occupied by 30-60 8-shaped pores, starting nearly opposite antennae, and ending slightly nearer to posterior spiracular pore bands than to apical setae, the row usually single, but sometimes distinctly double, triple at several points, the pores as numerous as 8-shaped pores of nearer row at ends of row and usually two or three times as numerous as that elsewhere; disk pores dorsad of 8-shaped pores and about half as numerous as those, terminating near apical setae or along edge of anal opening, also occurring ventrad of 8-shaped pores, this row terminating fairly near the posterior pair of 8-shaped pores, the pores irregularly spaced and less numerous than those dorsad of 8-shaped pores.

*Dorsal surface*: 8-shaped pores arranged in 7-9 transverse groups along median line, and distributed between those groups and margin in fairly definite transverse rows, majority of pores in median groups 16  $\mu$  long and 12 wide, those of posterior and penultimate groups 12-13  $\mu$  long and 8-9 wide, the others around 12  $\mu$  long and 8 wide; minute 8-shaped pores absent; disk pores fairly numerous; tubular ducts 40  $\mu$  long.

*Ventral surface*: Antenna irregular, usually sunken in derm, with 2 setae longer and 2-6 shorter than diameter of antenna; 2 or 3 trilocular or quinquelocular pores between antenna and margin; beak with 2 pairs of setae; spiracle with bar very broad, with a sclerotized subcircular area around opening and with 5-10 quinquelocular pores in sclerotized area, 35-55 similar pores extending from spiracle to body margin in a row that is irregularly double to quadruple; multilocular pores, having 4-10 (usually 8-10) loculi, in 3 rows, one of which is sometimes interrupted, posterior row with 7-21 pores, middle row with 9-27, anterior row with 1-16, the total number observed ranging from 20-55; 3-7 dark-rimmed 8-shaped pores each side of beak, a few scattered elsewhere, occasionally 2-4 posterior to beak; submarginal 8-shaped pores in a row 4-6 pores wide (the pores far apart, some toward center of body), interrupted near each antenna, but continued between them, and terminating near a transverse line through about the twenty-fifth posteriormost pair of marginal 8-shaped pores, 4-6 opposite every other marginal 8-shaped pore of nearer row; 1-4 disk pores in each spiracular pore band, 2-5 in each row of multilocular pores, and usually 1-3 in a transverse row anterior to multilocular pores; submarginal setae in a complete row terminating near third or fourth posteriormost pair of marginal 8-shaped pores; 2-4 setae in each row of multilocular pores and 1 or 2 usually anterior to multilocular pores.

*Apex of abdomen*: Notch minute; setae, apical 80-92  $\mu$  long, interapical 28-36  $\mu$  long, dorsal 12-16  $\mu$  long, inner ventral 4-5.2  $\mu$  long, intermediate ventral 5.2-7.2  $\mu$  long, outer ventral (slightly outside intermediate and more nearly anterior to interapical than to apical) 8  $\mu$  long; anal ring with 6 setae 80-92  $\mu$  long, and apparently with 36 pores; ventral surface of apex usually sclerotized in a small

area around inner ventral setae, surrounding area slightly sclerotized in dentate rows.

*Larva*.—Elongate elliptical.

Margin: With 28 8-shaped pores, the posterior 6 pairs slightly smaller than the rest, and with their axes transverse, axes of others longitudinal; a pair of minute setae close to each of the posterior 3 pairs; 4 pairs of setae at anterior end.

Dorsal surface: 8-shaped pores in a submedian row of 10 on each half of body, larger than marginal pores of same segments; disk pores near marginal 8-shaped pores and fairly near a few of the submedian pores; a pair of minute setae near anterior pair of 8-shaped pores.

Ventral surface: Antennal setae, I, 2; IV, 1; V, 1 stout and sometimes 1 slender; VI, 2 long, 2 stout, 3 fairly stout, 2 slender; antennal bases one-sixth length of antenna apart; beak setae, 2 pairs apical, 1 pair basal; spiracle usually with 1 trilocular and 1 quinquelocular pore but occasionally 2 trilocular pores; leg setae, coxa 4, femur 1 on inner margin near base and 1 each on inner and outer margins near center, tarsus 2 on inner and 1 on outer margin; tibia about two-thirds as long as tarsus; 7 pairs of submarginal 8-shaped pores, none between antennae; 11 pairs of submarginal minute setae, on abdomen, thorax, and head; 3 pairs of setae between antennae and mouth parts.

Apex of abdomen: Setae, apical 125  $\mu$  long, interapical 23.4–30  $\mu$  long, dorsal 5.4  $\mu$  long, inner ventral 7.2  $\mu$  long, intermediate ventral 9  $\mu$  long, outer ventral (close to intermediate, not anterior to apical) 7.2  $\mu$  long; anal ring with 6 setae 27–28.8  $\mu$  long and with about 20 pores, apparently not divided; ventral surface of apex sometimes slightly sclerotized around inner ventral setae.

*Data*.—Redescribed from the following material: Unmounted specimens, 7 mounted females, and 11 mounted larvae from *Asclepias fruticosa*, Pretoria, Transvaal, C. P. Lounsbury, September 20, 1914, Brain No. 16; 1 mounted female from *Huernia transvaalensis*, Pretoria, Transvaal, S. Stent, July 8, 1916, Brain No. 29, paratype; 7 mounted females from *Caralluma caudata*, Pretoria, Transvaal, S. Stent, July 8, 1916, Brain No. 29, type and paratypes; 1 mounted female from *Stapezia kavirondo*, Kenya, intercepted at Washington, D. C., L. L. Spesard, March 28, 1935; 1 mounted female from *Huernia* sp., Bushman Land, Cape Province, intercepted at Washington, D. C., J. M. R. Adams, June 3, 1935; 1 mounted female and 2 mounted larvae from *Caralluma* sp., South Africa, intercepted at San Francisco, Calif., September 15, 1936; 4 mounted females from *Hoodia* sp. and 2 mounted females from *Huernia bicampanulata*, South Africa, intercepted at San Francisco, Calif., A. C. Dennett, September 15, 1936.

*Asterolecanium stentae* is very closely related to *arabidis*. However, the multilocular pores of *stentae* usually are much less numerous, are arranged differently, and have fewer loculi than those of *arabidis*. Another difference between the two is the greater number of dark-rimmed 8-shaped pores and their conspicuous arrangement in several transverse rows in *arabidis*. The arrangement of the submarginal 8-shaped pores is also different in the two. In *arabidis* they occur in groups within the row, and occupy a comparatively narrow space, whereas in *stentae* they are spaced uniformly and spread out toward the center of the body. At the apex of the abdomen all the setae usually are conspicuously longer in *arabidis* than in *stentae*, and the outer ventral setae are nearly anterior to the apical in the former but are virtually anterior to the interapical in the latter. Larvae of these species are nearly identical, but the dorsal 8-shaped pores in *stentae* are slightly larger in comparison to the marginal pores than in *arabidis*. The species also is allied to *algeriense*, *launcae*, and *nevadense*.



## ASTEROLECANIUM STRIATUM, new species

(Fig. 68, A-K; pl. 6, J)

*Habit.*—Living on bark and fruit.

*Test of female.*—Somewhat pyriform, 1–1.25 mm. long, 0.75–1 wide; slightly convex dorsally, with a longitudinal median and a submarginal carina, and with transverse striations; flat ventrally; greenish or brownish yellow, fairly transparent, fairly thin, shiny or dull; marginal filaments whitish, broken; dorsal filaments whitish, scattered, shorter than marginal; elliptical larval exit in margin.

*Adult female.*—Longer than wide, posterior end narrowed and produced; 0.75–1 mm. long, 0.5–0.75 wide.

Margin: 8-shaped pores in a single row terminating about two-thirds length of an apical seta from bases of setae, posterior pores 6–7  $\mu$  long and 4.5 wide, the others 8  $\mu$  and 5 wide, a pore's width to length apart; quinquelocular pores in a single row terminating about the length of an 8-shaped pore from bases of apical setae, at least as numerous as 8-shaped pores.

Dorsal surface: 8-shaped pores numerous, tending toward arrangement in close transverse rows, the majority 4  $\mu$  long and 2.5 wide, a few in rather indistinct submarginal rows 5–6  $\mu$  long and 3.5–4 wide; minute 8-shaped pores absent; disk pores in submarginal area, very sparse; tubular ducts 22  $\mu$  long.

Ventral surface: Antenna very short, sunken in derm, with 1 or 2 setae about as long as or longer than diameter of antenna; beak apparently with 2 pairs of setae; spiracle with bar expanded at inner end and with atrium slightly enlarged and containing 4–6 quinquelocular pores, 7–12 similar pores extending from spiracle to body margin in a double or triple row; multilocular pores, totaling 60–80 and having 10 loculi, in 6 or 7 complete and 2 or 3 interrupted rows (9 rows in all), each complete row with 6–11 pores and each interrupted row with 2–4; 5 or 6 dark-rimmed 8-shaped pores each side of beak, a few scattered on anterior end, and others tending toward arrangement in 5 or 6 transverse rows posterior to mouth parts; submarginal 8-shaped pores in an irregularly double row terminating near the fourth posteriormost row of multilocular pores, nearly as numerous as marginal 8-shaped pores; submarginal setae in a complete row terminating slightly beyond the posterior pair of marginal 8-shaped pores; 3–5 setae in the posterior row of multilocular pores and 2 in each of the next 3 rows.

Apex of abdomen: Notch present; lobes well developed; setae, apical 60  $\mu$  long, interapical 10.8  $\mu$  long, dorsal 5.4  $\mu$  long, inner ventral 5.8  $\mu$  long, intermediate ventral about 5.4  $\mu$  long, outer ventral 5.4  $\mu$  long; anal ring with 6 setae 32  $\mu$  long and with an inner row of 6 and an outer row of 16 or 18 pores; ventral surface of apex with an irregular sclerotized area extending anteriorly from interapical setae, surrounding area reticulate.

*Second stage.*—Resembling adult but smaller; ventral surface with 4 pores in each spiracular row; apex of abdomen as in adult but all setae one-third to one-fifth shorter.

*Larva.*—Elliptical.

Margin: With 28 8-shaped pores, the posterior 4 pairs slightly smaller than the rest, and their axes transverse or diagonal, axes of the others longitudinal; apparently 3 pairs of setae at anterior end.

Dorsal surface: A total of 32–40 8-shaped pores arranged in a submedian row of 7–9 and a lateral row of 9–11 (4 pores outside a straight line and suggestive of an intermediate row), on each half of body, submedian pores apparently about one-fourth smaller than marginal, anterior lateral pores larger than the rest and as large as marginal pores of same segments; disk pores between submedian and lateral, and between lateral and marginal, 8-shaped pores.

Ventral surface: Antennal setae, I, apparently 1; IV, 1; V, 1; VI, 4 long, 2 stout, 3 fairly stout; antennal bases one-third length of antenna apart; beak setae, 2 pairs apical, 1 pair basal; spiracle with 2 apparently quinquelocular pores; leg setae, coxa 4, femur 1 on inner margin near base and 1 on outer margin near center, tarsus 2 on inner and 1 on outer margin; tibia one-third as long as tarsus; 9 pairs of submarginal 8-shaped pores; 9 pairs of submarginal minute setae, on abdomen and thorax, 3 pairs of submarginal larger setae at anterior end; 3 pairs of setae between antennae.

Apex of abdomen: Notch present; setae, apical 34  $\mu$  long, interapical 7.2  $\mu$  long, dorsal apparently 3.6  $\mu$  long, inner ventral 2.8  $\mu$  long, intermediate ventral 2.8  $\mu$  long, outer ventral 3.6  $\mu$  long; anal ring with 6 setae 18  $\mu$  long and apparently with an inner row of 6 and an outer row of 12 pores, divided on dorsal and ventral sides.



*Test of male*.—Elliptical, 0.8 mm. long, 0.5 wide; slightly convex dorsally, with longitudinal median and lateral carinae and rather indefinite transverse striations; flat ventrally; pale greenish yellow, transparent, very thin; marginal and dorsal filaments rubbed off.

*Adult male*.—0.7 mm. long.

Head: Antennae broken; characters indeterminable.

Thorax: Bar between wing bases curved on anterior margin, with a fold in center, three times as long as wide; tibia and tarsus broken off.

Abdomen: Five segments each with a seta dorsally on lateral margin; 4 segments each with a seta in ventral submedian area; each lobe area with 1 long and 3 short setae; penis sheath apparently with 4 setae on dorsal surface near base and 14 on each side of ventral opening.

*Male nymph*.—Antenna 10-segmented; other characters indeterminable.

*Data*.—Described from unmounted specimens (paratypes) and the following mounted material: Six females from *Citrus* sp., Java, G. Compere, Compere No. 514, holotype and paratypes; 16 females, 4 second-stage specimens, 24 larvae, 2 fragmentary adult males, and 1 male nymph from *Citrus* sp., Singapore, Straits Settlements, from T. H. Burkill, January and June 1924, paratypes; 1 female from pomelo, Batavia, Java, intercepted at Boston, Mass., O. A. Hardy, July 8, 1934, paratypes; 5 females and 8 larvae from *Citrus* sp., "Pasar Minggoe," Java, C. Franssen collector, 1936, from K. G. E. Kalshoven, paratypes.

Most of the host material has been heavily infested with this scale, and the majority of the insects have been severely attacked with fungus.

#### ASTEROLECANIUM STYPHELIAE (Maskell)

(Fig. 68, L-P; pl. 6, A)

Described by Maskell in 1892 (69, pp. 24-25) as *Planchonia styphe- liae* from *Styphe- lia richei* and *Leptospermum juniperinum* from Aus- tralia, supplied by Mr. French.

*Habit*.—Living on both surfaces of leaves.

*Test of female*.—Elongate ovoid, 1.5-2 mm. long, 1-1.5 wide; convex dorsally, sometimes with a faint longitudinal median carina and transverse striations; flat ventrally; pale brownish yellow, transparent, thin, shiny; marginal filaments white; elliptical larval exit in ventral surface at margin.

*Adult female*.—Elongate ovoid, 1-1.7 mm. long, 0.9-1.3 wide.

Margin: 8-shaped pores in a single row terminating two to three times a pore's length from bases of apical setae, posterior pores 9  $\mu$  long and 5 wide, the others 11-12  $\mu$  long and 7 wide, from less than a pore's width to slightly more than the length of a pore apart; quinquelocular pores in a single row terminating within 6 8-shaped pores from end of row of those pores, slightly more numerous than corresponding 8-shaped pores.

Dorsal surface: Minute 8-shaped pores fairly numerous; disk pores rather sparse; tubular ducts 28  $\mu$  long.

Ventral surface: Antenna thimble-shaped, with 2 setae slightly shorter, 1 much shorter, and 2 slightly longer than diameter of antenna: 1-7 quinquelocular pores between antenna and margin; beak with 2 pairs of setae: spiracular bar fairly broad, 5-12 quinquelocular pores extending from spiracle to body margin in a single row; multilocular pores, totaling 54-71 and with 8-10 loculi, in 6 complete and 3 or 4 interrupted rows, the posterior row with 5-7 pores, each of the next 2 with 10-12, next with 10-15, next with 8-12, next with 5-8, next with 2-7, each of the next 2 with 2-4, and next (if present, anterior to posterior spiracles) with 2; 1 or 2 dark-rimmed 8-shaped pores each side of beak, a few scattered on anterior end, and others arranged in 2 transverse rows among multilocular pores; submarginal 8-shaped pores in a row which is usually single, although occasionally double for a few pores, and terminating near penultimate row of multilocular pores, the pores as numerous as marginal 8-shaped pores; submarginal setae in a complete row terminating near penultimate pair of marginal 8-shaped pores; 2 pairs of setae in posterior row of multilocular pores and 1 pair in each of the next 2 rows.

Apex of abdomen: Notch present; lobes indicated; setae, apical with tip broken,  $77\ \mu$  long (probably not more than 80 if entire), interapical  $9\text{--}12.6\ \mu$  long, inner ventral  $3.6\text{--}5.4\ \mu$  long, outer ventral  $9\ \mu$  long; anal ring with 6 setae  $32\ \mu$  long and with an inner row of 6 and an outer one of 16 pores, divided on dorsal side; ventral surface of apex strongly sclerotized in a rather wide linear area extending anteriorly from each interapical seta, lightly sclerotized in dentate rows elsewhere.

*Second stage.*—Resembling adult but smaller; margin without quinquelocular pores at ends of body; apex of abdomen much as in adult but all setae one-sixth shorter and with a setal base in the position of a dorsal seta.

*Larva.*—Elongate elliptical.

Margin: With 28 8-shaped pores, posterior pores smallest, the others gradually increasing in size cephalad, axes of all longitudinal; a minute seta close to each pore of the posterior 3 pairs; 3 pairs of setae anteriorly.

Dorsal surface: A total of 14–17 8-shaped pores usually in a submedian row of 6 or 7 and a lateral row of 1–3, on each half of body, but the lateral pores sometimes absent on 1 half, posterior pores slightly smaller than anterior ones, all a little smaller than marginal pores of same segments; disk pores between submedian and marginal, and entad of submedian, 8-shaped pores.

Ventral surface: Antennal setae, I, 2; IV, 1; V, 1; VI, 2 long, 2 stout, 3 fairly stout, 2 slender; antennal bases one-third length of antenna apart; beak setae, 2 pairs apical, 1 pair basal; spiracle with 1 trilocular and 1 quinquelocular pore; leg setae, coxa 4, femur 1 on inner margin near base and 1 on outer margin near center, tarsus 1 each on inner and outer margins; tibia one-third as long as tarsus; 10 pairs of submarginal 8-shaped pores; 10 pairs of submarginal minute setae, on abdomen and thorax, 2 pairs of submarginal larger setae at anterior end; 1 pair of setae between antennae.

Apex of abdomen: Notch present; setae, apical  $45\ \mu$  long, interapical  $5.4\text{--}7.2\ \mu$  long, dorsal so minute as to be nearly indistinguishable, inner ventral  $3.6\ \mu$  long, outer ventral  $5.4\ \mu$  long; anal ring with 6 setae  $9\ \mu$  long and with an inner row of apparently 6 and an outer row of apparently 12 pores, divided on dorsal and ventral sides; ventral surface of apex with a sclerotized area extending anteriorly from near each apical seta.

*Test of male.*—Elongate elliptical, 1–1.4 mm. long, 0.6 wide; dorsally slightly convex near anterior end, nearly flat near posterior end, with faint longitudinal median and lateral carinae and with transverse striations; yellow, transparent, thin, shiny; marginal filaments white, shortest at posterior end.

*Adult male.*—1 mm. long.

Head: Antenna 10-segmented, formula (longest to shortest), III, IV, V, VI, X, VII, VIII, IX, I, II; antennal setae, I, 7; II, 9; III, IV, 11; V, 15; VI, VII, VIII, IX, 11–13; X, 16 shorter and 2 very long; basal bars strongly diagonal; 20 setae between or anterior to ventral eyespots; 4 setae on dorsal surface.

Thorax: Bar between wing bases nearly rectangular, two and a half times as long as wide; tibia one-ninth longer than tarsus.

Abdomen: Five segments each with a seta dorsally on lateral margin, 3 segments each with a seta in ventral lateral area; each lobe area with 1 long and 2 or 3 short setae; penis sheath with 1 pair of long and 1 pair of short setae dorsally near base, and 10 setae on each side of ventral opening.

*Male nymph.*—Distinguishing characters similar to those of adult male.

*Third-stage male.*—Similar to second-stage but elliptical, and with more quinquelocular pores.

*Data.*—Redescribed from the following material: Four females, one second-stage specimen, eight larvae, one adult male, two male nymphs, and one third-stage male (all mounted) from Australia, Maskell Collection No. 218; two mounted females from *Leucopogon virgatus*, New South Wales, E. Dämel, 1865, U. S. N. H.; unmounted specimens and three mounted females from *Leucopogon richei*, Swan District, Australia, E. Pritzel, August 1901, U. S. N. H., and specimens (including seven females, six larvae, one adult male, and two male nymphs that have been mounted) on *Styphelia richei*, Cheltenham, Victoria, Australia, C. French, June 1905, from W. W. Froggatt, No. 54.

Closely related to *multiporum*, and rather similar to *transversum*.



## ASTEROLECANIUM SUBDOLUM, new species

(Fig. 69, A-E; pl. 6, F)

*Habit*.—Living on the lower surface of leaves.*Test of female*.—Nearly elliptical, posterior end slightly produced and bluntly pointed; 2 mm. long, 1 wide; nearly flat dorsally, with a faint longitudinal median carina; flat ventrally; bright yellow, transparent, thin, shiny, punctate; marginal filaments whitish, longest at anterior and posterior ends.*Adult female*.—In shape similar to test, 1.75 mm. long, 1 wide.*Margin*: 8-shaped pores in a single row terminating a pore's width from bases of apical setae, posterior pores 12  $\mu$  long and 7 wide, others 14  $\mu$  long and 8 wide, a pore's width apart at anterior end, less than that elsewhere; quinquelocular pores in a single row terminating near the penultimate or posterior pair of 8-shaped pores, half as numerous as corresponding 8-shaped pores near posterior end, as numerous as 8-shaped pores elsewhere; disk pores dorsad of 8-shaped pores and about half as numerous as those, terminating slightly before or beyond the end of the row of 8-shaped pores, irregularly spaced.*Dorsal surface*: Minute 8-shaped and disk pores fairly sparse; tubular ducts absent along median line posterior to mouth parts, numerous elsewhere, 30  $\mu$  long; dorsal tubes present.*Ventral surface*: Antenna dome-shaped, with 2 setae longer and 2 shorter than diameter of antenna; beak without setae; spiracular bar fairly broad; 25-30 quinquelocular pores extending from anterior spiracle to body margin in a row which is single at the spiracle, but 3 or 4 pores wide at the margin; 5 or 6 pores in a group near posterior spiracle and 1 or 2 extending toward body margin but nearer the group than the margin; multilocular pores, totaling 80 and with 8-10 loculi, in 4 complete and 3 interrupted rows, posterior row with 14 pores, penultimate with 15, next with 26, next with 14, and each of interrupted rows with 2-6; 1 dark-rimmed 8-shaped pore 1 side of beak, a few anterior to mouth parts, and a fair number in 3 longitudinal lateral rows on abdomen; submarginal 8-shaped pores in a single row terminating near the posterior row of multilocular pores, half as numerous as corresponding marginal 8-shaped pores; 6 pairs of submarginal setae on abdomen, the posterior pair near the fifth 8-shaped pore from end of row; 1 pair of setae each in the posterior and penultimate rows of multilocular pores.*Apex of abdomen*: Setae, apical, 28  $\mu$  long, interapical 8  $\mu$  long, inner ventral 4  $\mu$  long, outer ventral 5.4  $\mu$  long; anal ring with 6 setae 36  $\mu$  long and with an inner row of 6 and an outer one of 20 pores, divided on dorsal side and tending toward division on ventral; ventral surface of apex slightly sclerotized near median line and margin.*Larva*.—Elliptical.*Margin*: With 28 8-shaped pores, anterior pores slightly larger than the rest, axes of all longitudinal; 3 pairs of setae at anterior end.*Dorsal surface*: 8-shaped pores in a submedian row of 4 or 5 on each half of body, anterior pore slightly larger than the others, all smaller than marginal pores of same segments; disk pores in lateral area.*Ventral surface*: Antennal setae, I, 1; IV, 1; V, 0; VI, 2 long, 2 stout, 3 fairly stout, 1 slender; antennal bases nearly one-half length of antenna apart; beak with 2 pairs of setae at tip; anterior spiracle with 1 trilocular pore, posterior spiracle with 1 trilocular and 1 quinquelocular; leg setae, coxa 4, femur 1 on inner margin near base and 1 each on inner and outer margins near center, tarsus 2 on inner and 1 on outer margin; tibia one-half as long as tarsus; probably 9 pairs of submarginal 8-shaped pores; apparently 7 pairs of submarginal minute setae on abdomen and apparently 2 pairs of submarginal larger setae at anterior end; 2 pairs of setae between antennae and mouth parts.*Apex of abdomen*: Setae, apical broken near base, interapical apparently 9  $\mu$  long, inner ventral 2  $\mu$  long, outer ventral 3.6  $\mu$  long; anal ring with 6 setae 12.6  $\mu$  long and with an inner row of 6 and an outer one of apparently 12 pores, tending toward division on dorsal side.*Data*.—Described from one unmounted specimen, one mounted female, and one mounted larva from *Phyllostachys aurea*, Koolong Ue, Fukien, China, F. A. McClure, July 26, 1930, holotype and paratypes.This species is closely related to *chinae* and *fusum*. It differs from



*chinae*, however, in lacking dorsal 8-shaped pores, and from *fusum* in having the marginal 8-shaped pores terminating very near the apical setae and in having 80, instead of 34 to 40, multilocular pores.

### ASTEROLECANIUM SUBVENTRUOSUM, new species

(Fig. 69, F-J; fig. 79, A; pl. 7, I)

*Habit*.—Living on bark, in shallow pits.

*Test of female*.—Nearly circular, 1.25–1.5 mm. in diameter; slightly convex or nearly flat dorsally, with faint transverse striations; convex ventrally; brownish or clear yellow, transparent, slightly rough; marginal filaments whitish; dorsal filaments not observed; elliptical larval exit in margin.

*Adult female*.—Nearly circular, around 1.25 mm. in diameter.

*Margin*: 8-shaped pores mostly in a double row but posterior 2–10 pores sometimes in a single row, terminating about one-half length of an apical seta from bases of setae, the posterior pores and a few others 9  $\mu$  long and 6 wide, the majority 12  $\mu$  long and 8 wide, the pores usually spaced about a pore's length from each other, the rows usually a pore's width apart; quinquelocular pores in a single row terminating near the third 8-shaped pore from end of row, slightly less numerous than corresponding 8-shaped pores of nearer row at end of row, slightly more numerous than 8-shaped pores elsewhere; disk pores dorsad of, and much less numerous than, the 8-shaped pores, also occurring entad of quinquelocular pores, and terminating anterior to bases of apical setae, more numerous than those dorsad of 8-shaped pores.

*Dorsal surface*: 8-shaped pores scattered except close to margin and posterior end, fairly numerous, 8  $\mu$  long and 5 wide; minute 8-shaped and disk pores rather numerous; tubular ducts 28  $\mu$  long.

*Ventral surface*: Antenna sharply conical, its apex spinelike, with 2 setae shorter than, and 1 as long as, diameter of antenna; 3–5 quinquelocular pores between antenna and margin; beak with 1 pair of setae; spiracular bar subcircular; 12–15 quinquelocular pores extending from spiracle to body margin in a single row; multilocular pores, totaling 100–112 and with 9 or 10 loculi, in 5 complete and 5 interrupted rows (posterior 3 interrupted rows with 1 or 2 pores missing in median area), the anterior row anterior to posterior spiracles, posterior row with 10 pores, each of next 3 rows with 15–21, each of next 4 with 6–10, anterior row apparently with 5 or 6; 1 dark-rimmed 8-shaped pore each side of mouth parts, a few scattered on anterior end, and a few tending toward arrangement in 3 or 4 transverse rows posterior to beak; submarginal 8-shaped pores in a single row terminating near the posterior row of multilocular pores, about half as numerous as corresponding marginal 8-shaped pores of nearer row; submarginal setae in a complete row terminating near the posterior pair of marginal 8-shaped pores; 2 pairs of setae in the posterior row of multilocular pores and 1 pair in the penultimate row.

*Apex of abdomen*: Notch shallow; lobes barely indicated; setae, apical 58  $\mu$  long, interapical 5.4  $\mu$  long, inner ventral 5.4  $\mu$  long, outer ventral 9  $\mu$  long; anal ring with 6 setae 25  $\mu$  long and with an inner row of 6 and an outer row of apparently 12 pores, divided on dorsal and ventral sides; ventral surface of apex sclerotized in dentate rows.

*Larva*.—Nearly elliptical, posterior end narrowed.

*Margin*: With 28 8-shaped pores, the posterior 5 or 6 pairs smaller than the others, the anterior pair largest, axes of the posterior 6 pairs transverse, of the others longitudinal; 2 pairs of setae at anterior end.

*Dorsal surface*: 8-shaped pores, totaling 9–11 in the specimens examined, in a submedian row of 2–4 and a lateral row of 1 or 2, on each half of body, nearly as large as posterior marginal 8-shaped pores; disk pores nearer marginal than lateral 8-shaped pores, and near submedian pores.

*Ventral surface*: Antennal setae, I, 0; IV, 1; V, 0; VI, 2 long, 2 stout, 2 fairly stout; antennal bases about one-third length of antenna apart; beak setae, 2 pairs apical, 1 pair basal; spiracle with 1 trilocular and 1 quinquelocular pore; leg setae, coxa 3, femur 1 on inner margin near base and 1 on outer margin near center, tarsus 1 each on inner and outer margins; tibia one-half as long as tarsus; 9 pairs of submarginal 8-shaped pores; 7 pairs of submarginal minute setae, 6 of which are on the abdomen and 1 at the anterior end; 2 pairs of setae between antennae and mouth parts.

Apex of abdomen: Setae, apical  $64\ \mu$  long, interapical  $7.2\ \mu$  long, inner ventral  $2.5\ \mu$  long, outer ventral  $5\ \mu$  long; anal ring with 6 setae  $16.2\ \mu$  long and with an inner row of 6 and an outer one apparently of 12 or 14 pores, with a tendency toward division on dorsal and ventral sides; ventral surface of apex slightly sclerotized in dentate rows.

*Data*.—Described from unmounted specimens, four mounted females, and seven mounted larvae from *Styphelia* sp., Australia, G. Compere, Compere No. 872, holotype and paratypes.

This species is closely related to *ventruosum*, the most conspicuous difference between the two being the presence of numerous dorsal 8-shaped pores in *subventruosum* and their absence in *ventruosum*.

### ASTEROLECANIUM SUISHAE, new species

(Fig. 70, B-E; pl. 4, H)

Erroneously assigned to *pasaniae* by Takahashi in 1930 (93, pp. 33, 40).

*Habit*.—Living on both surfaces of leaves.

*Test of female*.—Circular, 1.85–2.25 mm. in diameter; flat dorsally, sometimes with a faint longitudinal median carina; flat ventrally; light brownish or greenish yellow, transparent, very thin, shiny, punctate; marginal filaments very pale brownish yellow or bright salmon; larval exit apparently a slit in ventral surface at margin.

*Adult female*.—Circular, 1.65–2.10 mm. in diameter.

Margin: 8-shaped pores in a single row terminating around a pore's length from bases of apical setae, posterior pores  $8\ \mu$  long and 5 wide, or all pores 9–10  $\mu$  long and 5 wide, around a pore's width apart; quinquelocular pores in a single row, usually interrupted for a space equal to that occupied by 9–35 8-shaped pores at anterior end and terminating at a point opposite one of the posterior 33 8-shaped pores, the pores varying in number but usually less numerous than corresponding 8-shaped pores near ends of row and around twice as numerous as 8-shaped pores elsewhere.

Dorsal surface: Minute 8-shaped pores sparse; disk pores numerous; tubular ducts  $24\ \mu$  long.

Ventral surface: Antenna roughly conical, with 3 setae nearly as long as, and 1 much shorter than, diameter of antenna; beak with 2 pairs of setae; spiracular bar fairly broad; 23–39 (usually around 30) quinquelocular pores extending from spiracle to body margin in a row that is irregularly single to triple; multilocular pores, totaling 57–68 and with 6–10 loculi, in 4 complete and 4 or 5 interrupted rows, the posterior row with 13–17 pores, penultimate row with 11–16, next with 12–14, next with 10–13, and each of interrupted rows with 2–4; 2 or 3 dark-rimmed 8-shaped pores each side of mouth parts, a few scattered near spiracles and on abdomen; submarginal 8-shaped pores in a double row terminating near median line, usually 1 or 2 opposite each marginal 8-shaped pore; submarginal setae present only posterior to posterior spiracles, the posterior pair near the penultimate or posterior pair of marginal 8-shaped pores; 2 pairs of setae in the posterior row of multilocular pores and 1 pair in each of the other complete rows.

Apex of abdomen: Setae, apical  $56\ \mu$  long, interapical  $12\ \mu$  long, outer ventral  $3.6\ \mu$  long; anal opening ventral, circular, its margin membranous.

*Larva*.—Elliptical.

Margin: With 28 8-shaped pores, the anterior pair slightly larger than the rest, axes of all longitudinal; 2 pairs of setae at anterior end.

Dorsal surface: 8-shaped pores in a submedian row of 5–7 and a lateral of 9, on each half of body, anterior pore of each row slightly larger than the others, about as long as the width of marginal pores; disk pores between submedian and lateral, and a few between lateral and marginal, 8-shaped pores.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 0; VI, 2 long, 2 stout, 2 fairly stout, 2 slender; antennal bases one-half length of antenna apart; beak with 2 pairs of setae at tip; anterior spiracle with 1 trilocular and 1 quinquelocular pore, posterior spiracle with 1 apparently trilocular pore; leg setae, coxa 3, femur 1 on inner margin near base, tarsus 1 each on inner and outer margins; tibia one-fifth as long as tarsus; 9 pairs of submarginal 8-shaped pores; 7 pairs of submarginal



minute setae on abdomen, 1 pair of submarginal larger setae at anterior end; 3 pairs of setae between antennae and mouth parts.

Apex of abdomen: Setae, apical  $45\ \mu$  long, interapical  $7.2\ \mu$  long, outer ventral  $2\ \mu$  long; anal opening apical; anal tube very short, slightly sclerotized, somewhat bulbous; anal ring a sclerotized band, its ventral side nearly on surface, with 2 setae  $4-5\ \mu$  long.

*Data*.—Described from unmounted material, nine mounted females, and two mounted larvae from *Lithocarpus* sp., Suisha, Taiwan (Formosa), R. Takahashi, September 1928, holotype and paratypes.

Closely related to *pasaniæ*, but differing from it in lacking a sclerotized, tongue-shaped projection from the marginal 8-shaped pores, in having 57 to 68 instead of around 36 multilocular pores, and in having a double, instead of a single, row of submarginal 8-shaped pores.

### ASTEROLECANIUM SUMATRAE, new species

(Fig. 70, F-L; fig. 71, A)

*Habit*.—Living on the upper surface of leaves.

*Test of female*.—Slightly longer than wide, around 3 mm. long and 2.5 wide; flat dorsally and ventrally; yellow, transparent, thin, shiny, punctate; marginal filaments pale golden, fragmentary; dorsal filaments rubbed off; circular larval exit in ventral surface at margin.

*Adult female*.—Slightly longer than wide, around 2.5 mm. long, 2 wide.

Margin: 8-shaped pores in a single row terminating two-thirds length of an apical seta from setal bases, the posterior pores  $9-10\ \mu$  long and 5 wide and the others  $11-12\ \mu$  long and 7-8 wide, around a pore's length apart; quinquelocular pores mostly in a single row, but sometimes in a double row near spiracular pore bands, terminating near the posterior or penultimate pair of 8-shaped pores, at least twice as numerous as corresponding 8-shaped pores except near spiracular pore bands, where they are four times as numerous as 8-shaped pores.

Dorsal surface: 8-shaped pores in at least 10 groups of 7-12 pores each, along median line (derm torn anterior to mouth parts and presence or absence of other median pores indeterminate), and in 22 groups (1-5 pores in each of the posterior 3 groups, 10-14 in each of the others) in submarginal area, majority of pores  $8\ \mu$  long and 6 wide, a few  $6-7\ \mu$  long and 4-5 wide; minute 8-shaped pores numerous; disk pores fairly numerous; tubular ducts  $18\ \mu$  long.

Ventral surface: Antenna thimble-shaped, with numerous minute papillalike excrescences, presence or absence of long setae indeterminate; beak apparently without setae; spiracular bar broad; a group of 5-7 quinquelocular pores outside spiracular opening and 45-55 similar pores extending from group to body margin in a triple or quadruple row; multilocular pores, totaling about 105 and with 8-10 loculi, in 3 complete and apparently 8 interrupted rows (interrupted rows irregularly disposed and exact number indeterminate), 17-25 pores in each complete row, 3-7 in each interrupted row; 6 dark-rimmed 8-shaped pores each side of beak, some scattered on anterior end, and others tending toward arrangement in 3 or 4 transverse rows among multilocular pores; submarginal 8-shaped pores in a triple row terminating near the posterior row of multilocular pores, at least twice as numerous as corresponding marginal 8-shaped pores; submarginal setae in a complete row terminating near the penultimate pair of marginal 8-shaped pores; 2 pairs of setae each in the posterior and penultimate rows of multilocular pores.

Apex of abdomen: Notch present; lobes strongly developed; setae, apical (tips broken)  $63\ \mu$  long, interapical  $11\ \mu$  long, outer ventral  $9\ \mu$  long; anal ring with 6 setae  $32\ \mu$  long and apparently with an inner row of 6 and an outer row of 14 pores, apparently not divided; ventral surface of apex slightly sclerotized.

*Larva*.—Apparently elongate ovoid.

Margin: With 28 8-shaped pores, the anterior pair slightly larger than the others, axes of all longitudinal; apparently 2 pairs of setae at anterior end.

Dorsal surface: 8-shaped pores in a submedian row of 10 and a lateral row of 12, on each half of body, 3 pores of lateral row outside a straight lateral line and suggesting a submarginal row, pores of submedian row gradually increasing in size from posterior pore to the second from anterior end, about



same size as marginal pores of same segments, lateral pores about half the size of marginal pores of same segments; disk pores occurring fairly close to marginal 8-shaped pores, and between submedian and lateral 8-shaped pores.

Ventral surface: Antennal setae, I, apparently 1; IV, 1, V, 0; VI, 2 long, 2 stout, 2 fairly stout; antennal bases about one-half length of antenna apart; beak with 2 pairs of setae at tip; spiracle with 2 quinquelocular pores; leg setae, coxa 3, femur 0, tarsus 1 on inner margin; tibia one-half as long as tarsus; 10 pairs of submarginal 8-shaped pores; 8 pairs of submarginal minute setae, on abdomen and thorax, 2 pairs of submarginal larger setae at anterior end; 1 or 2 setae between antennae.

Apex of abdomen: Setae, apical  $45\ \mu$  long, interapical  $5.4\ \mu$  long, outer ventral apparently  $5\ \mu$  long; anal ring with 6 setae  $2\ \mu$  long.

*Data*.—Described from one test (partially destroyed in mounting insect), one mounted female, and two mounted larvae from *Quercus hystrix*, "Toetoepan," Tapanuli, Sumatra, H. S. Yates, N. Y. B. G., holotype and paratypes.

### ASTEROLECANIUM THESPESIAE Green

(Fig. 71, B-F; pl. 6, N)

Described in 1909 (*42*, p. 331).

*Habit*.—"On small branches of *Thespesia populnea*. Jaffna. March. The insects occupy small depressions in the bark." (*42*, p. 331.)

*Test of female*.—Broadly ovoid, posterior end very slightly produced; 1.85-2 mm. long, 1.25-1.75 wide; nearly flat dorsally, lateral margins sometimes slightly raised, thereby giving the effect of marginal carinae, usually with a low, rather indistinct longitudinal median carina and faint transverse striations; usually distinctly convex ventrally, sometimes nearly flat; brownish yellow, transparent, fairly thick; marginal filaments whitish, fragmentary; dorsal filaments whitish, very short; elliptical larval exit in margin.

*Adult female*.—Nearly circular, posterior end slightly produced; 1.25-1.75 mm. in diameter.

Margin: 8-shaped pores in a double row (the row sometimes triple for a few pores) terminating twice a pore's length from bases of apical setae, 10-12  $\mu$  long and 8 wide, the intervals between them varying from the width to twice the length of a pore, the 2 rows about a pore's width apart; quinquelocular pores in a single row, often crowded with the row appearing double in lateral area, terminating with the 8-shaped pores or beyond, at least as numerous as corresponding 8-shaped pores of nearer row at ends of body, two or three times as numerous as 8-shaped pores in crowded lateral areas; disk pores in a rather indefinite row dorsad of 8-shaped pores, irregularly spaced and rather sparse, also in a single row ventrad of quinquelocular pores, not quite so numerous as 8-shaped pores of nearer row, and terminating near end of that row.

Dorsal surface: 8-shaped pores numerous, present except near posterior end and close to margin, median pores tending toward arrangement in longitudinal rows, the others toward arrangement in transverse rows, 9-12  $\mu$  long and 6-8 wide, the median pores as large as any of the rest; minute 8-shaped pores numerous; disk pores fairly numerous; tubular ducts 30-32  $\mu$  long.

Ventral surface: Antenna bluntly conical, with 2 setae slightly longer, and 3 a little shorter, than diameter of antenna; 3 or 4 quinquelocular pores between antenna and margin; beak with 2 pairs of setae; spiracle with bar subcircular, atrium enlarged, shallow, and containing 6 quinquelocular pores, 6 (at anterior spiracle) to 15 (at posterior spiracle) similar pores extending from spiracle to body margin in a single row; multilocular pores, totaling 177-190 and with 7-10 loculi, apparently in 7 or 8 complete rows, the anterior row apparently anterior to posterior spiracles, posterior row with 15-17 pores, penultimate row with 20-27, next with 31-37, next with 30-36, next with 26-31, next with 19, next with 14, and anterior row with 15; 1-4 dark-rimmed 8-shaped pores each side of beak, a few scattered anterior to mouth parts, and a few tending toward arrangement in 5 or 6 transverse rows posterior to mouth parts; submarginal 8-shaped pores in a double row terminating near posterior row of multilocular pores, 2 opposite each or every other marginal 8-shaped pore; submarginal setae in a complete

row terminating near posterior pair of marginal 8-shaped pores; 2 pairs of setae in posterior row of multilocular pores and 1 pair in each of the next 2 rows.

Apex of abdomen: Notch present; lobes indicated; setae, apical 77.4  $\mu$  long (tips broken, probably not more than 80  $\mu$  if intact), interapical 16.2  $\mu$  long, dorsal 12.6  $\mu$  long, inner ventral 10.8  $\mu$  long, intermediate ventral 9  $\mu$  long, outer ventral 10.8–12.6  $\mu$  long; anal ring with 6 setae around 40  $\mu$  long, but with the number and arrangement of pores indeterminable, divided on dorsal and ventral sides; ventral surface of apex with an irregularly linear sclerotized area extending anteriorly from intermediate ventral seta, surrounding area sclerotized and rugose.

*Larva*.—Nearly elongate elliptical, posterior end narrowed.

Margin: With 23 8-shaped pores, the posterior pores slightly smaller than the others, axes of the posterior 6 pairs transverse, of the others longitudinal; a minute seta close to each pore of the posterior 3 pairs; 4 pairs of setae at anterior end.

Dorsal surface: 8-shaped pores in a submedian row of 9 or 10 and a lateral row of 13, on each half of body, 2–4 lateral pores inside a straight line and suggesting an intermediate row, anterior pores slightly larger than posterior pores and all a little smaller than marginal pores of same segments; disk pores between lateral and marginal, and between lateral and submedian, 8-shaped pores; sometimes a pair of minute setae near anterior pair of submedian 8-shaped pores.

Ventral surface: Antennal setae, I, 2; IV, 1; V, 1; VI, 2 long, 2 stout, 3 fairly stout, 2 slender; antennal bases one-fourth length of antenna apart; beak setae, 2 pairs apical, 1 pair basal; spiracle with 1 trilocular and 1 quinquelocular pore; leg setae, coxa 4, femur 1 on inner margin near base and 1 each on inner and outer margins near center, tarsus 2 on inner and 1 on outer margin; tibia one-third as long as tarsus; 9 pairs of submarginal 8-shaped pores; sometimes 2 or 4 disk pores beside or posterior to the posterior 2 submarginal 8-shaped pores; 10 pairs of submarginal minute setae, on abdomen and thorax, 3 pairs of submarginal larger setae at anterior end; 3 pairs of setae between antennae and mouth parts.

Apex of abdomen: Notch present; lobes barely indicated; setae, apical 63  $\mu$  long, interapical 7.2  $\mu$  long, dorsal 4.5  $\mu$  long, inner ventral 3.6–5.4  $\mu$  long, intermediate ventral 2.5  $\mu$  long, outer ventral 4  $\mu$  long; anal ring with 6 setae 27  $\mu$  long and with an inner row of 6 and an outer row of 12 pores, tending toward division on dorsal and ventral sides.

*Data*.—Redescribed from specimens (2 females and 20 larvae, mounted) on *Thespesia populnea*, Jaffna, Ceylon, from E. E. Green, type.

Very similar to *brachylenae*.

### ASTEROLECANIUM TOKYONIS Kuwana

(Fig. 71, G–J; pl. 3, I)

Described by Kuwana (55, pp. 149–150) in 1916 from *Pasania cuspidata*, from Nishigahara and Tokyo, Japan.

*Habit*.—Living on bark, in shallow pits.

*Test of female*.—Longer than wide, with a shallow notch in posterior margin; 2.5 mm. long, 2 wide; nearly flat dorsally, slightly convex ventrally; greenish yellow, transparent; marginal filaments whitish, fragmentary; dorsal filaments entirely rubbed off; elliptical larval exit in margin.

*Adult female*.—Slightly longer than wide, measuring 2 mm. in length and 1.75 in width.

Margin: 8-shaped pores mostly in a double row but posterior 6 or 7 pores in a single row, terminating around length of an apical seta from bases of setae, 9  $\mu$  long and 6 wide, one to three times (usually about twice) a pore's length apart, the 2 rows about a pore's length apart; quinquelocular pores in a single row terminating with 2 pores posterior to the last 8-shaped pore, one and one-half times as numerous as 8-shaped pores of nearer row.

Dorsal surface: 8-shaped pores very numerous, about 5  $\mu$  long and 3 wide; minute 8-shaped pores absent; disk pores numerous; tubular ducts 32  $\mu$  long.



Ventral surface: Antenna thimble-shaped, with 3 (broken) setae; 2 quinquelocular pores between antenna and margin; beak setae, apparently 2 pairs apical and 1 pair median; spiracle with bar broad, atrium slightly enlarged and containing 3-7 quinquelocular pores, 31-40 similar pores extending from spiracle to body margin in an irregularly single or double row; multilocular pores, totaling 157 and with 7-12 (usually 10) loculi, apparently in 6 complete rows (anterior row possibly interrupted), posterior and penultimate rows each with 30, each of next 2 with 34, next with 13, and anterior row with 6; 4 dark-rimmed 8-shaped pores each side of beak, a few scattered elsewhere, possibly tending toward arrangement in transverse rows posterior to mouth parts; submarginal 8-shaped pores in a single row terminating near posterior row of multilocular pores, about one-third as numerous as corresponding marginal 8-shaped pores of nearer row; submarginal setae in a complete row terminating slightly farther posteriorly than the marginal 8-shaped pores, much more numerous than usual, 34 occurring behind posterior spiracles: 1 pair of setae in each of the posterior 4 rows of multilocular pores.

Apex of abdomen: In poor position for study. Notch present; lobes indicated; setae, apical broken, at least  $63 \mu$  long, interapical broken, dorsal  $12.6 \mu$  long, intermediate ventral apparently  $5.4 \mu$  long, outer ventral  $18 \mu$  long; anal ring with 6 setae apparently  $36 \mu$  long, with an inner row of apparently 6 and an outer row of an indeterminable number of pores, divided on dorsal and ventral sides; ventral surface of apex slightly sclerotized and slightly reticulate.

*Data*.—Redescribed from one test and one mounted female on *Quercus (Pasania) henryi*, Tuk Shan, Kweichow, China, Y. Tsiang, August 22, 1930, N. Y. B. G.

Assigned to *tokyonis* on the basis of the original description. In the specimen examined there are many small, conspicuous dorsal 8-shaped pores which were not mentioned by Kuwana, and two pairs of setae in the anal area in addition to those included in the original description.

#### ASTEROLECANIUM TOWNSENDI Cockerell

(Fig. 72, A-K; pl. 3, H)

Described in 1902 (25, pp. 468-469).

*Habit*.—Living on bark, sometimes in shallow pits.

*Test of female*.—Broadly ovoid or nearly circular, posterior end slightly produced and slightly or distinctly elevated; 2.5 mm. long, 2.25 wide, or 2-2.5 mm. in diameter; convex dorsally, sloping to posterior tip, sometimes with a faint longitudinal median carina near posterior end; presumably flat or very slightly convex ventrally; marginal brownish or clear yellow, transparent, rather thick, shiny, punctate; marginal filaments whitish, fragmentary; dorsal filaments rubbed off; elliptical larval exit in margin.

*Adult female*.—Nearly circular, posterior end slightly produced; around 2.25 mm. in diameter.

Margin: 8-shaped pores in a single row terminating around three times a pore's length (less than one-half length of an apical seta) from bases of setae,  $12 \mu$  long and 8 wide, usually a pore's width apart; quinquelocular pores in a row that is single posteriorly and irregularly so anteriorly but double on the middle portion, terminating at or near the posterior pair of 8-shaped pores, quinquelocular pores as numerous as 8-shaped pores at posterior end of row, nearly twice as numerous on remainder of posterior fourth and on the anterior fourth, and up to four times as numerous as corresponding 8-shaped pores on middle portion; disk pores among 8-shaped pores and terminating with 1 posterior to the last 8-shaped pore, 1 near each 8-shaped pore near end of row, and 1 near every other 8-shaped pore elsewhere.

Dorsal surface: 8-shaped pores with a tendency toward a longitudinal grouping in median area and occurring in transverse rows elsewhere, majority  $14-16 \mu$  long and  $10-12$  wide, many  $20 \mu$  long and  $14$  wide; minute 8-shaped pores absent; disk pores fairly numerous; tubular ducts  $36 \mu$  long.

Ventral surface: Antenna dome-shaped, sunken in derm. with 2 setae longer and 2 slightly shorter than diameter of antenna; 5 or 6 quinquelocular pores between antenna and margin; beak with 2 pairs of setae; spiracular bar fairly



broad and expanded at inner end; 35-55 quinquelocular pores extending from spiracle to body margin in a row irregularly double or triple near spiracle but 5 or 6 pores wide near margin; multilocular pores, totaling 271, with 6-14 (usually 10-12) loculi, in 5 complete and 4 interrupted rows, the posterior row with 26 pores, penultimate row with 40, next with 66, next with 56, next with 43, next with 17, next with 11, next with 7, and anterior row with 5; 4 or 5 dark-rimmed 8-shaped pores each side of beak, some scattered on anterior end, and others arranged in at least 4 transverse rows on abdomen; submarginal 8-shaped pores in a double row terminating near the posterior row of multilocular pores, 1 or 2 opposite each marginal 8-shaped pore; submarginal setae in a complete row terminating anterior to posterior pair of marginal 8-shaped pores; 2 pairs of setae in posterior row of multilocular pores and 1 pair in each of the next 2 rows.

Apex of abdomen: Notch present; lobes indicated; setae, apical  $92 \mu$  long, interapical  $20 \mu$  long, dorsal  $16 \mu$  long, intermediate ventral  $8 \mu$  long, outer ventral  $12 \mu$  long; anal ring with 6 setae  $36-40 \mu$  long and with an inner row of apparently 6 pores and an outer one of an indeterminable number, but probably around 14, divided on dorsal side and tending toward division on ventral side; ventral surface of apex sclerotized and rugose.

*Larva*.—Nearly elliptical, posterior end slightly narrowed.

Margin: With 28 8-shaped pores, the posterior 6 pairs slightly smaller than next 7, the anterior pair a little larger than any others, axes of the posterior 6 pairs transverse, of the others longitudinal; a pair of minute setae close to each of the posterior 3 pairs; 4 pairs of setae at anterior end.

Dorsal surface: 8-shaped pores in a submedian row of 9 or 10, a lateral row of 3-5, and a submarginal row of 5-7, on each half of body, the total number ranging from 38-42, lateral and submarginal rows rather indistinct and appearing somewhat as an irregular lateral row, anterior pores slightly larger than posterior pores, all practically the same size as marginal pores of same segments; disk pores between submarginal and marginal 8-shaped pores.

Ventral surface: Antennal setae, I, 2; IV, 1; V, 0; VI, 2 long, 2 stout, 3 fairly stout, 2 slender; antennal bases one-third length of antenna apart; beak setae, 2 pairs apical, 1 pair basal; spiracle with 1 trilocular and 1 quinquelocular pore; leg setae, coxa 4, femur 1 on inner margin near base and 1 each on inner and outer margins near center, tarsus 2 on inner and 1 on outer margin; tibia three-fifths as long as tarsus; 8 pairs of submarginal 8-shaped pores of which 1 pair is between the antennae; 10 pairs of submarginal minute setae, on abdomen and thorax, 3 pairs of submarginal larger setae at anterior end; 2 pairs of setae between antennae and mouth parts.

Apex of abdomen: Notch present; lobes sometimes indicated; setae, apical  $81 \mu$  long, interapical  $9 \mu$  long, dorsal 2-3  $\mu$  long, intermediate and outer ventral  $5.4 \mu$  long; anal ring with 6 setae  $24 \mu$  long and with an inner row of 6 and an outer one of apparently 12 pores, divided on dorsal side.

*Test of male*.—Elongate elliptical, a minute patch at posterior end; 1.5-1.75 mm. long, 0.7 wide; fairly convex dorsally, with a faint longitudinal median carina; presumably flat ventrally; pale yellow, transparent, thin, shiny, punctate; marginal and dorsal filaments whitish, fragmentary; dorsal filaments presumably scattered over surface.

*Third-stage male*.—Elongate ovoid, posterior end narrowed; margin with quinquelocular pores much less numerous than in female; dorsal surface with 8-shaped pores arranged in transverse groups along median line and in lateral and submarginal areas, less numerous than in female, varying in size like those of female; ventral surface with 6-9 quinquelocular pores in each spiracular row; submarginal 8-shaped pores in an irregularly single row, less numerous than in female; legs represented by 3 pairs of faintly sclerotized, slightly elevated, circular areas, each with a minute spurlike claw or a bluntly sclerotized spot; apex of abdomen as in female, but all setae, except dorsal and ring setae, around one-third shorter, the ring setae as long as, the dorsal setae slightly longer than, corresponding setae in female.

*Data*.—Redescribed from specimens (two females, seven larvae, and six third-stage males, mounted) on *Guazuma* sp., Platanas, Jalisco, Mexico, received July 1903, type.

Most closely related to *cristatum*.

## ASTEROLECANIUM TRANSVERSUM Morrison and Morrison

(Fig. 72, L-N; fig. 73, A, B; pl. 6, B)

Described in 1927 (73, pp. 7-8).

*Habit*.—Living on bark, in pits.*Test of female*.—Usually wider than long, posterior end sometimes slightly produced; around 1 mm. long and 1.2 wide or 1-1.5 mm. in diameter; flat to slightly convex dorsally, with faint transverse striations; convex ventrally; brownish yellow, transparent, thick, rather rough, dull; marginal filaments whitish, fragmentary; elliptical larval exit in margin.*Adult female*.—Usually wider than long, measuring around 0.8 mm. long and 1 wide.Margin: 8-shaped pores in a single row terminating three or four times a pore's length from bases of apical setae, a few pores out of alignment or set diagonally to margin, posterior pores 8-9  $\mu$  long and 5 wide, the others 9-10  $\mu$  long and 6-7 wide, usually a pore's length apart; quinquelocular pores in a single row, usually terminating posterior to posterior pair of 8-shaped pores although sometimes between penultimate and posterior pores, slightly more numerous than 8-shaped pores.Dorsal surface: Minute 8-shaped pores rather sparse; disk pores very sparse; tubular ducts 28  $\mu$  long.

Ventral surface: Antenna thimble-shaped, with 2 setae longer than diameter of antenna; 3-8 quinquelocular pores between antenna and margin; beak with 2 pairs of setae; spiracular bar broad; 9-16 quinquelocular pores extending from spiracle to body margin in a single row; multilocular pores, totaling 74-88 and with 9 or 10 loculi, in 5 complete and 4 interrupted rows, anterior row usually anterior to posterior spiracles, posterior row with 5-7 pores, penultimate row with 9-15, each of next 3 with 10-17, next with 8-10, next with 4-7, next with 4, and anterior row with 2; 1 or 2 dark-rimmed 8-shaped pores each side of beak, a few scattered on anterior end and a few tending toward arrangement in 2 transverse rows among multilocular pores; submarginal 8-shaped pores in a single row terminating near penultimate row of multilocular pores, about half as numerous as corresponding marginal 8-shaped pores; submarginal setae in a complete row terminating about halfway between posterior marginal 8-shaped pores and apical setae; 2 pairs of setae in posterior row of multilocular pores and 1 pair in each of the next 2 rows.

Apex of abdomen: Notch present; lobes indicated; setae, apical (tips broken) 60  $\mu$  long, interapical 9-10.8  $\mu$  long, inner ventral 2  $\mu$  long, intermediate ventral 4-5.4  $\mu$  long, outer ventral 5.4-7.2  $\mu$  long; anal ring with 6 setae 27  $\mu$  long and with an inner row of 6 and an outer one of 14 or 16 pores; ventral surface of apex with a short sclerotized area extending anteriorly from intermediate ventral seta.*Larva*.—Elongate ovoid.

Margin: With 28 8-shaped pores, axes of the posterior 6 pairs transverse or diagonal, of the others longitudinal; 2 pairs of setae at anterior end.

Dorsal surface: 8-shaped pores in a submedian row of 9 or 10 and a lateral row of 11 or 12, on each half of body, 4 pores of lateral row outside the line of the others and suggesting a submarginal row, practically uniform in size or anterior pores larger than the rest, distinctly smaller than marginal pores; disk pores between submedian and lateral, and between lateral and marginal, 8-shaped pores.

Ventral surface: Antennal setae, I, 2; IV, 1; V, 1; VI, 2 long, 2 stout, 3 fairly stout, 2 slender; antennal bases one-third length of antenna apart; beak setae, 2 pairs apical, 1 pair basal; anterior spiracle with 2 trilocular pores, posterior with 1; leg setae, coxa 4, femur 1 on inner margin near base and 1 on outer margin near center, tarsus 1 each on inner and outer margins; tibia one-half as long as tarsus; 10 pairs of submarginal 8-shaped pores; 8 pairs of submarginal minute setae, on abdomen and thorax, 3 pairs of submarginal larger setae at anterior end; 1 pair of setae between antennae and mouth parts.

Apex of abdomen: Notch present; setae, apical 54  $\mu$  long, interapical 7.2  $\mu$  long, inner ventral 2.5  $\mu$  long, intermediate ventral 5.4  $\mu$  long, outer ventral 4.8  $\mu$  long; anal ring with 6 setae 21.6  $\mu$  long and with an inner row of 6 and an outer one of 14 pores, divided on dorsal and ventral sides; ventral surface of apex heavily sclerotized in a small area extending anteriorly from each intermediate ventral seta, lightly sclerotized elsewhere.



*Data*.—Redescribed from the following material: Three mounted females and 8 mounted larvae, Australia, Maskell Collection No. 218, holotype and paratypes (source unknown, possibly Tasmania, 73, p. 8); unmounted material, 4 mounted females, and 12 mounted larvae, Maskell Collection No. 44, Cockerell Collection; unmounted material and 2 mounted females from *Banksia* sp., Mittagong, New South Wales, W. W. Froggatt, January 10, 1901, Froggatt No. 52; unmounted material, 3 mounted females, and 5 mounted larvae from *Banksia integrifolia*, Somerville, Victoria, Australia, from W. W. Froggatt, 1910, Froggatt No. 1.

*Asterolecanium transversum* is rather similar to *stypheleae* and *hakeae* but has an additional pair of ventral setae at the apex of the abdomen, and also differs from them in other characters. There are three pairs of ventral setae on the apex of the abdomen instead of two as was stated in the original description (73, p. 8).

### ASTEROLECANIUM BONDARI Lepage<sup>12</sup>

(Fig. 73, C-P; pl. 9, T)

*Habit*.—Living on both surfaces of leaves.

*Test of female*.—Elongate, widest on anterior third, tapering gradually to posterior end, anterior end usually truncate; 1.25–1.50 mm. long, 0.5–0.75 wide; sharply convex dorsally, flat ventrally; greenish or dull yellow, transparent, thin, punctate; marginal filaments light brownish or pale salmon; circular larval exit in margin.

*Adult female*.—In shape similar to test, 1.10–1.4 mm. long, 0.5–0.7 wide.

*Margin*: 8-shaped pores in a single row terminating two to three times the length of an apical seta from bases of setae, posterior pores 8  $\mu$  long and 4 wide, the others 9  $\mu$  long and 5 wide; usually about a pore's width apart; trilocular pores in a single row terminating at a point opposite one of the last 9 8-shaped pores, about one and one-half times as numerous as 8-shaped pores.

*Dorsal surface*: Minute 8-shaped pores in median area, sparse; disk pores sparse; tubular ducts 28  $\mu$  long.

*Ventral surface*: Antenna thimble-shaped, with 2 setae longer and 1 or 2 shorter than diameter of antenna; beak with 2 pairs of setae; spiracle with bar slender, atrium slightly enlarged, but not containing pores; 9–12 quinquelocular pores extending from spiracle to body margin in a single row; multilocular pores, with 9 or 10 loculi, in 2 complete rows and 1 interrupted row of 3–5 pores each: a group of 8–13 dark-rimmed 8-shaped pores each side of mouth parts and 2 or 3 posterior to beak; submarginal 8-shaped pores in a single row terminating near posterior row of multilocular pores, about half as numerous as corresponding marginal 8-shaped pores; submarginal setae in a complete row terminating around one-half length of an apical seta from bases of apical setae; 1 pair of setae each in posterior row and in median row of multilocular pores.

*Apex of abdomen*: Lobes indicated; setae, apical 40–45  $\mu$  long, interapical 10–12  $\mu$  long, outer ventral 4  $\mu$  long; anal opening in margin, inconspicuous; anal tube membranous, inconspicuous; anal ring consisting of 2 sclerotized, elliptical plates with an end of one contiguous to an end of the other, each plate with a seta 20  $\mu$  long at each end and a roughly rectangular clear area in center; a circular opening ventrad of, and in the angle formed by, the junction of the 2 plates.

*Larva*.—Elongate elliptical.

*Margin*: With 28 8-shaped pores, the posterior pair and the anterior 2 pairs larger than the rest, axes of all practically longitudinal; a pair of minute setae close to each of the posterior 3 pairs; 3 pairs of setae at anterior end.

*Dorsal surface*: 8-shaped pores in a submedian row of 10 and a lateral row of 5, on each half of body, submedian pores about as large as marginal pores of same segments, anterior lateral pore slightly smaller than submedian pores and much larger than the other lateral pores; disk pores in submarginal area.

<sup>12</sup>This species was described by H. S. Lepage (Papéis Avulsos do Departamento de Zoologia, Secretaria da Agricultura, Sao Paulo, Brazil, v. 1, pp. 69–72, illus. 1940) while this publication was in press. Part of the material studied by the present writer bears the same collection data as the type specimens.



Ventral surface: Antennal setae, I, 1; IV, 1; V, 1; VI, 3 long, 2 stout, 3 fairly stout; antennal bases around one-half length of antenna apart; beak setae, 2 pairs apical, 1 pair basal; spiracle with 1 trilocular and 1 quinquelocular pore; leg setae, coxa 2, femur 1 on inner margin near base, tarsus 1 each on inner and outer margins; tibia one-half as long as tarsus; 9 pairs of submarginal 8-shaped pores; 11 pairs of submarginal minute setae, on abdomen, thorax, and head; 2 pairs of setae near antennae.

Apex of abdomen: Lobes indicated; setae, apical broken at base, interapical  $3.6 \mu$  long, a pair  $1 \mu$  long entad of interapical, outer ventral  $1.8 \mu$  long; anal opening apical, apparently small and circular; anal tube sclerotized, very short, and larger at inner end than at opening; anal ring not differentiated from tube, apparently without setae or pores.

*Test of male*.—Somewhat elliptical, anterior end more often truncate than rounded; 1.10 mm. long, 0.5 wide; convex dorsally, sometimes with a faint longitudinal median carina; flat ventrally; pale yellow, transparent, thin; marginal filaments very pale yellow, nearly colorless.

*Third-stage male*.—Elliptical; margin with 8-shaped pores terminating twice a pore's length from bases of apical setae, trilocular pores terminating near third 8-shaped pore from end of row, nearly as numerous as 8-shaped pores; ventral surface with 5-7 quinquelocular pores between each spiracle and body margin and 1 dark-rimmed 8-shaped pore beside beak, legs represented by 3 pairs of circular, slightly raised areas apparently without claws; apex of abdomen with apical setae broken, interapical and ventral setae smaller than in female; anal opening possibly apical, anal tube, anal ring, and anal setae apparently absent.

*Data*.—Redescribed from unmounted specimens and the following mounted material: Three females and three larvae from *Maximilliana* sp., and three females from *Cocos* sp., Santa Catalina, Lower Orinoco, Venezuela, Rushby and Squires, 1896, N. Y. B. G., U. S. N. H.; one female from *Maximilliana caribaea*, "Teteron Bay," Trinidad, British West Indies, N. L. Britton, March 11, 1920, N. Y. B. G.; seven females and one third-stage male from *Attalea funifera*, Bahia, Brazil, received from G. Bondar, 1923, No. 619.

Closely related to *pallidum* and *truncatum*, but differing from them in lacking pores in the atrium of the spiracle and in the arrangement and number of the multilocular pores.

### ASTEROLECANIUM TRUNCATUM, new species

(Fig. 74, A-F; pl. 9, 1)

*Habit*.—Living on the lower surface of leaves.

*Test of female*.—Elongate, both ends usually truncate, widest on anterior third, tapering gradually to posterior end; 1.75-2 mm. long, 0.5-0.75 wide; convex dorsally, flat ventrally; brownish or light yellow, transparent, fairly thin, punctate; marginal filaments light brownish or pale salmon; circular larval exit in dorsal surface close to margin.

*Adult female*.—In shape similar to test, 1.5-1.75 mm. long, 0.5-0.7 wide.

Margin: 8-shaped pores in a single row terminating around one-half length of an apical seta from setal bases, posterior pores  $8 \mu$  long and 4 wide, the others  $9 \mu$  long and 4 wide, from the width to the length of a pore apart; trilocular pores in a single row terminating opposite a point between the fourteenth to the thirtieth 8-shaped pore from end of row of those pores, slightly more numerous than corresponding 8-shaped pores.

Dorsal surface: Minute 8-shaped and disk pores in median area, very sparse; tubular ducts  $28 \mu$  long.

Ventral surface: Antenna thimble-shaped, with 2 setae twice as long as, and 1 or 2 about as long as, diameter of antenna; 3-7 trilocular pores between antenna and margin; beak with 2 pairs of setae; spiracle with bar expanded at inner end, atrium enlarged and containing 5 or 6 quinquelocular pores, 10-15 similar pores extending from spiracle to body margin in an irregular double row; multilocular pores, with 10 loculi, in 3 complete and 5 interrupted rows, the posterior row with 9-14 pores, penultimate row with 13-20, anterior complete

row with 5 or 6, each of interrupted rows with 2, the total number observed being 37-50; a group of 4-6 dark-rimmed 8-shaped pores each side of mouth parts and a few in lateral area of abdomen; submarginal 8-shaped pores in a single row terminating near median line, half as numerous as corresponding marginal 8-shaped pores; submarginal setae in a complete row terminating near posterior pair of marginal 8-shaped pores; 2 pairs of setae in posterior row of multilocular pores and 1 pair in each of the other complete rows.

Apex of abdomen: Lobes indicated; setae, apical 60-64  $\mu$  long, interapical 16-20  $\mu$  long, intermediate (?) ventral (slightly entad of, and anterior to, interapical) 4  $\mu$  long; anal opening apical, inconspicuous; anal tube membranous and also inconspicuous; anal ring consisting of 2 sclerotized elliptical plates each with a seta 32-36  $\mu$  long at each end and a roughly rectangular, rather clear area in center; a circular opening between the plates.

*Larva*.—Elliptical.

Margin: With 28 8-shaped pores, the posterior 2 or 3 pairs larger than the next 7 or 9, the anterior 3 or 4 pairs largest of all, axes of all diagonal or transverse; a minute seta close to each pore of the posterior 3 pairs; 2 pairs of setae at anterior end.

Dorsal surface: 8-shaped pores apparently in a submedian row of 8-10 and a lateral row of 5-7, on each half of body; next to anterior submedian pore much larger than others, the anterior submedian pore smaller, the others virtually the same size as marginal pores of the same segments, next to anterior lateral pore much larger than the other lateral pores which are slightly smaller than anterior submedian pore; a few disk pores between lateral and marginal 8-shaped pores.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 1; VI, 3 long, 2 stout, 3 fairly stout; antennal bases one-third length of antenna apart; beak setae, 2 pairs apical, 1 pair basal; spiracle with 1 trilocular and 1 quinquelocular pore; leg setae, coxa 3, femur 1 on inner margin near base, tarsus 1 on inner margin; tibia one-third as long as tarsus; 9 pairs of submarginal 8-shaped pores; apparently 10 pairs of submarginal minute setae, on abdomen, thorax, and head; 3 pairs of setae near antennae.

Apex of abdomen: Setae, apical 30  $\mu$  long, interapical 3.6  $\mu$  long, intermediate (?) ventral (entad of interapical on ventral margin) 1.8  $\mu$  long; anal opening in margin; anal tube short, membranous; anal ring not differentiated from tube.

*Data*.—Described from the following material: Unmounted specimens, six mounted females, and six mounted larvae from *Maximilliania caribaea*, Santa Lucrecia, Mexico, B. P. Reko, April 29, 1923, U. S. N. H., holotype and paratypes; one mounted female from *Attalea cohune*, "Monte Cachirulo," Guatemala, April 1869, U. S. N. H., paratype; unmounted material and three mounted females from *Attalea cohune*, Manzanillo, Mexico, E. Palmer, December 1-31, 1890, U. S. N. H., paratypes; unmounted material and two mounted females from *Attalea cohune*, La Ceiba, Honduras, intercepted at New Orleans, La., Benton and Kostal, November 24, 1920, paratypes.

Allied to *pallidum* and *bondari*.

### ASTEROLECANIUM UDAGAMAE Green

(Fig. 74, G-R; pl. 8, C)

Described in 1909 on bamboo from Udagama, Ceylon (42, p. 319).

*Habit*.—Living on the lower surface of leaves.

*Test of female*.—Elongate, sides parallel, somewhat pointed at posterior end; about 2.10 mm. long, 0.4 wide; slightly convex dorsally, with a faint median longitudinal carina; nearly flat ventrally; pale greenish yellow, transparent, very thin, punctate; marginal filaments pale greenish yellow, longest at anterior end; dorsal filaments rubbed off; circular larval exit in ventral surface at margin.

*Adult female*.—Elongate, presumably around 2 mm. long, 0.35 wide.

Margin: 8-shaped pores in a single row apparently terminating around four times a pore's length (around two-thirds length of apical seta) from bases of setae, apparently 9-10  $\mu$  long and 5 wide, nearly contiguous.



Dorsal surface: A pair of submarginal 8-shaped pores near posterior end, apparently  $12\ \mu$  long and 6 wide; minute 8-shaped pores rather numerous; disk pores very sparse; tubular ducts  $24\ \mu$  long; dorsal tubes presumably present, but not observed owing to poor condition of specimen.

Ventral surface: Antenna circular, short, with 2 setae longer than diameter of antenna; beak without setae; spiracle with bar rather broad, atrium slightly enlarged and containing 6-9 quinelocular pores, apparently 4 or 5 similar pores extending from spiracle to body margin in a single row; multilocular pores, with 9 or 10 loculi, apparently in 3 rows, 6 pores in posterior row, 6 in median, 4 in anterior; 2 dark-rimmed 8-shaped pores each side of beak, and a few on abdomen apparently arranged in 2 transverse rows; submarginal 8-shaped pores not observed owing to poor condition of specimen; only 1 pair of submarginal setae observed (others probably present but indeterminate), this pair near the posterior pair of marginal 8-shaped pores; 1 pair of setae each in the posterior and median rows of multilocular pores.

Apex of abdomen: Notch present; lobes indicated; setae, apical  $48\ \mu$  long, interapical  $5.4\ \mu$  long, outer ventral  $5.4\ \mu$  long; anal ring with 4 setae  $5.4\ \mu$  long and two  $9\ \mu$  long, tending toward division on dorsal side; ventral surface of apex faintly sclerotized in dentate rows close to median line.

*Larva*.—Somewhat elliptical.

Margin: With 28 8-shaped pores, the anterior 2 pairs longer than others, axes of all longitudinal; apparently 2 pairs of setae at anterior end.

Dorsal surface: 8-shaped pores in a submedian row of apparently 9, on each half of body, posterior pore apparently the smallest, anterior pore the largest, all one-fourth to one-third smaller than marginal pores; disk pores not observed.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 1; VI, 2 long, 2 stout, 3 fairly stout, 1 slender; antennal bases apparently one-fifth length of antenna apart; beak setae, 2 pairs apical, 1 pair median; spiracle with 1 trilocular pore; leg setae, coxa 4, femur 1 on inner margin near base and 1 each on inner and outer margins near center, tarsus 2 on inner and 1 on outer margin; tibia one-half as long as tarsus; apparently 9 pairs of submarginal 8-shaped pores; probably 5 or 6 pairs of submarginal minute setae, on abdomen and thorax, apparently 1 pair of submarginal larger setae at anterior end; 1 pair of setae between antennae and mouth parts.

Apex of abdomen: Notch present; setae, apical  $28\ \mu$  long, interapical  $3.6\ \mu$  long, outer ventral around  $2\ \mu$  long; anal ring with 6 setae  $3.6\ \mu$  long.

*Data*.—Redescribed from two tests, one badly wrinkled mounted female, and two poor mounted larvae from *Arundinaria* sp., Avisawella, Ceylon, E. E. Green, October 1909.

The available specimens are very poor. Consequently it was impossible to observe the dorsal tubes, the ventral submarginal 8-shaped pores, and the submarginal setae in the adult. In the female examined marginal quinelocular pores were also indeterminate, though they were mentioned and figured by Green. The anal extremity in this specimen is not retracted within the margin as originally described.

### ASTEROLECANIUM UNGULATUM, new species

(Fig. 75, A-F; fig. 76, A-K; fig. 77, A; pl. 6, G)

*Habit*.—Living on the lower surface of leaves.

*Test of female*.—Nearly circular, approximately 1.3-1.6 mm. in diameter; practically flat dorsally, with a small longitudinal median carina; flat ventrally; pale greenish yellow, transparent, very thin, punctate, dull or shiny; marginal and dorsal filaments pale pinkish or pale golden, the latter present along median line and sometimes at varying intervals in submarginal area; triangular larval exit in ventral surface at margin.

*Adult female*.—Nearly circular, 1.2-1.4 mm. in diameter.

Margin: 8-shaped pores in a single row terminating about twice a pore's length from bases of apical setae, 10-11  $\mu$  long and 6 wide, slightly more than a pore's length apart.

Dorsal surface: 8-shaped pores in a median row of 2-8 and sometimes 2-6 in lateral area on each half of body, 11-12  $\mu$  long and 8 wide; minute 8-shaped and disk pores sparse; tubular ducts  $24\ \mu$  long.



Ventral surface: Antenna thimble-shaped, with 1 or 2 setae much shorter and 2 slightly longer than diameter of antenna; beak without setae; spiracular bar subcircular; 2 or 3 quinquelocular pores nearer spiracle than body margin; legs represented by 3 pairs of stout claws; multilocular pores, totaling 70-81 and with 8-10 loculi, in 5 complete and 3 or 4 interrupted rows (often 3 interrupted rows on 1 half of body and 4 on the other), the anterior row anterior to posterior spiracles, each of posterior 5 rows with 9-14 pores, each of the others with 2-7; dark-rimmed 8-shaped pores scattered and sparse; submarginal 8-shaped pores mostly in a single row but in a double row at posterior end, terminating near posterior row of multilocular pores, about half as numerous as corresponding marginal 8-shaped pores; submarginal setae in a complete row terminating near penultimate pair of marginal 8-shaped pores; 2 pairs of setae in posterior row of multilocular pores and 1 pair in penultimate row.

Apex of abdomen: Lobes indicated; setae, apical  $72 \mu$  long, interapical  $10.8 \mu$  long, intermediate ventral  $3.6 \mu$  long, outer ventral  $7.2 \mu$  long; anal ring with 6 setae  $28 \mu$  long and with an inner row of 6 and an outer one of 14 pores, divided on dorsal and ventral sides; ventral surface of apex with an irregularly sclerotized area anterior to each interapical seta, area between these sometimes slightly sclerotized in dentate rows.

*Second stage.*—Resembling adult female but distinctly longer than wide; dorsal surface without 8-shaped pores; apex of abdomen as in adult but all setae about one-fourth shorter.

*Test of male.*—Elliptical, 1 mm. long, 0.6 wide; dorsally slightly convex at anterior end, sloping to posterior end; flat ventrally; pale greenish yellow, transparent, very thin, punctate, shiny; marginal filaments pale yellowish, slightly longer at anterior end than elsewhere; dorsal filaments brownish, occurring along median line and in lateral area.

*Adult male.*—1 mm. long.

Head: Antenna 10-segmented: formula (longest to shortest), (X), (II), (IV), (V), (VI), (VII, VIII), (IX), (I, II); antennal setae, I, 11; II, III, 15 or 16; IV, V, 19 or 20; VI, VII, 25-27; VIII, IX, 21 or 22; X, 29 slender, 3 stout, and 3 apparently rather long; basal bars diagonal; 30 setae between ventral eyespots and antennae; 2 setae on dorsal surface.

Thorax: Bar between wing bases rectangular, with a longitudinal fold and a clear area in center, four times as long as wide; tibia one-fifth shorter than tarsus.

Abdomen: Five segments each with a seta dorsally on lateral margin, 2 segments each with a seta in ventral submedian area; each lobe area with 1 long and 3 short setae; penis sheath with 1 pair of setae dorsally near base and 6 setae on each side of ventral opening.

*Data.*—Described from specimens (13 females, 1 second-stage specimen, and 1 adult male, mounted) on *Durio zibethinus*, Botanic Garden, Singapore, Straits Settlements, I. H. Burkill, April 3, 1922, holotype and paratypes. and unmounted material and 1 mounted female from *Durio zibethinus*. Java. A. Zimmermann collector, from E. E. Green, received in 1933, paratypes.

Of the known species not living on bamboo, *ungulatum* and *epidendri* are the only ones having six setae on the anal ring in which setae have not been observed on the beak.

### ASTEROLECANIUM UNICUM, new species

(Fig. 77, B-F)

*Habit.*—Living on the upper surface of leaves.

*Test of female.*—Elongate, sides nearly parallel, tapering near ends; 2.5 mm. long, 0.7 wide; strongly and sharply convex dorsally, flat ventrally; pale yellow, transparent, punctate, shiny; marginal filaments same color as test; circular larval exit in margin.

*Adult female.*—Elongate, 2.25 mm. long, 0.6 wide.

Margin: 8-shaped pores in a single row terminating around one and a half times the length of an apical seta from setal bases,  $8 \mu$  long and 5 wide, from the width to twice the length of a pore apart; trilocular pores in a single row opposite about 30 8-shaped pores on lateral margins, 1 opposite every other 8-shaped pore at ends of row, about twice as numerous in middle of row.

Dorsal surface: Minute 8-shaped and disk pores fairly numerous; tubular ducts  $28\ \mu$  long.

Ventral surface: Antenna thimble-shaped, apparently with 2 setae as long as diameter of antenna; beak apparently without setae; spiracle with bar slightly expanded at inner end, atrium enlarged, bag-shaped, and containing 8-11 quinquelocular pores, apparently without pores extending from spiracle to body margin; multilocular pores, totaling 35 and with 10 loculi, in 3 complete and 2 interrupted rows, the posterior row with 13 pores, next with 11, next with 7, and each of the others with 2; 4 or 5 dark-rimmed 8-shaped pores each side of beak, a few in an irregular longitudinal lateral row, and others tending toward arrangement in 3 transverse rows among multilocular pores; submarginal 8-shaped pores apparently in a single row, terminating near posterior row of multilocular pores, about half as numerous as corresponding marginal 8-shaped pores; submarginal setae in a complete row terminating somewhat anterior to apical setae; 2 pairs of setae in posterior row of multilocular pores and 1 pair in each of the next 3 rows.

Apex of abdomen: Lobes indicated, on ventral surface; setae, apical  $64\ \mu$  long, one  $1\ \mu$  long anterior to apical on 1 side of single specimen examined; anal opening indeterminable (probably because specimen is weakly stained); ventral surface of apex slightly sclerotized in dentate rows.

*Data*.—Described from one test (destroyed in mounting adult) and one mounted female from *Calamus* sp., Tayabas Province, Luzon, Philippine Islands, B. Acedillo, April-May 1915, U. S. N. H., holotype.

This species resembles *hilli*, but differs from it in having the atrium of the spiracle greatly enlarged and containing 8 to 11 quinquelocular pores, in apparently lacking pores between spiracle and the body margin, in having only about 35 multilocular pores and apparently a single instead of a double row of submarginal 8-shaped pores, and in lacking interapical setae.

### ASTEROLECANIUM URICHI Cockerell

(Fig. 77, G-N; pl. 6, C)

Described in 1894 (*18*, p. 308).

*Habit*.—Living on leaves, nuts, and bark.

*Test of female*.—Elongate, margin sometimes indented by growth against hairs on leaf; 1-1.5 mm. long, 0.5-0.75 wide; nearly flat to slightly convex dorsally, rarely with a faint longitudinal median carina; flat ventrally; brownish or greenish yellow, sometimes very pale, transparent, faintly punctate; marginal filaments rich light brown, rarely with a pale-salmon cast; elliptical larval exit in dorsal surface at margin.

*Adult female*.—Elongate, around 1 mm. long, 0.6 wide.

Margin: 8-shaped pores in a single row terminating about one-third length of apical seta from setal bases, 8-9  $\mu$  long and 5 wide, usually about a pore's width apart, but the posterior 2 or 3 pores sometimes more widely separated; trilocular pores in a single row from nearly opposite antennae to about halfway between posterior spiracular pore bands and posterior pair of 8-shaped pores, rarely extending nearer posterior end of body, about as numerous as corresponding 8-shaped pores at each end of row, approximately twice as numerous as that elsewhere.

Dorsal surface: 8-shaped pores normally lacking but 3 or 4 noted rarely, 12  $\mu$  long and 8 wide; minute 8-shaped pores fairly numerous; disk pores sparse; tubular ducts  $24\ \mu$  long.

Ventral surface: Antenna a circular, raised area, with 2 short setae and 2 that are slightly longer than diameter of antenna; beak with 2 pairs of setae; spiracle with bar narrow, slightly expanded at inner end, atrium enlarged, bag-shaped, and containing 6-16 (usually 6-10) quinquelocular pores, 10-15 similar pores extending from spiracle to body margin in an irregularly single or double row; a group of 8-18 dark-rimmed 8-shaped pores each side of beak and 8-10 posterior to mouth parts; submarginal 8-shaped pores in a single row terminating near third or fourth 8-shaped pore from end of row, about one-



third as numerous as marginal 8-shaped pores; submarginal setae in a complete row terminating near penultimate pair of marginal 8-shaped pores; 2 pairs of setae (their bases nearly or actually contiguous) posterior to genital opening, 3 pairs of setae anterior to genital opening, equidistant from one another and situated successively farther cephalad.

Apex of abdomen: Setae, apical 20-24  $\mu$  long, interapical 7-8  $\mu$  long, outer ventral 3.6  $\mu$  long; anal opening apical, anal tube very short or absent, anal opening and tube usually not differentiated from anal ring, which is an elliptical plate, appearing as a semicircular rather than an elliptical plate if more heavily sclerotized on the dorsal than on the ventral side, with a seta 8-9  $\mu$  long at each end and a pore beside each seta, also a small circular opening in or near center of plate; ventral surface of apex rugose.

*Second stage.*—Resembling adult but smaller; margin with 4-6 trilocular pores opposite each spiracular pore band; ventral surface with atrium of spiracle enlarged and containing 1 or 2 trilocular or quinquelocular pores, 3 or 4 similar pores between spiracular opening and body margin, 1 dark-rimmed 8-shaped pore each side of beak and 3 or 4 posterior to mouth parts; apex of abdomen without apical or interapical setae, or setal bases; with a pair of minute ventral setae; anal opening apical; anal tube very short, membranous; anal ring slightly sclerotized, with 2 setal bases.

*Larva.*—Elliptical.

Margin: With 28 8-shaped pores, axes of virtually all transverse or diagonal; a minute seta close to each pore of the posterior 3 pairs; 3 pairs of setae at anterior end.

Dorsal surface: 8-shaped pores in a lateral row of 9 on each half of body, about two-thirds the size of marginal pores; disk pores between lateral and marginal 8-shaped pores.

Ventral surface: Antennae 5-segmented; antennal setae, I, 1; IV, 1; V, 3 long, 2 stout, 3 fairly stout; antennal bases one-half length of antenna apart; beak setae, 2 pairs apical, 1 pair median; spiracle with 1 trilocular and 1 quinquelocular pore; leg setae, coxa 2, femur 1 on inner margin near base, tarsus 1 each on inner and outer margins; tibia one-third as long as tarsus; 9 pairs of submarginal 8-shaped pores; apparently 11 pairs of submarginal minute setae, on abdomen, thorax, and head; 3 pairs of setae near antennae.

Apex of abdomen: Setae, apical 36  $\mu$  long, interapical 9  $\mu$  long, outer ventral 2  $\mu$  long; anal opening apical, anal tube very short; anal ring circular, heavily sclerotized, with 2 setae apparently 4  $\mu$  long.

*Data.*—Redescribed from unmounted material and the following mounted specimens: Four females from palm, Port-of-Spain, Trinidad, F. W. Ulrich No. 4, type; 3 females and 17 larvae from *Palmae* (*Guilielma* sp.?), Panama, U. S. N. H.; 17 females and 8 larvae from *Bactris minor*, Grenada, West Indies, July 1900; 3 females and 10 larvae from *Palmae*, Mexico?, June 30, 1906, U. S. N. H.; 21 females, 1 second-stage specimen, and 27 larvae from unknown palm, St. Clair, Port-of-Spain, Trinidad, H. Morrison, November 24, 1918, probably from the same tree as the type material: 2 females from palm fruit, Bluefields, Nicaragua, intercepted at New Orleans, La., E. Kostal, October 26, 1920; 5 females and 4 larvae from *Guilielma speciosa*, Goeldi Museum, Para, Brazil, intercepted at Washington, D. C., W. B. Wood, April 23, 1921; 1 mounted female from *Pyrenoglyphis* (*Bactris*) *major*, Canal Zone, intercepted at New Orleans, La., M. S. Mirimani, August 26, 1935.

*Asterolecanium urichi* is closely related to *difficile* and *simile*. Characters differentiating it from *simile* are discussed under that species. It can be separated from *difficile* by the lack of a conspicuous interruption in the marginal row of 8-shaped pores, by the absence of marginal trilocular pores on the anterior end of the body, by the absence of multilocular pores, and by the length of the apical setae, which are about twice the length of the ring setae.



## ASTEROLECANIUM VARIABLE, new species

(Fig. 78, A-E; pl. 8, O)

*Habit*.—Living on the upper surface of leaves, in shallow pits.

*Test of female*.—Circular, longer than wide, or slightly wider than long, posterior end sometimes slightly produced; approximately 0.7–1.10 mm. in diameter; flat or slightly convex dorsally, sometimes with a faint longitudinal median carina and curved lateral carinae meeting at anterior end, and with transverse striations; convex ventrally; greenish or clear yellow, translucent, punctate near margin; marginal filaments pale salmon, slightly shorter at posterior end than elsewhere; elliptical larval exit in margin.

*Adult female*.—In shape similar to test, approximately 0.65–1 mm. in diameter.

Margin: 8-shaped pores in a single row terminating twice a posterior pore's length from bases of apical setae, posterior pores 8  $\mu$  long and 5 wide, the others 9–10  $\mu$  long and 6 wide, usually about a pore's width apart, but sometimes about a pore's length apart at posterior end; quinquelocular pores varying considerably in distribution and number, arranged in a single row terminating anywhere between posterior pair of 8-shaped pores and midpoint between these pores and posterior spiracular pore bands, complete, or interrupted at anterior end for a space equal to that occupied by 15–25 8-shaped pores, slightly less numerous than corresponding 8-shaped pores near posterior end of row, a little more numerous than 8-shaped pores close to posterior spiracular pore bands and usually twice as numerous as 8-shaped pores anterior to posterior spiracular pore bands.

Dorsal surface: Minute 8-shaped pores numerous; disk pores fairly sparse; tubular ducts 24  $\mu$  long.

Ventral surface: Antenna short, with 2 setae as long as diameter of antenna; beak with 2 pairs of setae; spiracle with bar fairly broad; a group of 3 or 4 quinquelocular pores near spiracular opening, and 13–22 extending to body margin in an irregularly double row; multilocular pores, totaling 35–45 and having 5–10 (usually 10) loculi, in 4 or 5 complete and 2–4 interrupted rows, each of 4 complete rows with 6–8 pores (fifth when present with 3 or 4) and each of interrupted rows with 2; dark-rimmed 8-shaped pores scattered each side of beak and on anterior half of body; submarginal 8-shaped pores in a single row terminating near posterior row of multilocular pores, about as numerous as marginal 8-shaped pores; submarginal setae in a complete row terminating about one-half length of an apical seta from bases of apical setae; 2 or 4 pairs of setae in posterior row of multilocular pores, 1 pair in each of the other complete rows, and 1 pair in 1 or 2 interrupted rows.

Apex of abdomen: Lobes indicated; setae, apical 48–52  $\mu$  long, interapical 5–7  $\mu$  long, outer ventral 4–5  $\mu$  long; anal opening ventral, well removed from body margin, circular, its margin faintly sclerotized, with 2 setae 4  $\mu$  long on anterior edge.

*Larva*.—Nearly elliptical.

Margin: With 28 8-shaped pores, posterior pores smallest, the others gradually increasing in size anteriorly, but those on anterior half nearly uniform in size, axes of all longitudinal; 2 pairs of setae at anterior end.

Dorsal surface: 8-shaped pores possibly normally in a submedian and in a lateral row of 8–10 each, on each half of body, the total number ranging from 33–37, but some larvae with a total of only 4–28; when there are several pores in each row, the posterior pores are slightly smaller than the anterior ones, but all are at least as large as the marginal pores of the same segments; disk pores between submarginal and lateral, and a few between lateral and marginal 8-shaped pores.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 0; VI, 2 long, 2 stout, 2 fairly stout, 2 slender; antennal bases one-half length of antenna apart; beak setae, 3 pairs apical; spiracle with 1 trilocular and 1 quinquelocular pore; leg setae, coxa 3, femur 1 on inner margin near base, tarsus 1 each on inner and outer margins; tibia one-fourth length of tarsus; 9 pairs of submarginal 8-shaped pores; 7 pairs of submarginal minute setae on abdomen, 1 pair of submarginal larger setae at anterior end; 3 pairs of setae between antennae and mouth parts.

Apex of abdomen: Lobes sometimes indicated; setae, apical 48–54  $\mu$  long, interapical 5.4  $\mu$  long, outer ventral 3.6  $\mu$  long; anal opening ventral, close to body margin; anal tube very short, sclerotized; anal ring a sclerotized band, with 2 setae 3.6  $\mu$  long.

*Third-stage male*.—Resembling adult female but distinctly longer than wide; margin with quinquelocular pores interrupted for a space opposite 9 8-shaped pores at anterior end and terminating about 11 8-shaped pores from the posterior 8-shaped pores, less numerous than in female; ventral surface with 6 or 7 quinquelocular pores between each spiracle and body margin, legs represented by 3 pairs of heavily sclerotized, circular, raised areas, each with a straight, stout claw; 4 pairs of median setae near posterior end of abdomen, the pairs in a successively cephalad arrangement; apex of abdomen as in adult female.

*Data*.—Described from unmounted specimens (paratypes) and the following mounted material: Five females and 19 larvae from Japanese oak, Westbury, N. Y., September 8, 1903, paratypes; 4 females, 5 larvae, and 1 third-stage male from *Quercus variabilis*, Tsingtao, Shangtung, China, C. Y. Chiao, July 17, 1930, N. Y. B. G., holotype and paratypes.

Allied to *perpleavum*.

### ASTEROLECANIUM VARIOLOSUM (Ratzeburg)

(Fig. 78, F-P; pl. 5, J)

Described as *Coccus variolosus* on oak from Kunersdorf, near Potsdam, Germany, and reported from Friedrichshain, Germany, in 1870 (80, pp. 187-194).

The original description is practically useless for separating this species from other pit-forming species occurring on the bark of oak. Moreover, type specimens of the species have not been available for study, and they may be no longer in existence, since they have not been located in Eberswalde or Berlin. The species treated here is so common in Germany, however, that there is a strong possibility it is the true *variolosum*.

The synonymy indicated by Lindinger (63, p. 130) is not accepted in this paper. Some of the species which he synonymized with *variolosum* definitely do not belong to *Asterolecanium*, and it is impossible to tell whether others do or do not. If any of them do belong in this genus, there is no certainty that they are the same as *variolosum*.

*Habit*.—Living on bark, in shallow to deep pits.

*Test of female*.—Usually longer than wide, rarely wider than long or circular; 1.75-2.25 mm. long, 1.5-1.95 wide, usually about 2 mm. long and 1.6 wide; slightly to distinctly convex dorsally, with posterior tip flattened, and usually with faint transverse striations; slightly or distinctly convex ventrally; greenish, brownish, or golden yellow, transparent, often shiny, sometimes slightly punctate in lateral areas; marginal filaments same color as test, slightly shorter at posterior end than elsewhere; elliptical larval exit in dorsal surface at margin.

*Adult female*.—Slightly longer than wide, posterior end slightly produced; 1.7-2.15 mm. long, 1.3-1.7 wide, usually 1.95 mm. long, 1.5 wide.

Margin: 8-shaped pores in a single row terminating once or twice the length of a posterior pore from bases of apical setae, posterior pores 8  $\mu$  long and 5 wide, the others 9-10  $\mu$  long and 6 wide, from the width to the length of a pore apart; quinquelocular pores in a single row (sometimes in a double row near spiracular pore bands) terminating 13-46 (usually 25-36) 8-shaped pores from end of row, usually interrupted opposite 22-35 8-shaped pores at anterior end, less numerous than corresponding 8-shaped pores at ends of row, one and a half times as numerous as 8-shaped pores elsewhere, except near spiracular pore bands, where they are still more numerous.

Dorsal surface: Minute 8-shaped pores numerous; disk pores fairly numerous; tubular ducts 32  $\mu$  long.

Ventral surface: Antenna thimble-shaped, with 2 setae as long as diameter of antenna; beak with 2 pairs of setae; spiracular bar expanded at inner end; a group of 7-16 quinquelocular pores outside spiracular opening and others extending to body margin, the row double or triple near spiracle and 5 or 6 pores wide near margin, a total of 35-100 (usually 50-75) in group and row combined;



multilocular pores, with 7-10 loculi, in 4 complete rows, the posterior row with 12-23 pores, each of the others with 7-16 (usually 10-14), the total number being 40-71 (usually 50-62); a loose group of 7-10 dark-rimmed 8-shaped pores each side of beak, some scattered on anterior end, and others tending toward arrangement in 2 transverse rows posterior to beak; submarginal 8-shaped pores in an irregularly double row terminating near penultimate row of multilocular pores, in the ratio of 1 or 2 to about 3 marginal 8-shaped pores; submarginal setae in a complete row terminating near penultimate pair of marginal 8-shaped pores; 2 pairs of setae in posterior row of multilocular pores, 1 pair in each of the other rows, and 1 pair before anterior row.

Apex of abdomen: Setae, apical 36-44  $\mu$  long, interapical 8-9  $\mu$  long, outer ventral 7  $\mu$  long; anal opening ventral, near body margin, its margin sclerotized, with 2 setae, each 2-3  $\mu$  long, on anterior edge.

Larva.—Nearly elliptical, posterior end sometimes narrowed.

Margin: With 28 8-shaped pores, axes of all longitudinal; 2 pairs of setae at anterior end.

Dorsal surface: Normally without 8-shaped pores, but rarely with 1-3 on anterior end, these as large as marginal pores; disk pores in lateral area.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 0; VI, 2 long, 2 stout, 2 fairly stout, 2 slender; antennal bases one-half length of antenna apart; beak setae, 3 pairs apical; anterior spiracle with 1 trilocular or quadrilocular and 1 quinquelocular pore, or with 2 quinquelocular pores, posterior spiracle with 1 quinquelocular pore; leg setae, coxa 3, femur 1 on inner margin near base, tarsus 1 each on inner and outer margins; tibia one-fourth as long as tarsus; 9 pairs of submarginal 8-shaped pores; 7 pairs of submarginal minute setae on abdomen, 1 pair of submarginal larger setae at anterior end; 2 pairs of setae between antennae and mouth parts.

Apex of abdomen: Setae, apical 64  $\mu$  long, interapical 12  $\mu$  long, outer ventral 6-8  $\mu$  long; anal opening apical; anal tube very short; anal ring with 2 setae about 7.2  $\mu$  long.

Data.—Redescribed from unmounted material and more than 100 mounted females and many mounted larvae from the following sources (all collected on *Quercus*): *Q. sideroxylla*, England, R. Newstead; Europe, Maskell Collection No. 65; Botanic Garden, Sydney, New South Wales, W. W. Froggatt No. 18; West Australia, G. Compere No. 33; *Q. robur*, Breslau, Silesia, Germany, C. Baenitz, U. S. N. H.; *Q. pedunculata*, Vienna, Austria, labeled *quercicola* det. Löw, loaned by M. Beier; white oak, August 8, 1878; D. C., T. Pergande, November 22, 1879; *Q. sideroxylla*, November 22, 1879; *Q. robur*, November 22, 1879; Department of Agriculture Grounds, Washington, D. C., December 18, 1880; Smithsonian Grounds, Washington, D. C., N. L. Britton, September 24, 1885; Ridgewood, N. J., A. S. Fuller, April 4, 1893; Washington, D. C., F. C. Pratt, May 15, 1894; white oak, Washington, D. C., May 15, 1894; *Q. pedunculata*, near Prague, Czechoslovakia, K. Sulc, April 3, 1894; Geneva, N. Y., S. H. ver Plank, July 12, 1895; golden oak, Worcester, Mass., November 2, 1896; Department of Agriculture Grounds, Washington, D. C., C. L. Marlatt, November 11, 1898; Carthage, Mo., July 9, 1899; Ottawa, Canada, J. Fletcher, August 1900; Philadelphia, Pa., January 21, 1905; *Q. concordia*, Dreshertown, Pa., S. N. Baxter, June 2, 1905; Department of Agriculture Grounds, Washington, D. C., C. Popenoe, September 10, 1907; Washington, D. C., E. R. Sasser, July 19, 1910; golden oak, Overbrook, Pa., F. Windle, September 1911; *Q. pedunculata*, Stockton, Calif., F. Maskew, August 1913; Funchal, Madeira, C. H. Gable, May 7, 1915; Washington, D. C., S. Keen, August 25, 1919; *Q. pedunculata*, in Herbarium at Novoherkassk, Russia, 1920, collection locality unknown; Wheeling, W. Va., E. J. Spaeth, October 7, 1921; Department of Agriculture Grounds, Washington, D. C., W. B. Wood, March 8, 1922; England, intercepted at Washington, D. C., W. B. Wood,



April 17, 1922; *Q. robur*, Funchal, Madeira, A. de Moronha, April 1923; English oak, Department of Agriculture Grounds, Washington, D. C., H. Morrison, July 11, 1924; Webster Grove, Mo., L. Haseman, September 10, 1925; Santiago, Chile, C. E. Porter, November 25, 1926; *Q. robur* var. *monstrosa cucullata*, Berlin, Germany, intercepted at Washington, D. C., W. T. Owrey, January 27, 1930; *Q. robur*, Berlin, Germany, intercepted at Washington, D. C., R. G. Cogswell, January 27, 1930; *Q. pedunculata thomasi*, Germany, intercepted at Washington, D. C., W. B. Wood, February 8, 1930; from a Mr. Bartlett, September 22, 1932, no further data; *Q. sessilis* var. *mespilifolia*, Berlin-Dahlem, Germany, intercepted at Washington, D. C., J. M. R. Adams, March 4, 1936.

This widely distributed species is well known for its destructiveness. It is closely related to *quercicola*.

### ASTEROLECANIUM VENTRUOSUM (Maskell)

(Fig. 78, *Q, R*; fig. 79, *A-C*)

Described by Maskell in 1895 as *Planchonia ventruosa* (70, p. 63).

*Habit*.—"This insect forms for itself depressions or pits in the bark, adapted to the convexity of its ventral surface; and, when it is lifted out, there remain slender, white, cottony trails, denoting the spiracular regions." (70, p. 63.)

*Test of female*.—"Test of adult female green, waxy, flat or sometimes slightly concave. The green colour is in the test itself, and not due to the insect showing through it. Form of test broadly elliptical, or with a very slight posterior tapering. Fringe pink or white." (70, p. 63.)

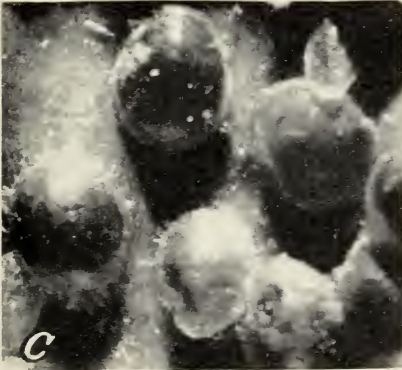
*Adult female*.—Circular, posterior end slightly produced; 0.75 mm. in diameter.

*Margin*: 8-shaped pores mostly in a double row but about posterior 16 pores in an irregular single row, terminating about one-half length of an apical seta from setal bases, posterior pores 11  $\mu$  long and 7 wide, others 12–13  $\mu$  long and 8 wide, about a pore's width apart where single, and from a pore's width to twice a pore's length apart where double, the 2 rows less than a pore's width apart; quinquelocular pores in a single row interrupted at anterior end opposite 2 8-shaped pores and terminating 4–7 8-shaped pores from end of row of those pores, less numerous than corresponding 8-shaped pores near end of row, usually twice as numerous as 8-shaped pores of nearer row elsewhere; disk pores along dorsal row of 8-shaped pores, terminating sometimes before and sometimes beyond end of row of those pores and less numerous than they are; disk pores also occurring ventrad of quinquelocular pores, this row terminating anterior to bases of apical setae, the pores as numerous as 8-shaped pores of nearer row.

*Dorsal surface*: Minute 8-shaped and disk pores fairly numerous; tubular ducts 27  $\mu$  long.

*Ventral surface*: Antenna sharply conical, apex spinelike, with 1 seta apparently shorter than diameter of antenna; 2–4 quinquelocular pores between antenna and margin; beak apparently with 1 pair of setae; spiracle with bar fairly broad, expanded at inner end, atrium slightly enlarged and containing 3–7 quinquelocular pores, 14–18 similar pores extending from spiracle to body margin in an irregularly single row; multilocular pores, totaling 91 and with 7–11 loculi, apparently arranged in 7 complete rows and 1 interrupted row, the latter anterior to posterior spiracles, the number in each row not readily determinable but posterior row apparently with 14, penultimate row with 9, next with 13, next with 11, next with 19, next with 12, next with 9, and anterior row with 4; a few scattered, dark-rimmed 8-shaped pores; submarginal 8-shaped pores in a single row terminating near penultimate row of multilocular pores, about as numerous as corresponding marginal 8-shaped pores of nearer row; submarginal setae in a complete row terminating near posterior pair of marginal 8-shaped pores; 2 pairs of setae in posterior row of multilocular pores and 1 pair in each of the next 2 rows.

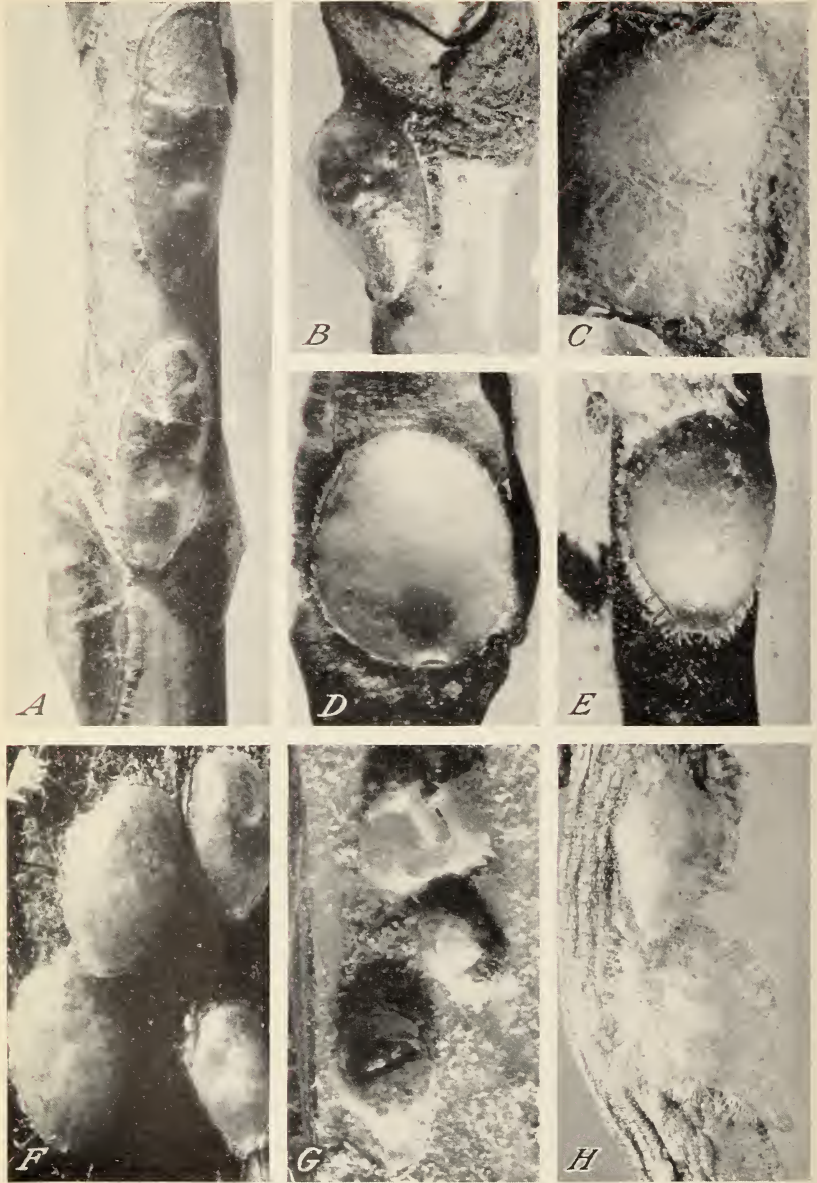
*Apex of abdomen*: Notch present; setae, apical 65  $\mu$  long, interapical 7.2  $\mu$  long, inner ventral 7.2  $\mu$  long, outer ventral 9  $\mu$  long; anal ring with 6 setae 28  $\mu$  long and with an inner row of 6 and an outer row of 14 pores, divided on dorsal and ventral sides; ventral surface of apex weakly sclerotized close to notch, slightly reticulate.



SPECIES OF ASTEROLECANIUM.

*A, stentae; B, algeriense; C, agavis; D, euryopis; E, launcae; F, ilicicola.*

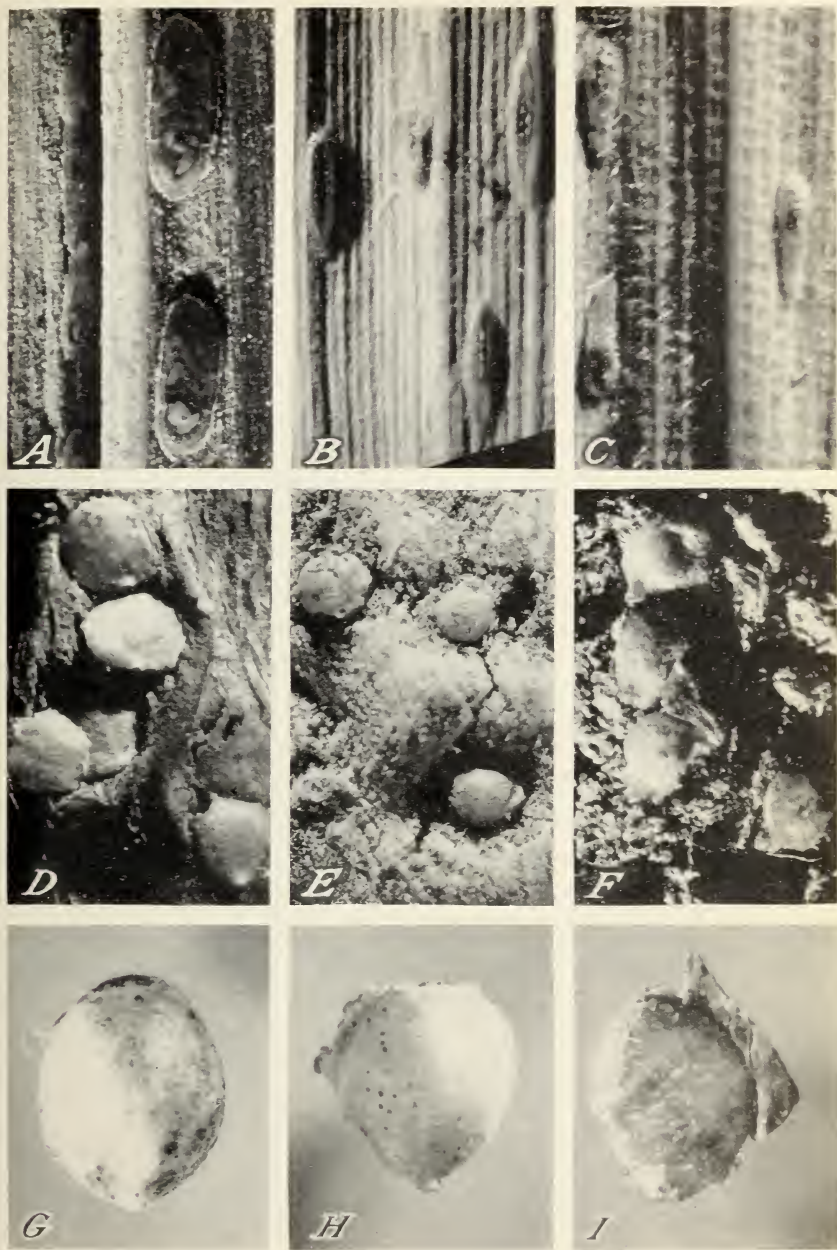




SPECIES OF ASTEROLECANIUM.

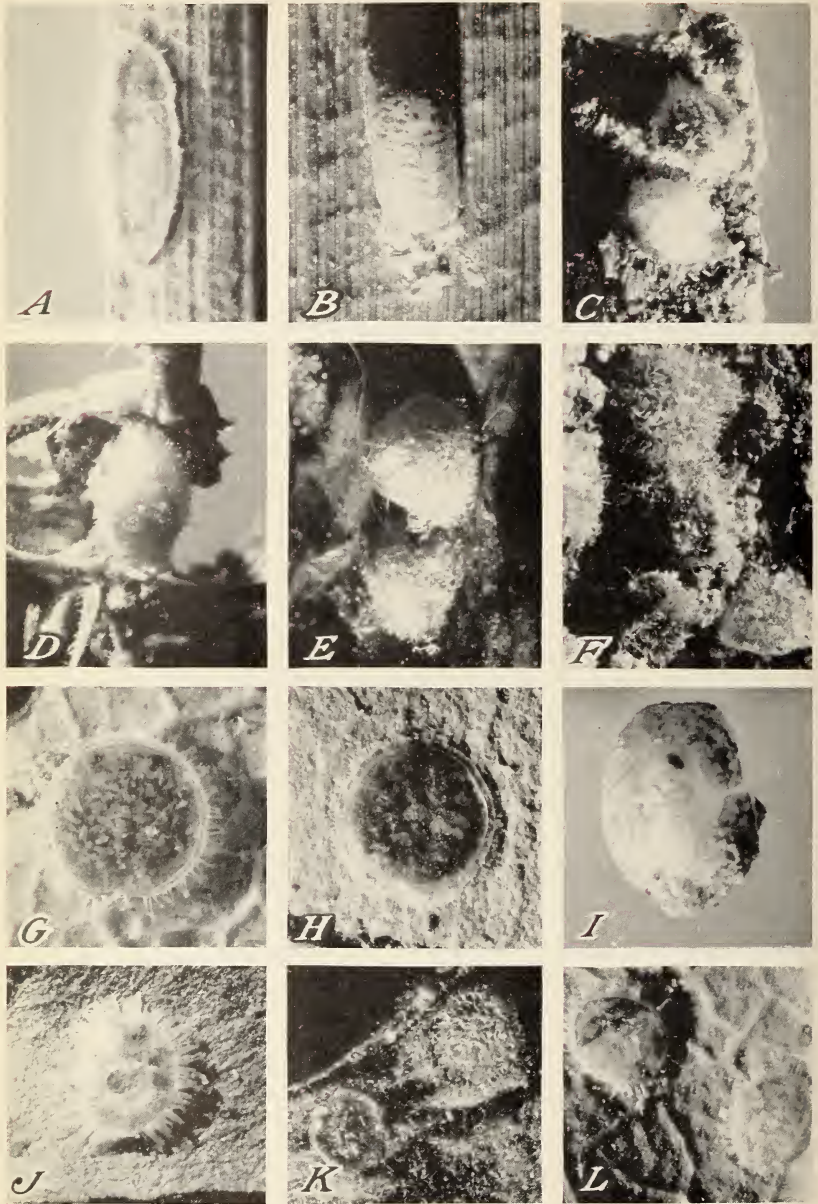
A, *bambusicola*; B, *hemisphaericum*; C, *zanthenes*; D, *fimbriatum*; E, *arabidis*, type; F, *bambusae*, not type; G, *bambusae*, type; H, *arabidis*, not type.





## SPECIES OF ASTEROLECANIUM.

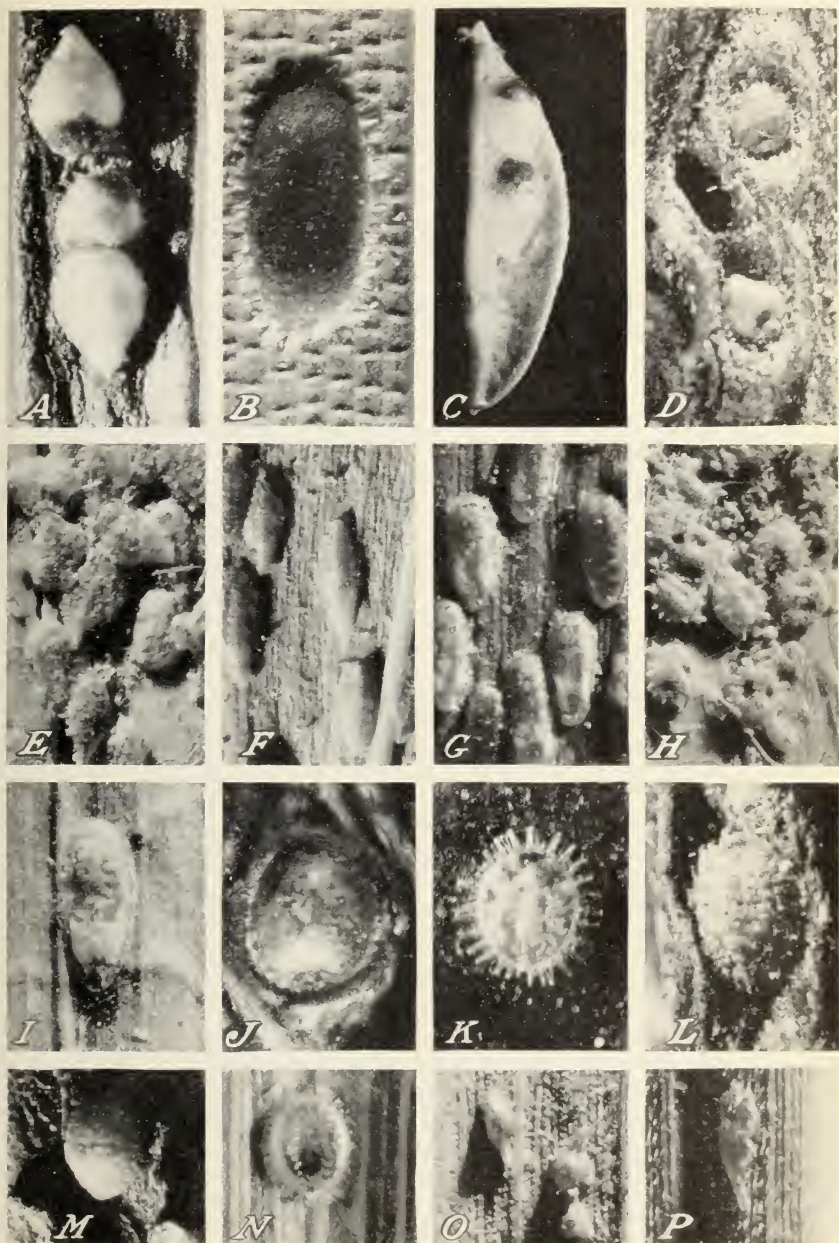
*A*, *spectabile*; *B*, *longum*; *C*, *ordinarium*; *D*, *conspicuum*; *E*, *bellum*; *F*, *ingae*; *G*, *gutta*; *H*, *townsendi*; *I*, *tokyonis*.



## SPECIES OF ASTEROLECANIUM.

*A*, *masuii*; *B*, *distinctum*; *C*, *coffea*; *D*, *nevadense*; *E*, *grandiculum*; *F*, *pustulans*; *G*, *sanbernardense*; *H*, *suishae*; *I*, *quaesitum*; *J*, *psychotriae*; *K*, *inconspicuum*; *L*, *perplexum*.

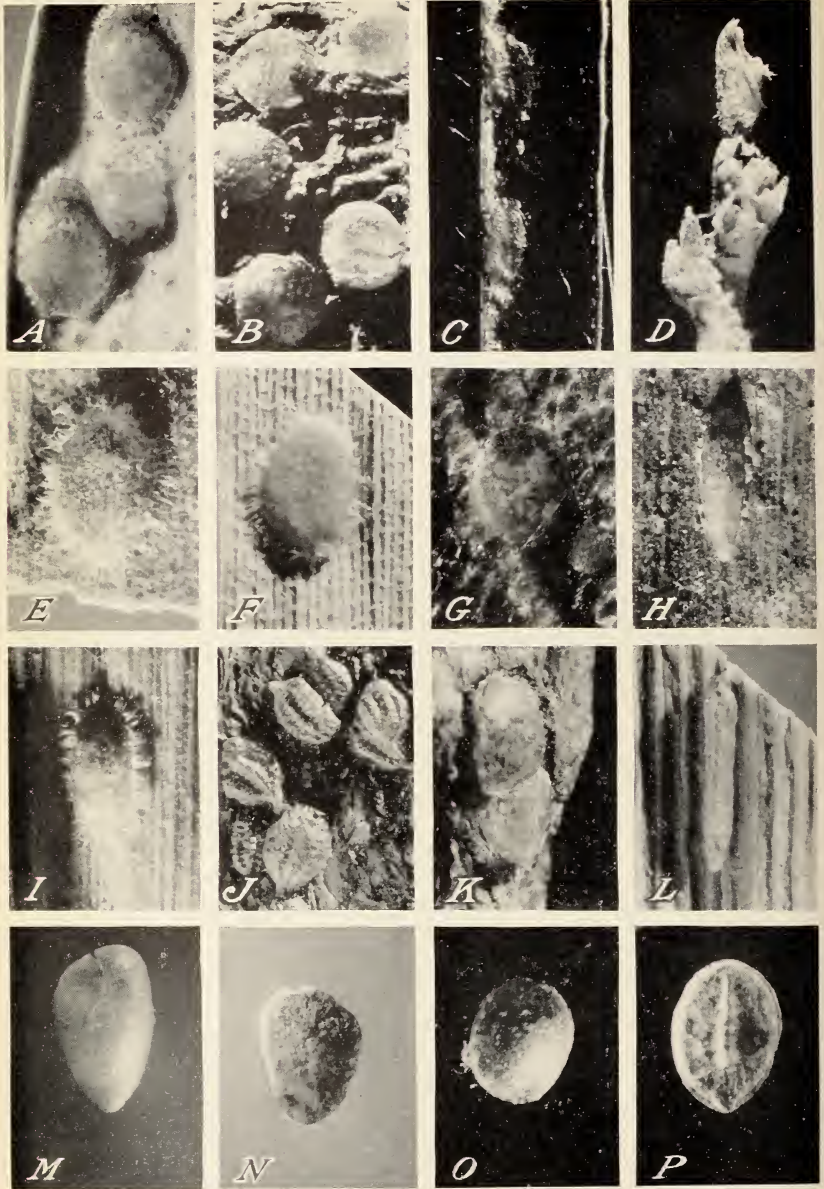




## SPECIES OF ASTEROLECANIUM.

A, *lacrimula*; B, *notabile*; C, *vitreum*; D, *viennae*; E, *miliaris miliaris*; F, *miliaris robustum*; G, *sabalis*; H, *coronatum*; I, *hilli*; J, *variolosum*; K, *epidendri*; L, *viridulum*; M, *quadrisetosum*; N, *radiatum*; O, *solenophoroides*; P, *caudatum*.





## SPECIES OF ASTEROLECANIUM.

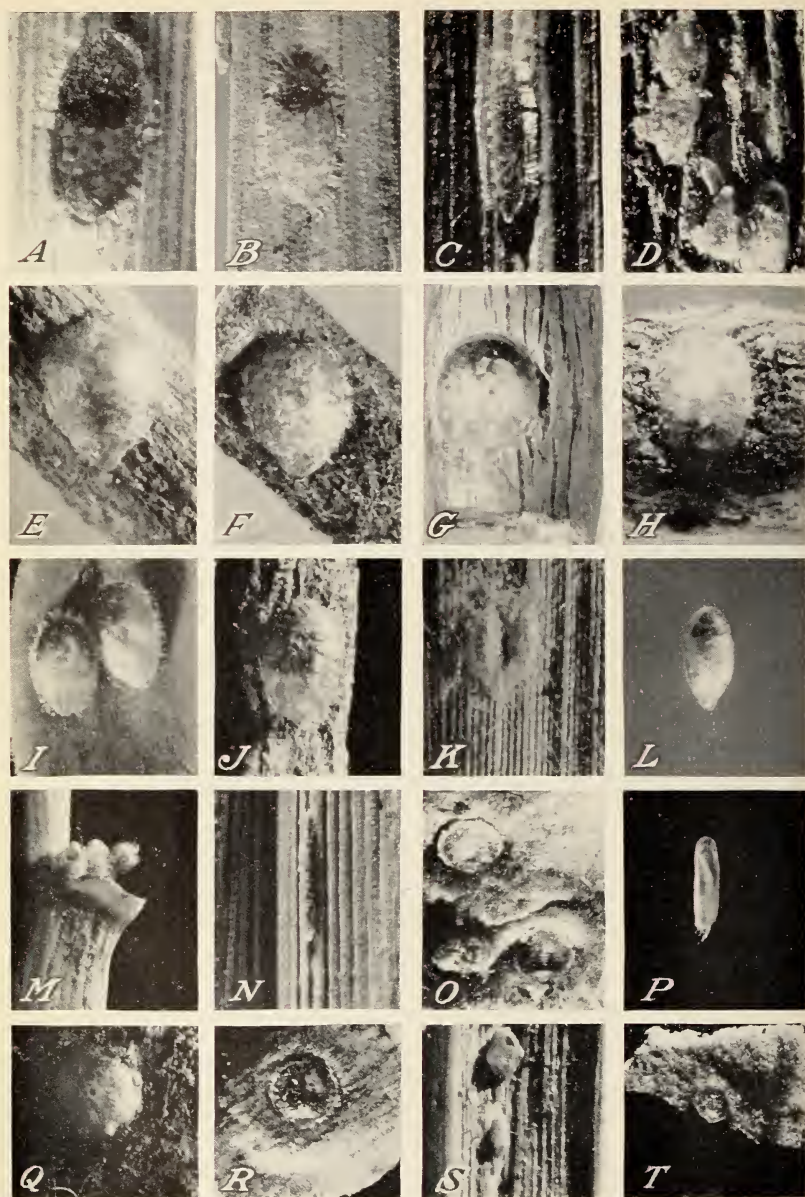
*A*, *stypheliae*; *B*, *transversum*; *C*, *urichi*; *D*, *gemmae*; *E*, *chinae*; *F*, *subdolum*; *G*, *unguatum*; *H*, *palmae*; *I*, *rubrocomatum*; *J*, *striatum*; *K*, *acaciae*; *L*, *disiunctum*; *M*, *multiporum*; *N*, *thespesiae*; *O*, *euphorbiae*; *P*, *nitidum*.



## SPECIES OF ASTEROLECANIUM.

*A*, minus; *B*, luteolum; *C*, minutum; *D*, elongatum; *E*, sasae; *F*, victoriar; *G*, garriniae; *H*, machili; *I*, subventuosum; *J*, cristatum; *K*, phoenicis; *L*, abiectum; *M*, japonicum; *N*, flagellariae; *O*, pusillum; *P*, minusculum; *Q*, pseudolanceolatum; *R*, pseudomiliaris; *S*, mimicum; *T*, circulare.





## SPECIES OF ASTEROLECANIUM.

A, *delicatum*; B, *florum*; C, *udagamae*; D, *simile*; E, *repugnans*; F, *roboris*; G, *quercicola*; H, *puteanum*; I, *epacridis*; J, *medium*; K, *vulgare*; L, *inusitatum*; M, *scirrosis*; N, *penicillatum*; O, *variabile*; P, *ceriferum ceriferum*; Q, *hakeae*; R, *castaneae*; S, *exiguum*; T, *semisepultum*.





## SPECIES OF ASTEROLECANIUM.

A, *simplex*; B, *singulare*; C, *litseae*; D, *pasaniae*; E, *javae*; F, *petrophilae*; G, *longulum*; H, *oblongum*; I, *truncatum*; J, *oraniae*; K, *boliviae*; L, *acutulum*; M, *corallinum*; N, *borneense*; O, *pinangae*; P, *fusum*; Q, *pallidum*; R, *amboinae*; S, *captiosum*; T, *bondari*; U, *degeneratum*; V, *difficile*; W, *skaniana*; X, *inlabefactum*; Y, *horishae*; Z, *brunetae*; AA, *proboscidis*; BB, *parvum*; CC, *gilvum*; DD, *adjunctum*.



*Data*.—Redescribed from one mounted female labeled Australia, Maskell Collection No. 423, U. S. National Museum Catalogue No. 40362, allotype.

Maskell stated (70, p. 63), "Hab. In Australia, on *Acacia* sp. I have specimens from Adelaide, sent by Mr. Koebele, on twigs with dark-red bark, and in these the fringes of the adult are pink; others, from Sydney, sent by Mr. Froggatt, are on twigs with lighter and greyish bark, and the fringes are white; but otherwise the specimens are identical." From these data, published with the original description, it seems that the specimen at hand is from the lot collected by Mr. Koebele. Morrison and Morrison pointed out (73, p. 8) that the specimens mentioned by Maskell as being from twigs with dark-red bark and having the marginal fringe pink might be considered as *ventuosum* because they are treated first in the description, and that the specimens from lighter and grayish bark with the marginal fringe whitish actually represented another species, which they described as *acaciae* (73, pp. 3-4).

The two pores on the antenna mentioned by Morrison and Morrison probably were setal bases, pores not having been found on the antennae of members of this genus. The apical setae are 65  $\mu$  long, instead of 165  $\mu$  long, as stated by Morrison and Morrison, the latter length undoubtedly being a typographical error.

#### ASTEROLECANIUM VICTORIAE, new species

(Fig. 79, D-I; pl. 7, F)

*Habit*.—Living on both surfaces of leaves, in shallow depressions.

*Test of female*.—Nearly ovoid, 1.10-2 mm. long, 1-1.75 wide; slightly convex dorsally, flat or slightly convex ventrally; brownish yellow, transparent, thin, smooth; marginal filaments whitish; circular larval exit in ventral surface close to margin.

*Adult female*.—Somewhat ovoid, 1-1.75 mm. long, 0.75-1.5 wide.

Margin: 8-shaped pores in a single row terminating twice the length of a posterior pore from bases of apical setae, posterior pores 9  $\mu$  long and 6 wide, the remainder 11-12  $\mu$  long and 7-8 wide, usually less than a pore's width apart; quinquelocular pores in a single row terminating near the tenth 8-shaped pore from end of row, about half as numerous as corresponding 8-shaped pores.

Dorsal surface: Minute 8-shaped pores fairly numerous; disk pores sparse; tubular ducts 24  $\mu$  long.

Ventral surface: Antenna nearly flat, with 2 setae longer and 3-5 much shorter than diameter of antenna; beak with 2 pairs of setae; spiracular bar broad; 2-5 quinquelocular pores in a group at spiracular opening and 3 or 4 similar pores extending to body margin in a single row, 6-10 in group and row combined; multilocular pores, totaling 71-81 and with 6-10 loculi, in 6 complete and 2 interrupted rows, the posterior row with 4 or 5 pores, each of next 4 rows with 11-15, each of the next 3 rows with 5-8; 1-3 dark-rimmed 8-shaped pores each side of beak and a few arranged in 4 or 5 transverse rows posterior to beak; submarginal 8-shaped pores in a single row terminating near the second from the last row of multilocular pores, as numerous as corresponding marginal 8-shaped pores; submarginal setae in a complete row terminating near penultimate pair of marginal 8-shaped pores; 2 pairs of setae in posterior row of multilocular pores, 1 pair in each of next 2 rows.

Apex of abdomen: Notch present; lobes indicated; setae, apical 72  $\mu$  long, interapical 9  $\mu$  long, one 5.4  $\mu$  long usually entad of interapical on 1 side of body only, inner ventral 7.2  $\mu$  long, outer ventral 9  $\mu$  long; anal opening ventral, circular, its margin membranous; anal tube slightly sclerotized, cylindrical; anal ring with 4 setae 2  $\mu$  long.

*Larva*.—Elliptical.

Margin: With 28 8-shaped pores, axes of all longitudinal; 3 pairs of setae at anterior end.



Dorsal surface: 8-shaped pores in a submedian row of 7 on each half of body, anterior pores slightly larger than posterior ones, all a little smaller than marginal pores; disk pores close to submedian and to marginal 8-shaped pores.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 1; VI, 2 long, 2 stout, 3 fairly stout, 2 slender; distance between antennal bases equal to one-fifth length of antenna; beak setae, 2 pairs apical, 1 pair basal; anterior spiracle with 1 trilobular and 1 quinquelocular pore, posterior spiracle with none; leg setae, coxa 4, femur 1 on inner margin near base and 1 on outer margin near center, tarsus 1 each on inner and outer margins; tibia about one-half as long as tarsus; 10 pairs of submarginal 8-shaped pores; 10 pairs of submarginal minute setae, on abdomen and thorax, 1 pair of submarginal larger setae at anterior end; 2 pairs of setae between antennae and mouth parts.

Apex of abdomen: Notch present; lobes sometimes indicated; setae, apical  $65 \mu$  long, interapical  $7.2 \mu$  long, one  $2.5 \mu$  long usually present entad of interapical on 1 side of body only, inner ventral  $3.6 \mu$  long, outer ventral  $5.4 \mu$  long; anal opening in margin; anal tube short; anal ring with 4 setae about  $5.4 \mu$  long.

*Test of male*.—Elliptical, 1 mm. long,  $0.75$  wide; slightly convex dorsally, with a longitudinal median carina; flat ventrally; yellow, transparent, thin; marginal filaments whitish.

*Adult male*.— $0.95$  mm. long.

Head: Antenna broken; basal bars transverse; 9 setae anterior to ventral eyespots.

Thorax: Bar between wing bases curved on anterior margin, two-fifths as long as wide, with a median longitudinal fold; tibia as long as tarsus.

Abdomen: Five segments each with a seta dorsally on lateral margin, 3 segments each with a seta in ventral lateral area; each lobe area with 1 long and 2 short setae; penis sheath very long, with 3 pairs of setae dorsally near base and 8 or 9 setae on each side of ventral opening.

*Male nymph*.—Distinguishing characters similar to those of adult male.

*Data*.—Described from specimens (four females, three larvae, one adult male, and one male nymph, mounted) on *Leptospermum* sp., Sandringham, Victoria, Australia, from Ch. French, received in June 1905, holotype and paratypes.

Allied to *vitreum*.

### ASTEROLECANIUM VIENNAE, new species

(Fig. 80, A-I; pl. 5, D)

*Habit*.—Living in pits in the bark.

*Test of female*.—Roughly circular, approximately 1 mm. in diameter, posterior end usually slightly produced and turned forward; more or less convex dorsally, with faint transverse striations, and sometimes with a faint longitudinal median carina; nearly flat, or convex ventrally; bright greenish yellow, semitransparent, shiny, punctate; marginal filaments whitish; larval exit at or close to end of produced area.

*Adult female*.—Nearly circular, posterior end slightly produced; approximately  $0.95$  mm. in diameter.

Margin: 8-shaped pores mostly in an irregularly double and single row terminating around one-half length of apical seta from setal bases,  $8-10 \mu$  long and  $5-8$  wide, usually a pore's length apart; quinquelocular pores in a single row of  $4-17$  (usually  $10-12$ ) where each spiracular pore band meets margin.

Dorsal surface: Minute 8-shaped and disk pores numerous; tubular ducts  $28 \mu$  long.

Ventral surface: Antenna short, with 2 setae as long as diameter of antenna; beak apparently with 2 pairs of setae; spiracle with bar slightly expanded at inner end;  $21-45$  quinquelocular pores extending from spiracle to body margin in a row which is double or triple at opening but  $8-12$  pores wide at margin; enlarged trilobular or quinquelocular pores replacing multilobular, in 2 rows of  $1-3$  each; dark-rimmed 8-shaped pores not observed; submarginal 8-shaped pores usually in an irregularly double row terminating near anterior row of multilobular pores, at least as numerous as corresponding marginal 8-shaped pores; submarginal setae in a complete row terminating fairly near penultimate pair of marginal 8-shaped pores: 1 or 2 pairs of setae in posterior row and 1 pair in anterior row of enlarged quinquelocular pores, and 3 pairs anterior to those, the latter uniformly spaced.

Apex of abdomen: Setae, apical apparently  $29\ \mu$  long, interapical (entad of, and anterior to, apical seta on ventral surface)  $7.2\ \mu$  long, outer ventral (sometimes present) about  $6\ \mu$  long; anal opening ventral, circular, its margin sclerotized, with 1 seta around  $4\ \mu$  long on anterior edge.

*Larva*.—Elliptical.

Margin: 8-shaped pores absent; 2 pairs of setae anteriorly.

Dorsal surface: 8-shaped pores in a submedian row of 9 or 10 and a lateral row of 12, on each half of body, lateral pores slightly larger than submedian, anterior pores of each row slightly larger than posterior pores; disk pores near lateral 8-shaped pores.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 0; VI, 2 long, 2 stout, 2 fairly stout, 2 slender; antennal bases one-half length of antenna apart; beak setae, 3 pairs apical; anterior spiracle with 2 trilocular pores, posterior with 1; leg setae, coxa 3, femur 1 on inner margin near base, tarsus 1 each on inner and outer margins; tibia one-fourth as long as tarsus; 9 pairs of submarginal 8-shaped pores; 7 pairs of submarginal minute setae on abdomen. 1 pair of submarginal larger setae at anterior end; 3 pairs of setae between antennae and mouth parts.

Apex of abdomen: Setae, apical  $90\ \mu$  long, interapical  $5.4\ \mu$  long, outer ventral  $3.6\ \mu$  long; anal opening ventral, close to body margin, circular, its margin sclerotized, with 2 setae  $4\text{--}5.4\ \mu$  long on anterior edge.

*Data*.—Described from unmounted specimens, 3 mounted females, and 26 mounted larvae from *Quercus cerris*, Rekawinkel, near Vienna, Austria, May 23, 1896, holotype and paratypes.

In the adult stage the double row of marginal 8-shaped pores distinguishes this species from all other known forms occurring on Fagaceae except *tokyonis*. It differs from *tokyonis* in many respects, but particularly in lacking an anal ring having pores and six setae. In the larvae the absence of marginal 8-shaped pores serves to separate it from all other known species on oak except *ilicicola*, but the latter normally lacks dorsal 8-shaped pores whereas *viennae* has more than 40.

### ASTEROLECANIUM VIRIDULUM Cockerell

(Fig. 80, J-Q; pl. 5, L)

Described by Cockerell in 1902 (*24*, p. 89) and redescribed by Morrison in 1919 (*72*, pp. 66-67).

*Habit*.—Living on bark, either on flat surfaces or in shallow pits.

*Test of female*.—Circular or ovoid, 1.5-2 mm. in diameter to 1.5-2.5 mm. long and 1.4-2 wide, posterior end usually slightly produced and elevated; convex dorsally, slightly convex or flat ventrally; greenish or rather clear bright yellow, transparent, smooth, shiny; marginal and dorsal filaments usually dirty white, sometimes with a pale-golden tinge, the latter varying in length, none longer than marginal, arranged in transverse rows except for a median longitudinal group, median filaments as long as any and having a low, crestlike appearance; elliptical larval exit in margin.

*Adult female*.—Circular or ovoid, 1.3-1.9 mm. in diameter to 1.3-2.2 mm. long and 1.4-1.8 wide, posterior end slightly produced.

Margin: 8-shaped pores in a double or triple row (sometimes posterior 5-10 pores in a single row) terminating about length of an apical seta from setal bases, 12-13  $\mu$  long and 8 wide, from the width to nearly twice the length of a pore apart; the 2 rows from the width to the length of a pore apart; quinquelocular pores usually in a complete (sometimes briefly interrupted at anterior end) single row terminating at a point removed by 9-26 pores from end of row of 8-shaped pores, nearly or quite as numerous as corresponding 8-shaped pores of nearer row at ends of body, usually twice as numerous as that elsewhere; disk pores along dorsal row of 8-shaped pores, much less numerous than the latter.

Dorsal surface: 8-shaped pores sometimes in a median longitudinal row, and tending toward arrangement in transverse rows elsewhere, the majority 12  $\mu$  long and 8 wide, a few 9  $\mu$  long and 6 wide; minute 8-shaped pores sparse; disk pores fairly numerous; tubular ducts 32-34  $\mu$  long.

Ventral surface: Antenna bluntly conical, with 2 setae about same length as, and 2 longer than, diameter of antenna; 4 or 5 quinquelocular pores sometimes present between antenna and margin; beak with 2 pairs of setae; spiracular bar broad and expanded at inner end; 20-30 quinquelocular pores extending from spiracle to body margin in an irregularly single, double, or triple row; multifolocular pores, totaling 100-130 and with 8-14 (usually 9 or 10) loculi, in 6 complete and 1-3 interrupted rows, posterior and penultimate rows each with 15-20 pores, each of next 2 rows with 20-25, next with 15-20, anterior complete row with 10-15, and each of the others with 2-6; 4-6 dark-rimmed 8-shaped pores each side of mouth parts, a few scattered anterior to mouth parts, and a few tending toward arrangement in 3 or 4 transverse rows near posterior end of abdomen; submarginal 8-shaped pores usually in an irregularly single or double row, terminating near posterior row of multifolocular pores, 1 or 2 opposite each marginal 8-shaped pore of nearer row; submarginal setae in a complete row terminating with or beyond marginal 8-shaped pores; 2 pairs of setae in posterior row of multifolocular pores and 1 pair in each of the next 2 rows.

Apex of abdomen: Notch present; lobes sometimes indicated; setae, apical 54-64  $\mu$  long, interapical 12.6  $\mu$  long, dorsal 3.4-7.2  $\mu$  long, intermediate ventral 5.4-7.2  $\mu$  long, outer ventral 9  $\mu$  long; anal ring with 6 setae 45-52  $\mu$  long and with an inner row of 6 and an outer row of 16-20 pores, divided on dorsal and ventral sides; ventral surface of apex slightly sclerotized and rugose.

*Second stage.*—Resembling adult female but smaller; margin with 8-shaped pores in a single row except at 1 or 2 points, where it may be irregularly double for 2-4 pores, quinquelocular pores terminating at a point 5-10 8-shaped pores from end of row of those pores, the row interrupted at anterior end, the pores less numerous than corresponding 8-shaped pores; dorsal surface with 8-shaped pores less numerous than in adult, arranged in a double lateral and a submedian row somewhat as in the larva, slightly smaller than marginal pores; ventral surface with 4 or 5 quinquelocular pores in each spiracular row, submarginal 8-shaped pores in a single row; apex of abdomen as in adult but all setae about one-fifth shorter.

*Larva.*—Nearly elongate elliptical, posterior end narrowed.

Margin: With 28 8-shaped pores, posterior pores smallest, the others gradually increasing slightly in size cephalad, axes of the posterior 6 pairs transverse, of the others longitudinal; a minute seta near each pore of the posterior 3 pairs; 3 pairs of setae at anterior end.

Dorsal surface: 8-shaped pores in a submedian row of 8-10 (usually 9 or 10), and a lateral row of 7-10 (usually 9), on each half of body, the pores of each row nearly uniform in size, but the posterior one slightly smaller than anterior pore, all smaller than marginal pores of same segments; disk pores between lateral and marginal, and between lateral and submedian, 8-shaped pores; a pair of minute setae near anterior pair of submedian 8-shaped pores.

Ventral surface: Antennal setae, I, 2; IV, 1; V, 0; VI, 2 long, 2 stout, 3 fairly stout, 2 slender; antennal bases one-third length of antenna apart; beak setae, 2 pairs apical, 1 pair basal; spiracle with 1 trilocular and 1 quinquelocular pore; leg setae, coxa 4, femur 1 on inner margin near base and 1 each on inner and outer margins near center, tarsus 2 on inner and 1 on outer margin; tibia one-half as long as tarsus; 8 pairs of submarginal 8-shaped pores of which 1 pair is between the antennae; 11 pairs of submarginal minute setae, on abdomen, thorax, and head, 1 pair of submarginal larger setae at anterior end; 2 pairs of setae between antennae.

Apex of abdomen: Notch present; lobes sometimes indicated; setae, apical 90  $\mu$  long, interapical 10.8-12.6  $\mu$  long, dorsal 4  $\mu$  long, intermediate ventral 3.6  $\mu$  long, outer ventral 7.2  $\mu$  long; anal ring with 6 setae each 21.6  $\mu$  long, with an inner row of 6 and an outer one of 12 pores, divided on dorsal side and tending toward division on ventral; ventral surface of apex sclerotized in dentate rows.

*Test of male.*—Elliptical, with a minute notch at posterior end; 1 mm. long, 0.5-0.6 wide; nearly flat dorsally but slightly raised at anterior end, with a faint median and lateral carina and transverse striations; flat or convex ventrally; greenish yellow, transparent, smooth, shiny; marginal and dorsal filaments whitish, the latter apparently very short.

*Adult male.*—1.75 mm. long.

Head: Antenna 10-segmented, formula (longest to shortest), (X), (III, IV), (V), (VI), (II, VII, VIII, IX), (I); antennal setae, I, 2; II, 7; III, 9; IV, V, apparently 11; VI, 12; VII, 7; VIII, 9; IX, 10; X, 15 slender and 3 very long; basal bars very faint, slightly diagonal; 12 setae on ventral surface.



**Thorax:** Bar between wing bases curved on anterior margin, slightly more than twice as long as wide; tibia one-third longer than tarsus.

**Abdomen:** Five segments each with a seta dorsally on lateral margin, 3 segments each with a seta in ventral submedian area; lobes strongly developed, each with 1 long and 4 short setae; penis sheath with 1 pair of setae dorsally, with 6 setae on each side of ventral opening and many minute clear areas at tip.

*Male nymph.*—Distinguishing characters similar to those of adult male.

*Third-stage male.*—Resembling second stage but elliptical; dorsal 8-shaped pores slightly more numerous than in earlier stage, legs represented by 3 pairs of circular sclerotized areas each with a short, stout claw.

*Data.*—Redescribed from unmounted material from all but type lot, and the following mounted specimens: Four females from "kind of ironweed," Tucuman, Argentina, L. Bruner, July 26, 1897, type; 2 females from Compositae, Campinas, Brazil, received from F. Noack, 1897; 3 females, Estaca, Rio Grande, Brazil, from H. von Ihering, March 19, 1905; 19 females, 4 second-stage specimens, 6 larvae, 1 adult male, 2 male nymphs, and 1 third-stage male from *Eupatorium* sp., Bompland, Misiones, Argentina, P. Jorgensen, July 1910, No. 819a; 8 females, 38 larvae, and 1 adult male from "Mio-mio" [*Baccharis coridifolia*] (the scientific name was determined from the vernacular name and not from identification of plant material), Corrientes, Argentina, M. Kisliuk, June 20, 1927; 2 females from *Vernonia* sp., Santos, State of Sao Paulo, Brazil, H. S. Fawcett, January 25, 1937, received from A. Hempel.

Allied to *grandiculum*.

### ASTEROLECANIUM VITREUM, new species

(Fig. 81, A-G; pl. 5, C)

*Habit.*—Living on both surfaces of leaves.

*Test of female.*—Somewhat ovoid, posterior end sometimes very slightly produced; 1-1.6 mm. long, 0.75-1.25 wide; convex dorsally, sloping to posterior end, flat ventrally; bright lemon yellow, transparent, fairly thin; marginal filaments whitish; elliptical larval exit in ventral surface at margin.

*Adult female.*—Ovoid or nearly circular, posterior end slightly produced; 0.85-1.35 mm. long, 0.6-1.25 wide.

Margin: 8-shaped pores in a single row terminating twice to three times the length of a posterior pore from bases of apical setae, around 10  $\mu$  long and 5.4 wide, usually slightly less than a pore's width apart; quinquelocular pores in a single row terminating opposite a point 2-16 8-shaped pores from end of row of those pores, the row complete, or interrupted at anterior end for a space opposite 2-15 8-shaped pores, usually about half as numerous as corresponding 8-shaped pores near ends of row, as numerous as 8-shaped pores elsewhere.

Dorsal surface: Minute 8-shaped and disk pores fairly sparse; tubular ducts very numerous, 18  $\mu$  long.

Ventral surface: Antenna circular, slightly raised, with 2 setae longer and 1 much shorter than diameter of antenna; beak with 2 pairs of setae; spiracular bar somewhat expanded at inner end; 4-12 quinquelocular pores between opening of anterior spiracle and body margin, 3 or 4 of which may be in a rather irregular group near opening and the others extending toward, or actually attaining, the body margin; with 2-6 quinquelocular pores, usually in a rather loose group outside opening of posterior spiracle and occasionally 1 or 2 toward body margin; multilocular pores, having 9-13 loculi, in 6 or 7 complete and 2 or 3 interrupted rows, with the anterior row in line with, or posterior to, the posterior spiracles; posterior row with 3-6 pores, each of the next 3 rows with 9-17, next with 11-16, next with 5-18, next with 5-11, and each of interrupted rows with 1-5, the total number being 69-98; 2-4 dark-rimmed 8-shaped pores each side of beak, a few scattered on anterior end, and a few on abdomen some of which are arranged in 3 or 4 transverse rows; submarginal 8-shaped pores in a rather crowded single row (appearing double at some points) terminating near penulti-

mate row of multilocular pores, nearly as numerous as marginal 8-shaped pores; submarginal setae in a complete row terminating near penultimate pair of marginal 8-shaped pores; 3-5 setae in posterior row of multilocular pores and 2 setae in each of the next 2.

Apex of abdomen: Lobes usually indicated; setae, apical (broken) apparently 80  $\mu$  long, interapical 5.4  $\mu$  long, inner ventral (nearly directly anterior to interapical) 3.6-5.4  $\mu$  long, outer ventral 5.4-7.2  $\mu$  long; anal opening in ventral surface and margin, elongate, fairly slender; anal tube short, cylindrical, faintly sclerotized throughout; anal ring a sclerotized unclosed band at end of anal tube, with 2 setae 2  $\mu$  long, the ring broken on ventral side for about a fifth of its circumference.

*Second stage*.—Resembling adult female but smaller; margin with 2 or 3 quinquelocular pores near each spiracular pore band; ventral surface with 3-5 quinquelocular pores between each spiracle and body margin, dark-rimmed 8-shaped pores very sparse, 2 pairs of setae observed in median abdominal area; apex of abdomen much as in adult, apical setae broken, others slightly shorter than in adult, anal opening in ventral surface, not extending to margin, anal tube very short, anal ring as in adult.

*Larva*.—Elongate ovoid.

Margin: With 28 8-shaped pores, the anterior 2 pairs slightly larger than the others, axes of all longitudinal; 3 pairs of setae at anterior end.

Dorsal surface: One to 3 submedian 8-shaped pores on each half of body, situated on head and thorax, practically the same size as marginal pores of same segments; minute 8-shaped pores in a lateral row of apparently 10-13 on each half of body; disk pores in submarginal and submedian areas; a pair of small setae near anterior pair of large 8-shaped pores.

Ventral surface: Antennal setae, I, 1; IV, 1; V, 1; VI, 2 long, 2 stout, 3 fairly stout, 2 slender; antennal bases one-third length of antenna apart; beak setae, 2 pairs apical, 1 pair basal; anterior spiracle with 1 trilocular and 1 quinquelocular pore, posterior with none; leg setae, coxa 4, femur 1 on inner margin near base and 1 on outer margin near center, tarsus 1 each on inner and outer margins; tibia around one-third as long as tarsus; 9 pairs of submarginal 8-shaped pores; 10 pairs of submarginal minute setae, on abdomen, thorax, and head, 1 pair of submarginal larger setae at anterior end; 2 pairs of setae between antennae and mouth parts.

Apex of abdomen: Notch present; setae, apical 54  $\mu$  long, interapical 5.4  $\mu$  long, dorsal (present in only 1 of specimens examined) 2  $\mu$  long, inner ventral 3.6  $\mu$  long, outer ventral 3.6-5.4  $\mu$  long; anal opening in ventral surface and margin; anal tube very short on ventral side, sclerotized throughout, slightly smaller at opening and ring than in center; anal ring sclerotized, with 2 setae 5.4-6.2  $\mu$  long.

*Data*.—Described from unmounted specimens (paratypes) and the following mounted material: Two females and 18 larvae and 18 larvae, Maskell No. 44, Cockerell Collection, paratypes; 5 females and 1 second-stage specimen from *Leptospermum* sp., Motueka, New Zealand, from G. Brittin, received in 1937, holotype and paratypes.

Although this species is quite distinct from the others treated in this paper, it appears most closely related to *victoriae*.

### ASTEROLECANIUM VULGARE, new species

(Fig. 81, H-T; pl. 8, K)

*Habit*.—Living on the lower surface of leaves.

*Test of female*.—Longer than wide, posterior end slightly produced; 1-1.5 mm. long, 0.65-1 wide; flat dorsally and ventrally; pale brownish yellow, transparent, fairly thin, slightly punctate; marginal and dorsal filaments very pale yellow, the latter fairly numerous; circular larval exit in margin.

*Adult female*.—Longer than wide, posterior end sometimes slightly produced; 1-1.4 mm. long, 0.6-1 wide.

Margin: 8-shaped pores in a single row terminating about one-half length of an apical seta from setal bases, penultimate pore twice its own length to slightly more than twice length of apical seta from posterior pore and a few pores just anterior to penultimate pore, twice a pore's length apart, the rest normally a pore's length apart, posterior pore 7-8  $\mu$  long and 5 wide, penultimate and a

few pores anterior to it 8  $\mu$  long and 6 wide, the others 10  $\mu$  long and 6 wide; disk pores dorsad of, and about as numerous as, 8-shaped pores, terminating near posterior pair of 8-shaped pores.

Dorsal surface: 8-shaped pores in median, submarginal, and lateral areas, but usually absent from a narrow submedian area posterior to mouth parts, arranged roughly in transverse rows of about 6-10 each, 12  $\mu$  long and 7-8 wide; minute 8-shaped pores fairly numerous in median area, sparse elsewhere; disk pores near majority of 8-shaped pores, 1 or 2 to an 8-shaped pore, a few elsewhere; tubular ducts 32  $\mu$  long; dorsal tubes present.

Ventral surface: Antenna circular, slightly raised, with 2 setae much longer than diameter of antenna; beak without setae; spiracular bar expanded at inner end; 3-7 quinquelocular pores in a loose group near spiracular opening, the pores in excess of 4 in direction of body margin, but not reaching it; multilocular pores, with 10 loculi, in 4 complete and 2 interrupted rows, posterior row with 7-10 pores, penultimate with 8 or 9, next with 9-12, next with 5 or 6, and each of interrupted rows with 1-4, the total number being 34-41; 1-3 dark-rimmed 8-shaped pores each side of beak, a few anterior to mouth parts, a few in lateral area of abdomen, and in 2 or 3 transverse rows among multilocular pores; submarginal 8-shaped pores in a single row terminating near penultimate row of multilocular pores, less numerous than corresponding marginal 8-shaped pores; 6 pairs of submarginal setae on abdomen, the posterior pair around one-half length of an apical seta from bases of apical setae; 1 pair of setae in each of the posterior 3 rows of multilocular pores.

Apex of abdomen: Notch present; lobes indicated; setae, apical 76  $\mu$  long, interapical 9  $\mu$  long, inner ventral 5.4  $\mu$  long, outer ventral 7.2  $\mu$  long; anal ring with 4 setae 32  $\mu$  long and two 36  $\mu$  long and with an inner row of 6 and an outer one of apparently 14 pores, tending toward division on dorsal side; ventral surface of apex weakly sclerotized in dentate rows.

*Test of male*.—Nearly elliptical, posterior end slightly pointed; 1.4 mm. long, 0.75 wide; slightly raised dorsally, without or with a very faint longitudinal median carina; flat ventrally; pale yellow, transparent, very thin; marginal filaments very pale yellow to whitish, longest at anterior end.

*Adult male*.—1.3 mm. long.

Head: Antenna 10-segmented, formula (longest to shortest), (IV), (V), (III, X), (VI), (VII, VIII, IX), (I, II); antennal setae, I, 11; II, 17; III-X, 21-24; X also with 1 stout and 4 very long; basal bars diagonal; 21 setae near ventral eyespots.

Thorax: Bar between wing bases curved on anterior margin, nearly three times as long as wide; tibia nearly as long as tarsus.

Abdomen: Five segments each with a seta dorsally on lateral margin, 3 segments each with a seta in submedian ventral area; each lobe area with 1 long and usually 2 short setae; penis sheath with 2 pairs of setae dorsally near base and 6 or 7 setae on each side of ventral opening.

*Data*.—Described from unmounted material, six mounted females, and two mounted adult males from *Bambusa* sp., Lung Tau Shan, Kuk Kong district, Kwangtung, China, F. A. McClure, January 7, 1925, holotype and paratypes.

This species closely resembles *chinae*, but it lacks marginal quinquelocular pores and the spiracular quinquelocular pores are arranged differently than in *chinae*.

### ASTEROLECANIUM ZANTHENES, new species

(Fig. 82, A-M; fig. 83, A; fig. 84, A-G; pl. 2, C)

Treated by Leonardi in 1920 (57, pp. 244-246) as *A. thesii* (Douglas).

*Habit*.—Living on twigs, stems, and leaf petioles and occurring on flat surfaces or in shallow pits.

*Test of female*.—Longer than wide, sometimes slightly pyriform, posterior end elevated and often turned forward; 2-2.5 mm. long, 1.5-2.15 wide; convex dorsally, flat ventrally; brownish or pale clear yellow, translucent, rather thick, slightly punctate; marginal filaments whitish; dorsal filaments in a tuft along



median line, and sometimes scattered from there to margin, whitish or pale yellow, median filaments twice as long as marginal, the rest shorter than marginal; larval exit elongate elliptical, in margin.

*Adult female*.—Broadly ovoid, 1.9–2.4 mm. long, 1.25–1.75 wide.

Margin: 8-shaped pores in a distinctly or irregularly double row (rarely in a triple row at some point in lateral area and usually irregularly single for around posterior 15 pores), terminating once or twice a pore's length from bases of apical setae, 12–16  $\mu$  long and 8–9 wide, the pores of each row around a pore's length apart and the 2 rows around a pore's width apart; quinquelocular pores usually absent but rarely 1–8 near points where spiracular pore bands meet margin; disk pores dorsal of, and about half as numerous as, 8-shaped pores of dorsal row, terminating near anal opening, also occurring ventrad of, and terminating with, the 8-shaped pores, approximately one-fourth as numerous as 8-shaped pores of nearer row.

Dorsal surface: 8-shaped pores in 4–6 groups along median line and sometimes scattered between those groups and margin, tending toward arrangement in transverse rows, the pores in median groups 16–18  $\mu$  long and 9 wide, the others 12–14  $\mu$  long and 8 wide; minute 8-shaped pores absent in specimens having 8-shaped pores scattered over surface, numerous and scattered between median 8-shaped pores and margin in other specimens; disk pores numerous; tubular ducts 40  $\mu$  long.

Ventral surface: Antenna irregularly circular, sometimes sunken in derm, with 2 setae slightly longer and 1–6 shorter than diameter of antenna; beak with 2 pairs of setae; spiracle with bar subcircular, a sclerotized area extending from bar around opening, 5–7 quinquelocular pores in sclerotized area and 38–58 similar pores extending to body margin in a double to quadruple row, a total of 45–64 in group and row and along margin; multilocular pores, with 7–13 (usually 10 or 11) loculi, in 3 complete rows of 9–16 each, the total ranging from 32–47; 4–8 dark-rimmed 8-shaped pores each side of mouth parts, a few scattered on anterior end, and others arranged in 7 or 8 transverse rows posterior to mouth parts; minute submarginal 8-shaped pores in an irregularly double, triple, or quadruple row terminating near a transverse line drawn through anterior row of multilocular pores, interrupted near antennae, but continued between them. 2–4 opposite every other marginal 8-shaped pore of adjacent row; 3 or 4 disk pores present in each spiracular pore band and 1–4 in each row of multilocular pores; submarginal setae in a complete row terminating opposite a point 3 or 4 pores from end of row of marginal 8-shaped pores; 2, or rarely 3, setae each in posterior and penultimate rows of multilocular pores.

Apex of abdomen: Notch small; setae, apical 92–100  $\mu$  long, interapical 40  $\mu$  long, dorsal 20–24  $\mu$  long, inner ventral 7.2–8  $\mu$  long, intermediate ventral 8–9  $\mu$  long, outer ventral 12–16  $\mu$  long; anal ring with 6 setae 72–76  $\mu$  long and with around 36 pores; ventral surface of apex heavily sclerotized around inner ventral setae, surrounding area sclerotized in dentate rows.

*Larva*.—Somewhat ovoid or broadly elliptical.

Margin: With 28 8-shaped pores, the posterior 6 pairs distinctly smaller than next 7 pairs, which are slightly smaller than the anterior pair, axes of the posterior 6 pairs transverse, of the others longitudinal; a minute seta close to each pore of the posterior 4 pairs; 4 pairs of setae at anterior end.

Dorsal surface: 8-shaped pores in a submedian row of 7–10 on each half of body, posterior pores very slightly smaller than anterior, all slightly smaller than marginal pores of same segments; disk pores occurring rather close to marginal 8-shaped pores and a few fairly close to dorsal 8-shaped pores; a small seta anterior to each anterior 8-shaped pore.

Ventral surface: Antennal setae, I, 2; IV, 1; V, 1; VI, 2 long, 2 stout, apparently 3 fairly stout, 2 slender; antennal bases one-fifth length of antenna apart; beak setae, 2 pairs apical, 1 pair basal; spiracle with 1 trilocular pore; leg setae, coxa 4, femur 1 on inner margin near base and 1 each on inner and outer margins near center, tarsus 2 on inner and 1 on outer margin; tibia one-half as long as tarsus; 7 pairs of submarginal 8-shaped pores, none present between antennae; 9 pairs of submarginal minute setae, on abdomen and thorax, 3 pairs of submarginal larger setae at anterior end; 3 pairs of setae between antennae and mouth parts.

Apex of abdomen: Setae, apical 135  $\mu$  long, interapical 36–41  $\mu$  long, dorsal 7.2  $\mu$  long, inner ventral 7.2–9  $\mu$  long, intermediate ventral 4–10.8  $\mu$  long, outer ventral 10.8–14.4  $\mu$  long; anal ring with 6 setae 32–35  $\mu$  long and with an inner row of 6 and an outer row of 12 pores.

*Data.*—Described from unmounted specimens (paratypes) and the following mounted material: Six females and 19 larvae from *Phagnalon annoticum*, near Ragusa, Dalmatia, Yugoslavia, O. Jaap, March 25, 1914, No. 217, including holotype: 3 females and 8 larvae from *Pittosporum tobira*, Sardinia, Chermotheca Italica IV, No. 87; 3 females and 14 larvae on *Coronilla valentina*, Menton, France, April 6, 1863, U. S. N. H.; 1 female and 2 larvae from *Phagnalon saxatile*, Algeria, A. Balachowsky, December 25, 1926, from E. E. Green; 1 female and 6 larvae from *Salvia* sp., Antioch, Syria, F. H. Bodenheimer, 1933, from A. Balachowsky; 1 female and 1 larva from *Pittosporum* sp., Palermo, Italy, Chermotheca Italica, received from E. E. Green in 1933; 1 female and 6 larvae from *Pittosporum* sp., Naples, Italy, and 1 female and 2 larvae from *Templetonia* sp., Palermo, Italy, received from F. Silvestri in May 1934.

Closely related to *arabidis*, *fimbriatum*, *launcae*, *nevadense*, and *stentae*, but differing from each of these in lacking a marginal row of quinquelocular pores.

### SPECIES UNKNOWN TO THE AUTHOR

#### ASTEROLECANIUM BORNMUELLERI Rübsaamen

Described in 1902 (82, pp. 314-316, 336) from specimens collected on *Quercus persica* in South Persia, in the Province of Farsistan near Myan-Kotel, between Schiraz and Kaserun.

Although the description is incomplete, the writer is of the opinion that this is a valid species, and is not a synonym of *variolosum* as Lindinger stated in 1912 (61, p. 360).

#### ASTEROLECANIUM CERIFERUM variety PROMINENS Green

This variety, described in 1909 (42, p. 326) from specimens collected on *Oxytenanthera thwaitesii*, Nuwara Eliya, Ceylon, is said to differ from the typical form "principally in the form of the female test, which, seen in profile, slopes distinctly upwards to the posterior extremity." The author adds, "Structure of adult female as in type: the marginal paired pores slightly larger and more distinct." Unless there are other differences between the two, the validity of *ceriferum prominens* is questionable.

#### ASTEROLECANIUM CONIMBRIGENSE Coutinho Saraiva

Described in 1936 (28, pp. 1-18) from specimens collected on *Quercus humilis* and *Q. hybrida*, presumably from near Coimbra, Portugal. Coutinho Saraiva states that this species is closely related to *seabrai* (see discussion under *seabrai* on p. 231).

#### LECANIUM EBURNEUM Heyden

Described in 1860 (52, p. 90) from specimens collected on *Hedera helix*, Neuchatel, Switzerland. Mayr, in 1876 (71, p. 759), discussed some parasites of *Coccus eburneus* Heyden, and Lindinger, in 1935 (63, p. 130), indicated that the name *eburneum* proposed by Heyden and used by Mayr was a synonym of *fimbriatum*. The species is un-

recognizable from the description. If the insect actually belongs to *Asterolecanium* there is greater possibility of its being identical with *arabidis* than with any other species. In case Heyden's specimens are found and prove to be the same as *arabidis* the name *eburneum* would have priority.

#### ASTEROLECANIUM FLAVOCILIATUM Green

Described in 1909 (42, p. 322) from specimens found on small branches of *Arundinaria*, usually concealed beneath the leaf sheaths, from Pundaluoya, Ceylon. The species appears to be rather similar to *coronatum*.

#### ASTEROLECANIUM GRANDE (Newstead)

Described in 1894 (74, pp. 179-183) in the genus *Pollinia*, from specimens collected on a grasslike plant in Baluchistan; placed in *Asterolecanium* by various workers including Fernald (32, p. 51). The species is not recognizable from the original description.

#### ASTEROLECANIUM HANCOCKI Laing

Described in 1929 (56, pp. 466-467), from specimens found on the bark of coffee, Kuvzeke, Uganda. Laing stated, "Scattered fairly thickly throughout ventral surface are small 8-shaped pores about half the size of marginal series, while on dorsal surface are numerous circular pores slightly larger than those of marginal series, indefinitely arranged immediately in front of anal setae, but on each of the preceding five segments there is a single transverse discontinuous series." On the basis of analogy with other species it seems likely that the 8-shaped pores of this form are on the dorsal surface rather than the ventral, and that the "circular pores" (doubtless multilocular) are on the ventral surface.

#### ASTEROLECANIUM LORANTHI Green

Described in 1922 (46, p. 1036), from a single specimen collected on *Loranthus neelgherrensis*, Hakgala, Ceylon. The species appears to resemble *litseae*.

#### ASTEROLECANIUM MINUTUM Green (Ms.)

In 1930 (79, p. 55), Ramakrishna Ayyar applied the name *Asterolecanium minutum* Green (Ms.) to specimens collected on bamboo leaves, Dhone Valley, Malabar. The name has not been validated and it is now preoccupied, Takahashi having described a species under the name *minutum* in 1930 (93, pp. 10-11). Specimens bearing the above data have been examined by the writer and it is her opinion that they do not belong in *Asterolecanium*, but represent an undescribed species of *Polea*.

#### ASTEROLECANIUM MORINI Mamet

Described in 1937 (66, p. 176) from specimens collected on *Pentas carnea*, Port Louis, Mauritius. From the description and figures,



this species appears very similar to *pustulans*, but Mamet mentioned and illustrated only four rows of multilocular pores, and only three pairs of setae on the apex of the abdomen. Although the name *morini* may be a synonym of *pustulans*, the available information does not warrant its suppression.<sup>13</sup>

#### ASTEROLECANIUM PUDIBUNDUM Green

Described from specimens found on *Arundinaria*, Pundaluoya, Ceylon, in 1909 (42, p. 323). It apparently is allied to such forms as *ceriferum*, *elongatum*, *proboscidis*, and *scirrosus*.

#### ASTEROLECANIUM PYRIFORME (Froggatt), new combination

Described as *Cerococcus pyriformis* in 1915 (35, p. 1057) but doubtless belonging to *Asterolecanium*, judging from the presence of the marginal filaments on the test, and the occurrence of six hairs on the anal ring. The species is unrecognizable from the description.

#### ASTEROLECANIUM REHI Rübssaamen

In 1902 (81, p. 62) the name *Asterolecanium rehi* was given to specimens collected from *Globularia salicina* in Funchal, Madeira. Rübssaamen stated that the insect was bright yellow, but gave no further descriptive notes and no illustrations. Lindinger listed the name as a synonym of *fimbriatum* and also as a nomen nudum (61, p. 164). Since it is impossible to consider the name a nomen nudum or to be certain of the identity of the form, the name *rehi* is retained as representing an unknown species. The writer believes, however, that the name may be synonymous with some older one, though not with *fimbriatum*.

#### ASTEROLECANIUM SEABRAI Coutinho Saraiva

Described in 1936 (27, pp. 1-31) from specimens collected on *Quercus faginea* near Coimbra, Portugal. From the descriptions of this species and *conimbrigense* (28, pp. 1-18) it appears that these insects show a stage in the evolution of the genus which has neither been recorded by other workers nor observed by the present writer. The adult females are said to have two minute setae on the anal ring, while the larvae have six long ring setae. The writer has not observed any species of *Asterolecanium* whose larvae have six anal ring setae the adults of which have a different number than the larvae. The discovery of two species exhibiting such development is very interesting.

#### ASTEROLECANIUM TENAX Bodenheimer

Described and illustrated in 1929 (4, pp. 111-112, pl. 23, figs. 47-49), from specimens collected in twig notches of *Tamarix* at Wadi Nasib, Sinai Peninsula, Egypt. *A. tenax* is said to have a double row of marginal 8-shaped pores and many marginal and spiracular simple

<sup>13</sup> Since the preparation of this publication, Mamet has elevated the variety *pustulans seychellarum* Green to specific rank and, after comparing specimens, has synonymized *morini* with *seychellarum* (Roy. Ent. Soc., London Proc., Ser. B, Taxonomy 8: 238-239, 1939). The present writer has already pointed out (see p. 165) that, in her opinion, *seychellarum* is a synonym of *pustulans* and Mamet's reasons for changing the status of the varietal name do not alter this opinion. It therefore seems necessary to consider *morini*, as well as *seychellarum*, synonymous with *pustulans*.

pores, and to lack anal ring and apical setae. The absence of apical setae is questionable because they are present in all other known species, although they are sometimes very short.

#### ASTEROLECANIUM TENUISSIMUM Green

Described from specimens collected on both surfaces of leaves of bamboo from Udagama and Yatiyantota, Ceylon, in 1909 (42, p. 318). The species appears to resemble *penicillatum*, *pseudolanceolatum*, and *solenophoroides*, but it differs from them in having three instead of four pairs of setae on the apex of the abdomen, and in having several multilocular pores, instead of two quinquelocular pores, near the genital opening.

#### ASTEROLECANIUM TUMIDUM Green

Described in 1909 (42, p. 330), from specimens found on leaves of bamboo, Udagama, Ceylon. The species appears to be rather similar to *exiguum* and *udagamae*.

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## ILLUSTRATIONS

(Figs. 2-84; pls. 1-9)

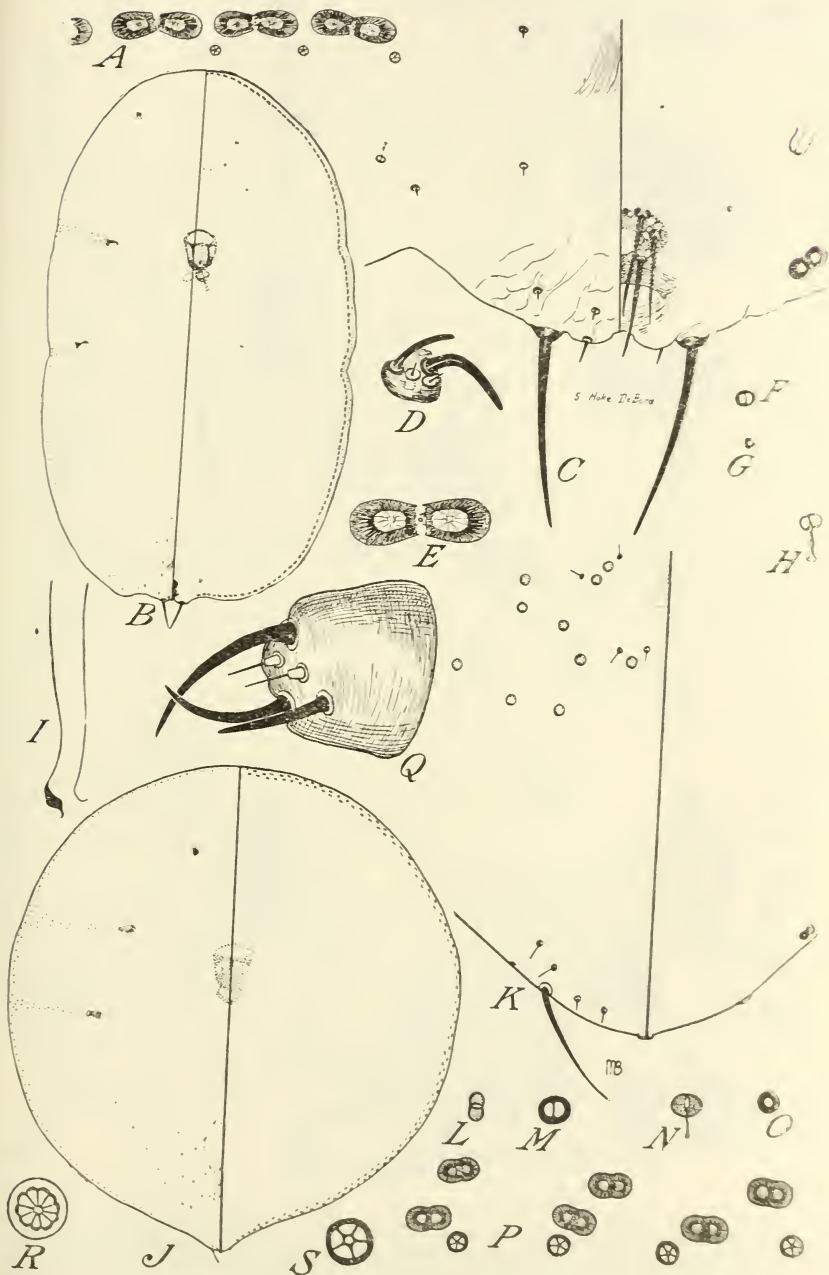


FIGURE 2.—*Asterolecanium abietum*: A, section of margin,  $\times 400$ ; B, outline,  $\times 60$ ; C, genital and anal area,  $\times 650$ ; D, antenna; E, marginal 8-shaped pore; F, dark-rimmed 8-shaped pore; G, disk pore; H, submarginal 8-shaped pore; I, tubular duct. *A. acaciae*: J, outline,  $\times 57$ ; K, genital and anal area,  $\times 330$ ; L, minute dorsal 8-shaped pore; M, dark-rimmed 8-shaped pore; N, submarginal 8-shaped pore; O, disk pore; P, section of margin; Q, antenna; R, multilocular pore.

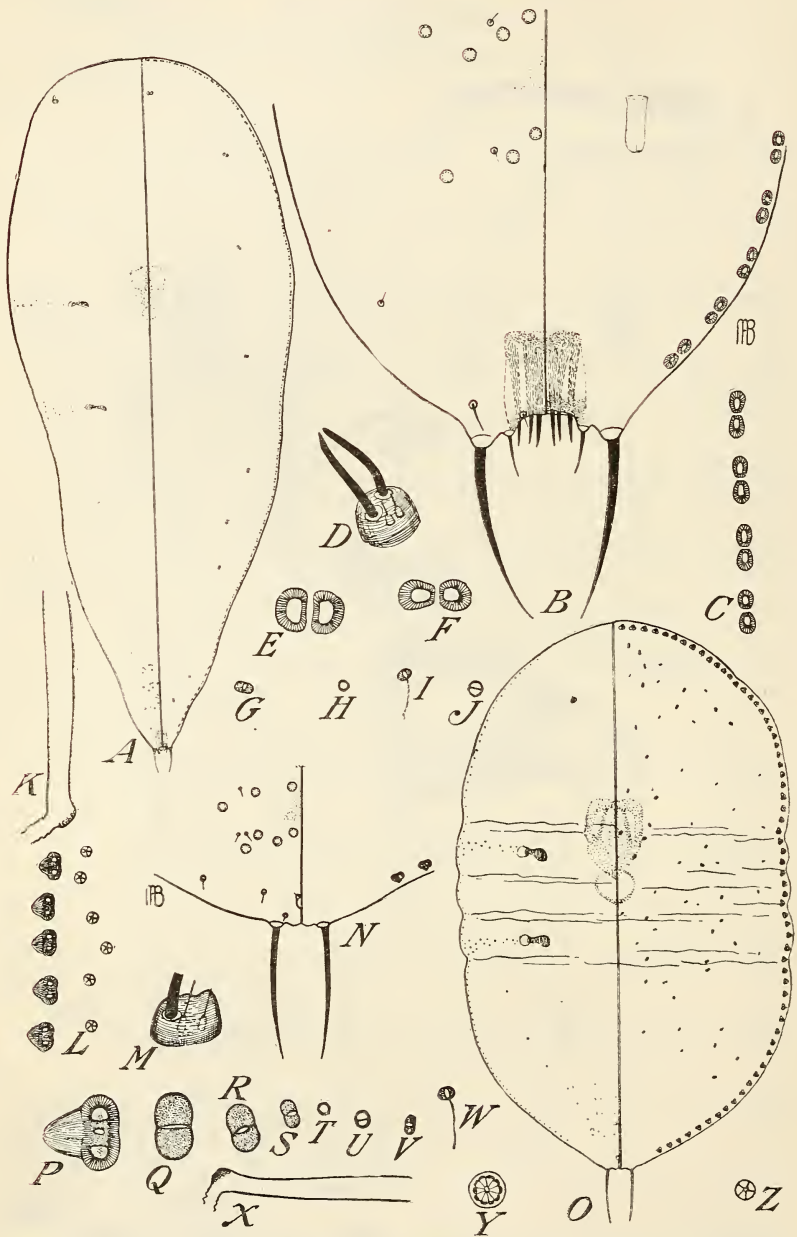


FIGURE 3.—*Asterolecanium acutulum*: A, outline,  $\times 87$ ; B, genital and anal area,  $\times 460$ ; C, section of margin,  $\times 650$ ; D, antenna; E, dorsal 8-shaped pore; F, marginal 8-shaped pore; G, minute dorsal 8-shaped pore; H, disk pore; I, submarginal 8-shaped pore; J, dark-rimmed 8-shaped pore; K, tubular duct. *A. adjunctum*: L, section of margin,  $\times 650$ ; M, antenna; N, genital and anal area,  $\times 330$ ; O, outline,  $\times 165$ ; P, marginal 8-shaped pore; Q, R, S, dorsal 8-shaped pores; T, disk pore; U, dark-rimmed 8-shaped pore; V, minute dorsal 8-shaped pore; W, submarginal 8-shaped pore; X, tubular duct; Y, multilocular pore; Z, quinquelocular pore.

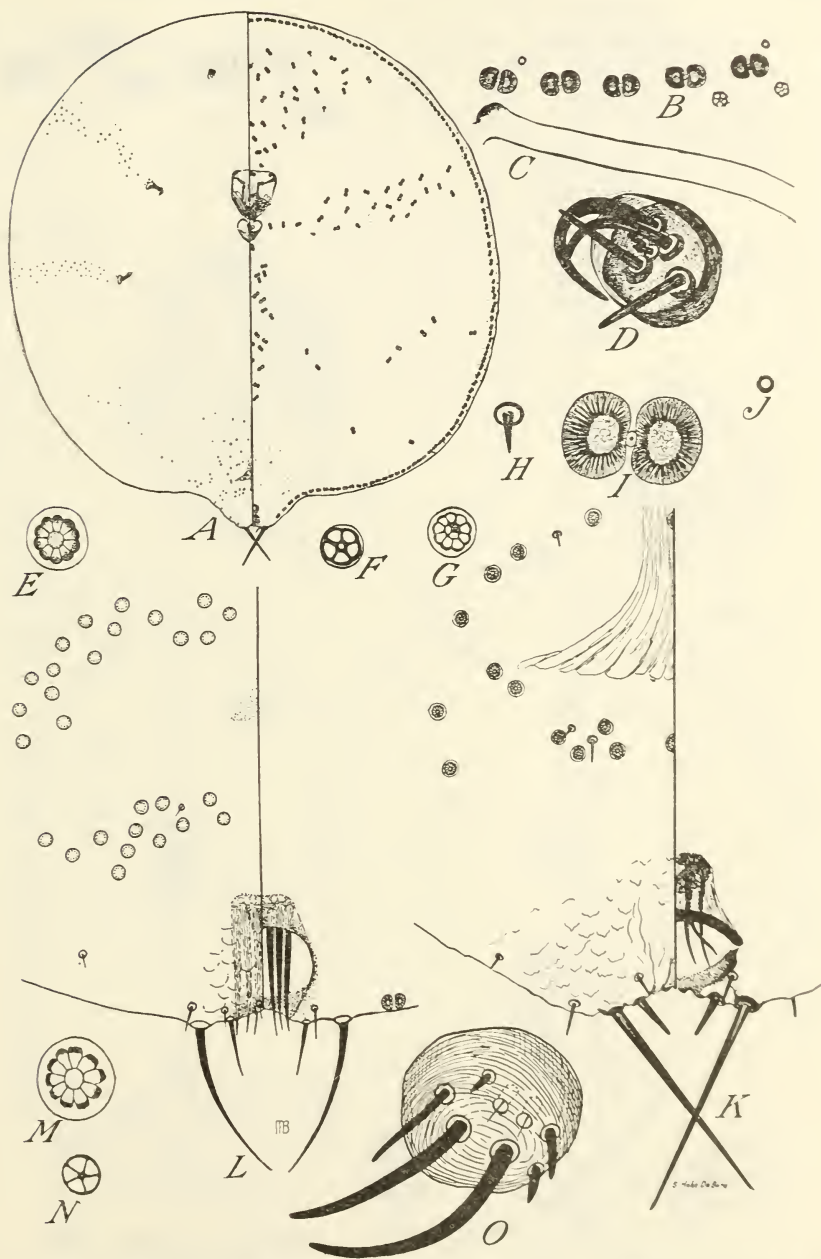


FIGURE 4.—*Asterolecanium agaris*: A, outline,  $\times 60$ ; B, section of margin; C, tubular duct; D, antenna; E, multilocular pore; F, G, marginal quinquelocular and small multilocular pore; H, submarginal seta; I, dorsal S-shaped pore; J, disk pore; K, genital and anal area,  $\times 460$ . *A. algeriense*: L, genital and anal area,  $\times 165$ ; M, multilocular pore; N, quinquelocular pore; O, antenna.



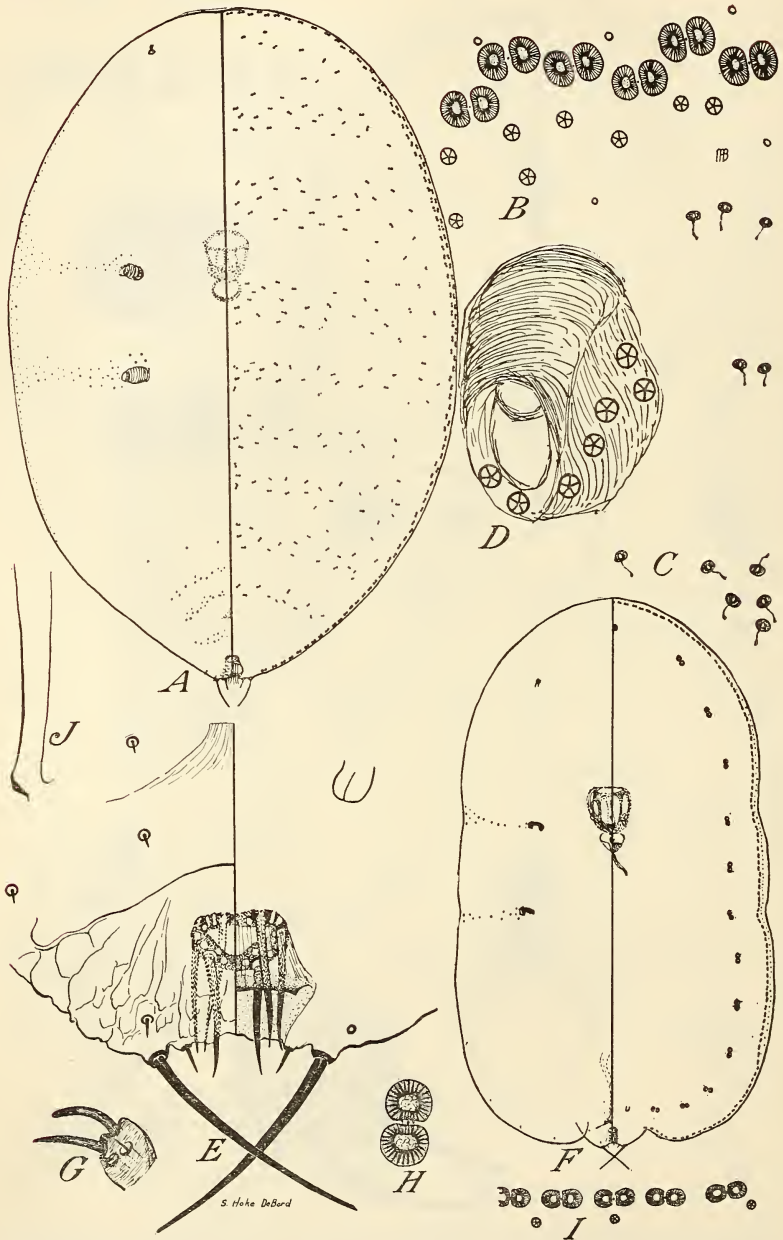


FIGURE 5.—*Asterolecanium algeriense*: A, outline,  $\times 40$ ; B, section of margin,  $\times 500$ ; C, section of submargin showing submarginal 8-shaped pores,  $\times 500$ ; D, spiracle,  $\times 500$ . *A. amboiniae*: E, genital and anal area,  $\times 650$ ; F, outline,  $\times 87$ ; G, antenna; H, dorsal 8-shaped pore; I, section of margin,  $\times 650$ ; J, tubular duct.

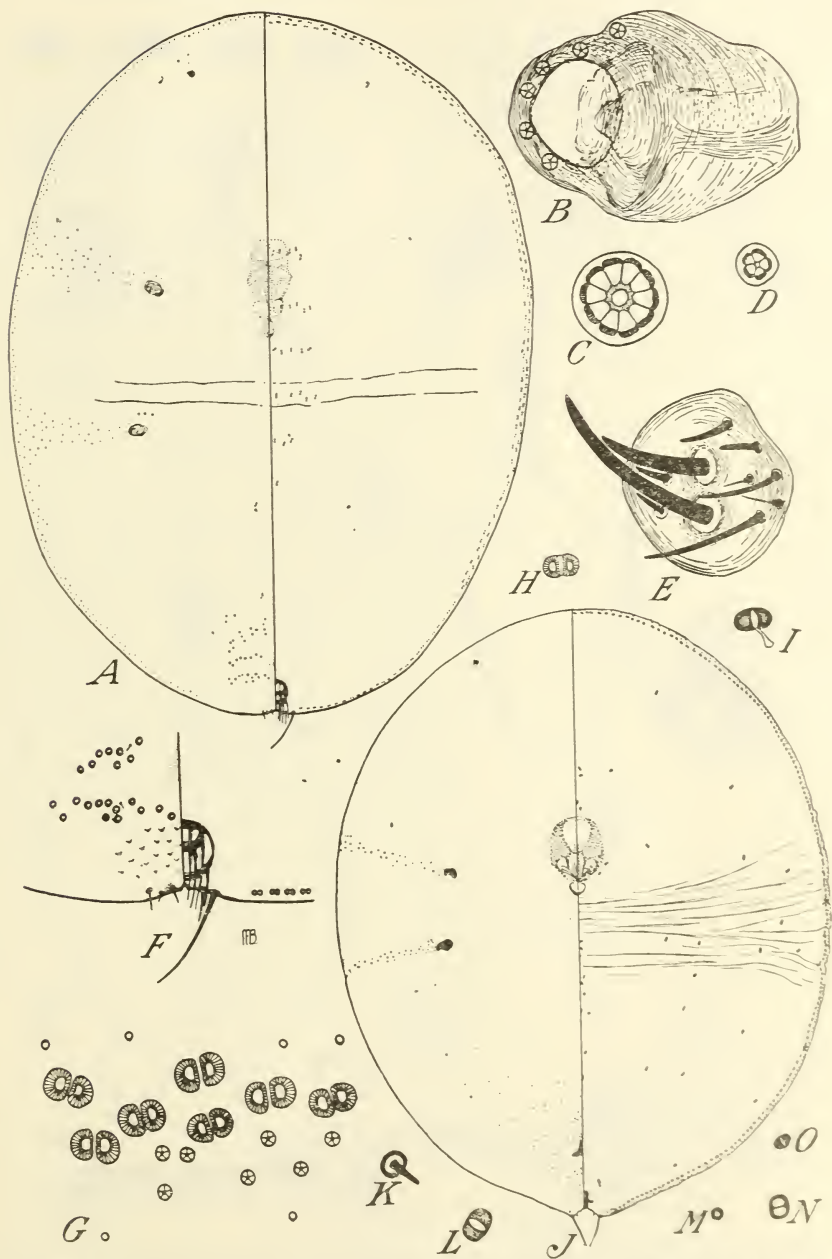


FIGURE 6.—*Asterolecanium arabidis*: A, outline,  $\times 40$ ; B, spiracle,  $\times 500$ ; C, multilocular pore; D, quinquelocular pore; E, antenna; F, genital and anal area,  $\times 90$ ; G, section of margin,  $\times 500$ ; H, minute dorsal 8-shaped pore; I, submarginal 8-shaped pore. *A. bambusae*: J, outline,  $\times 70$ ; K, submarginal seta; L, submarginal 8-shaped pore; M, disk pore; N, dark-rimmed 8-shaped pore; O, minute dorsal 8-shaped pore.

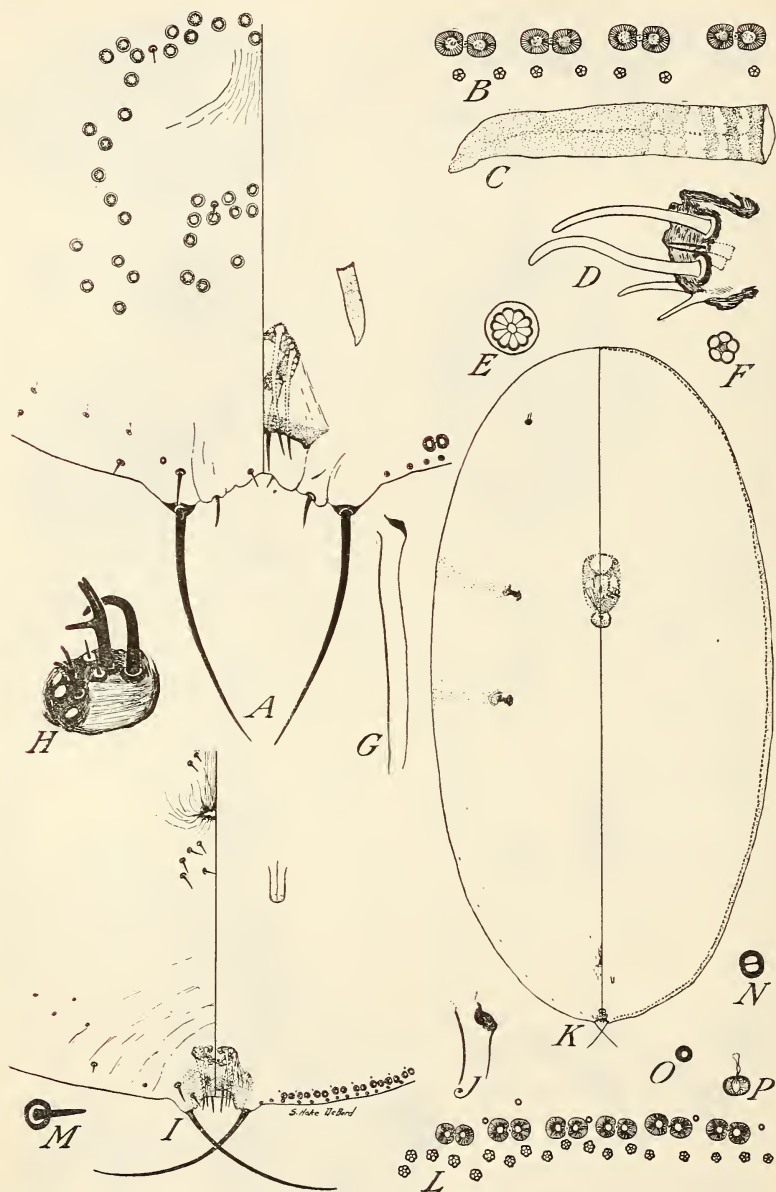


FIGURE 7.—*Asterolecanium bambusae*: A, genital and anal area,  $\times 460$ ; B, section of margin,  $\times 815$ ; C, dorsal tube; D, antenna; E, multilocular pore; F, quinquelocular pore; G, tubular duct. *A. bambusicola*: H, antenna; I, genital and anal area,  $\times 230$ ; J, tubular duct; K, outline,  $\times 70$ ; L, section of margin,  $\times 650$ ; M, submarginal seta; N, dark-rimmed 8-shaped pore; O, disk pore; P, submarginal 8-shaped pore.



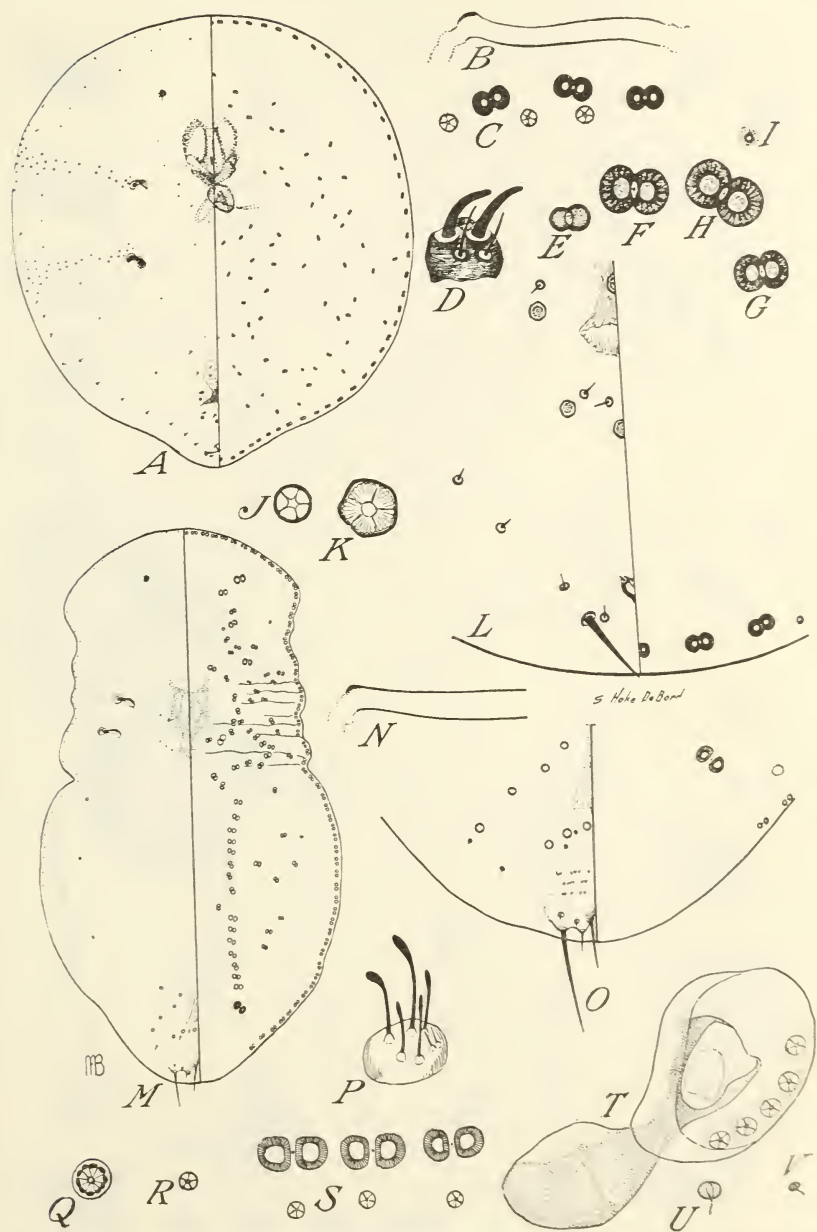


FIGURE 8.—*Asterolecanium bellum*: A, outline,  $\times 87$ ; B, tubular duct; C, section of margin; D, antenna; E, F, G, dorsal 8-shaped pores; H, marginal 8-shaped pore; I, disk pore; J, quinquelocular pore; K, multilocular pore; L, genital and anal area,  $\times 460$ . *A. boliviac*: M, outline,  $\times 87$ ; N, tubular duct; O, genital and anal area,  $\times 460$ ; P, antenna; Q, multilocular pore; R, quinquelocular pore; S, section of margin; T, spiracle; U, submarginal 8-shaped pore; V, minute dorsal 8-shaped pore.

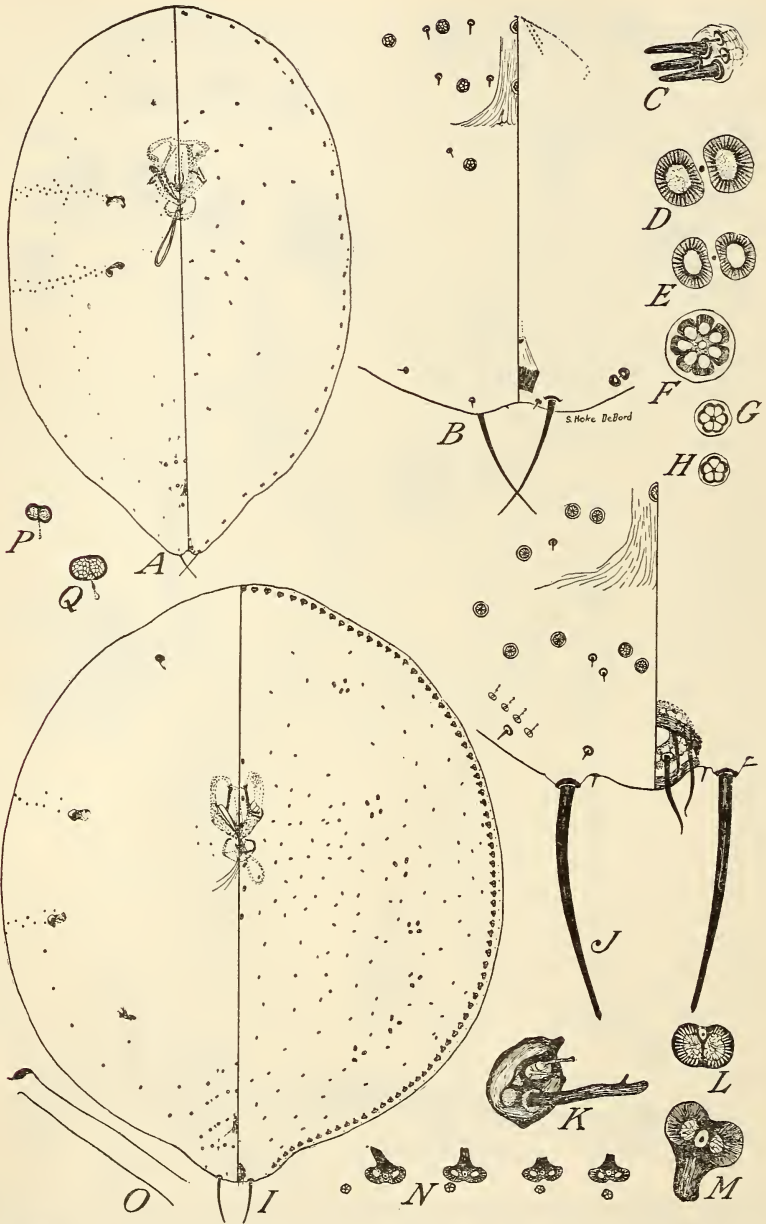


FIGURE 9.—*Asterolecanium borboniae*: A, outline,  $\times 87$ ; B, genital and anal area,  $\times 165$ ; C, antenna; D, marginal 8-shaped pore; E, dorsal 8-shaped pore; F, multilocular pore; G, H, quinquelocular pores. *A. borneense*: I, outline,  $\times 115$ ; J, genital and anal area,  $\times 650$ ; K, antenna; L, dorsal 8-shaped pore; M, marginal 8-shaped pore; N, section of margin,  $\times 530$ ; O, tubular duct; P, Q, minute dorsal 8-shaped pores.

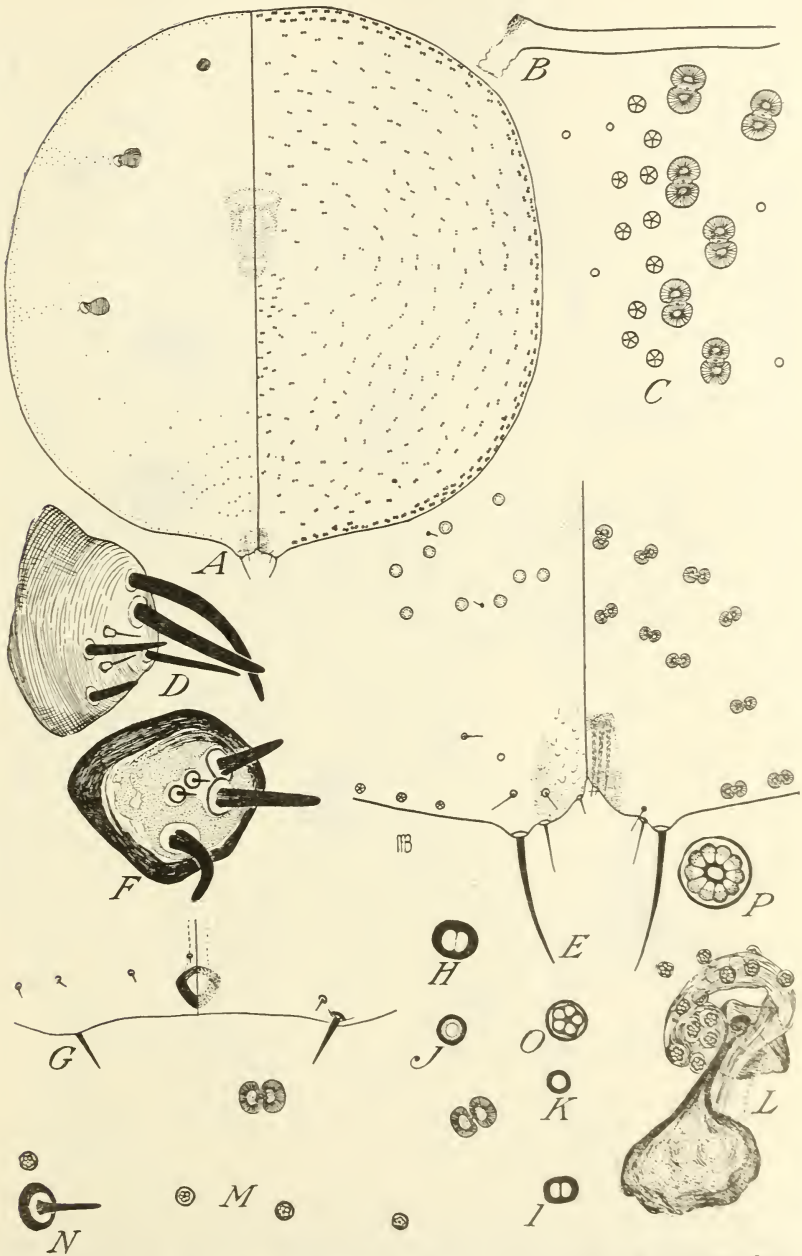


FIGURE 10.—*Asterolecanium brachylenae*: A, outline,  $\times 60$ ; B, tubular duct; C, section of margin,  $\times 650$ ; D, antenna; E, genital and anal area,  $\times 330$ . *A. brevispinum*: F, antenna; G, anal area,  $\times 650$ ; H, I, dark-rimmed 8-shaped pores; J, K, disk pores; L, spiracle,  $\times 530$ ; M, section of margin,  $\times 650$ ; N, submarginal seta; O, quinquelocular pore; P, multilocular pore.



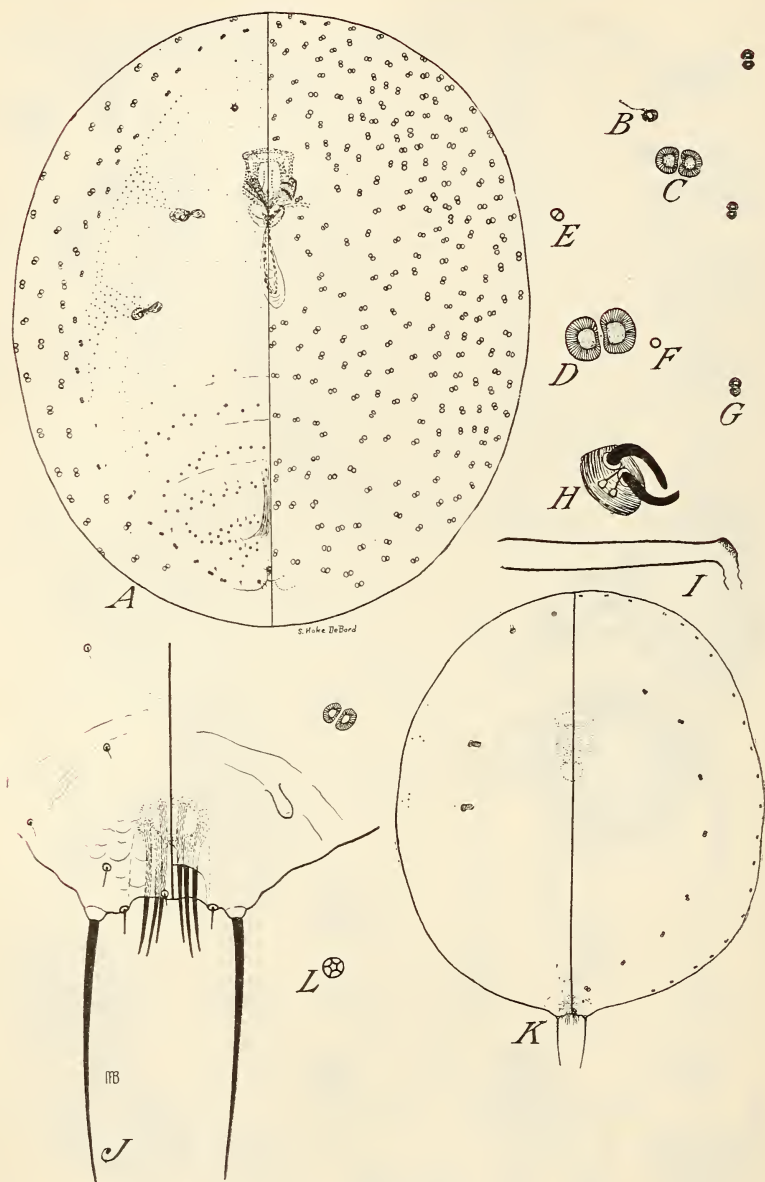


FIGURE 11.—*Asterolecanium brevispinum*: *A*, outline,  $\times 50$ . *A. brunetae*: *B*, submarginal 8-shaped pore; *C*, marginal 8-shaped pore; *D*, dorsal 8-shaped pore; *E*, dark-rimmed 8-shaped pore; *F*, disk pore; *G*, section of margin,  $\times 650$ ; *H*, antenna; *I*, tubular duct; *J*, genital and anal area,  $\times 650$ ; *K*, outline,  $\times 175$ ; *L*, quinquelocular pore.

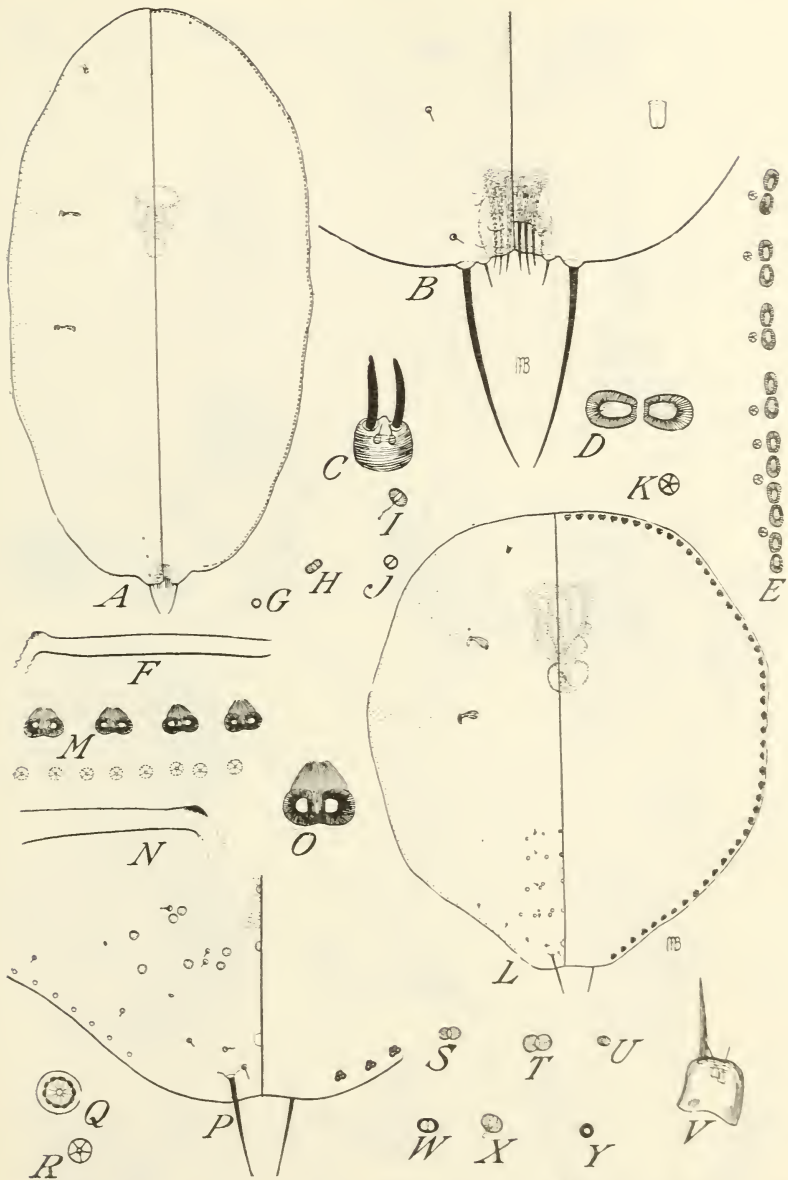


FIGURE 12.—*Asterolecanium captiosum*: A, outline,  $\times 60$ ; B, genital and anal area,  $\times 230$ ; C, antenna; D, marginal 8-shaped pore; E, section of margin,  $\times 230$ ; F, tubular duct; G, disk pore; H, minute dorsal 8-shaped pore; I, submarginal 8-shaped pore; J, dark-rimmed 8-shaped pore; K, quinquelocular pore. *A. castaneae*: L, outline,  $\times 175$ ; M, section of margin,  $\times 330$ ; N, tubular duct; O, 8-shaped pore; P, genital and anal area,  $\times 120$ ; Q, multilocular pore; R, quinquelocular pore; S, T, U, minute dorsal 8-shaped pores; V, antenna; W, dark-rimmed 8-shaped pore; X, submarginal 8-shaped pore; Y, disk pore.

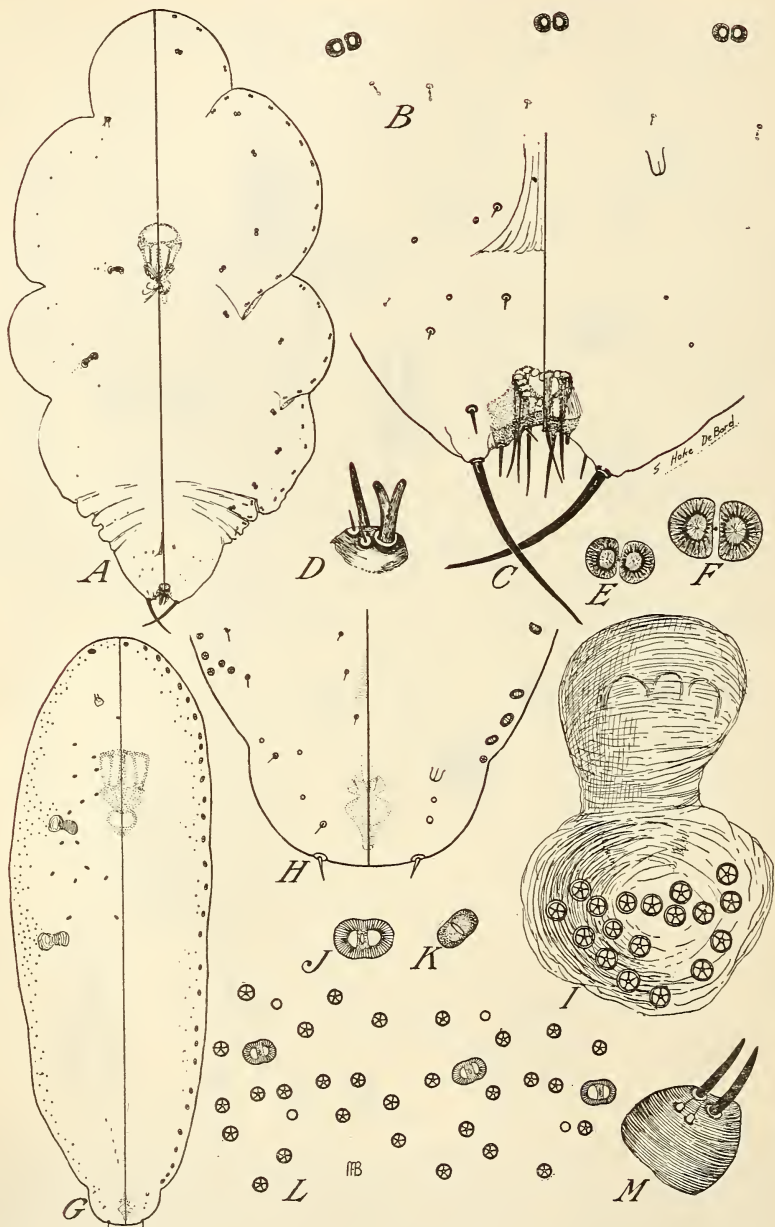


FIGURE 13.—*Asterolecanium caudatum*: A, outline,  $\times 87$ ; B, section of margin and ventral submarginal area,  $\times 650$ ; C, genital and anal area,  $\times 460$ ; D, antenna; E, marginal 8-shaped pore; F, dorsal 8-shaped pore. *A. ceriferum*: G, outline,  $\times 115$ ; H, genital and anal area,  $\times 230$ ; I, spiracle; J, marginal 8-shaped pore; K, ventral 8-shaped pore; L, section of margin,  $\times 750$ ; M, antenna.



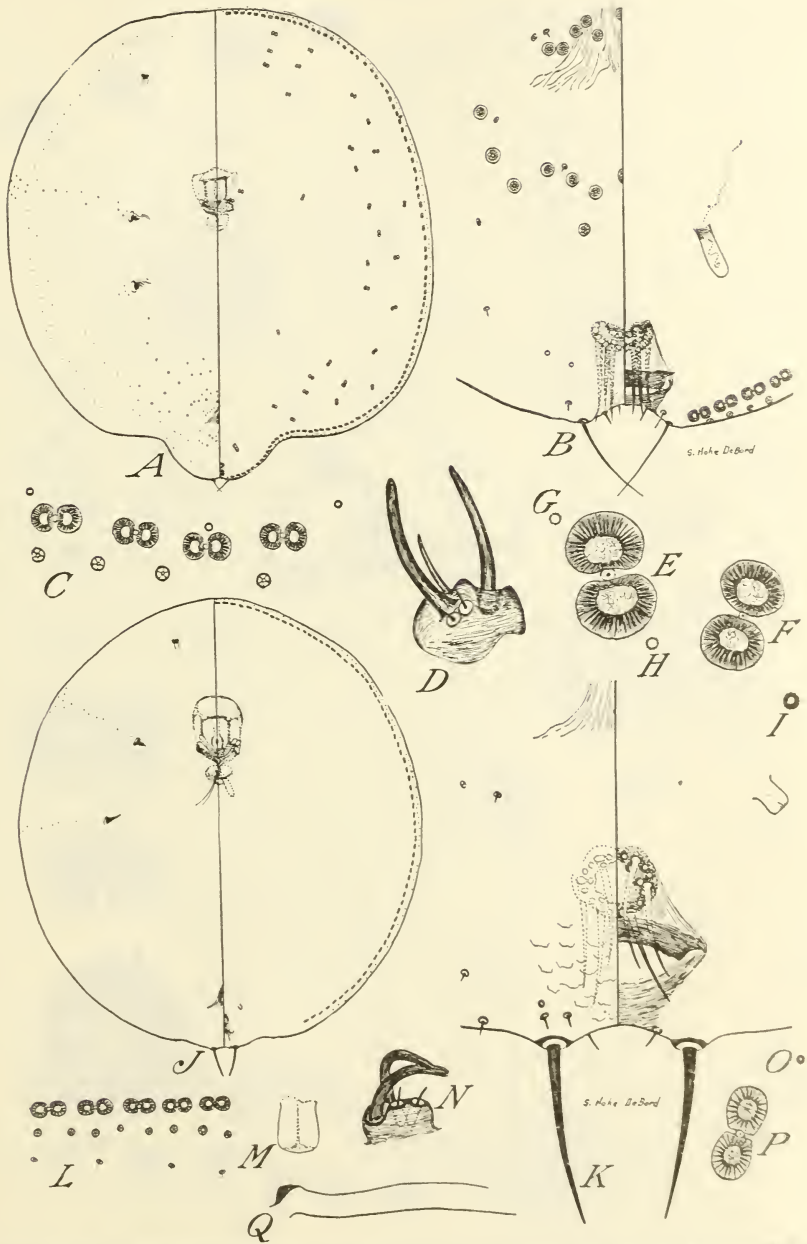


FIGURE 14.—*Asterolecanium chinac*: A, outline,  $\times 60$ ; B, genital and anal area,  $\times 330$ ; C, section of margin,  $\times 650$ ; D, antenna; E, dorsal 8-shaped pore; F, marginal 8-shaped pore; G, H, I, disk pores. *A. circulare*: J, outline,  $\times 115$ ; K, genital and anal area,  $\times 150$ ; L, section of margin and ventral submarginal area,  $\times 650$ ; M, dorsal tube; N, antenna; O, disk pore; P, 8-shaped pore; Q, tubular duct.

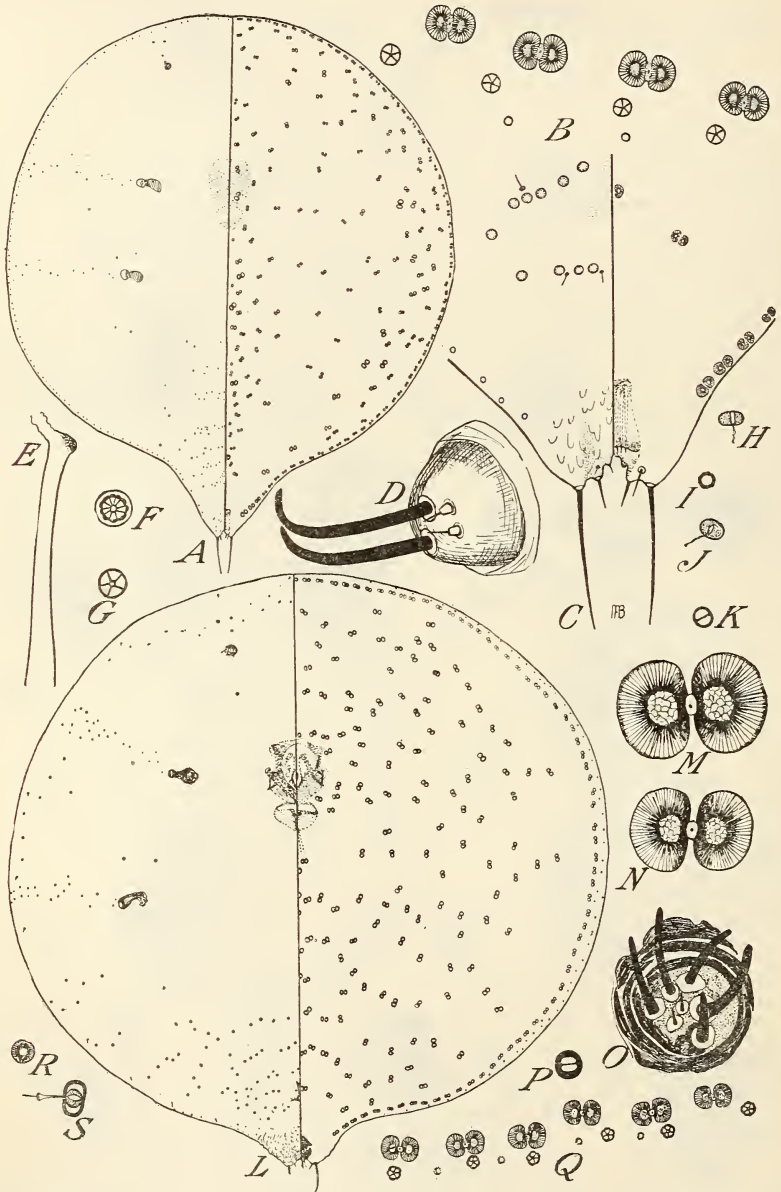


FIGURE 15.—*Asterolecanium coffeae*: A, outline,  $\times 87$ ; B, section of margin,  $\times 650$ ; C, genital and anal area,  $\times 330$ ; D, antenna; E, tubular duct; F, multilocular pore; G, quinquelocular pore; H, minute dorsal 8-shaped pore; I, disk pore; J, submarginal 8-shaped pore; K, dark-rimmed 8-shaped pore. *A. conspicuum*: L, outline,  $\times 87$ ; M, dorsal 8-shaped pore; N, marginal 8-shaped pore; O, antenna; P, dark-rimmed 8-shaped pore; Q, section of margin,  $\times 460$ ; R, disk pore; S, submarginal 8-shaped pore.

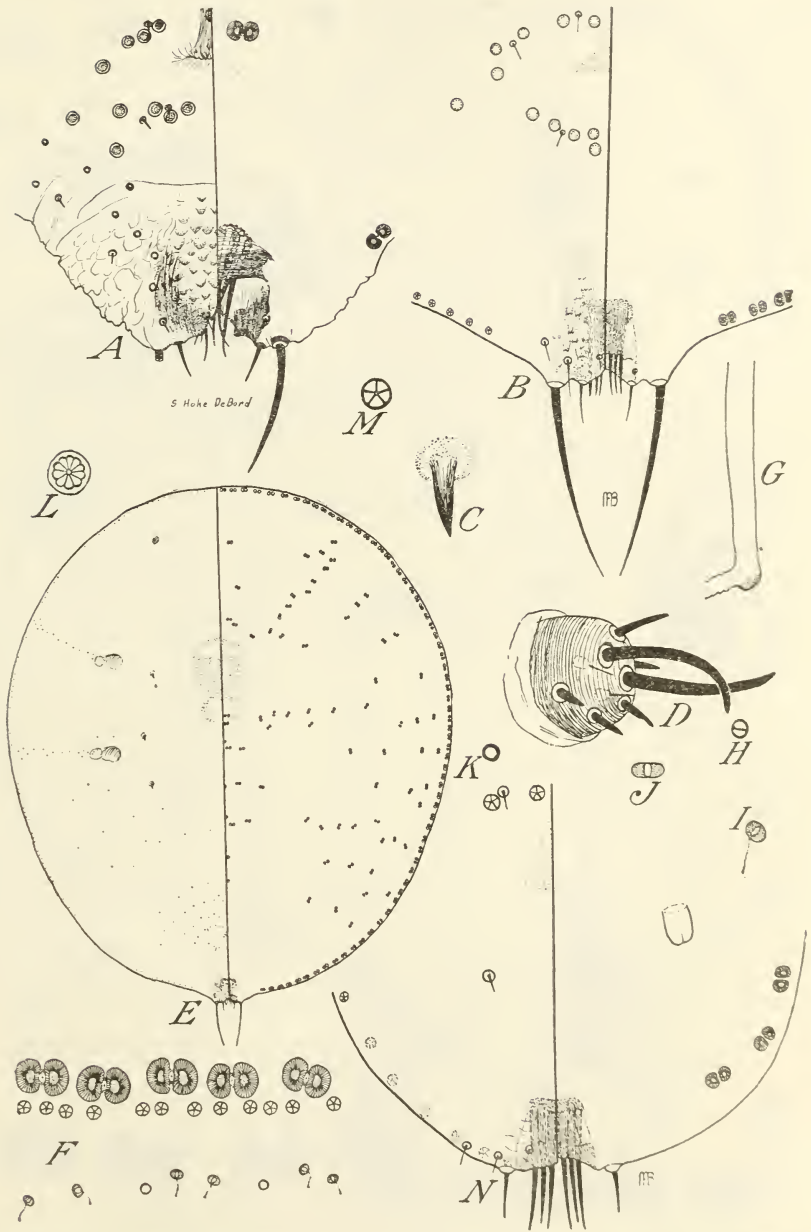


FIGURE 16.—*Asterolecanium conspicuum*: A, genital and anal area,  $\times 345$ . A, *corallinum*: B, genital and anal area,  $\times 330$ ; C, claw; D, antenna; E, outline,  $\times 87$ ; F, section of margin and ventral submarginal area,  $\times 650$ ; G, tubular duct; H, dark-rimmed 8-shaped pore; I, submarginal 8-shaped pore; J, minute dorsal 8-shaped pore; K, disk pore; L, multilocular pore; M, quinquelocular pore. A, *coronatum*: N, genital and anal area,  $\times 650$ .



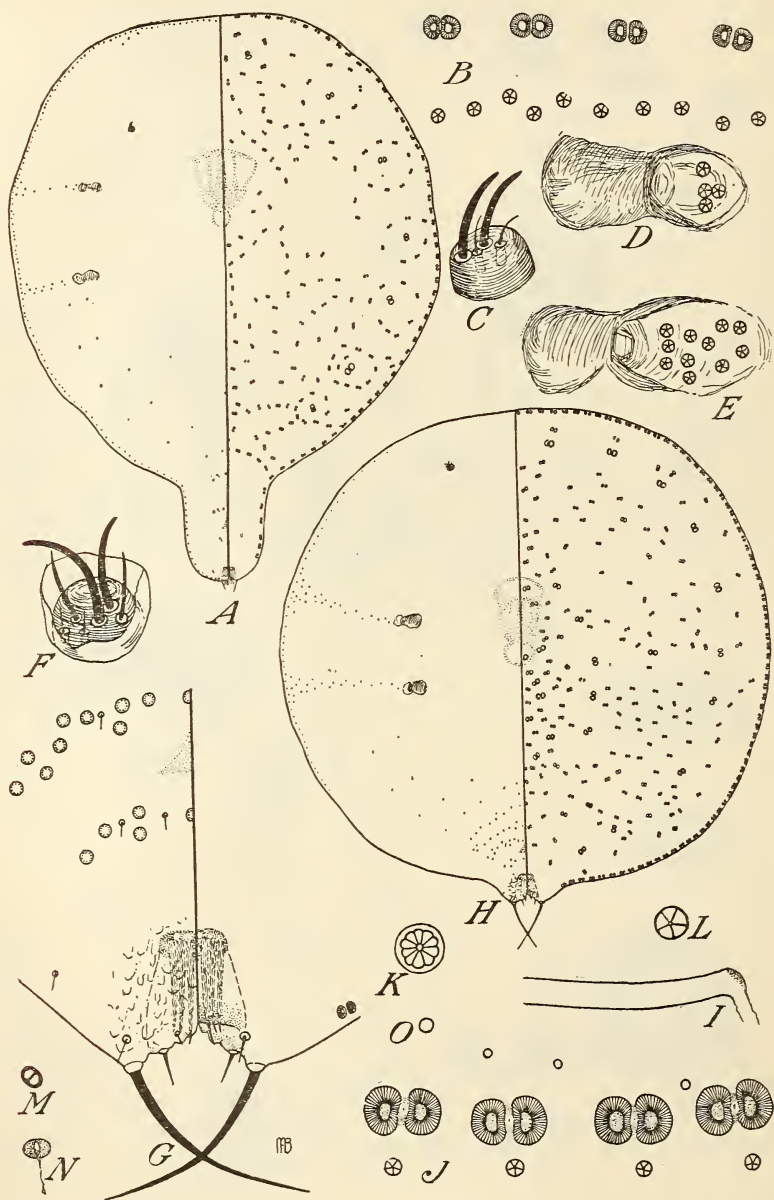


FIGURE 17.—*Asterolecanium coronatum*: A, outline,  $\times 120$ ; B, section of margin,  $\times 900$ ; C, antenna; D, anterior spiracle,  $\times 900$ ; E, posterior spiracle,  $\times 900$ . *A. cristatum*: F, antenna; G, genital and anal area,  $\times 345$ ; H, outline,  $\times 900$ ; I, tubular duct; J, section of margin,  $\times 650$ ; K, multifollicular pore; L, quinquelocular pore; M, dark-rimmed 8-shaped pore; N, submarginal 8-shaped pore; O, disk pore.

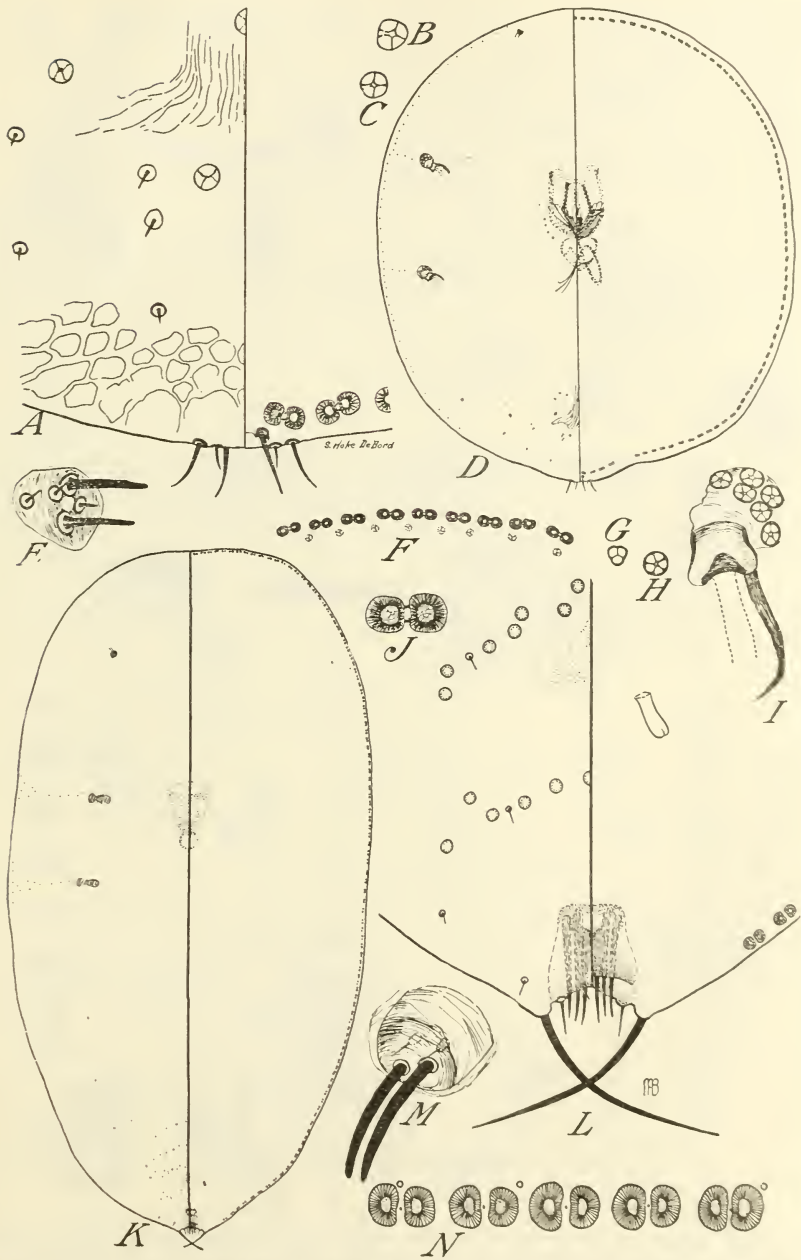


FIGURE 18.—*Asterolecanium degeneratum*: A, genital and anal area,  $\times 900$ ; B, C, multilocular pores; D, outline,  $\times 165$ ; E, antenna; F, section of margin,  $\times 530$ ; G, trilocular pore; H, quinquelocular pore; I, spiracle; J, 8-shaped pore. *A. delicatum*: K, outline,  $\times 60$ ; L, genital and anal area,  $\times 230$ ; M, antenna; N, section of margin,  $\times 900$ .

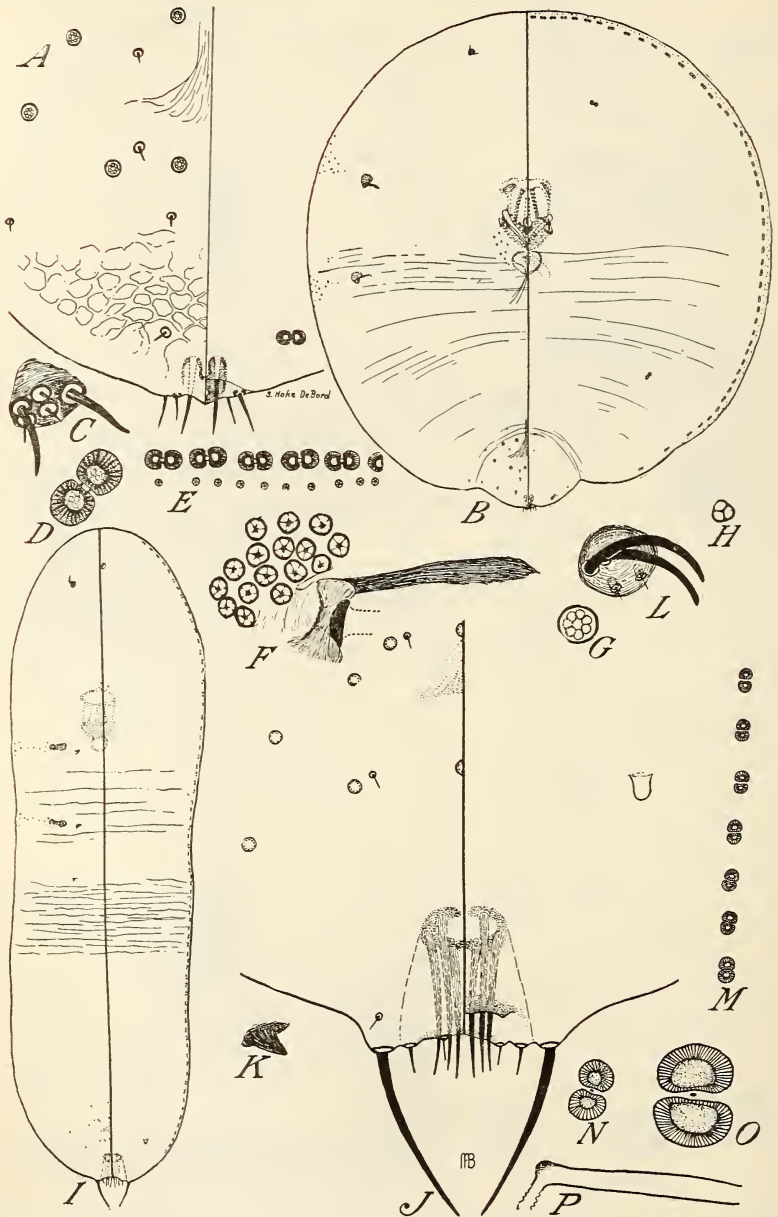


FIGURE 19.—*Asterolecanium difficile*: A, genital and anal area,  $\times 650$ ; B, outline,  $\times 115$ ; C, antenna; D, 8-shaped pore; E, section of margin,  $\times 650$ ; F, spiracle; G, multilocular pore; H, trilocular pore. *A. disjunctum*: I, outline,  $\times 87$ ; J, genital and anal area,  $\times 650$ ; K, claw; L, antenna; M, section of margin,  $\times 650$ ; N, marginal 8-shaped pore; O, dorsal 8-shaped pore; P, tubular duct.



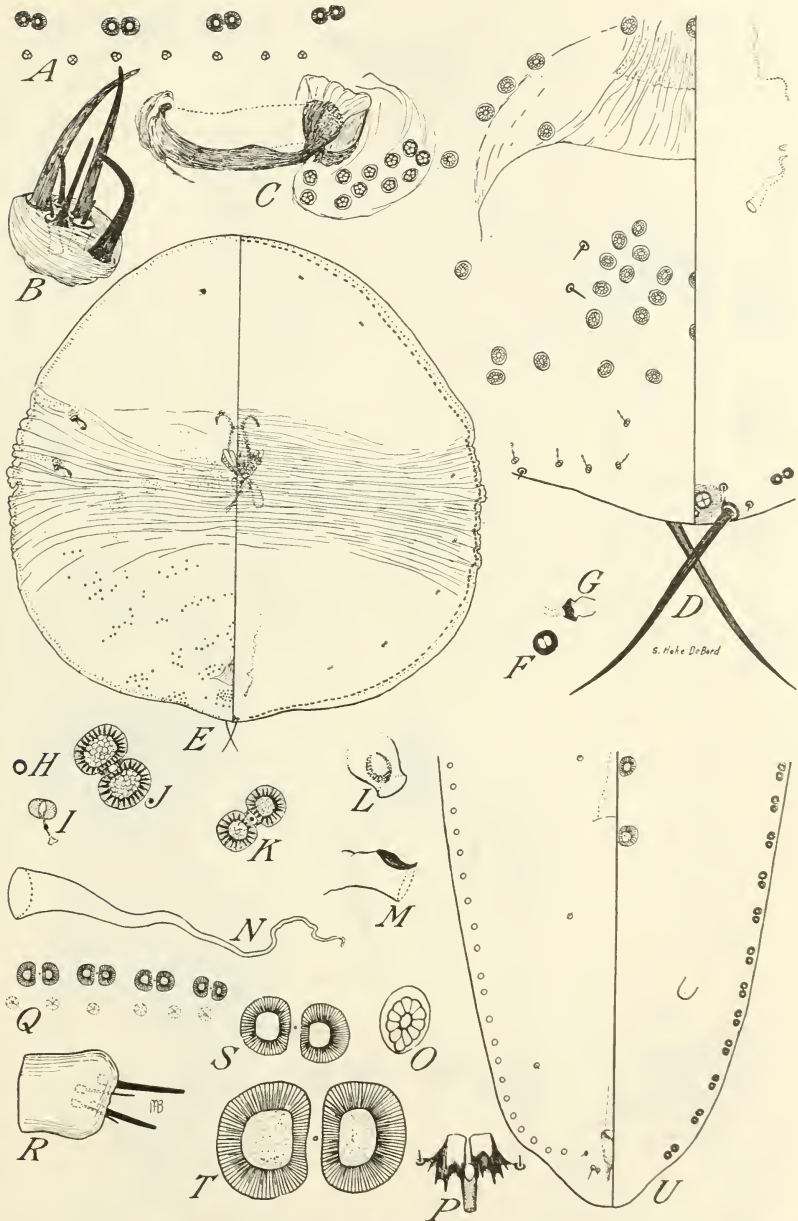


FIGURE 20.—*Asterolecanium distinctum*: A, section of margin,  $\times 650$ ; B, antenna; C, spiracle,  $\times 815$ ; D, genital and anal area,  $\times 460$ ; E, outline,  $\times 60$ ; F, G, dark-rimmed 8-shaped pore, two views; H, I, submarginal 8-shaped pore; J, dorsal 8-shaped pore; K, marginal 8-shaped pore; L, M, tubular duct, two views; N, internal duct; O, multilocular pore; P, cones and anal opening, cross section. *A. elongatum*: Q, section of margin,  $\times 330$ ; R, antenna; S, marginal 8-shaped pore; T, dorsal 8-shaped pore; U, genital and anal area,  $\times 175$ .

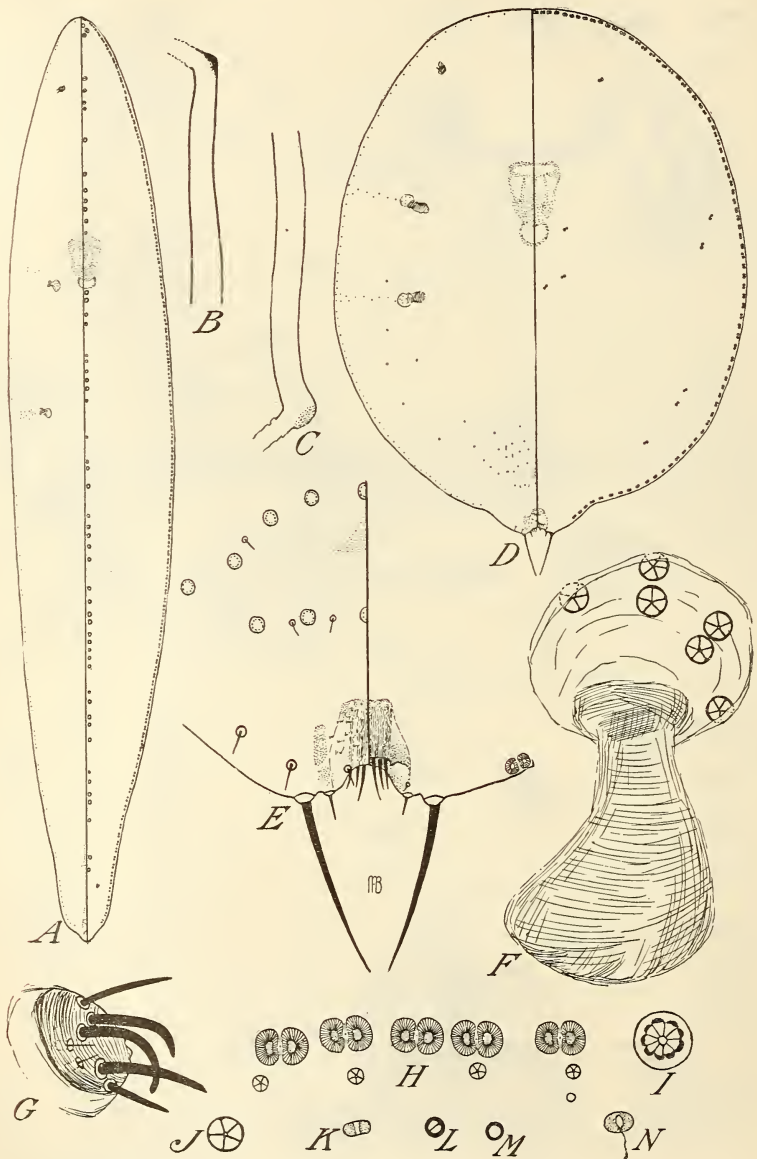


FIGURE 21.—*Asterotelecanium elongatum*: A, outline,  $\times 165$ ; B, tubular duct. *A. epacridis*: C, tubular duct; D, outline,  $\times 60$ ; E, genital and anal area,  $\times 330$ ; F, spiracle; G, antenna; H, section of margin,  $\times 650$ ; I, multilocular pore; J, quinelocular pore; K, minute dorsal 8-shaped pore; L, dark-rimmed 8-shaped pore; M, disk pore; N, submarginal 8-shaped pore.

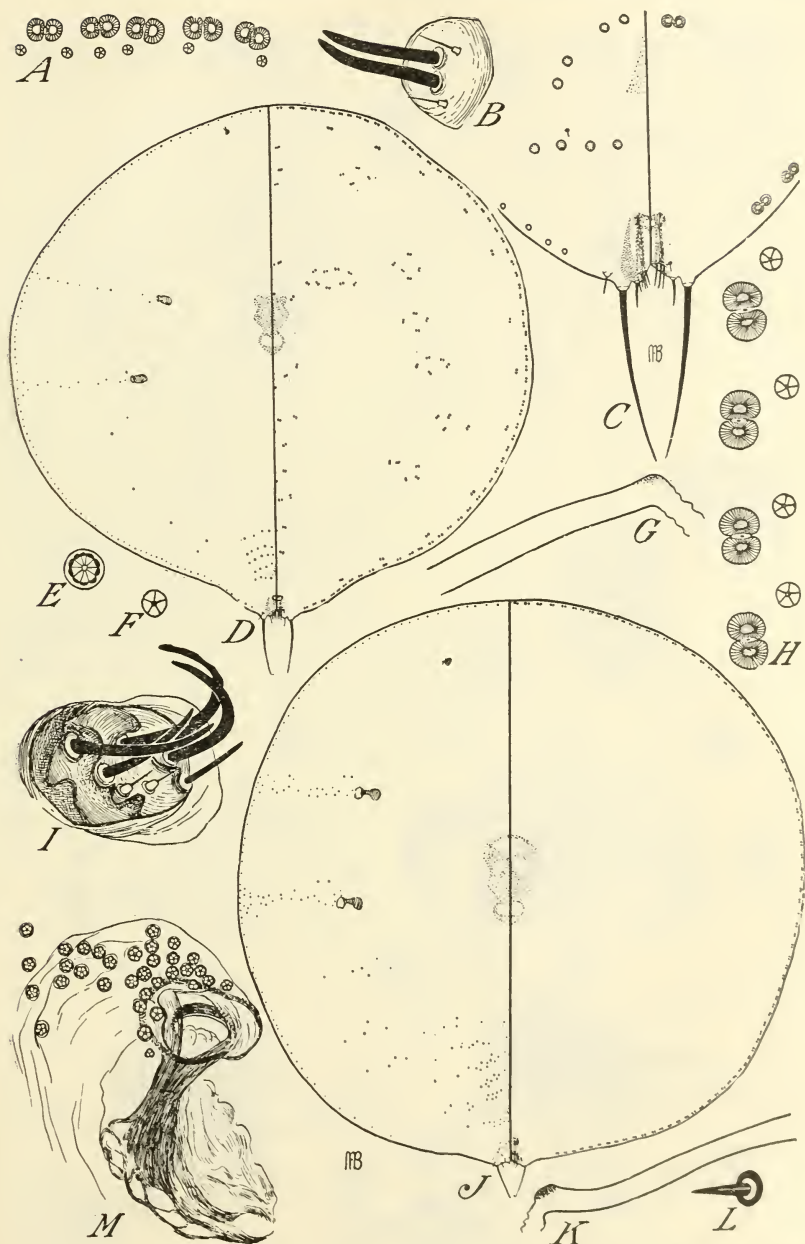


FIGURE 22.—*Asterolecanium epidendri*: A, section of margin,  $\times 900$ ; B, antenna; C, genital and anal area,  $\times 330$ ; D, outline,  $\times 60$ ; E, multilocular pore; F, quinquelocular pore; G, tubular duct. *A. cuphorbiae*: H, section of margin,  $\times 900$ ; I, antenna; J, outline,  $\times 60$ ; K, tubular duct; L, submarginal seta. *A. euryopsis*: M, spiracle,  $\times 530$ .



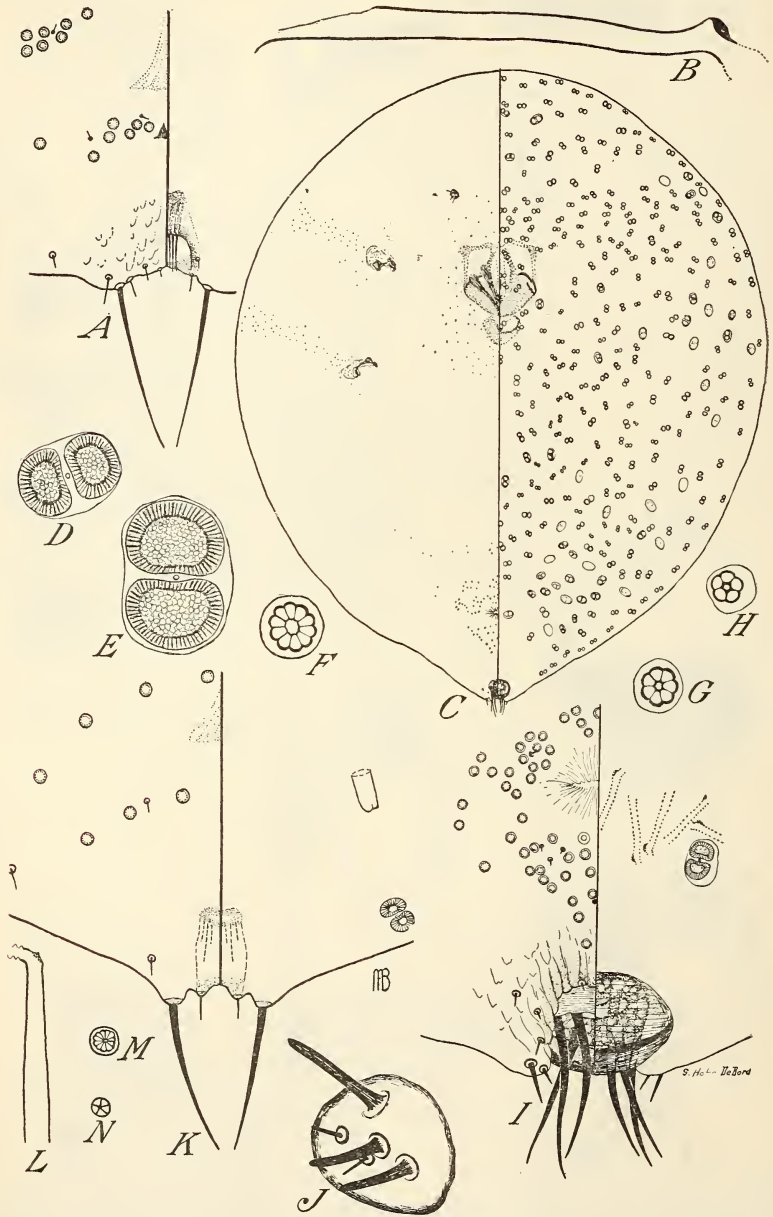


FIGURE 23.—*Asterolecanium euphorbiae*: A, genital and anal area,  $\times 330$ . *A. euryopsis*: B, tubular duct; C, outline,  $\times 60$ ; D, E, 8-shaped pores; F, multilocular pore; G, H, spiracular multilocular and quinquelocular pores, respectively; I, genital and anal area,  $\times 230$ ; J, antenna. *A. exiguum*: K, genital and anal area,  $\times 650$ ; L, tubular duct; M, multilocular pore; N, quinquelocular pore.

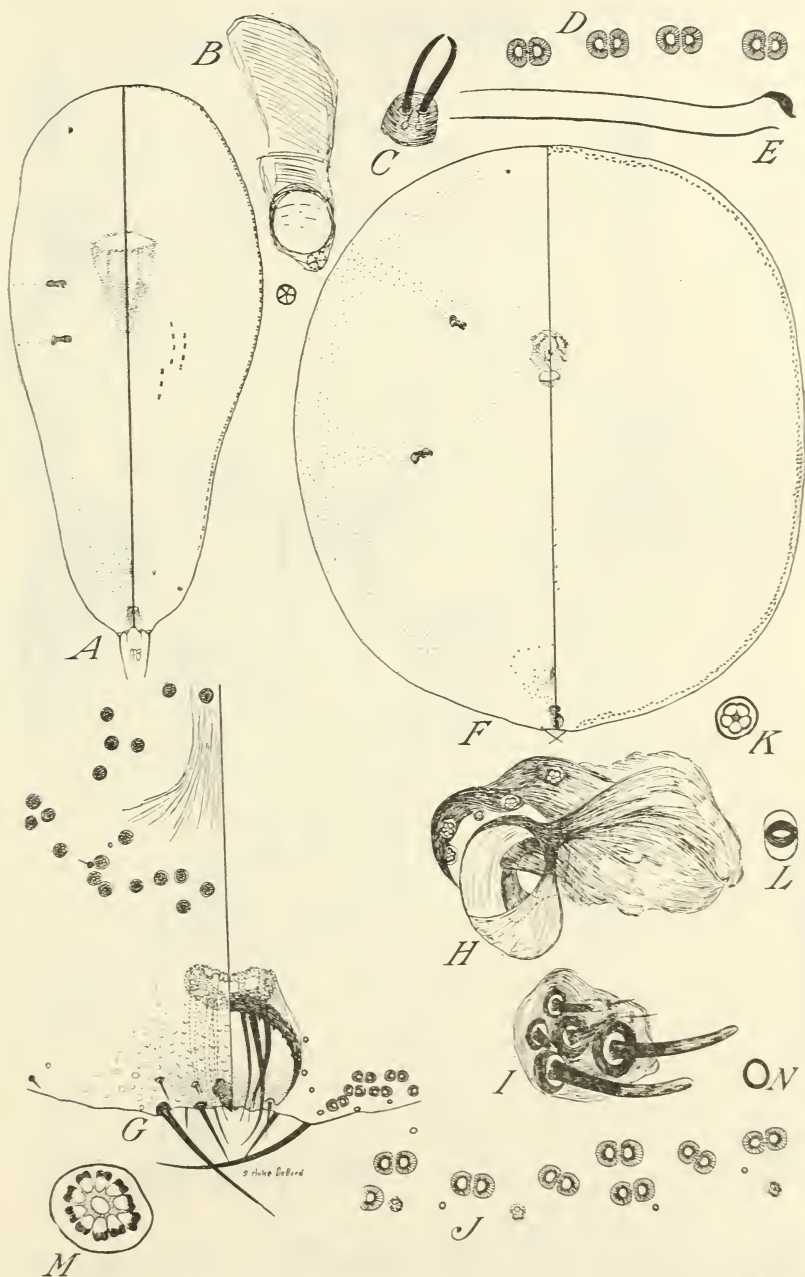


FIGURE 24.—*Asterolecanium exiguum*: A, outline,  $\times 165$ ; B, spiracle; C, antenna; D, section of margin. *A. fimbriatum*: E, tubular duct; F, outline,  $\times 60$ ; G, genital and anal area,  $\times 230$ ; H, spiracle,  $\times 530$ ; I, antenna,  $\times 530$ ; J, section of margin,  $\times 460$ ; K, quinquelocular pore; L, submarginal 8-shaped pore; M, multilocular pore; N, disk pore.

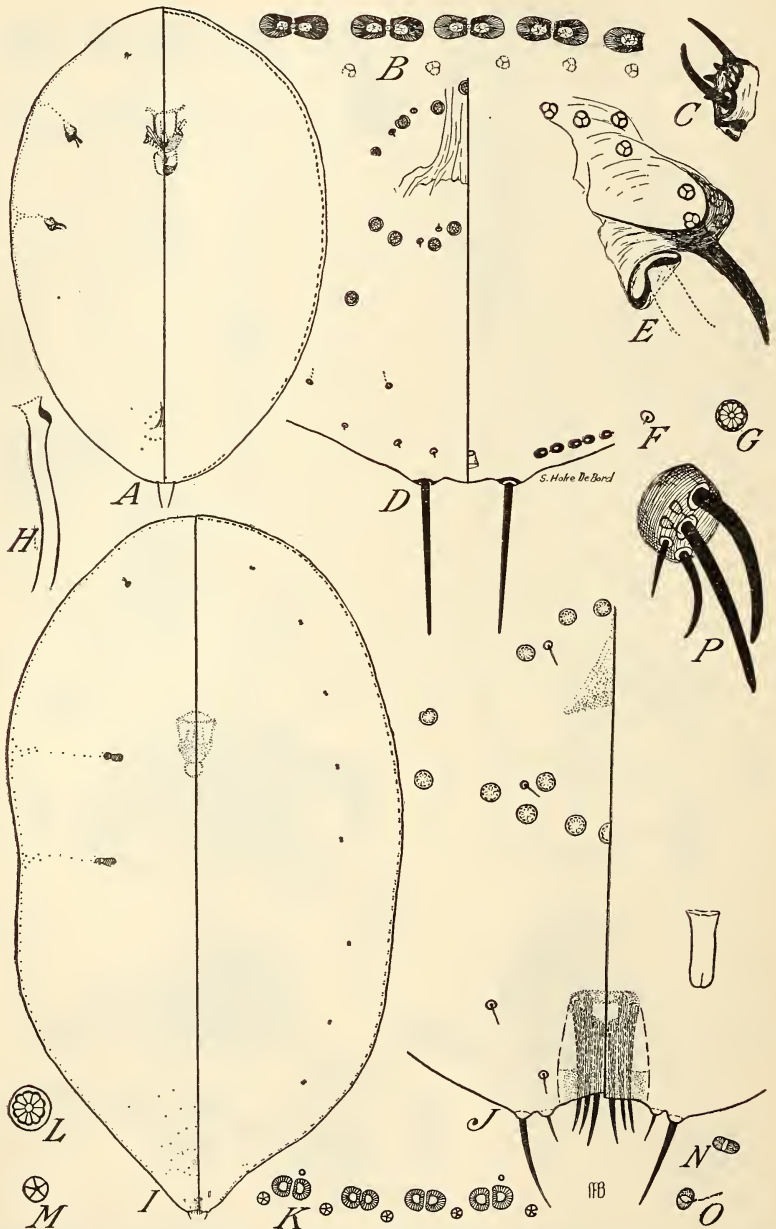


FIGURE 25.—*Asterolecanium flagellariae*: A, outline,  $\times 115$ ; B, section of margin; C, antenna; D, genital and anal area,  $\times 650$ ; E, spiracle,  $\times 1500$ ; F, submarginal seta; G, multilocular pore; H, tubular duct. *A. florum*: I, outline,  $\times 115$ ; J, genital and anal area,  $\times 460$ ; K, section of margin,  $\times 460$ ; L, multilocular pore; M, quinquelocular pore; N, minute dorsal 8-shaped pore; O, submarginal 8-shaped pore; P, antenna.



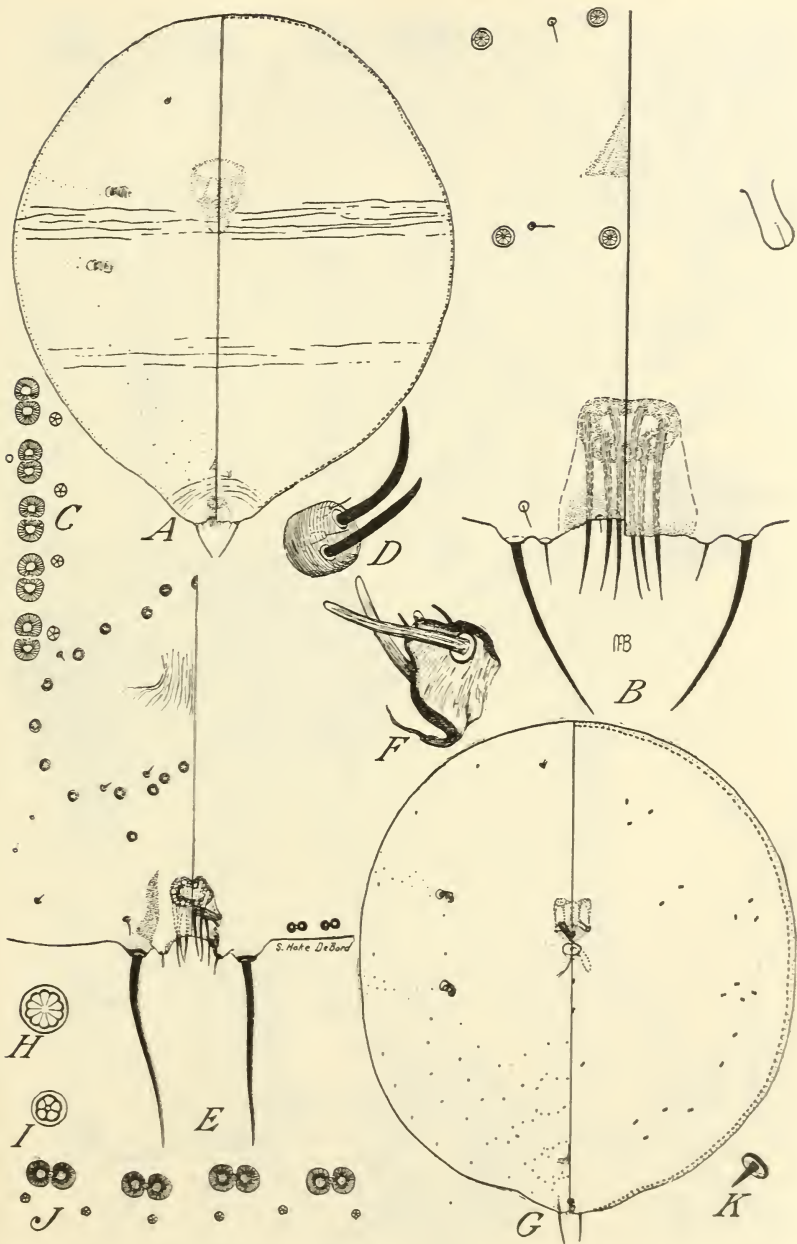


FIGURE 26.—*Asterolecanium fusum*: A, outline,  $\times 100$ ; B, genital and anal area,  $\times 900$ ; C, section of margin,  $\times 900$ ; D, antenna. *A. garciniae*: E, genital and anal area,  $\times 345$ ; F, antenna; G, outline,  $\times 60$ ; H, multilocular pore; I, quinquelocular pore; J, section of margin,  $\times 650$ ; K, submarginal seta.

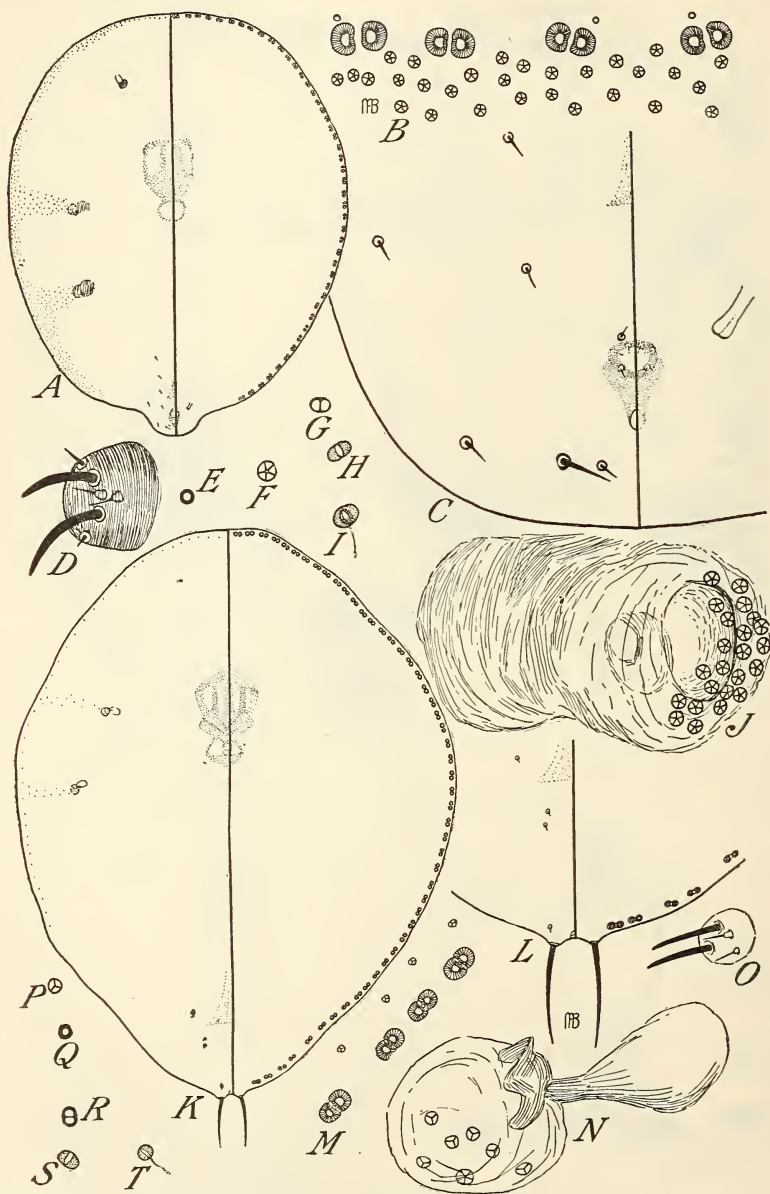


FIGURE 27.—*Asterolecanium gemmae*: A, outline,  $\times 100$ ; B, section of margin,  $\times 900$ ; C, genital and anal area,  $\times 900$ ; D, antenna; E, disk pore; F, quinquelocular pore; G, dark-rimmed 8-shaped pore; H, minute dorsal 8-shaped pore; I, submarginal 8-shaped pore; J, spiracle. *A. gilvum*: K, outline,  $\times 165$ ; L, genital and anal area,  $\times 330$ ; M, section of margin,  $\times 900$ ; N, spiracle,  $\times 900$ ; O, antenna; P, trilocular pore; Q, disk pore; R, dark-rimmed 8-shaped pore; S, minute dorsal 8-shaped pore; T, submarginal 8-shaped pore.

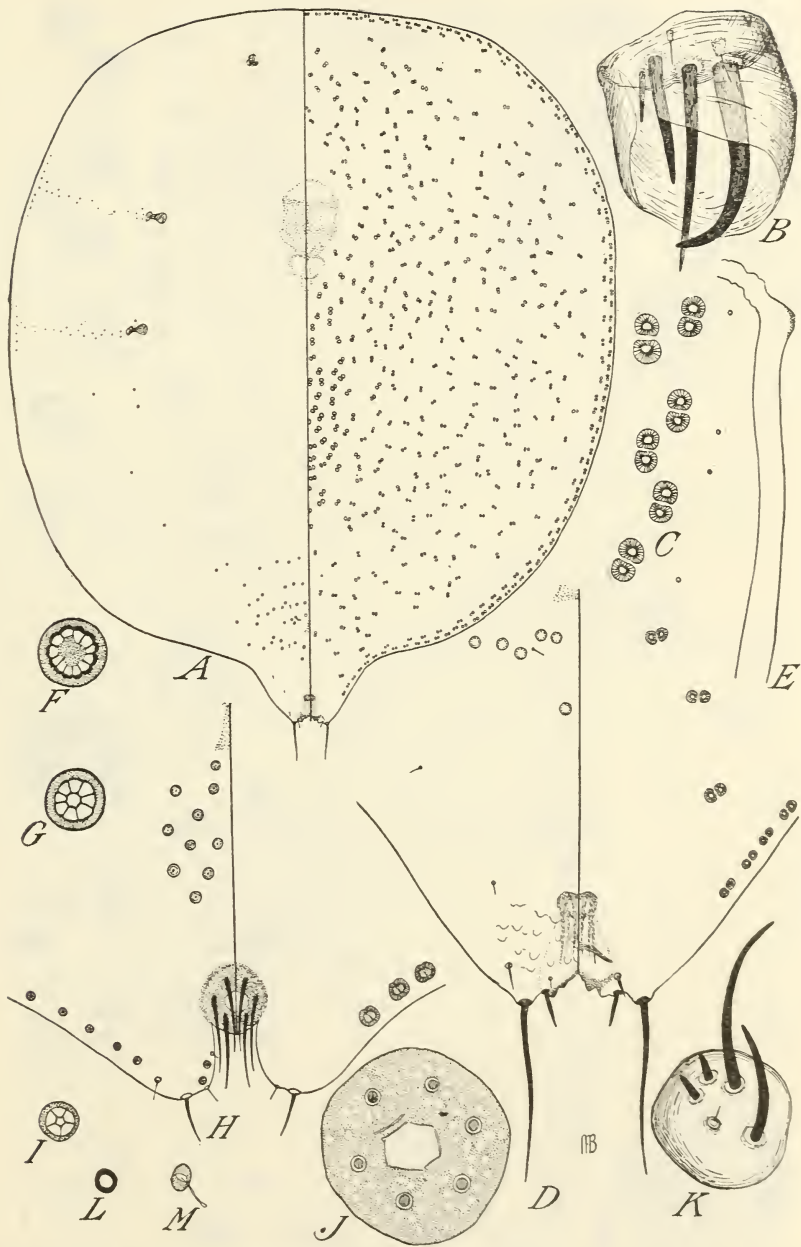


FIGURE 28.—*Asterolecanium grandicolum*: A, outline,  $\times 87$ ; B, antenna; C, section of margin,  $\times 800$ ; D, genital and anal area,  $\times 230$ ; E, tubular duct. A, gutta; F, G, multilocular pores; H, genital and anal area,  $\times 330$ ; I, quinquelocular pore; J, anal ring,  $\times 750$ ; K, antenna; L, disk pore; M, submarginal 8-shaped pore.



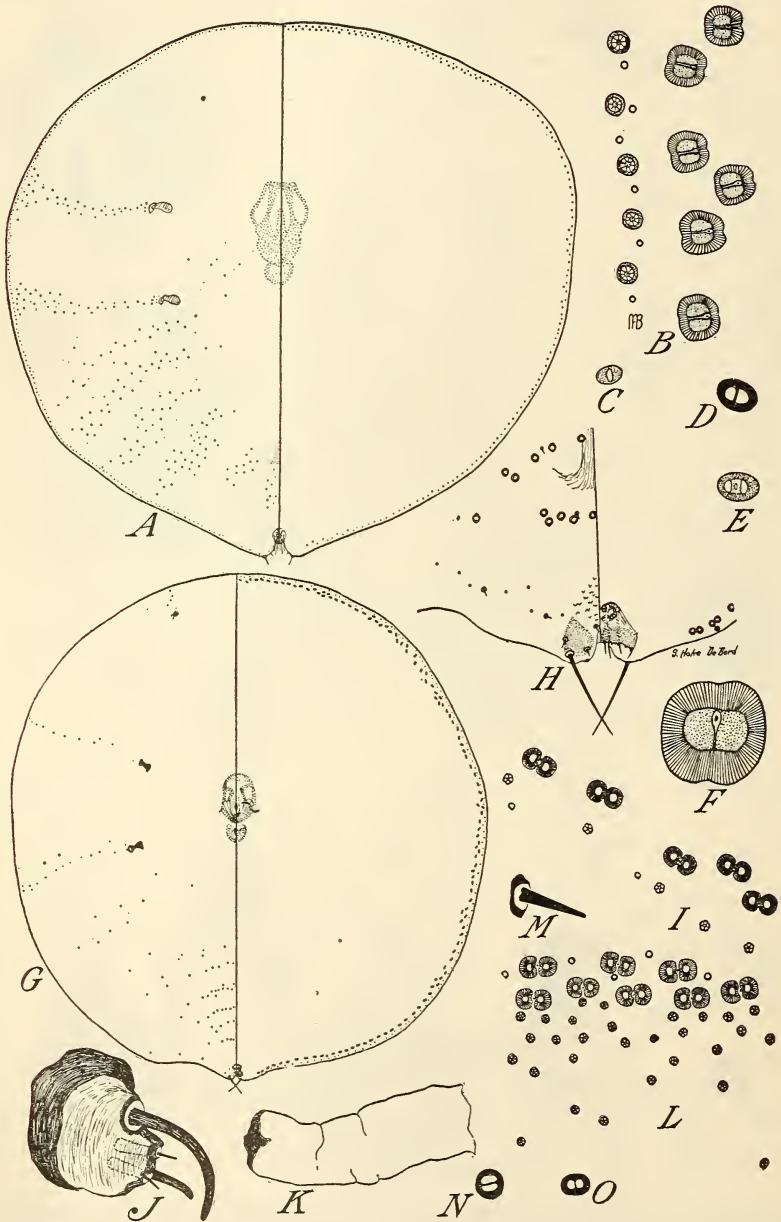


FIGURE 29.—*Asterolecanium gutta*: A, outline,  $\times 50$ ; B, section of margin,  $\times 650$ ; C, submarginal 8-shaped pore; D, dark-rimmed 8-shaped pore; E, minute dorsal 8-shaped pore; F, marginal 8-shaped pore. *A. hakeae*: G, outline,  $\times 60$ ; H, genital and anal area,  $\times 230$ ; I, section of margin,  $\times 650$ ; J, antenna. *A. hemisphaericum*: K, dorsal tube; L, section of margin,  $\times 460$ ; M, submarginal seta; N, dark-rimmed 8-shaped pore near beak; O, dark-rimmed 8-shaped pore on abdomen.

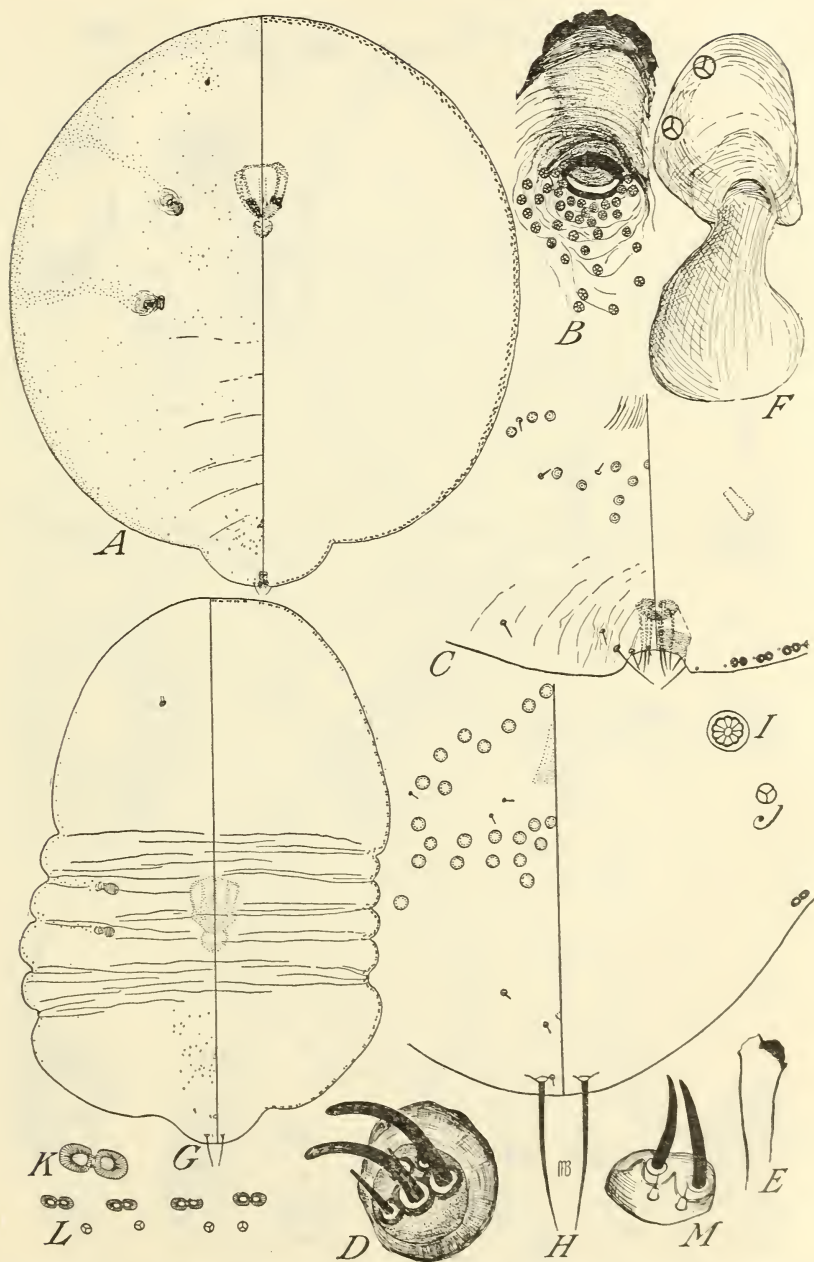


FIGURE 30.—*Asterolecanium hemisphaericum*: A, outline,  $\times 50$ ; B, spiracle,  $\times 460$ ; C, genital and anal area,  $\times 230$ ; D, antenna; E, tubular duct. *A. hilli*: F, spiracle; G, outline,  $\times 60$ ; H, genital and anal area,  $\times 330$ ; I, multilocular pore; J, trilocular pore; K, 8-shaped pore; L, section of margin,  $\times 650$ ; M, antenna.

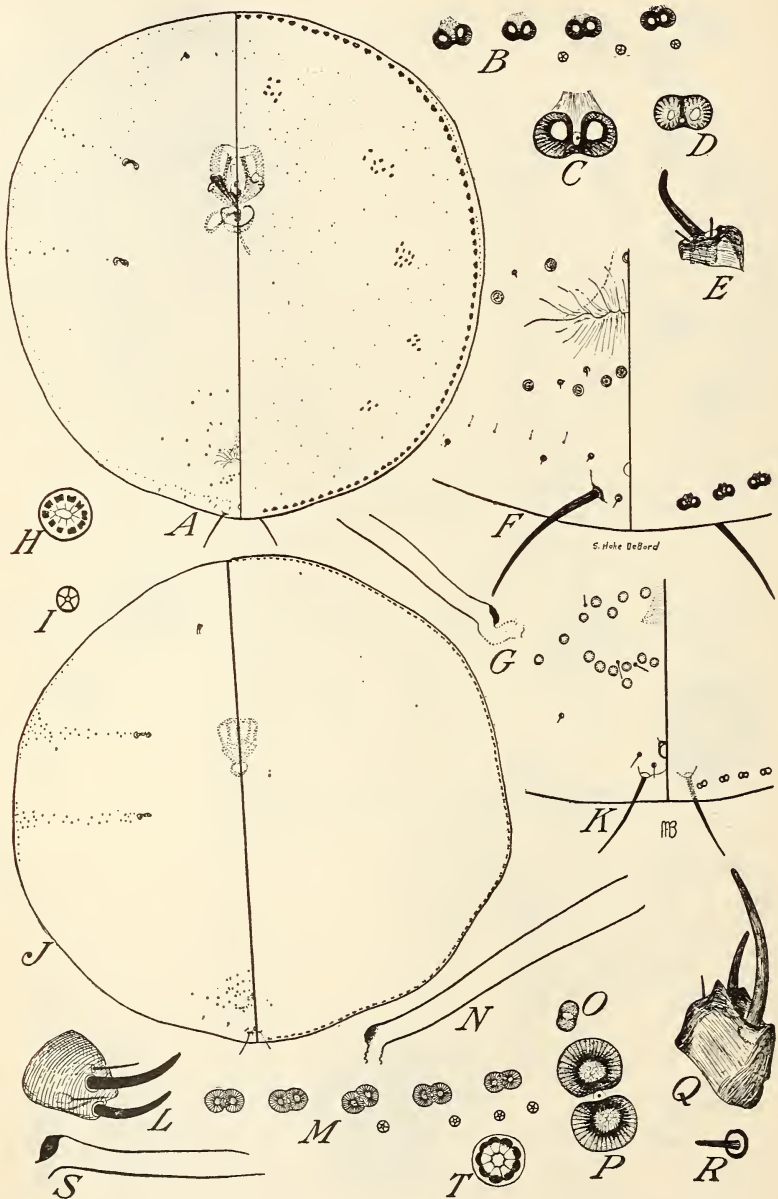


FIGURE 31.—*Asterolecanium horishae*: A, outline,  $\times 115$ ; B, section of margin,  $\times 650$ ; C, marginal 8-shaped pore; D, dorsal 8-shaped pore; E, antenna; F, genital and anal area,  $\times 460$ ; G, tubular duct. *A. ilicicola*: H, multilocular pore; I, quinquelocular pore; J, outline,  $\times 60$ ; K, genital and anal area,  $\times 230$ ; L, antenna; M, section of margin,  $\times 650$ ; N, tubular duct. *A. inconspicuum*: O, minute dorsal 8-shaped pore; P, marginal 8-shaped pore; Q, antenna; R, submarginal seta; S, tubular duct; T, multilocular pore.



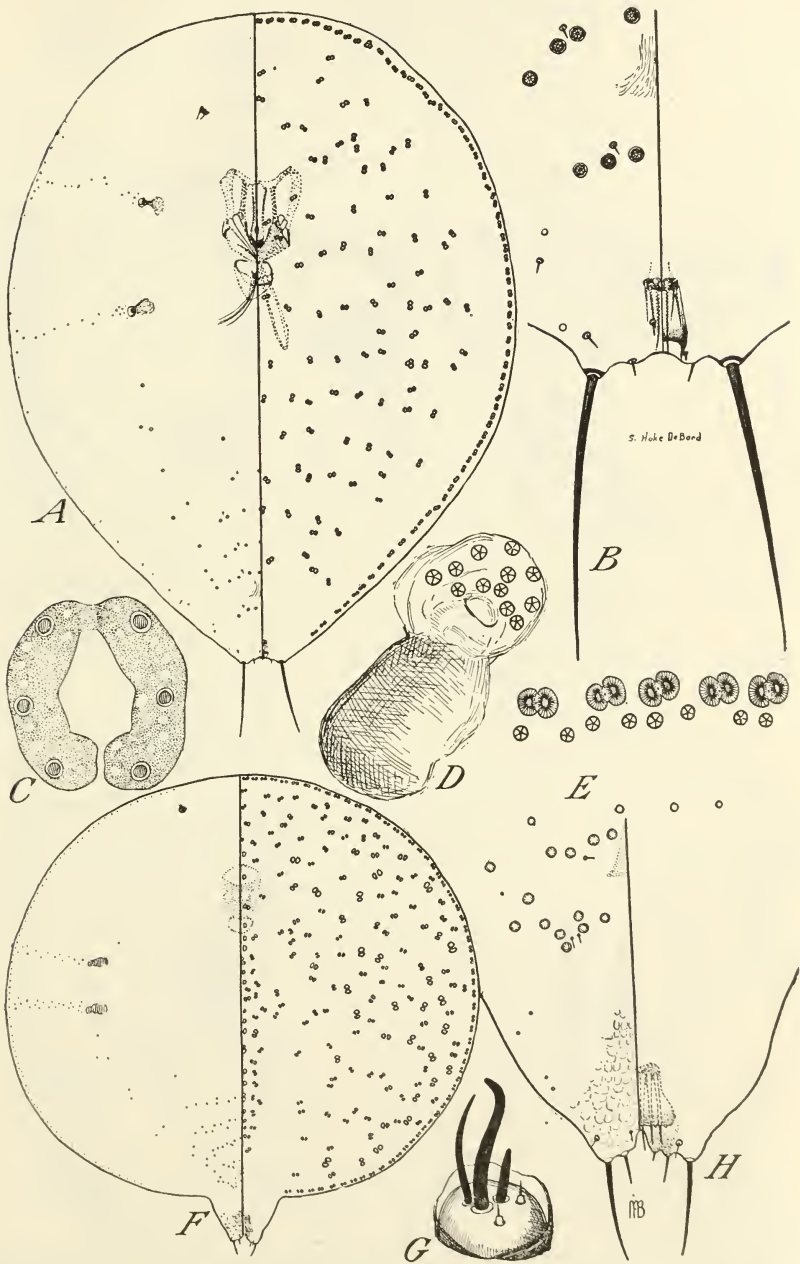


FIGURE 32.—*Asterolecanium inconspicuum*: A, outline,  $\times 115$ ; B, genital and anal area,  $\times 460$ . A. *ingae*: C, anal ring,  $\times 750$ ; D, spiracle,  $\times 900$ ; E, section of margin,  $\times 650$ ; F, outline,  $\times 100$ ; G, antenna; H, genital and anal area,  $\times 460$ .

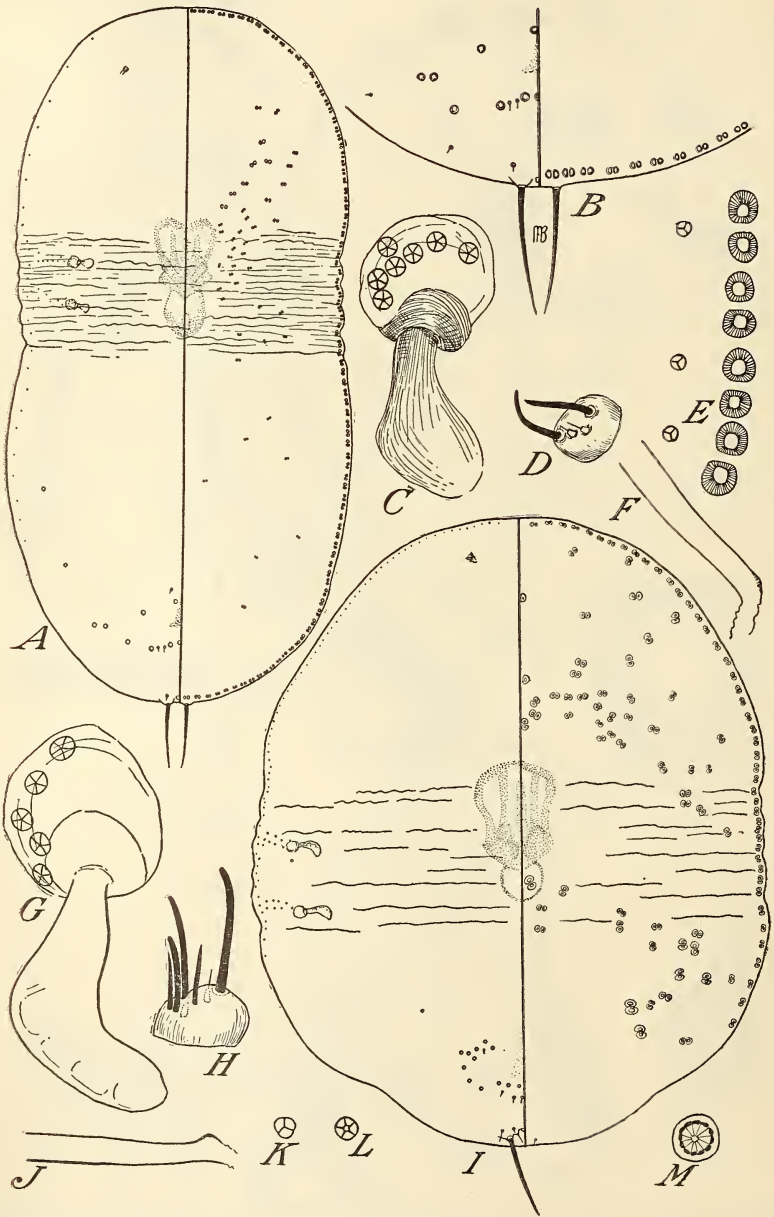


FIGURE 33.—*Asterolecanium inlabefactum*: A, outline,  $\times 100$ ; B, genital and anal area,  $\times 220$ ; C, spiracle; D, antenna; E, section of margin; F, tubular duct. *A. inusitatum*: G, spiracle; H, antenna; I, outline,  $\times 100$ ; J, tubular duct; K, trilocular pore; L, quinquelocular pore; M, multilocular pore.

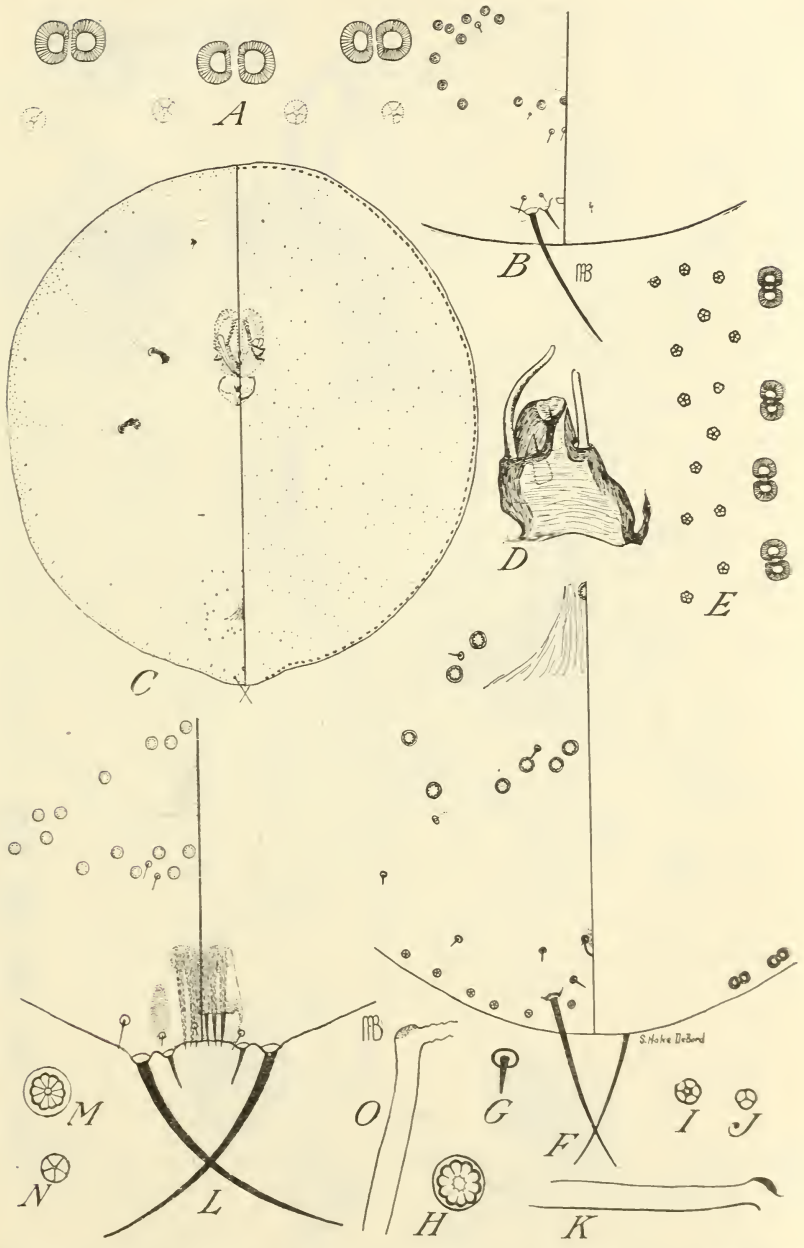


FIGURE 34.—*Asterolecanium inusitatum*: A, section of margin,  $\times 220$ . *A. japonicum*: C, outline,  $\times 87$ ; D, antenna; E, section of margin,  $\times 650$ ; F, genital and anal area,  $\times 460$ ; G, submarginal seta; H, multilocular pore; I, quinquelocular pore; J, trilocular pore; K, tubular duct. *A. javae*: L, genital and anal area,  $\times 230$ ; M, multilocular pore; N, quinquelocular pore; O, tubular duct.



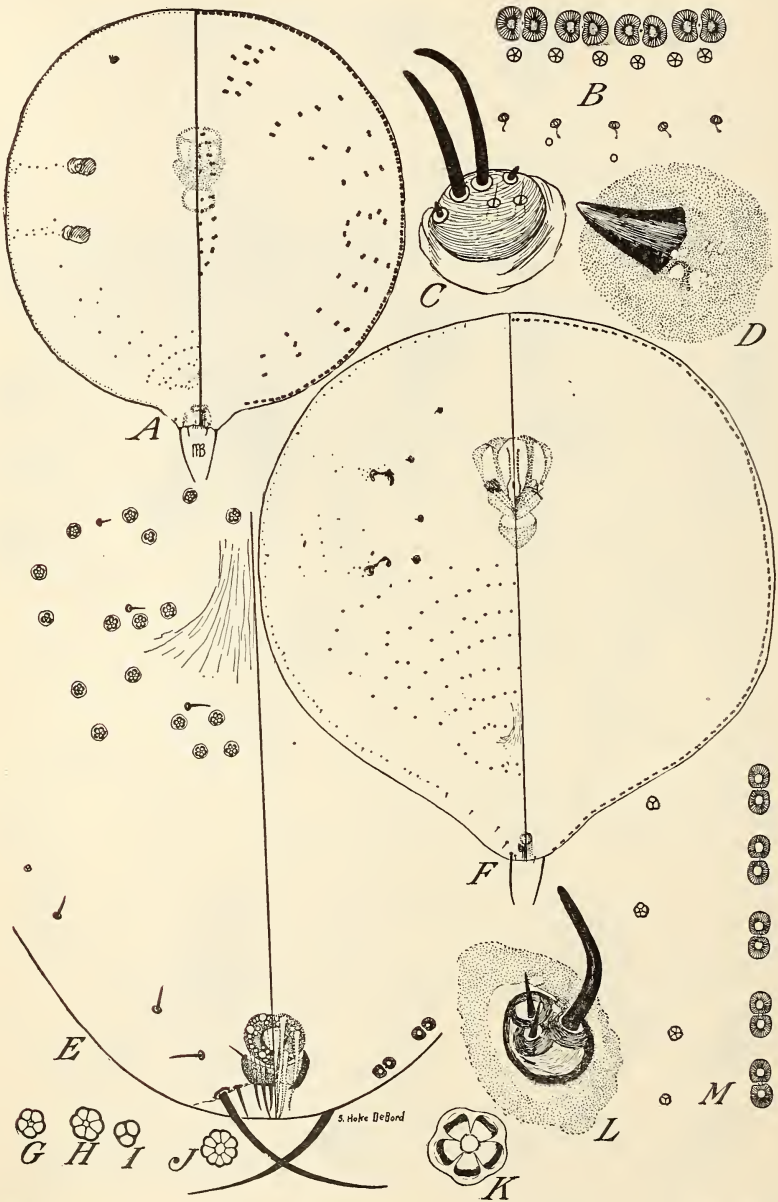


FIGURE 35.—*Asteroleccanium javae*: A, outline,  $\times 60$ ; B, section of margin and ventral submarginal area,  $\times 990$ ; C, antenna. *A. lacrimula*: D, claw; E, genital and anal area,  $\times 345$ ; F, outline,  $\times 87$ ; G, H, I, J, marginal quinquelocular, trilocular, and small multilocular pores; K, enlarged ventral quinquelocular pore; L, antenna; M, section of margin,  $\times 650$ .

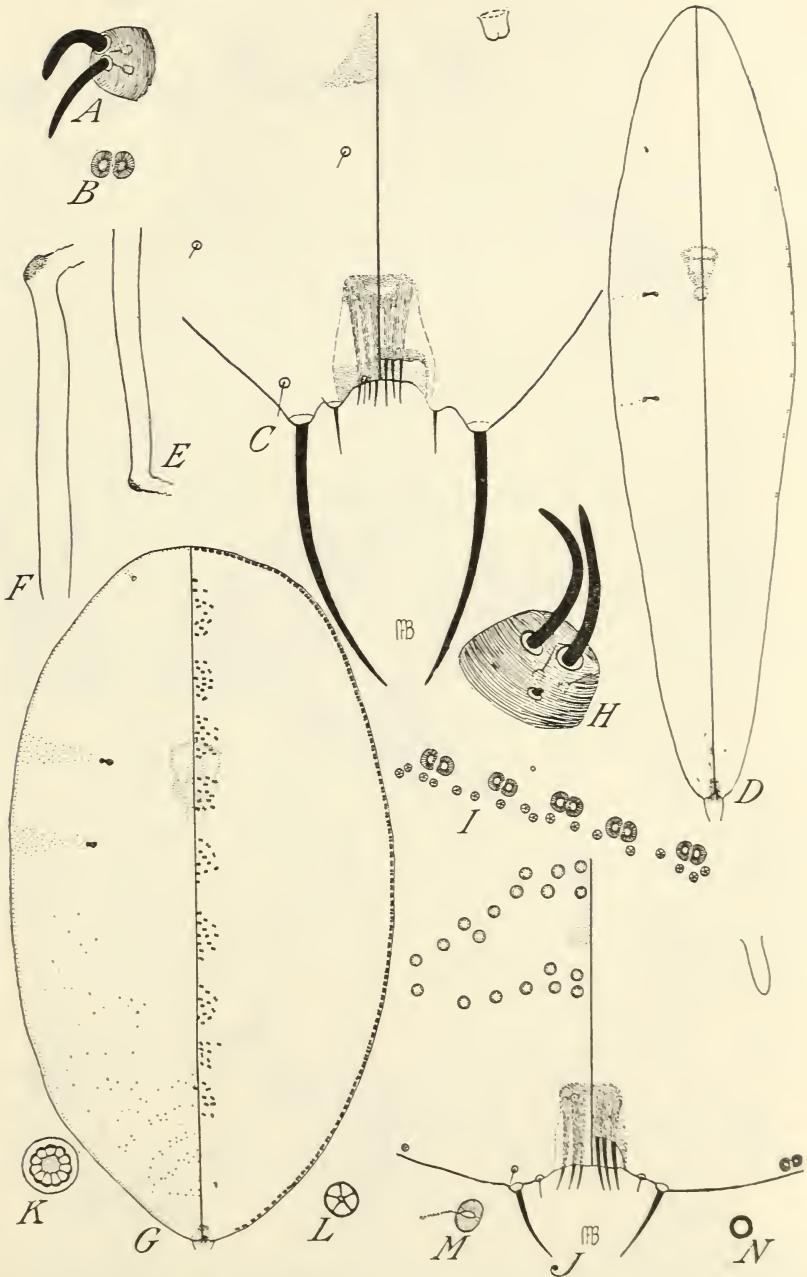


FIGURE 36.—*Asterolecanium longum*: A. antenna; B. marginal 8-shaped pore; C. genital and anal area,  $\times 460$ ; D. outline,  $\times 87$ ; E. tubular duct. *A. largum*: F. tubular duct; G. outline,  $\times 50$ ; H. antenna; I. section of margin,  $\times 230$ ; J. genital and anal area,  $\times 330$ ; K. multilocular pore; L. quinquelocular pore; M. submarginal 8-shaped pore; N. disk pore.

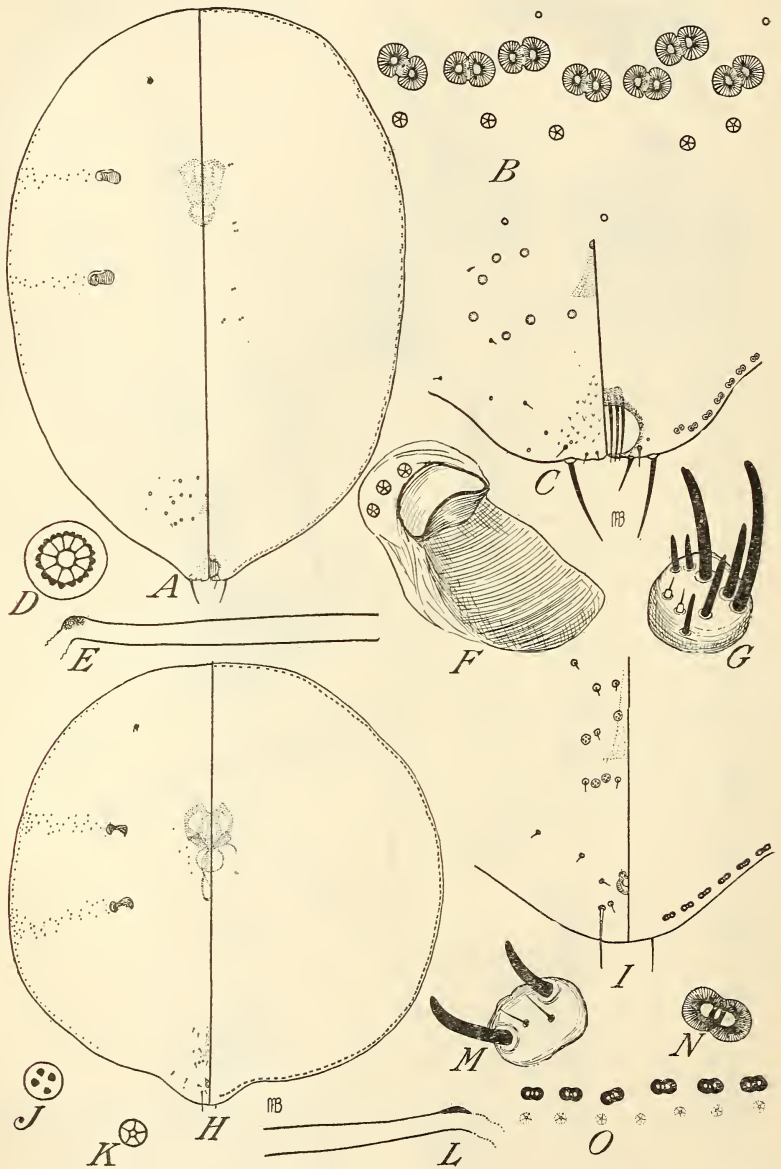


FIGURE 37.—*Asterolecanium launcae*: A, outline,  $\times 60$ ; B, section of margin,  $\times 650$ ; C, genital and anal area,  $\times 165$ ; D, multilocular pore; E, tubular duct; F, spiracle,  $\times 650$ ; G, antenna. *A. minus*: H, outline,  $\times 87$ ; I, genital and anal area,  $\times 230$ ; J, ventral quadrilocular pore; K, marginal quinquelocular pore; L, tubular duct; M, antenna; N, 8-shaped pore; O, section of margin,  $\times 650$ .





FIGURE 38.—*Asterolecanium litseae*: A. outline,  $\times 120$ ; B. claw; C. genital and anal area,  $\times 400$ ; D. section of margin and ventral submarginal area,  $\times 900$ ; E. antenna. *A. longulum*: F. outline,  $\times 60$ ; G. antenna; H. section of margin,  $\times 650$ ; I. dorsal tube; J. genital and anal area,  $\times 460$ ; K. 8-shaped pore; L. disk pore.

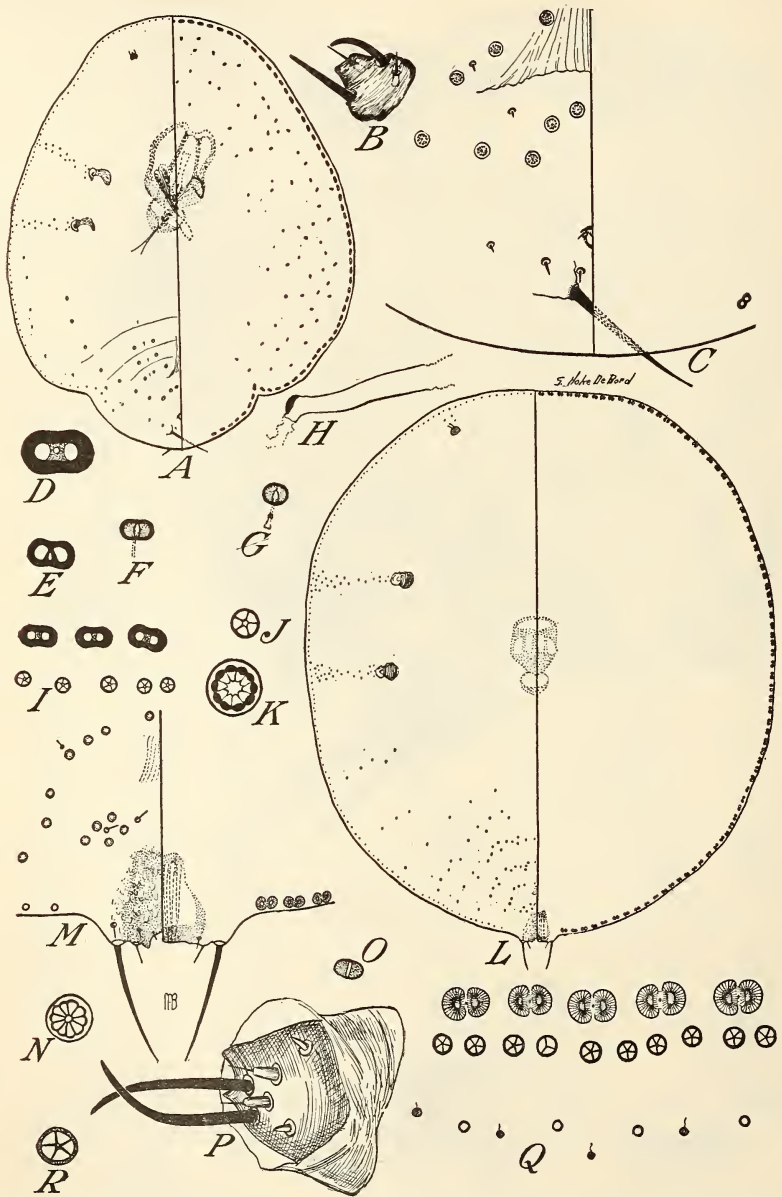


FIGURE 39.—*Asterolecanium luteolum*: A, outline,  $\times 120$ ; B, antenna; C, genital and anal area,  $\times 460$ ; D, marginal 8-shaped pore; E, F, dorsal 8-shaped pores; G, submarginal 8-shaped pore; H, tubular duct; I, section of margin,  $\times 650$ ; J, quinquelocular pore; K, multilocular pore. *A. machili*: L, outline,  $\times 100$ ; M, genital and anal area,  $\times 330$ ; N, multilocular pore; O, minute dorsal 8-shaped pore; P, antenna; Q, section of margin and ventral submarginal area,  $\times 650$ ; R, quinquelocular pore.

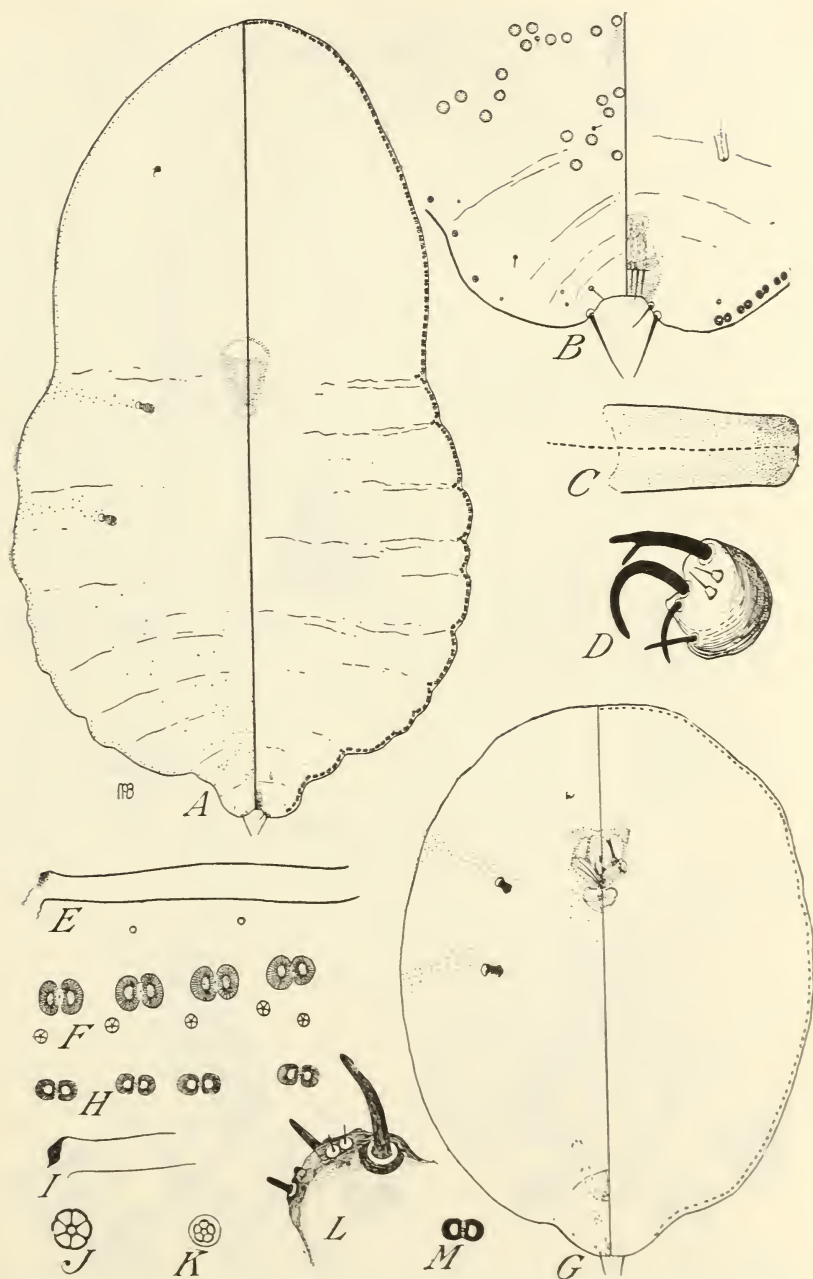


FIGURE 40.—*Asterolecanium masuii*: A, outline,  $\times 87$ ; B, genital and anal area,  $\times 330$ ; C, dorsal tube; D, antenna; E, tubular duct; F, section of margin,  $\times 650$ . *A. medium*: G, outline,  $\times 60$ ; H, section of margin,  $\times 650$ ; I, tubular duct; J, multilocular pore; K, quinquelocular pore; L, antenna; M, minute dorsal 8-shaped pore.



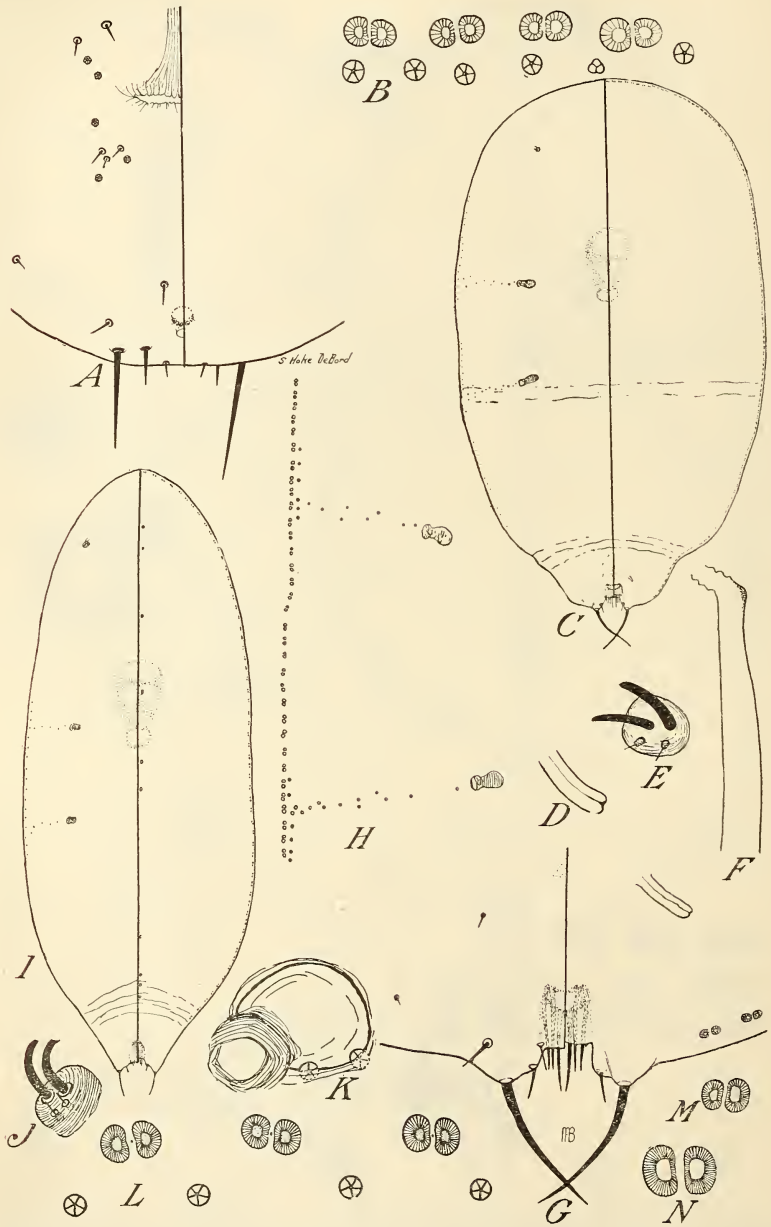


FIGURE 41.—*Asterolecanium medium*: A, genital and anal area,  $\times 345$ . *A. miliaris miliaris*: B, section of margin; C, outline,  $\times 165$ ; D, dorsal tube,  $\times 900$ ; E, antenna,  $\times 900$ ; F, tubular duct; G, genital and anal area,  $\times 650$ . *A. miliaris robustum*: H, spiracles and section of margin,  $\times 330$ . *A. mimicum*: I, outline,  $\times 165$ ; J, antenna; K, spiracle; L, section of margin; M, marginal 8-shaped pore; N, dorsal 8-shaped pore.

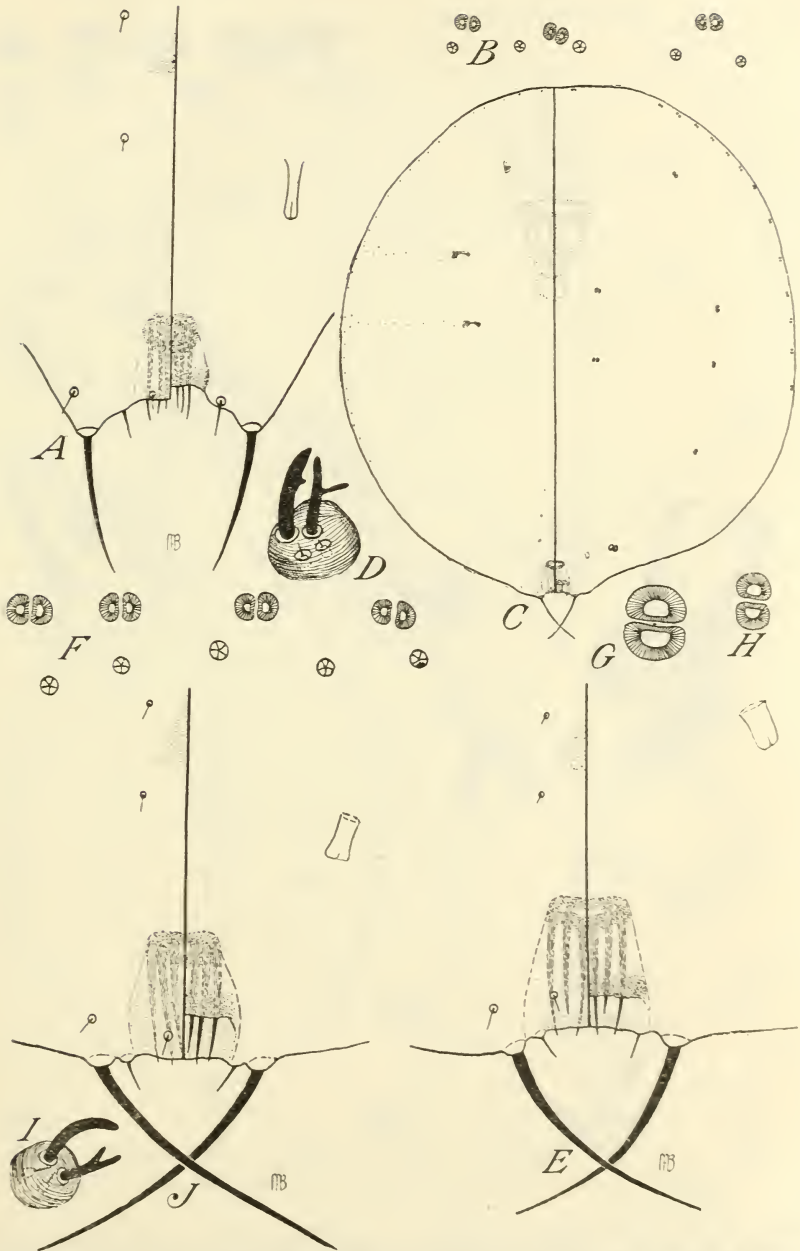


FIGURE 42.—*Asterolecanium mimicum*: A, genital and anal area,  $\times 650$ . *A. minusculum*: B, section of margin,  $\times 650$ ; C, outline,  $\times 175$ ; D, antenna; E, genital and anal area,  $\times 650$ . *A. minutum*: F, section of margin; G, H, dorsal 8-shaped pores; I, antenna; J, genital and anal area,  $\times 650$ .

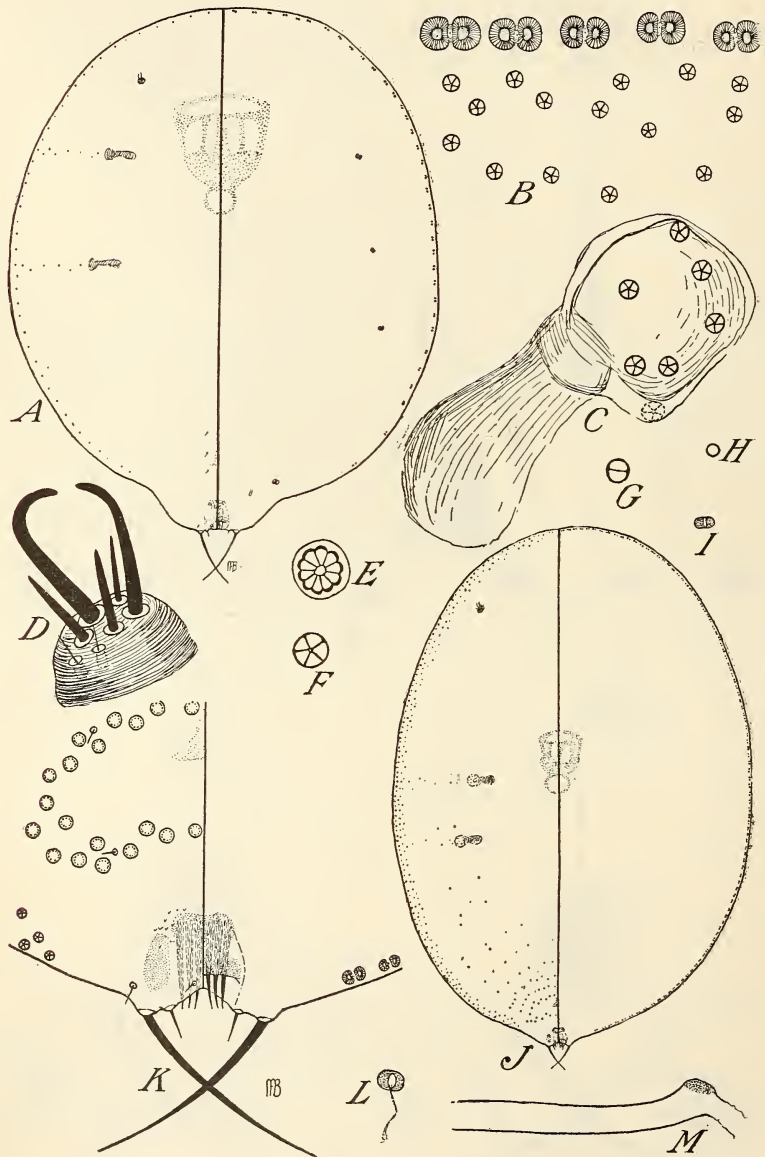


FIGURE 43.—*Asterolecanium minutum*: A, outline,  $\times 175$ . *A. multiporum*: B, section of margin,  $\times 650$ ; C, spiracle,  $\times 900$ ; D, antenna,  $\times 900$ ; E, multilocular pore; F, quinquelocular pore; G, dark-rimmed 8-shaped pore; H, disk pore; I, minute dorsal 8-shaped pore; J, outline,  $\times 60$ ; K, genital and anal area,  $\times 330$ ; L, submarginal 8-shaped pore; M, tubular duct.



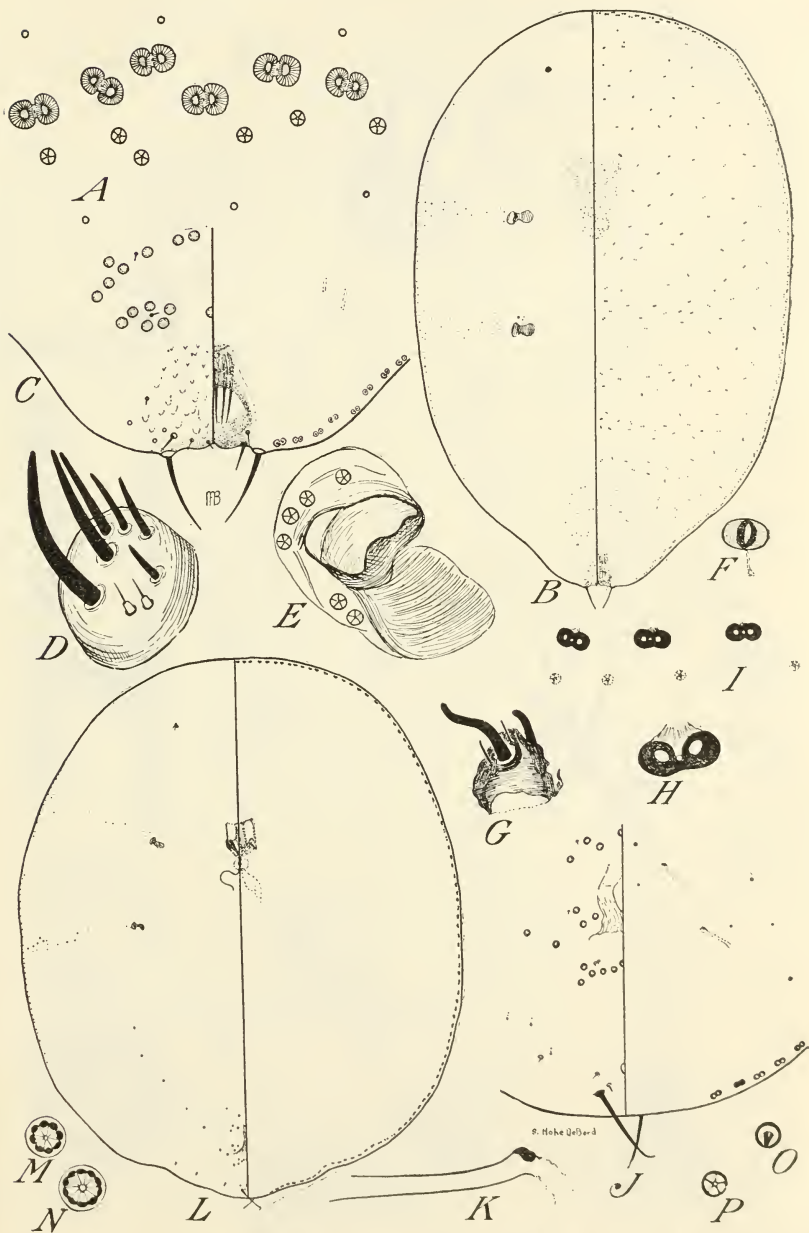


FIGURE 44.—*Asterolecanium nevadense*: A, section of margin,  $\times 650$ ; B, outline,  $\times 60$ ; C, genital and anal area,  $\times 165$ ; D, antenna; E, spiracle,  $\times 800$ ; F, dark-rimmed 8-shaped pore. *A. nitidum*: G, antenna; H, marginal 8-shaped pore; I, section of margin,  $\times 650$ ; J, genital and anal area,  $\times 230$ ; K, tubular duct; L, outline,  $\times 60$ ; M, N, multifolcular pores; O, submarginal seta; P, quinquelocular pore.

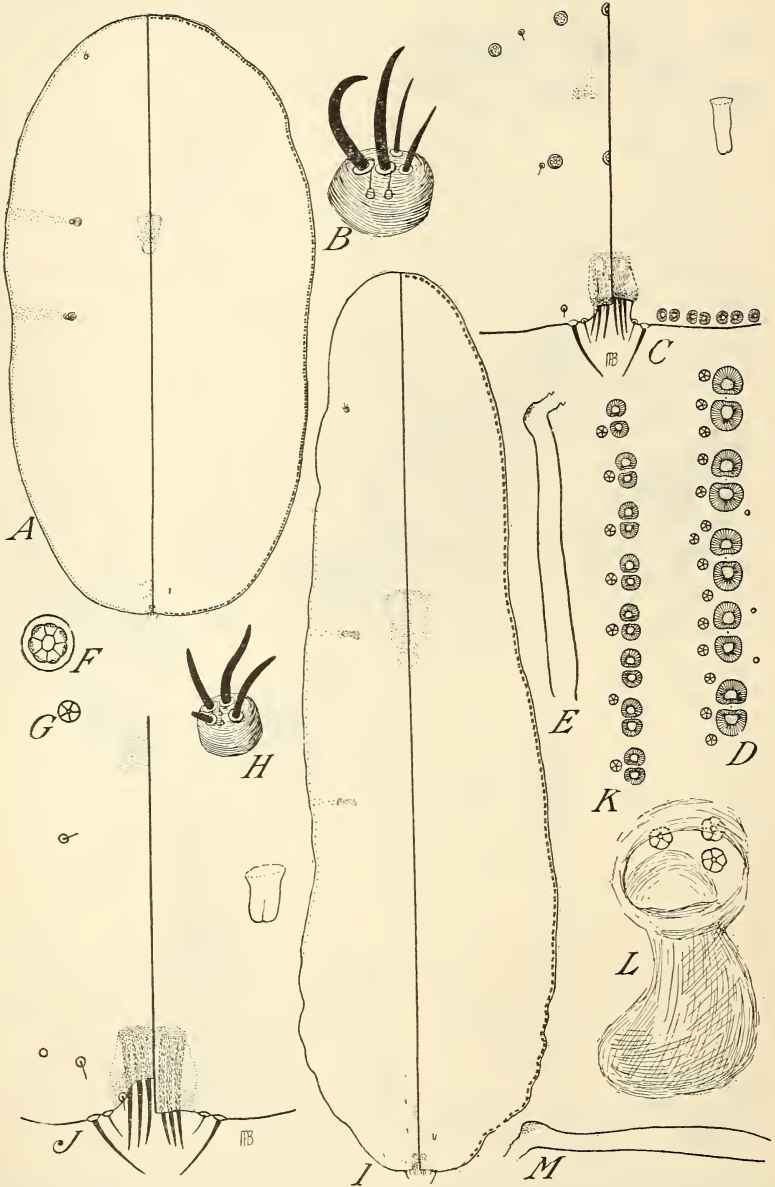


FIGURE 45.—*Asterolecanium notabile*: A, outline,  $\times 50$ ; B, antenna; C, genital and anal area,  $\times 330$ ; D, section of margin,  $\times 750$ ; E, tubular duct; F, multifolocular pore; G, quinquelocular pore. *A. oblongum*: H, antenna; I, outline,  $\times 120$ ; J, genital and anal area,  $\times 460$ ; K, section of margin,  $\times 650$ ; L, spiracle; M, tubular duct.

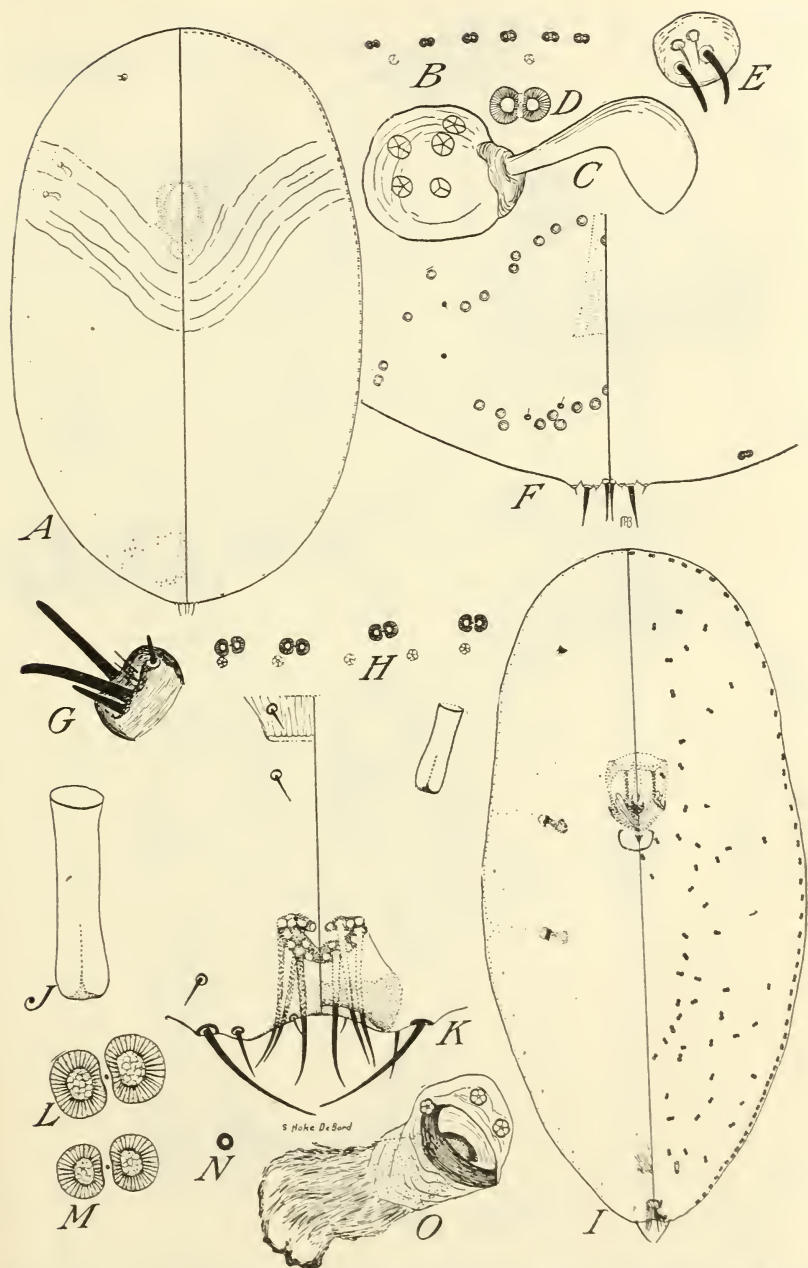


FIGURE 46.—*Asterolecanium oraniae*: A, outline,  $\times 120$ ; B, section of margin,  $\times 330$ ; C, spiracle; D, 8-shaped pore; E, antenna; F, genital and anal area,  $\times 330$ . *A. ordinarium*: G, antenna; H, section of margin,  $\times 650$ ; I, outline,  $\times 115$ ; J, dorsal tube; K, genital and anal area,  $\times 650$ ; L, dorsal 8-shaped pore; M, marginal 8-shaped pore; N, disk pore; O, spiracle.



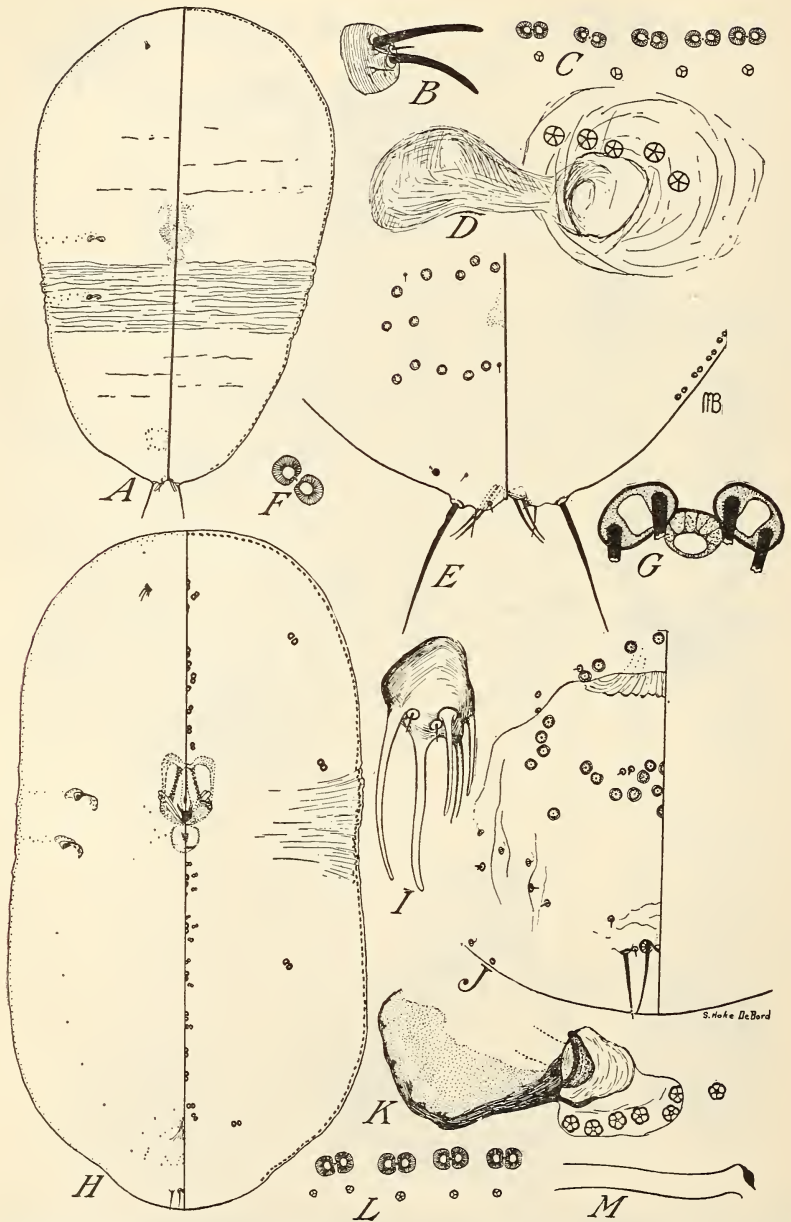


FIGURE 47.—*Asterolecanium pallidum*: A, outline,  $\times 100$ ; B, antenna; C, section of margin,  $\times 900$ ; D, spiracle; E, genital and anal area,  $\times 460$ ; F, 8-shaped pore; G, modified anal ring and setae. *A. palmae*: H, outline,  $\times 115$ ; I, antenna; J, genital and anal area,  $\times 460$ ; K, spiracle; L, section of margin,  $\times 650$ ; M, tubular duct.

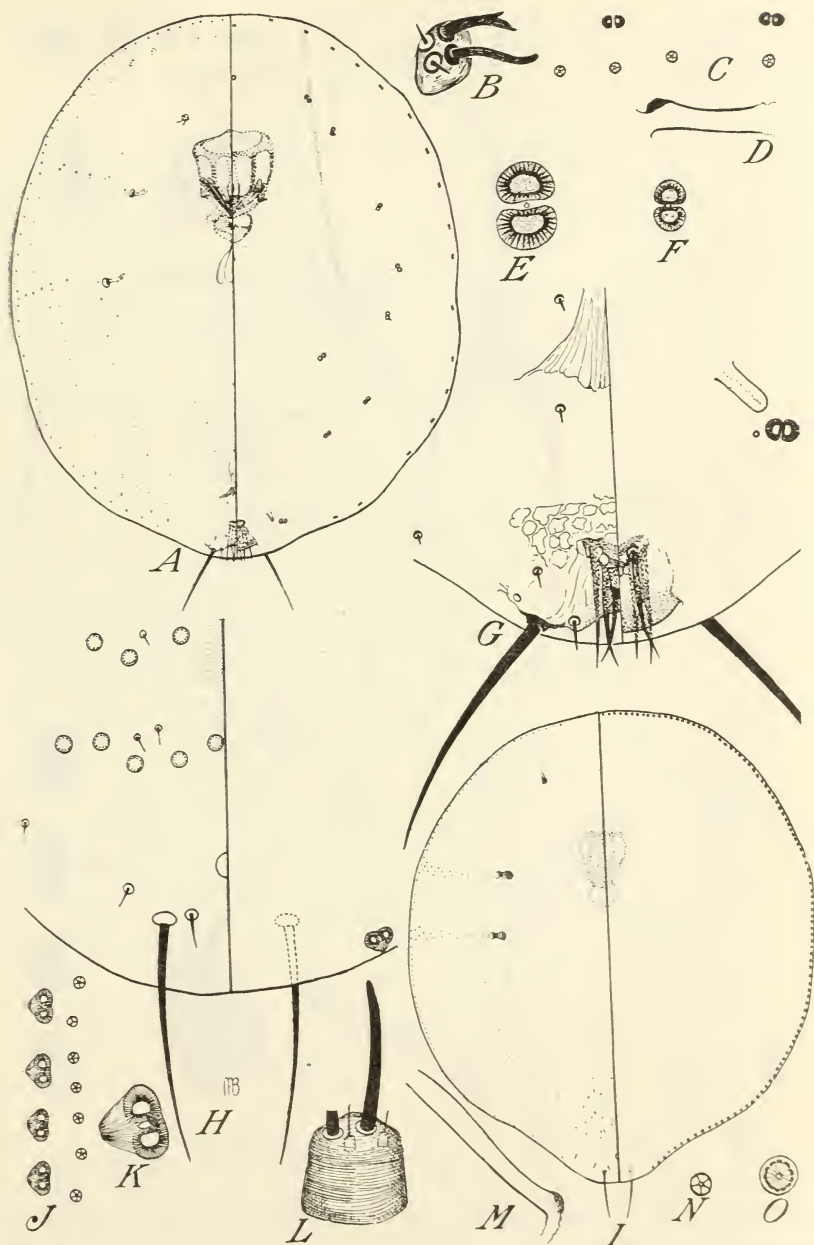


FIGURE 48.—*Asterolecanium parvum*: A, outline,  $\times 165$ ; B, antenna; C, section of margin,  $\times 650$ ; D, tubular duct; E, dorsal 8-shaped pore; F, marginal 8-shaped pore; G, genital and anal area,  $\times 650$ . *A. pasaniac*: H, genital and anal area,  $\times 650$ ; I, outline,  $\times 60$ ; J, section of margin,  $\times 650$ ; K, 8-shaped pore; L, antenna; M, tubular duct; N, quinquelocular pore; O, multilocular pore.

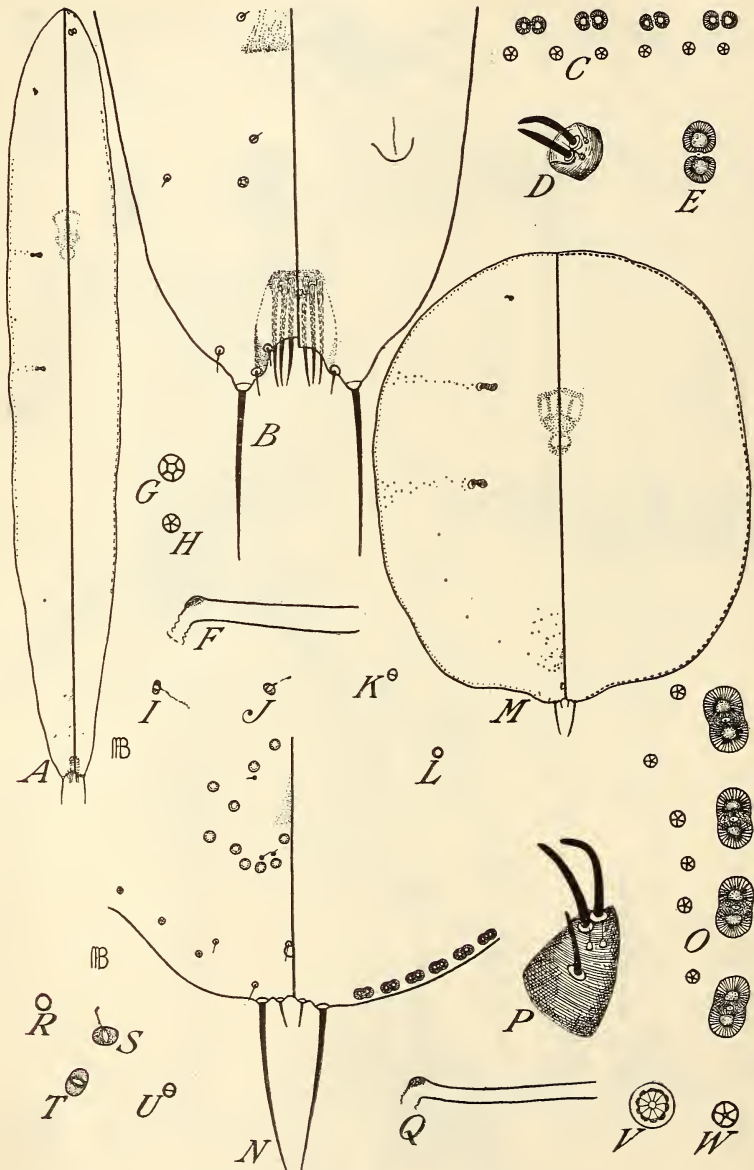


FIGURE 49.—*Asterolecanium penicillatum*: A, outline, × 60; B, genital and anal area, × 650; C, section of margin; D, antenna; E, 8-shaped pore; F, tubular duct; G, ventral quinquelocular pore; H, marginal quinquelocular pore; I, minute dorsal 8-shaped pore; J, submarginal 8-shaped pore; K, dark-rimmed 8-shaped pore; L, disk pore. *A. perplexum*: M, outline, × 60; N, genital and anal area, × 900; O, section of margin, × 900; P, antenna; Q, tubular duct; R, disk pore; S, submarginal 8-shaped pore; T, minute dorsal 8-shaped pore; U, dark-rimmed 8-shaped pore; V, multilocular pore; W, quinquelocular pore.



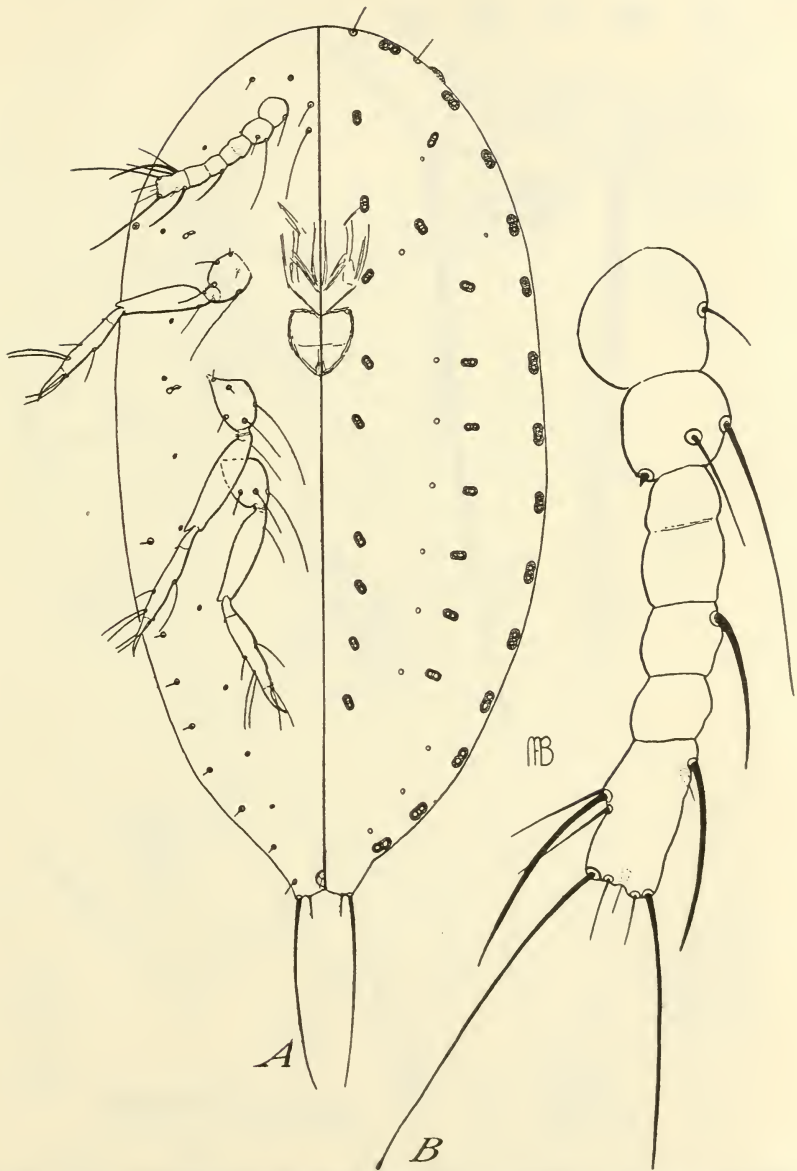


FIGURE 50.--*Asterolecanium perplexum*, larva; A, outline,  $\times 220$ ; B, antenna.

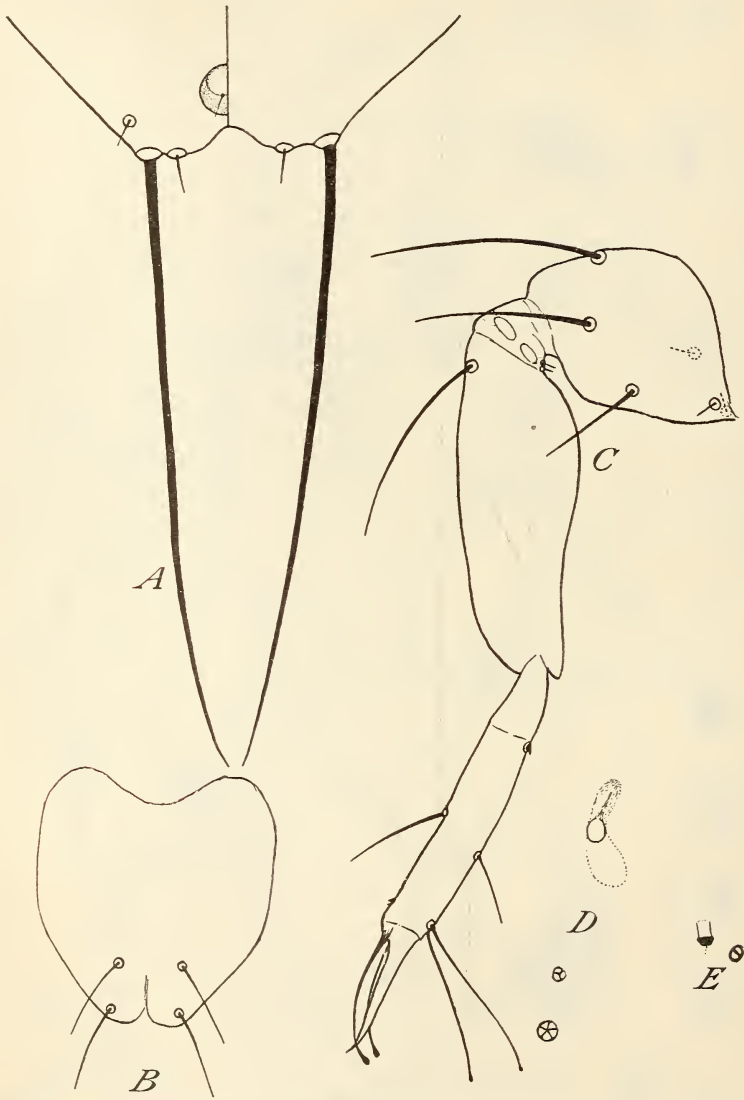


FIGURE 51.—*Asterolecanium perplexum*, larva: A, apex of abdomen; B, beak; C, anterior leg; D, spiracle and pores; E, submarginal 8-shaped pore, two views.

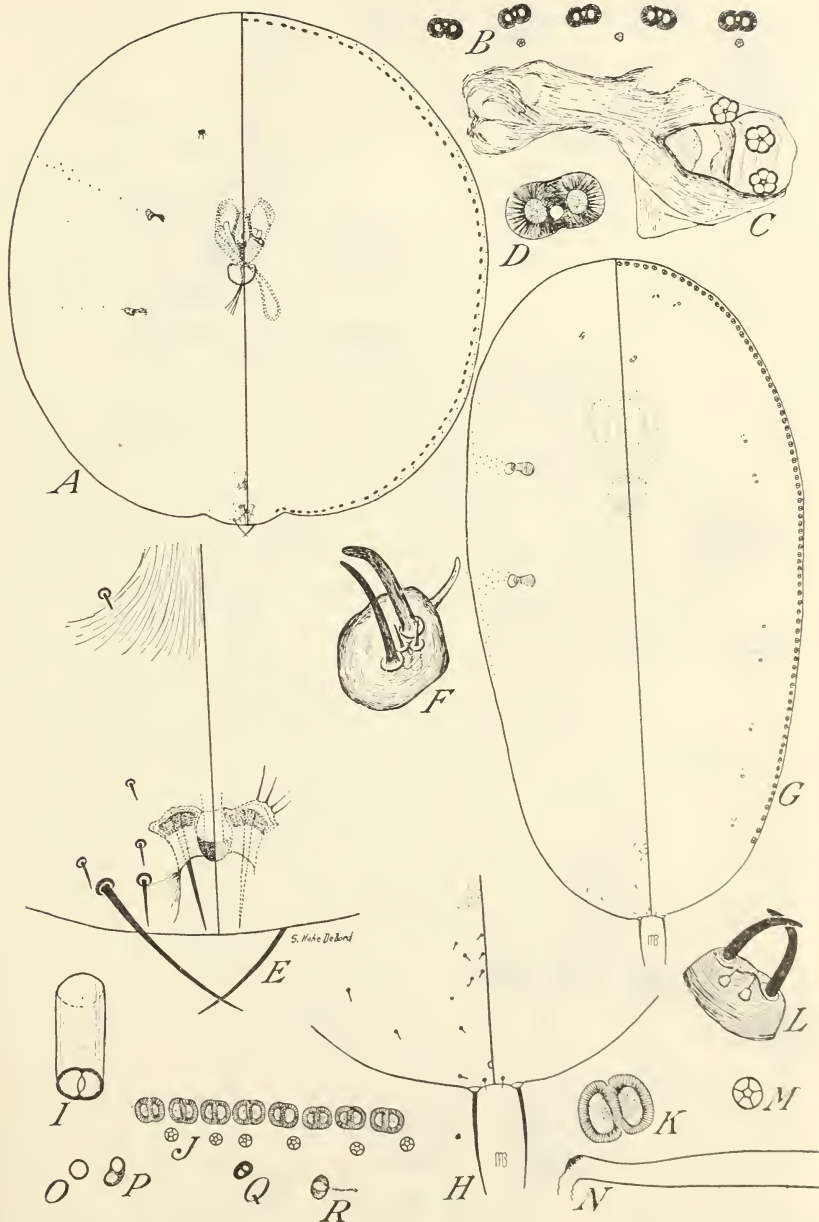


FIGURE 52.—*Asterolecanium petrophilae*: A, outline,  $\times 87$ ; B, section of margin,  $\times 520$ ; C, spiracle,  $\times 530$ ; D, 8-shaped pore; E, genital and anal area,  $\times 650$ ; F, antenna. *A. phoenicis*: G, outline,  $\times 100$ ; H, genital and anal area,  $\times 230$ ; I, dorsal tubular 8-shaped pore; J, section of margin,  $\times 900$ ; K, marginal 8-shaped pore; L, antenna; M, quinquelocular pore; N, tubular duct; O, disk pore; P, minute dorsal 8-shaped pore; Q, dark-rimmed 8-shaped pore; R, sub-marginal 8-shaped pore.



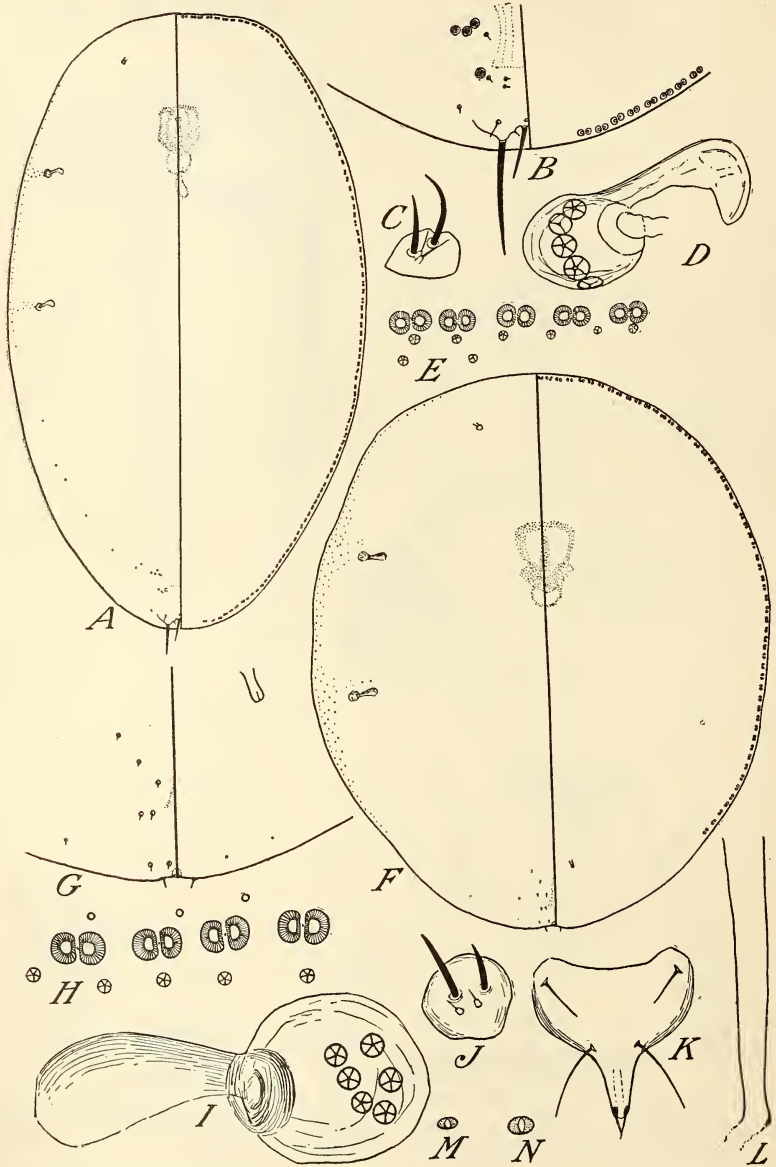


FIGURE 53.—*Asteroteccanium pinangae*: A, outline,  $\times 120$ ; B, genital and anal area,  $\times 330$ ; C, antenna; D, spiracle; E, section of margin. *A. proboscidis*: F, outline,  $\times 120$ ; G, genital and anal area,  $\times 330$ ; H, section of margin; I, spiracle; J, antenna; K, beak of larva; L, tubular duct; M, minute dorsal 8-shaped pore; N, submarginal 8-shaped pore.

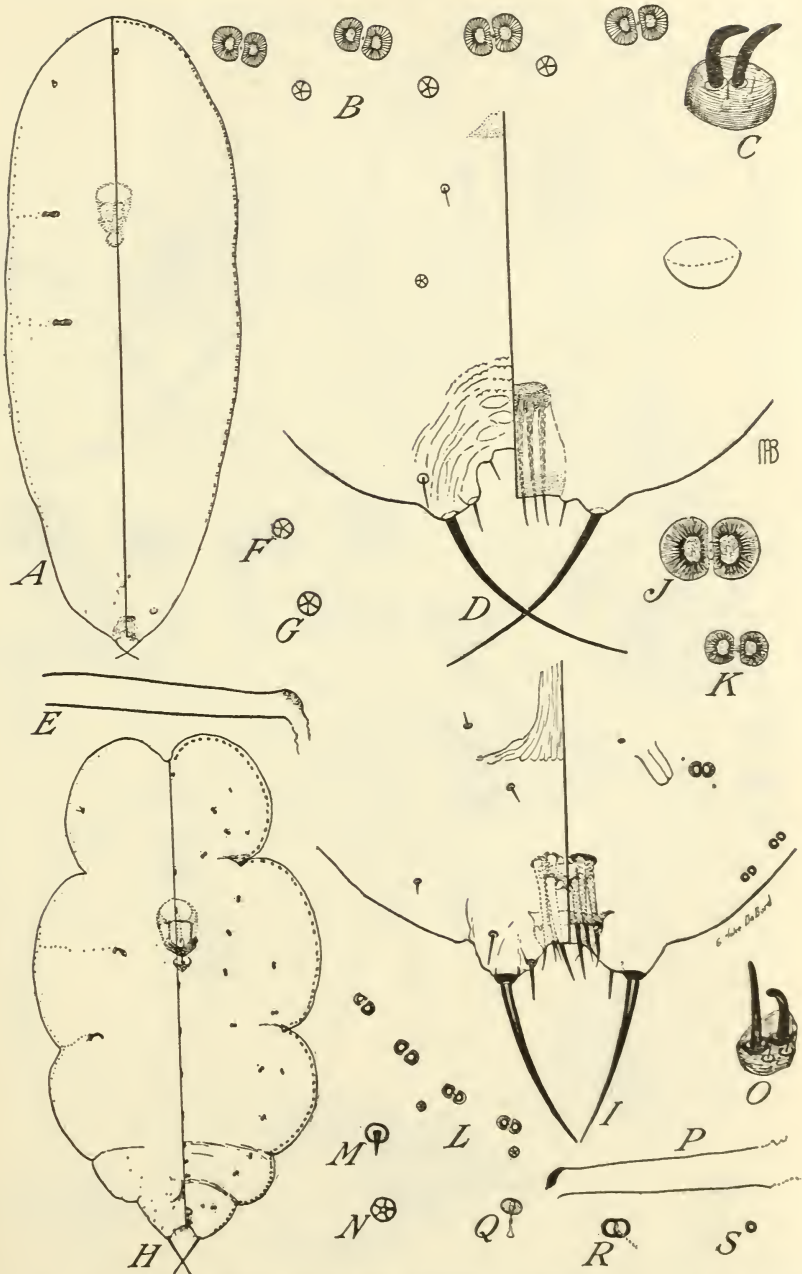


FIGURE 54.—*Asterolecanium pseudolanccolatum*: A, outline,  $\times 100$ ; B, section of margin; C, antenna; D, genital and anal area,  $\times 460$ ; E, tubular duct; F, marginal quinquelocular pore; G, ventral quinquelocular pore. *A. pseudomiliaris*: H, outline,  $\times 87$ ; I, genital and anal area,  $\times 460$ ; J, dorsal 8-shaped pore; K, marginal 8-shaped pore; L, section of margin,  $\times 650$ ; M, submarginal seta; N, quinquelocular pore; O, antenna; P, tubular duct; Q, submarginal 8-shaped

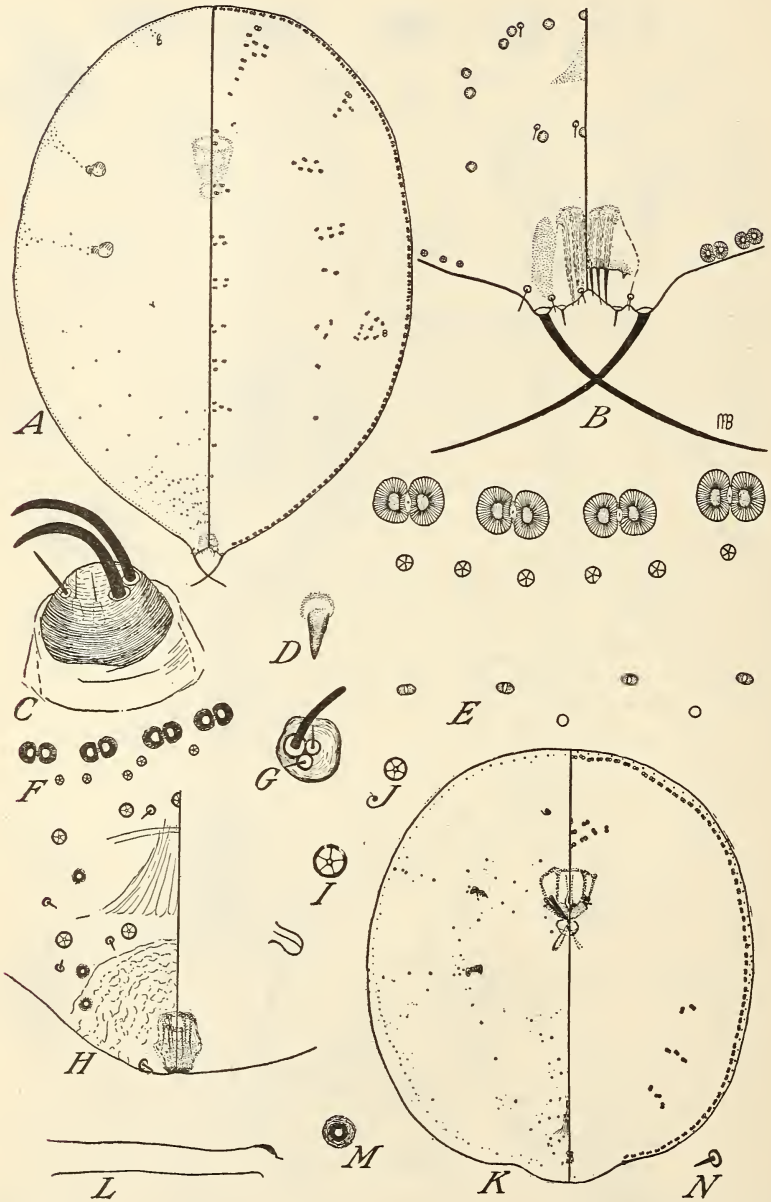


FIGURE 55.—*Asterolecanium psychotriac*: A, outline,  $\times 87$ ; B, genital and anal area,  $\times 330$ ; C, antenna; D, claw; E, section of margin and ventral submarginal area,  $\times 900$ . *A. pusillum*: F, section of margin,  $\times 650$ ; G, antenna; H, genital and anal area,  $\times 650$ ; I, ventral quinquelocular pore; J, marginal quinquelocular pore; K, outline,  $\times 115$ ; L, tubular duct; M, disk pore; N, submarginal seta.



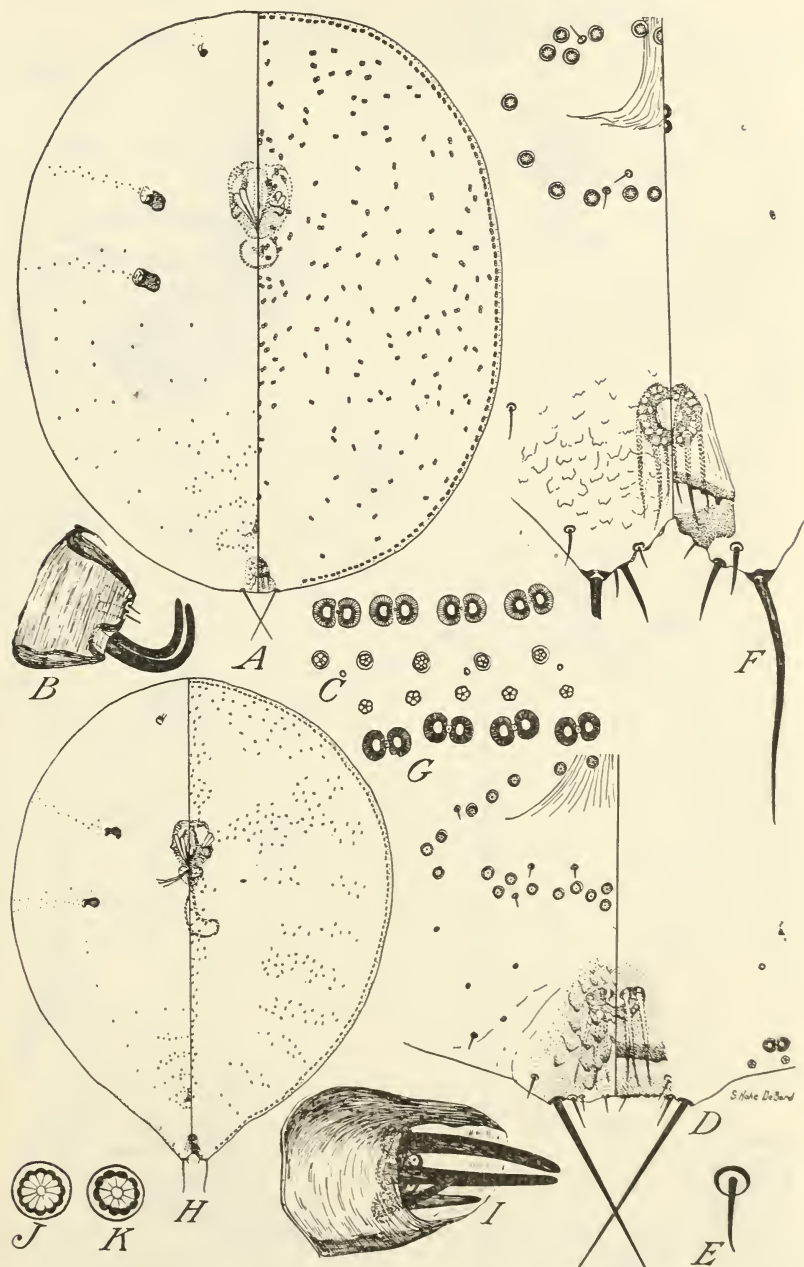


FIGURE 56.—*Asterolecanium pustulans*: A, outline,  $\times 87$ ; B, antenna; C, section of margin,  $\times 530$ ; D, genital and anal area,  $\times 345$ ; E, submarginal seta. *A. putcanum*: F, genital and anal area,  $\times 460$ ; G, section of margin,  $\times 650$ ; H, outline,  $\times 60$ ; I, antenna; J, K, multilocular pores.

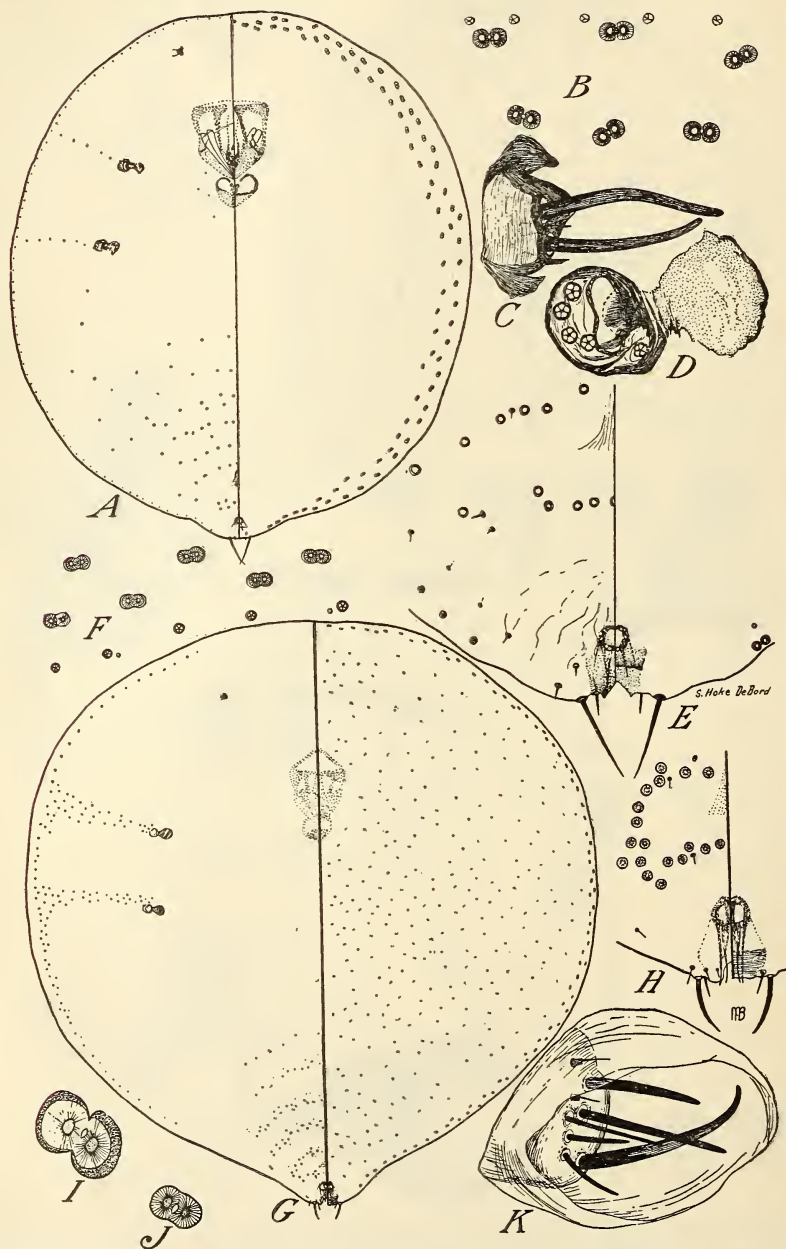


FIGURE 57.—*Asterolecanium quadrisetosum*: A, outline,  $\times 87$ ; B, section of margin,  $\times 530$ ; C, antenna; D, spiracle,  $\times 815$ ; E, genital and anal area,  $\times 345$ . *A. quaeisutum*: F, section of margin,  $\times 330$ ; G, outline,  $\times 60$ ; H, genital and anal area,  $\times 230$ ; I, marginal 8-shaped pore; J, dorsal 8-shaped pore; K, antenna.

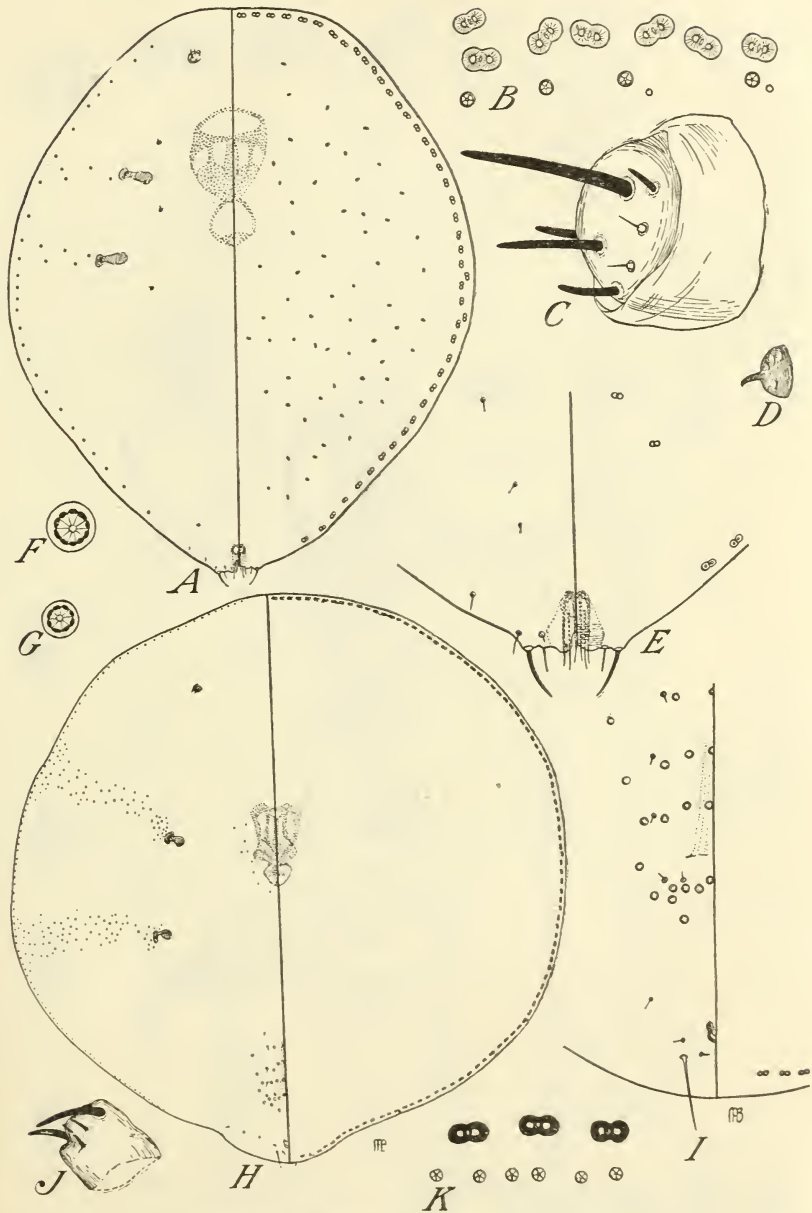


FIGURE 58.—*Asterolecanium quacsitum*, third-stage male: A, outline,  $\times 115$ ; B, section of margin,  $\times 800$ ; C, antenna; D, claw; E, posterior part of abdomen,  $\times 230$ . *A. quercicola*: F, G, multilocular pores; H, outline,  $\times 87$ ; I, genital and anal area,  $\times 230$ ; J, antenna,  $\times 900$ ; K, section of margin,  $\times 650$ .



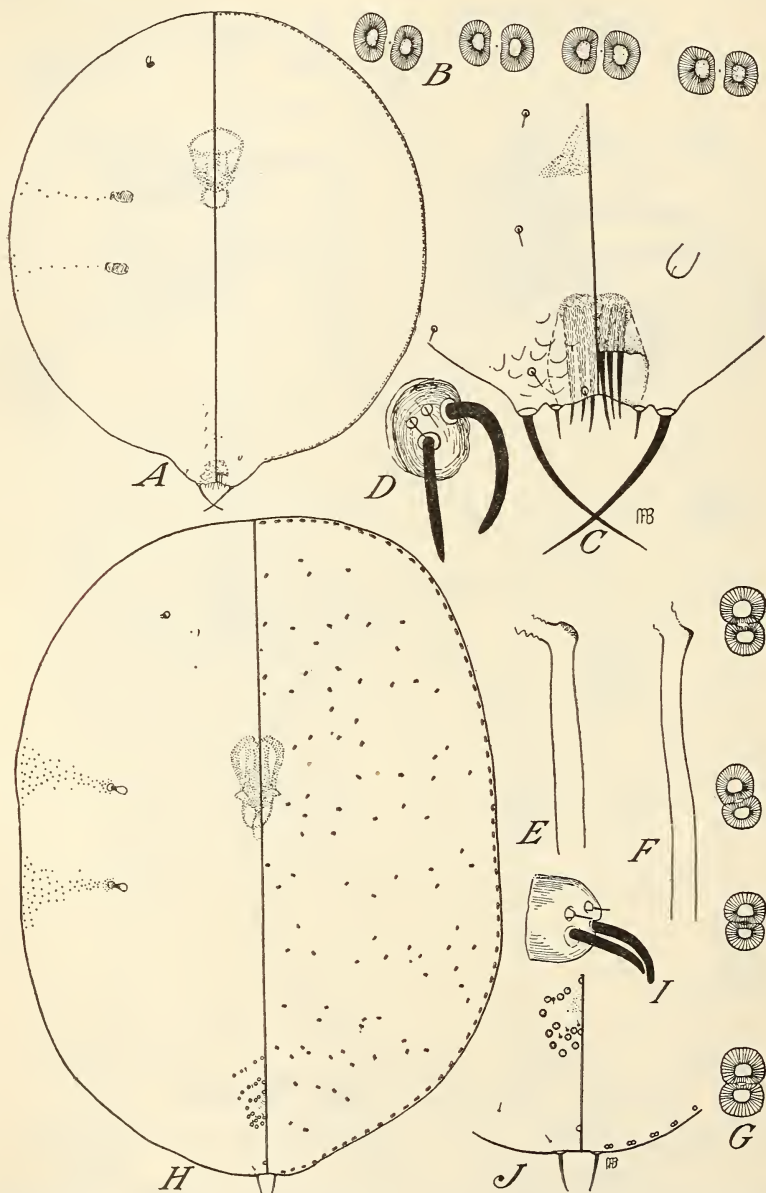


FIGURE 59.—*Asterolecanium radiatum*: A, outline,  $\times 115$ ; B, section of margin; C, genital and anal area,  $\times 650$ ; D, antenna; E, tubular duct. *A. repugnans*: F, tubular duct; G, section of margin; H, outline,  $\times 100$ ; I, antenna; J, genital and anal area,  $\times 230$ .

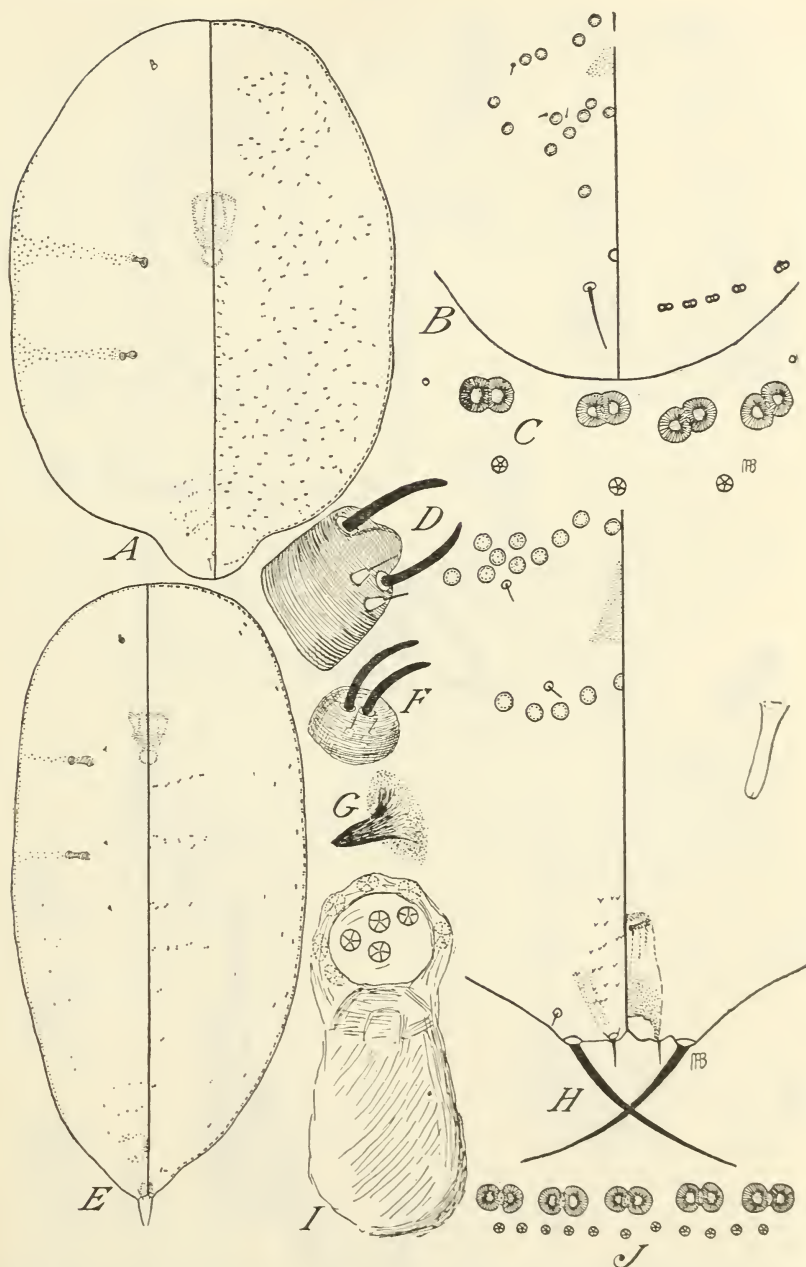


FIGURE 60.—*Asterolecanium roboris*: A, outline,  $\times 60$ ; B, genital and anal area,  $\times 460$ ; C, section of margin,  $\times 900$ ; D, antenna. *A. rubrocomatum*: E, outline,  $\times 87$ ; F, antenna; G, claw; H, genital and anal area,  $\times 460$ ; I, spiracle; J, section of margin,  $\times 230$ .

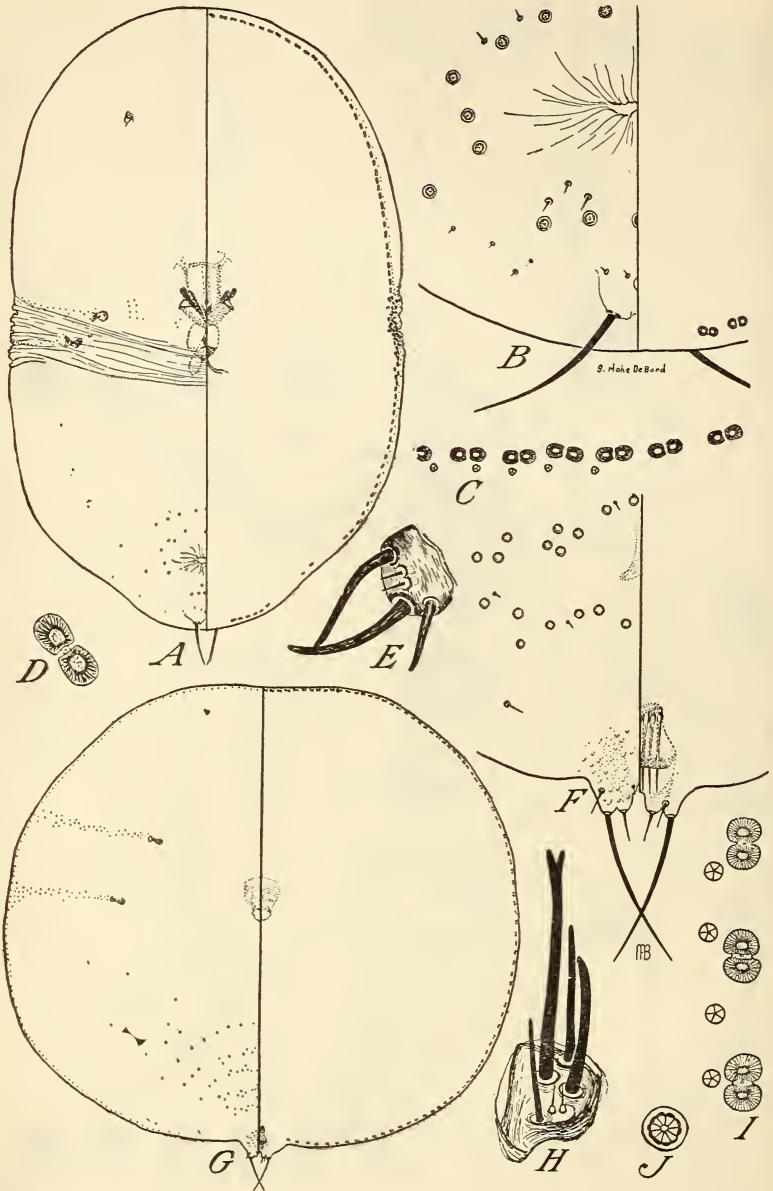


FIGURE 61.—*Asterolecanium sabalis*: A, outline,  $\times 115$ ; B, genital and anal area,  $\times 460$ ; C, section of margin,  $\times 650$ ; D, 8-shaped pore; E, antenna. *A. sanbernardense*: F, genital and anal area,  $\times 230$ ; G, outline,  $\times 60$ ; H, antenna; I, section of margin,  $\times 650$ ; J, multilocular pore.



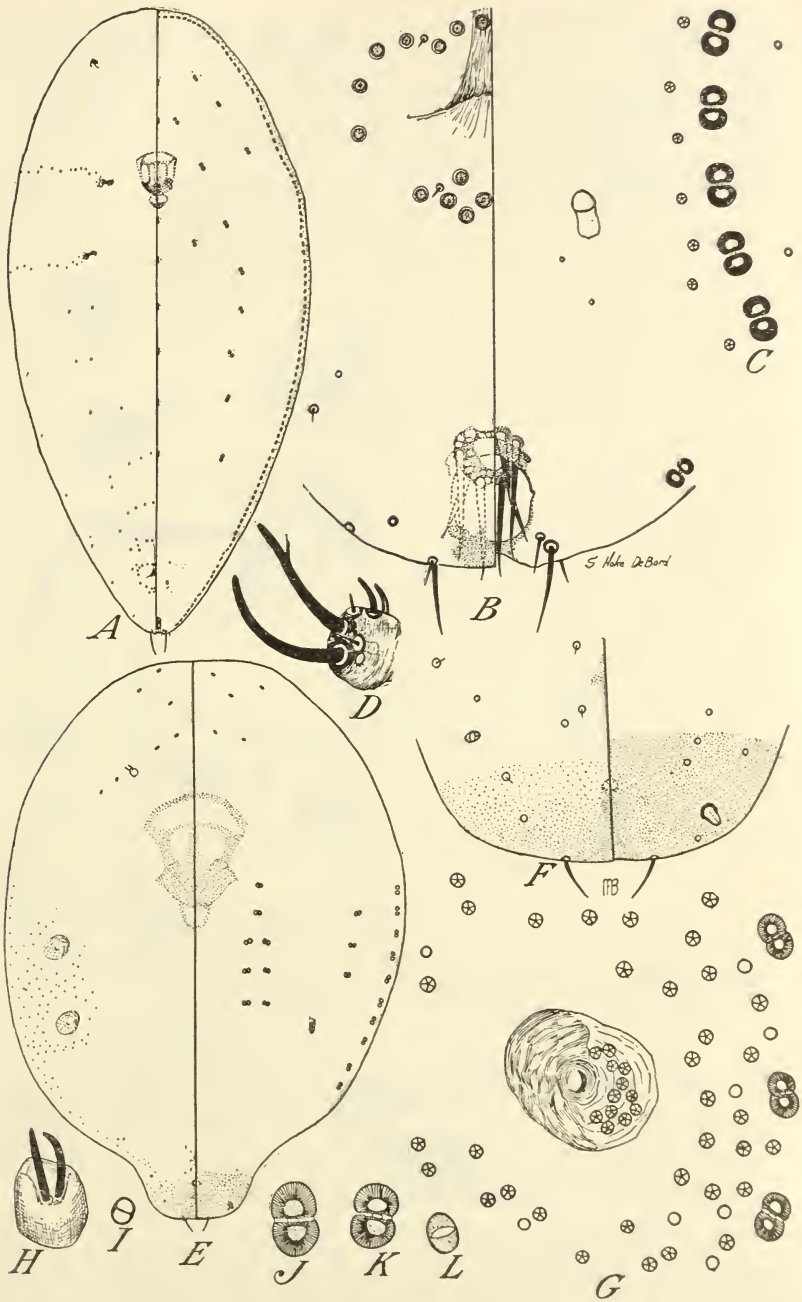


FIGURE 62.—*Asterolecanium sasae*: A, outline,  $\times 60$ ; B, genital and anal area,  $\times 460$ ; C, section of margin,  $\times 650$ ; D, antenna. *A. scirrosus*: E, outline,  $\times 120$ ; F, genital and anal area,  $\times 460$ ; G, section of margin, spiracle, and quinquelocular pores,  $\times 900$ ; H, antenna; I, dark-rimmed 8-shaped pore; J, dorsal 8-shaped pore; K, marginal 8-shaped pore; L, smaller dorsal and ventral 8-shaped pore.

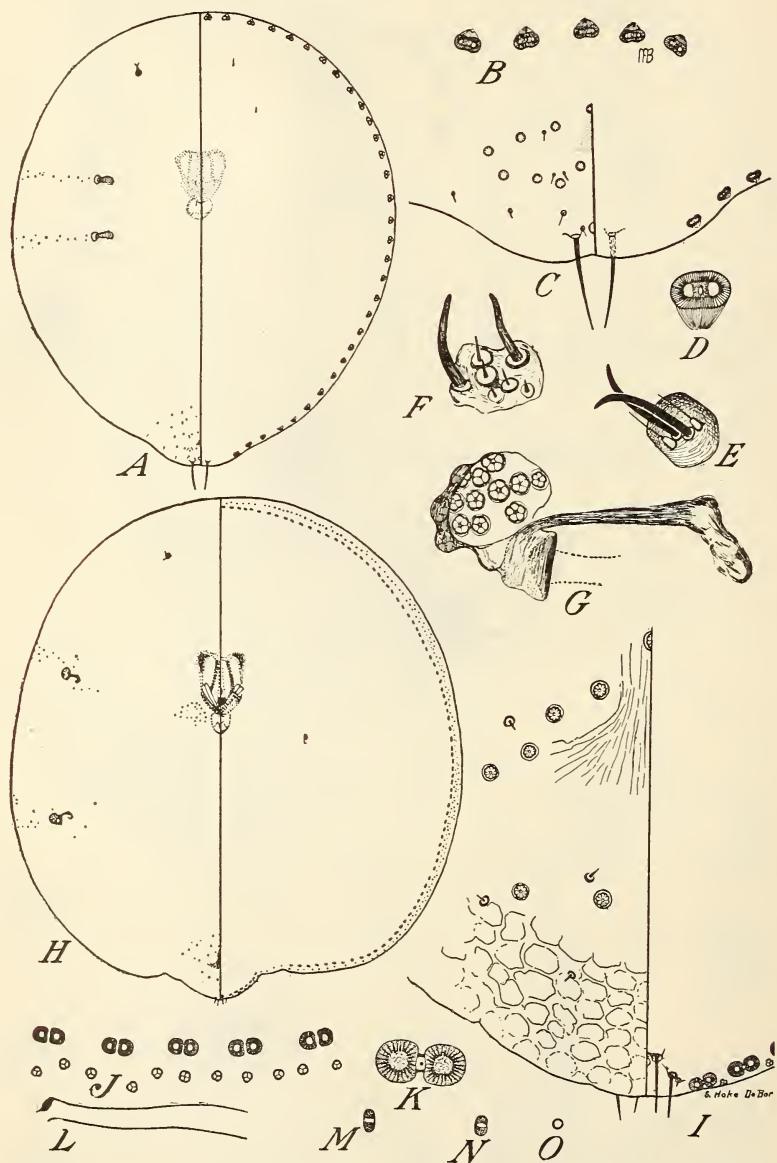


FIGURE 63.—*Asterolecanium semiseptulum*: A, outline,  $\times 120$ ; B, section of margin,  $\times 650$ ; C, genital and anal area,  $\times 460$ ; D, 8-shaped pore; E, antenna. *A. simile*: F, antenna; G, spiracle; H, outline,  $\times 87$ ; I, genital and anal area,  $\times 650$ ; J, section of margin,  $\times 650$ ; K, 8-shaped pore; L, tubular duct; M, minute dorsal 8-shaped pore; N, submarginal 8-shaped pore; O, disk pore.

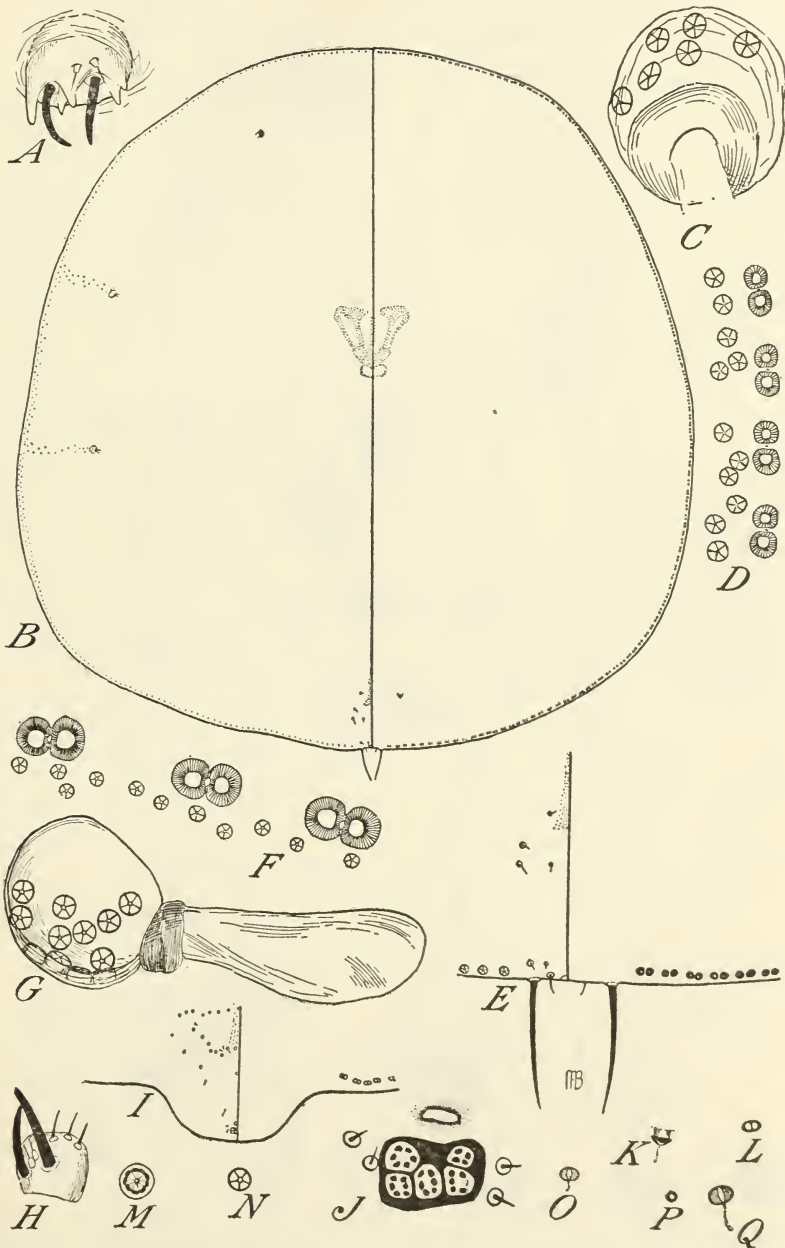


FIGURE 64.—*Asterolecanium simplex*: A, antenna; B, outline,  $\times 100$ ; C, spiracle; D, section of margin,  $\times 900$ ; E, genital and anal area,  $\times 230$ . *A. singularis*: F, section of margin,  $\times 900$ ; G, spiracle; H, antenna; I, genital and anal area,  $\times 165$ ; J, anal area; K, L, dark-rimmed 8-shaped pore, two views; M, multi-locular pore; N, quinquelocular pore; O, minute dorsal 8-shaped pore; P, disk pore; Q, submarginal 8-shaped pore.



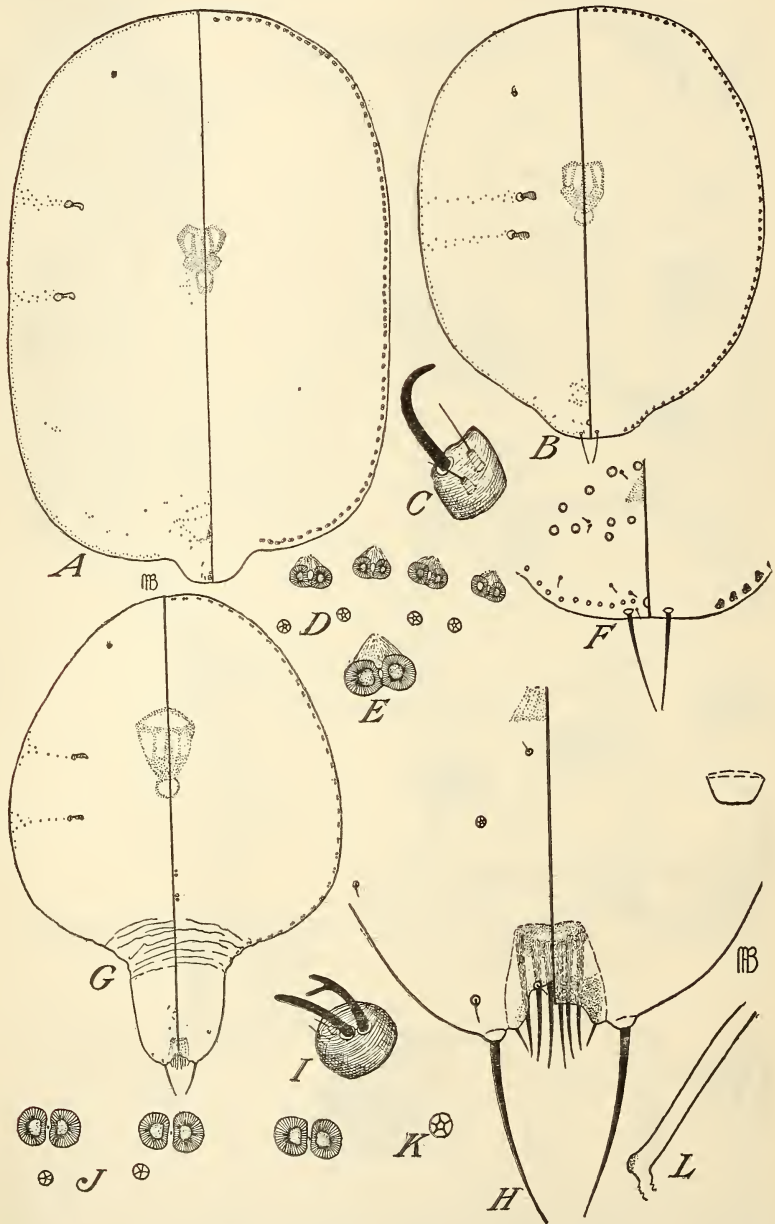


FIGURE 65.—*Asterolecanium singularis*: A, outline,  $\times 60$ . *A. skanianae*: B, outline,  $\times 60$ ; C, antenna; D, section of margin,  $\times 900$ ; E, 8-shaped pore; F, genital and anal area,  $\times 460$ . *A. solenophoroides*: G, outline,  $\times 60$ ; H, genital and anal area,  $\times 650$ ; I, antenna; J, section of margin; K, ventral quinquelocular pore; L, tubular duct.

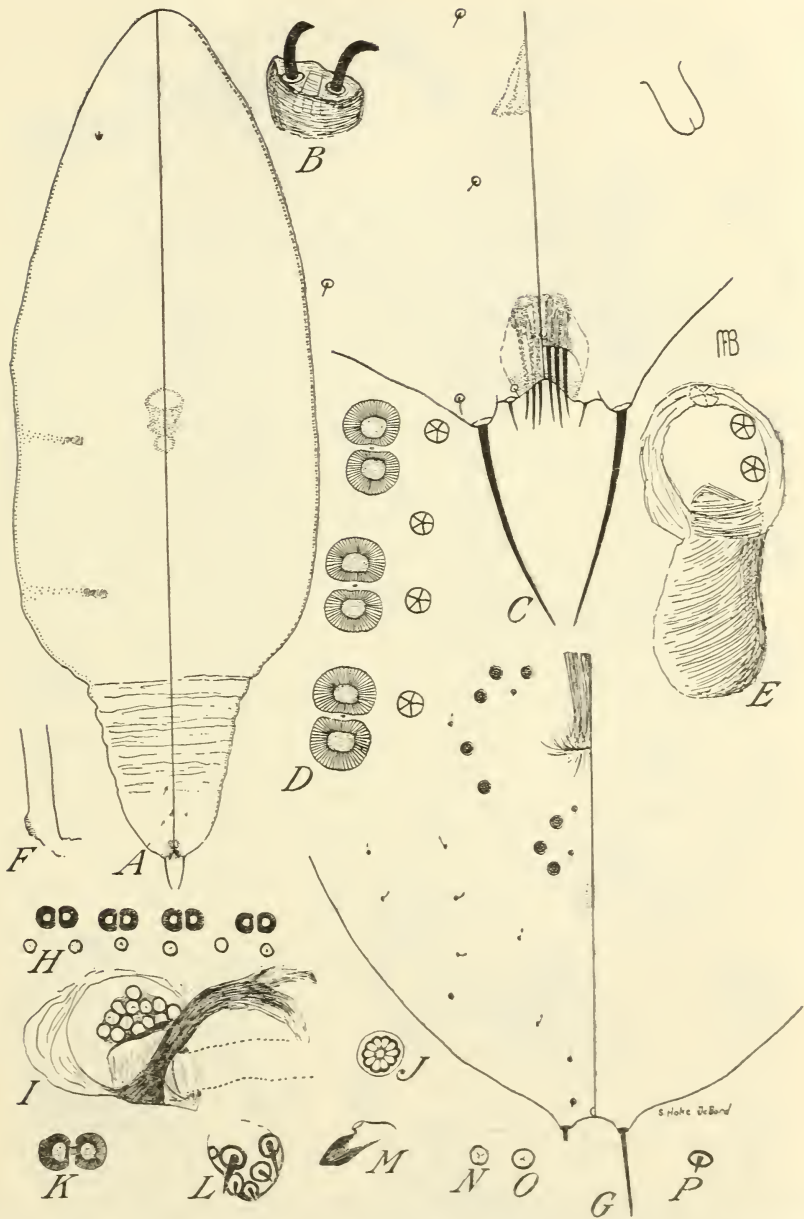


FIGURE 66.—*Asterolecanium sparus*: A, outline,  $\times 60$ ; B, antenna; C, genital and anal area,  $\times 460$ ; D, section of margin; E, spiracle; F, tubular duct. *A. spectabile*: G, genital and anal area,  $\times 460$ ; H, section of margin; I, spiracle; J, multilocular pore; K, 8-shaped pore; L, antenna; M, tubular duct; N, O, indistinctly trilobular pores; P, submarginal seta.

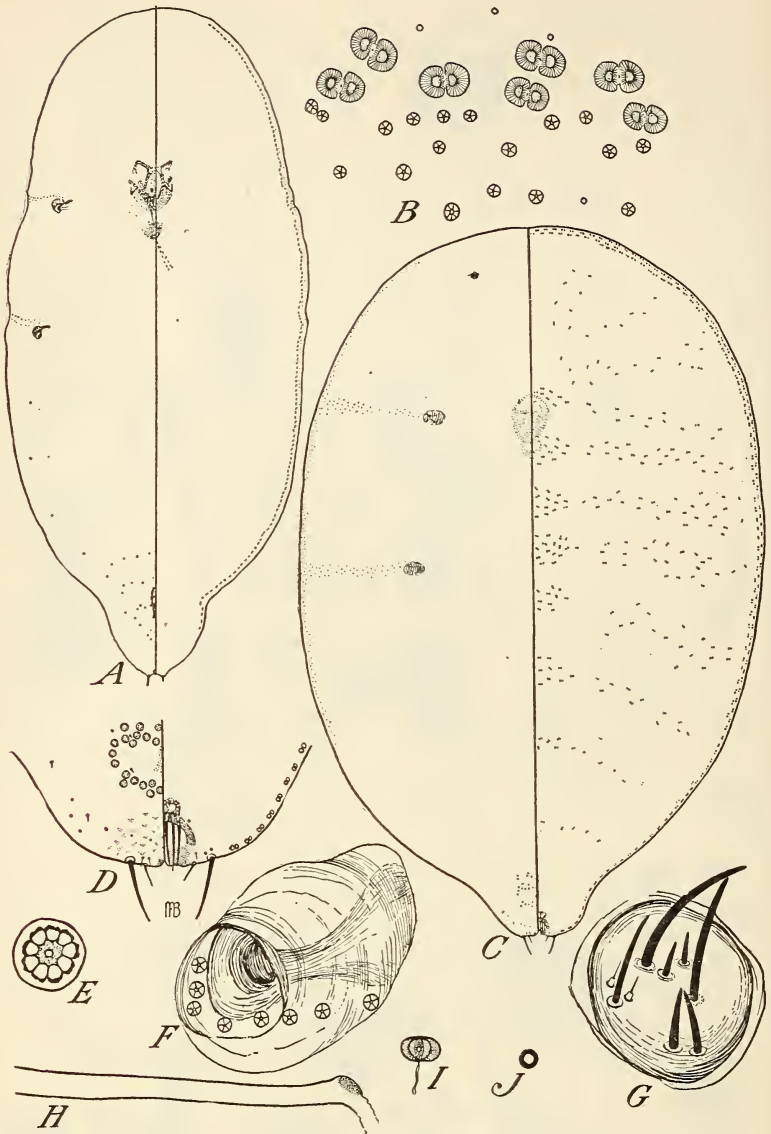


FIGURE 67.—*Asterolecanium spectabile*: A, outline,  $\times 87$ . A. *stentac*: B, section of margin,  $\times 650$ ; C, outline,  $\times 50$ ; D, genital and anal area,  $\times 165$ ; E, multilocular pore; F, spiracle,  $\times 900$ ; G, antenna; H, tubular duct; I, submarginal 8-shaped pore; J, disk pore.



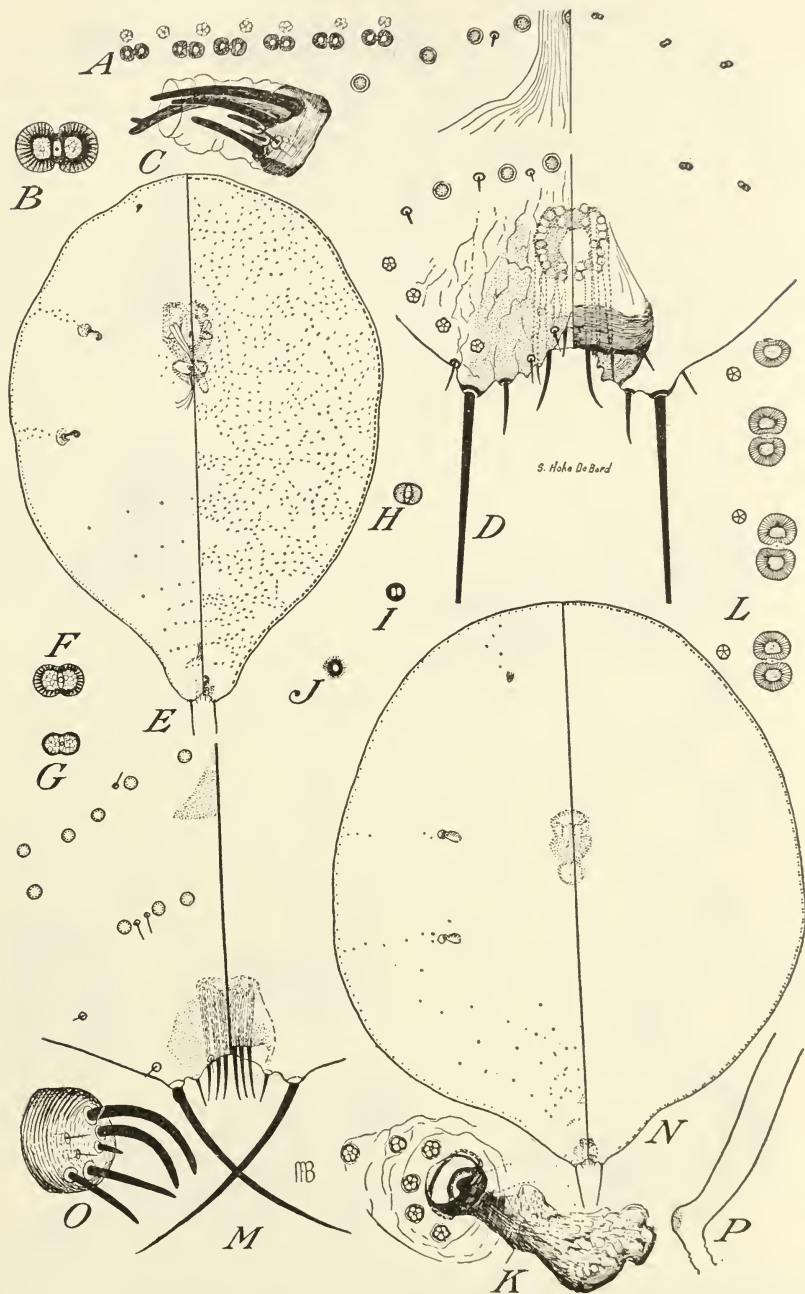


FIGURE 68.—*Asterolecanium striatum*: A, section of margin,  $\times 650$ ; B, marginal 8-shaped pore; C, antenna; D, genital and anal area,  $\times 650$ ; E, outline,  $\times 87$ ; F, G, dorsal 8-shaped pores; H, submarginal 8-shaped pore; I, dark-rimmed 8-shaped pore; J, disk pore; K, spiracle. *A. styphcliae*: L, section of margin,  $\times 900$ ; M, genital and anal area,  $\times 460$ ; N, outline,  $\times 60$ ; O, antenna; P, tubular duct.

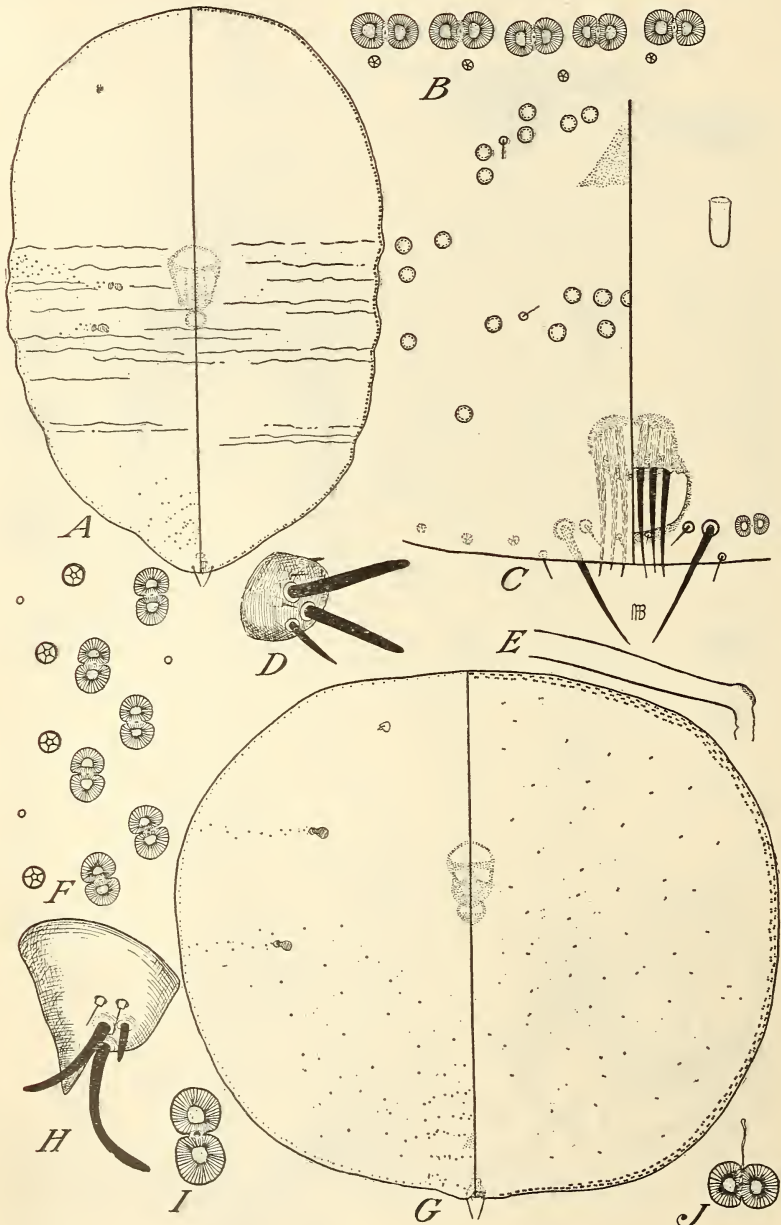


FIGURE 69.—*Asterolecanium subdolum*: A, outline,  $\times 60$ ; B, section of margin,  $\times 900$ ; C, genital and anal area,  $\times 650$ ; D, antenna; E, tubular duct. A. *subventuosum*: F, section of margin,  $\times 900$ ; G, outline,  $\times 60$ ; H, antenna; I, marginal 8-shaped pore; J, dorsal 8-shaped pore.

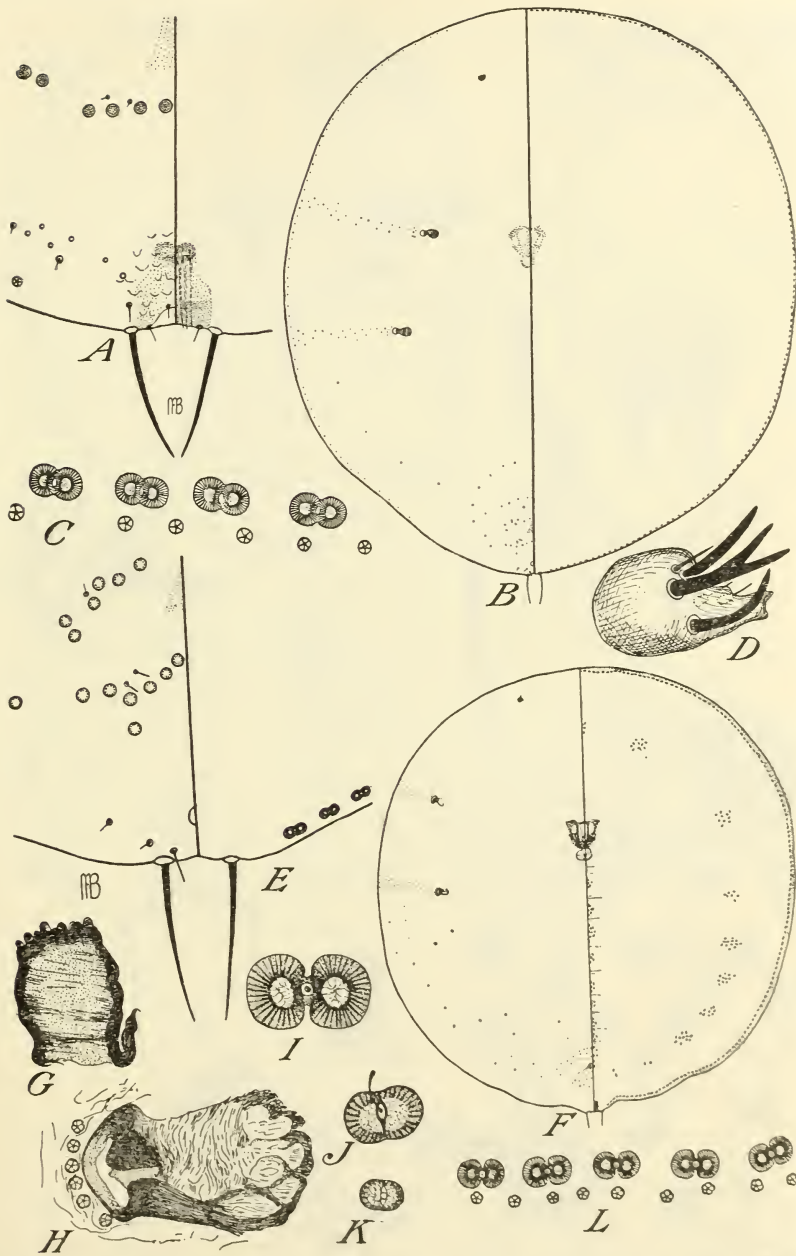


FIGURE 70.—*Asterolecanium subventruosum*: A, genital and anal area,  $\times 460$ . *A. suishac*: B, outline,  $\times 900$ ; C, section of margin,  $\times 650$ ; D, antenna; E, genital and anal area,  $\times 650$ . *A. sumatrac*: F, outline,  $\times 87$ ; G, antenna; H, spiracle; I, marginal 8-shaped pore; J, K, dorsal 8-shaped pores; L, section of margin,  $\times 650$ .



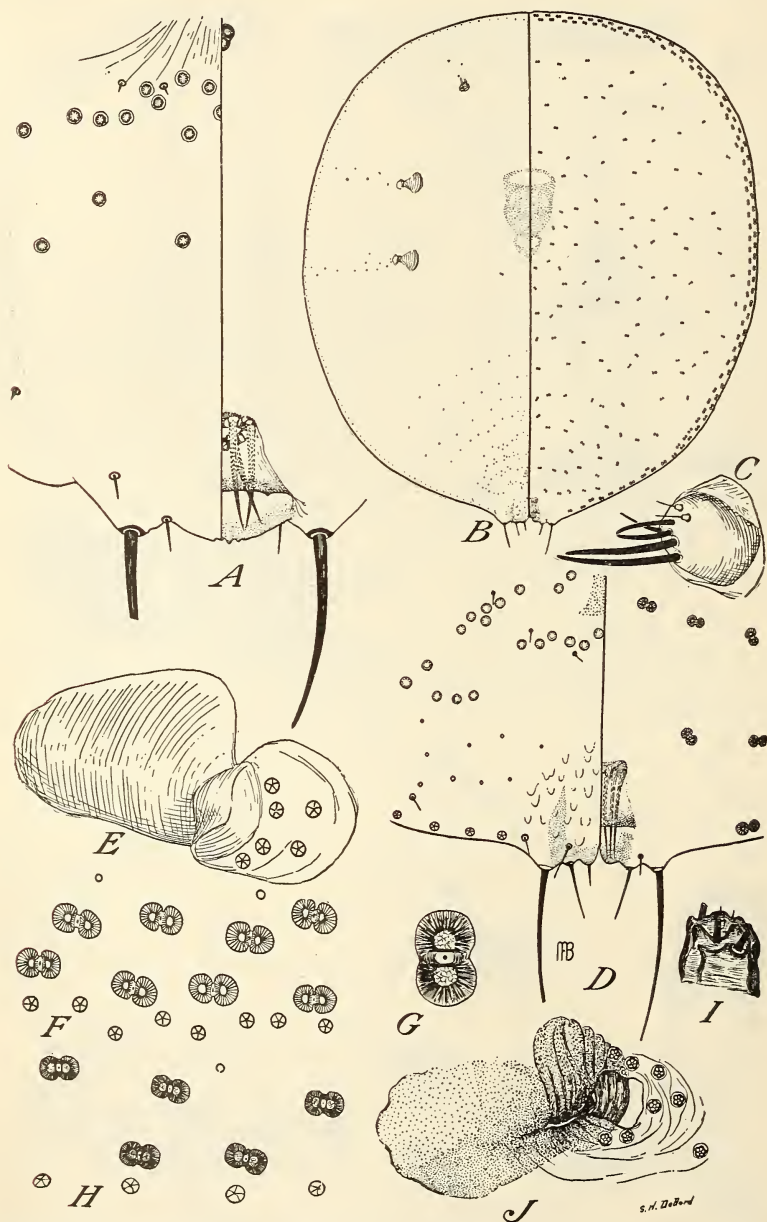


FIGURE 71.—*Asterolecanium sumatrae*: A, genital and anal area,  $\times 650$ . *A. thespesiae*: B, outline,  $\times 60$ ; C, antenna,  $\times 900$ ; D, genital and anal area,  $\times 330$ ; E, spiracle,  $\times 900$ ; F, section of margin,  $\times 650$ . *A. tokyonis*: G, marginal 8-shaped pore; H, section of margin,  $\times 650$ ; I, antenna,  $\times 650$ ; J, spiracle,  $\times 650$ .

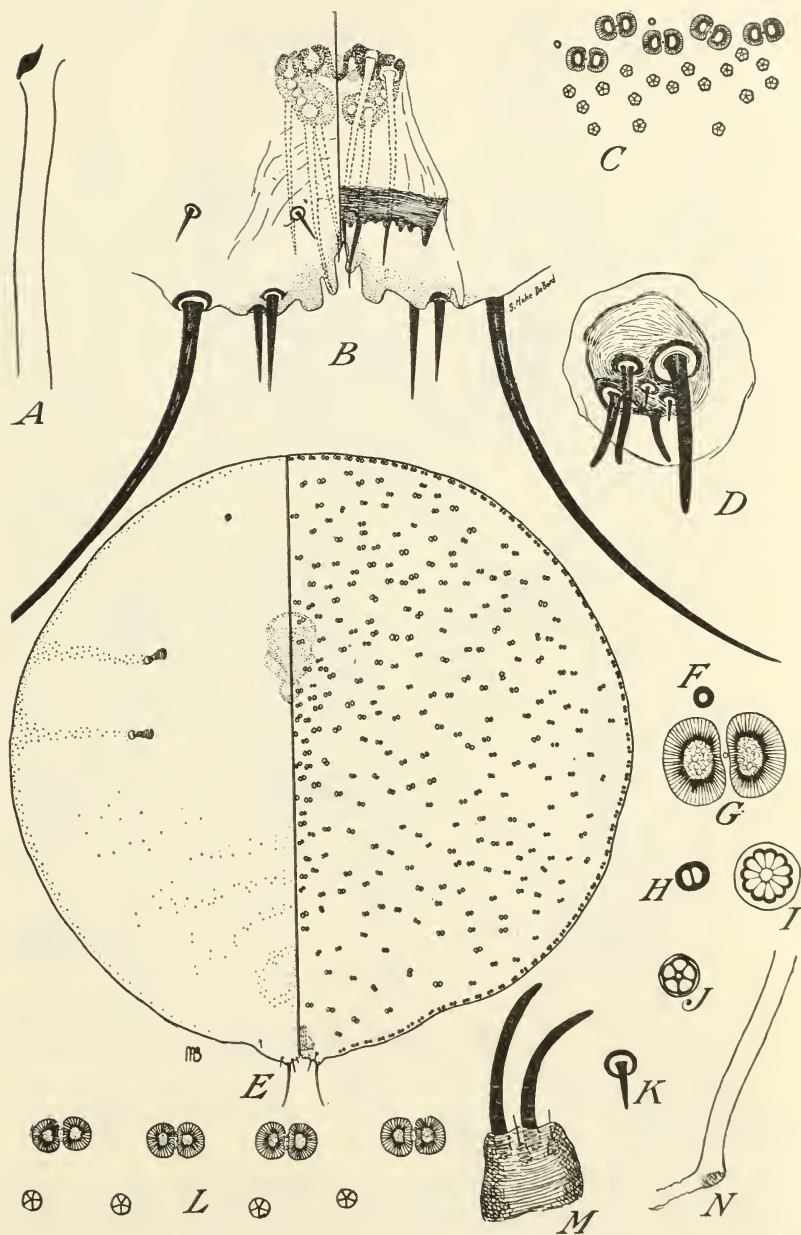


FIGURE 72.—*Asterolecanium townsendi*: A, tubular duct; B, anal area.  $\times 650$ ; C, section of margin.  $\times 460$ ; D, antenna; E, outline,  $\times 60$ ; F, disk pore; G, 8-shaped pore; H, dark-rimmed 8-shaped pore; I, multilocular pore; J, quinquelocular pore; K, submarginal seta. *A. transversum*: L, section of margin,  $\times 900$ ; M, antenna; N, tubular duct.

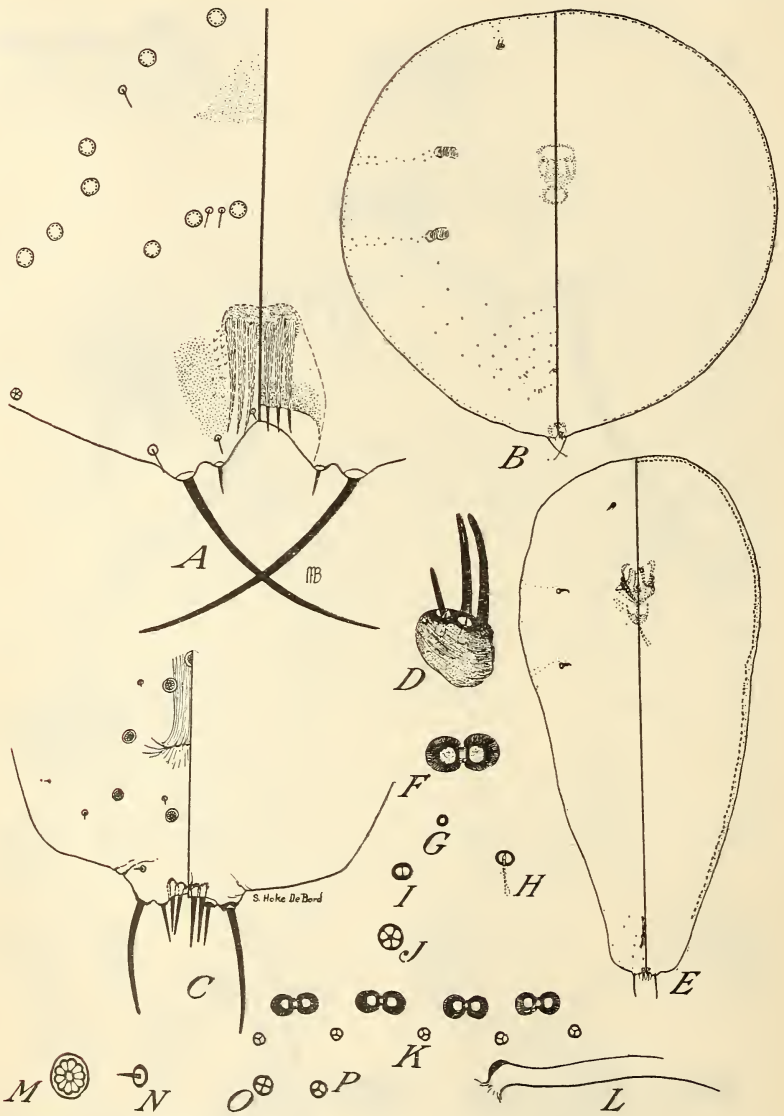


FIGURE 73.—*Asterolecanium transversum*: A, genital and anal area,  $\times 650$ ; B, outline,  $\times 60$ . *A. bondari*: C, genital and anal area,  $\times 460$ ; D, antenna; E, outline,  $\times 87$ ; F, 8-shaped pore; G, disk pore; H, submarginal 8-shaped pore; I, dark-rimmed 8-shaped pore; J, quinquelocular pore; K, section of margin; L, tubular duct; M, multilocular pore; N, submarginal seta; O, quadrilocular pore; P, trilocular pore.



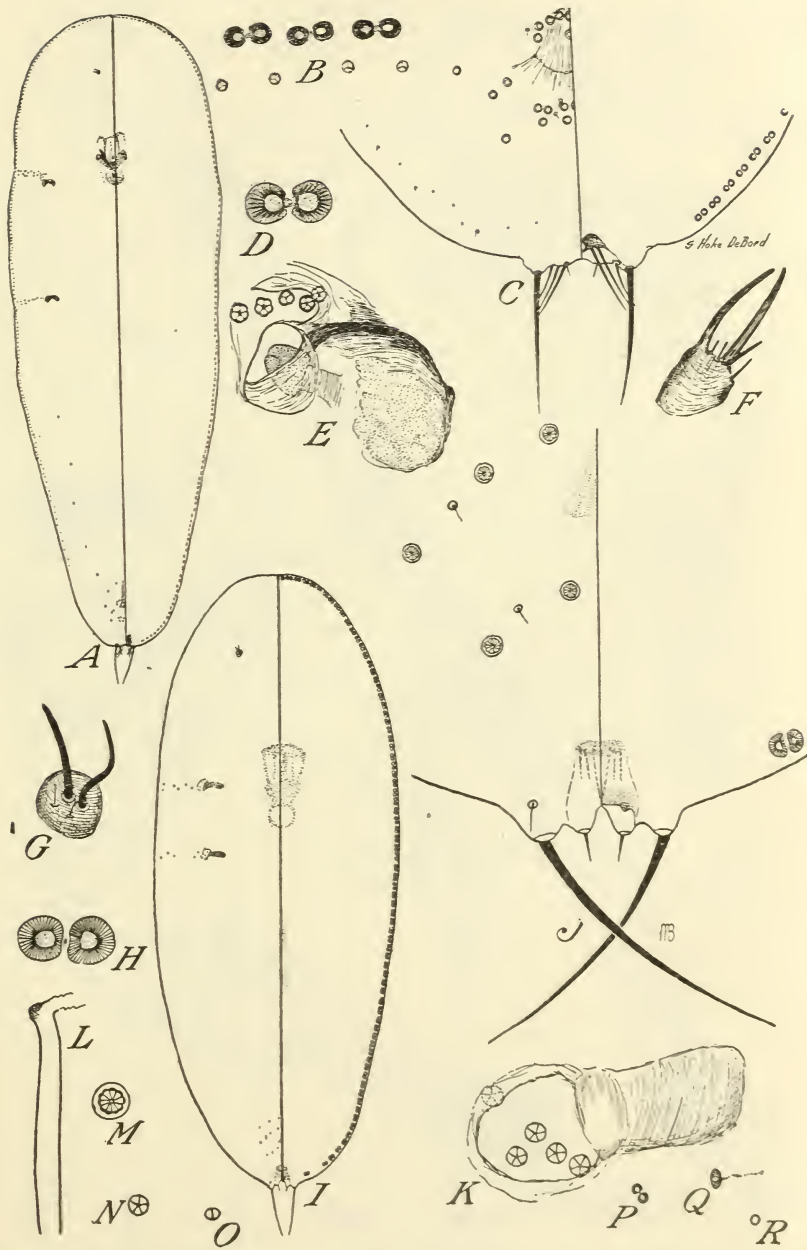


FIGURE 74.—*Asterolecanium truncatum*: A, outline,  $\times 60$ ; B, section of margin,  $\times 900$ ; C, genital and anal area,  $\times 345$ ; D, 8-shaped pore; E, spiracle; F, antenna. *A. udagamae*: G, antenna; H, 8-shaped pore; I, outline,  $\times 100$ ; J, genital and anal area,  $\times 650$ ; K, spiracle; L, tubular duct; M, multiloocular pore; N, quinquelocular pore; O, dark-rimmed 8-shaped pore; P, minute dorsal 8-shaped pore; Q, submarginal 8-shaped pore; R, disk pore.

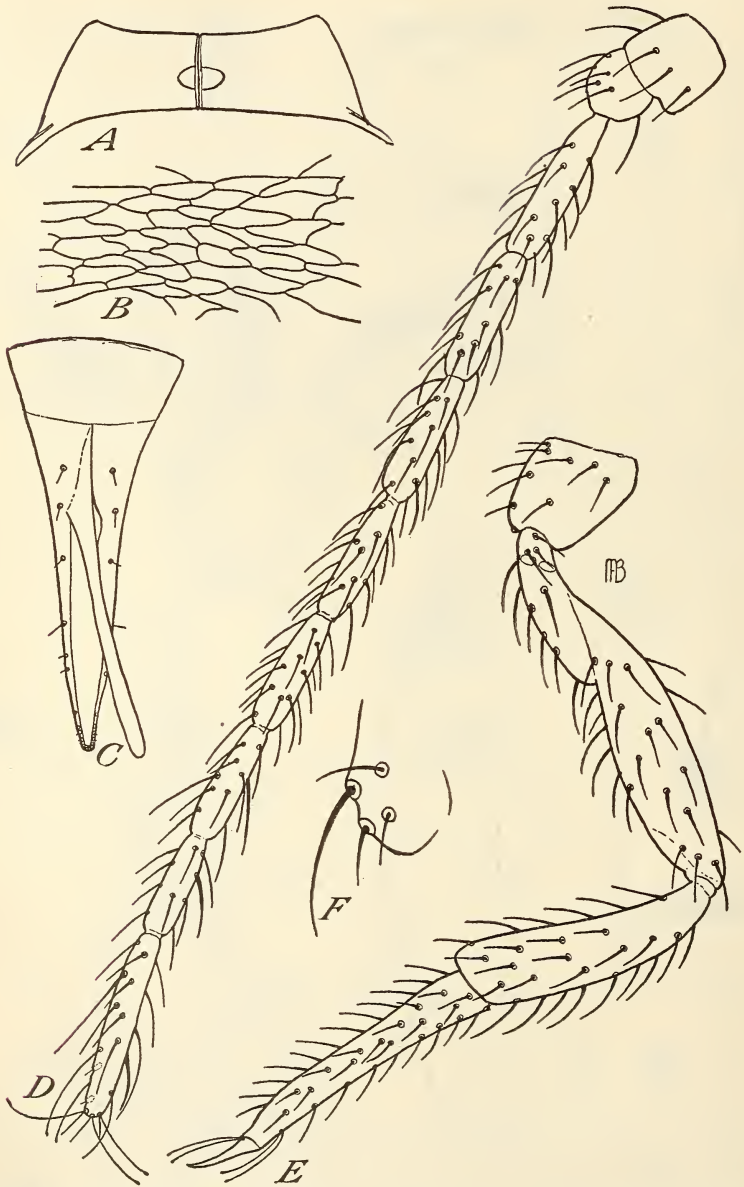


FIGURE 75.—*Asterolecanium unguatum*, adult male: A, bar between wing bases,  $\times 220$ ; B, section of reticulate area of derm,  $\times 900$ ; C, ventral view of penis sheath and penis,  $\times 220$ ; D, antenna,  $\times 220$ ; E, leg,  $\times 220$ ; F, lobe area of abdomen,  $\times 900$ .

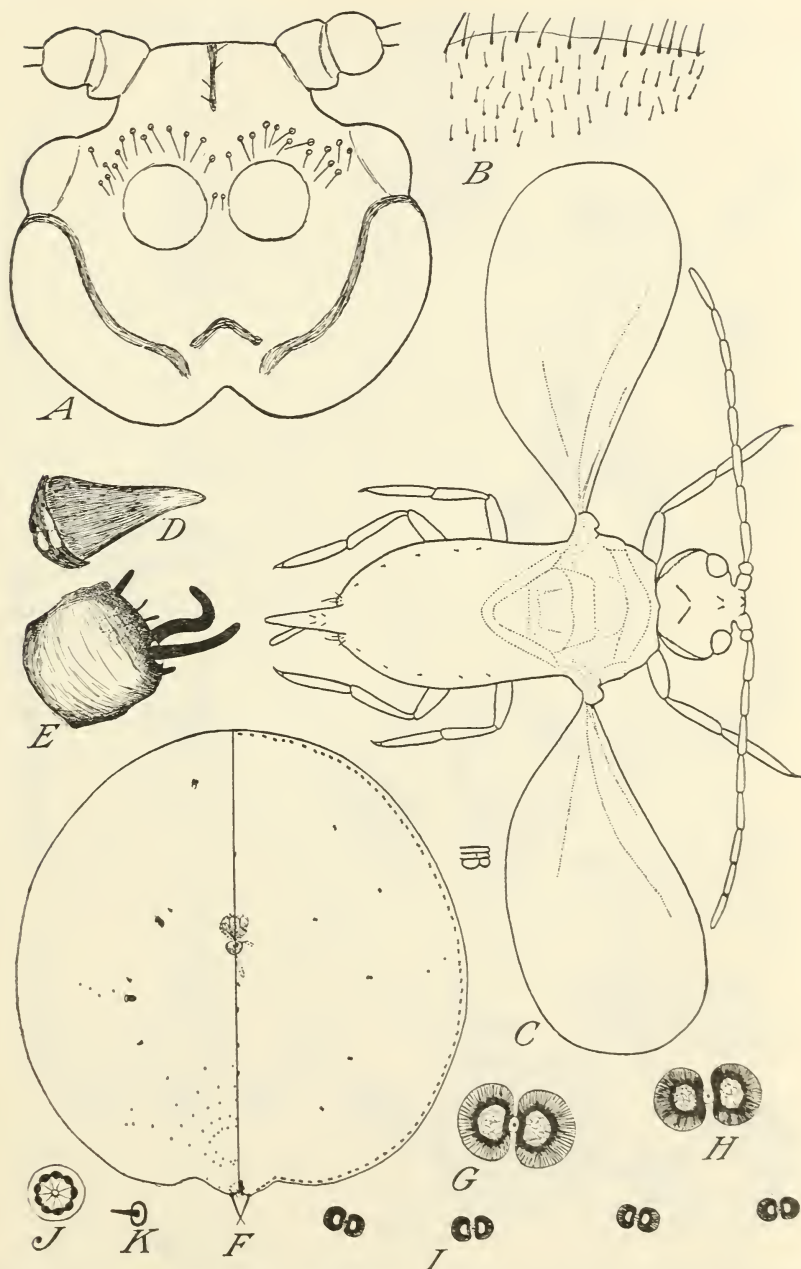


FIGURE 76.—*Asterolecanium unguatum*, adult male: A, ventral surface of head,  $\times 220$ ; B, margin of wing; C, outline, dorsal surface. *A. unguatum*, adult female: D, claw; E, antenna; F, outline,  $\times 60$ ; G, dorsal 8-shaped pore; H, marginal 8-shaped pore; I, section of margin,  $\times 650$ ; J, multilocular pore; K, submarginal seta.



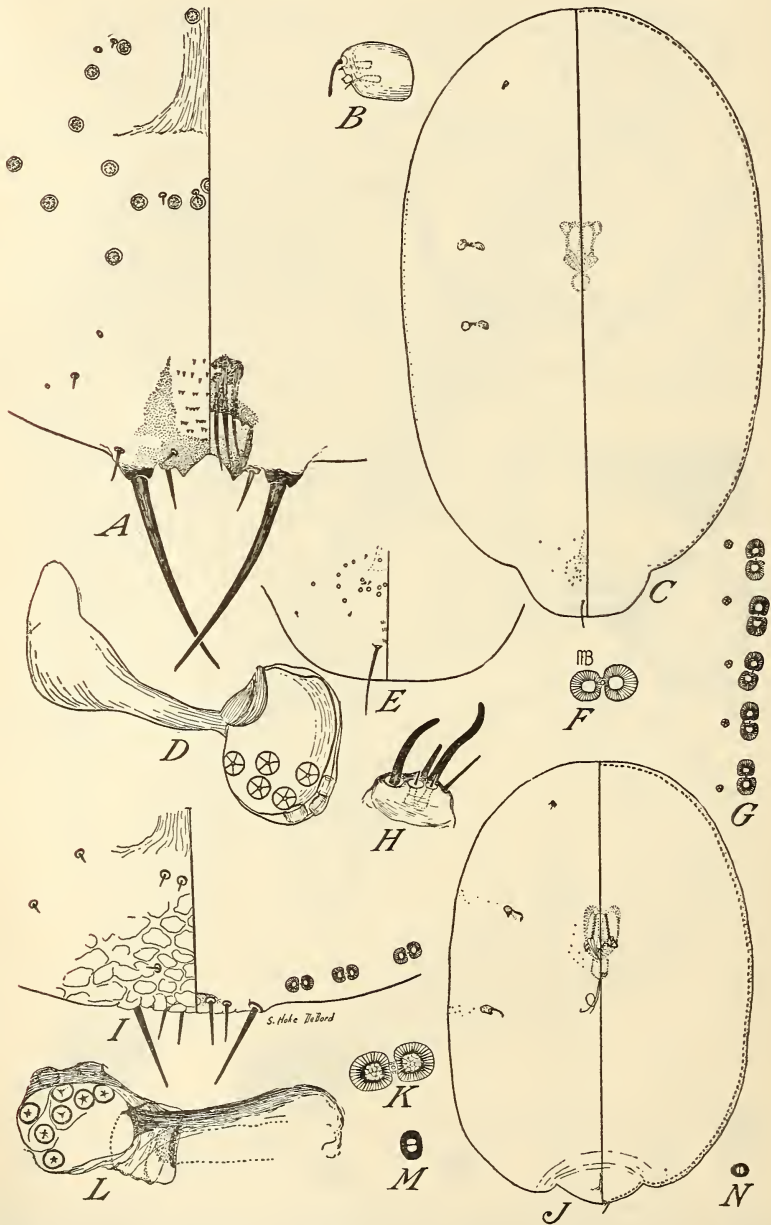


FIGURE 77.—*Asterolecanium unguatum*: A, genital and anal area,  $\times 460$ . *A. unicum*: B, antenna; C, outline,  $\times 60$ ; D, spiracle; E, genital and anal area,  $\times 345$ ; F, 8-shaped pore. *A. urichi*: G, section of margin,  $\times 825$ ; H, antenna; I, genital and anal area,  $\times 650$ ; J, outline,  $\times 87$ ; K, 8-shaped pore; L, spiracle; M, dark-rimmed 8-shaped pore near beak; N, dark-rimmed 8-shaped pore on abdomen.

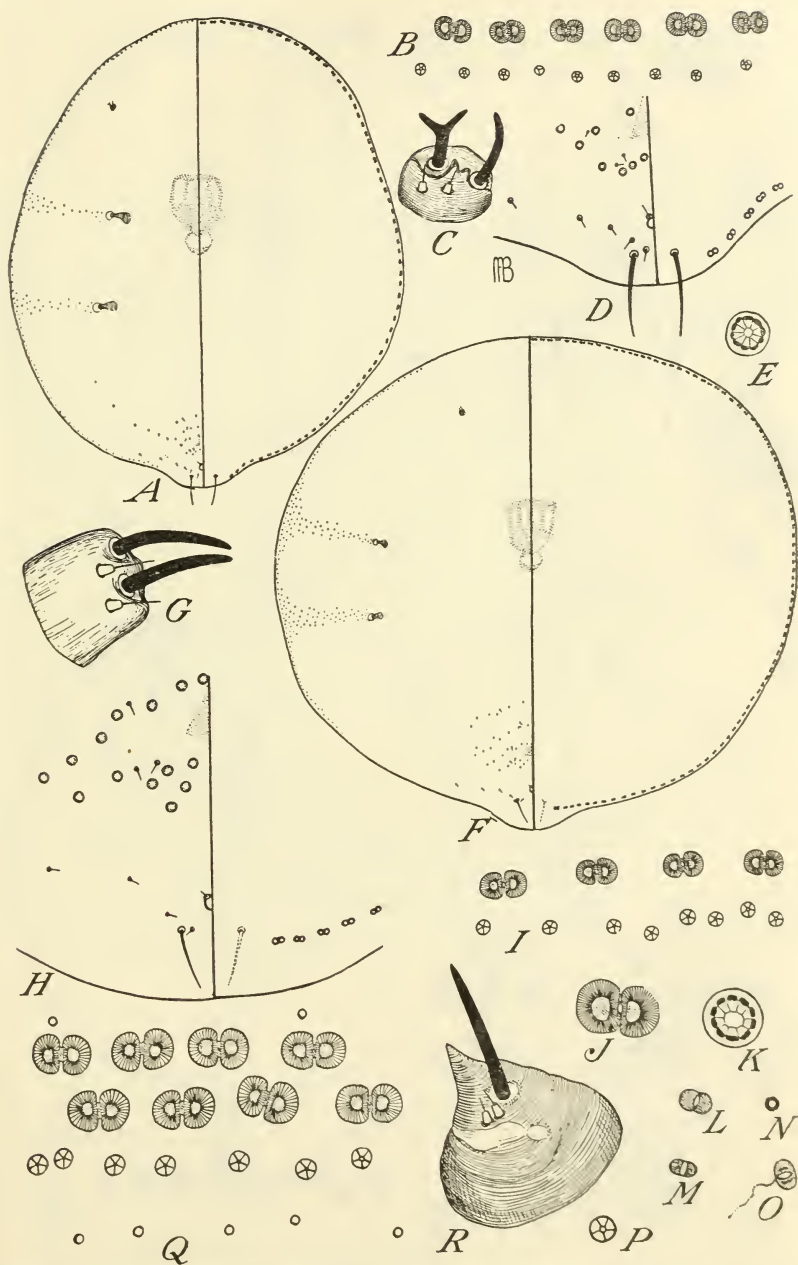


FIGURE 78.—*Asterolecanium variable*: A, outline,  $\times 100$ ; B, section of margin,  $\times 650$ ; C, antenna; D, genital and anal area,  $\times 345$ ; E, multilocular pore. *A. variolosum*: F, outline,  $\times 60$ ; G, antenna; H, genital and anal area,  $\times 460$ ; I, section of margin,  $\times 730$ ; J, 8-shaped pore; K, multilocular pore; L, M, minute dorsal 8-shaped pores; N, disk pore; O, submarginal 8-shaped pore; P, quinquelocular pore. *A. ventuosum*: Q, section of margin,  $\times 900$ ; R, antenna.

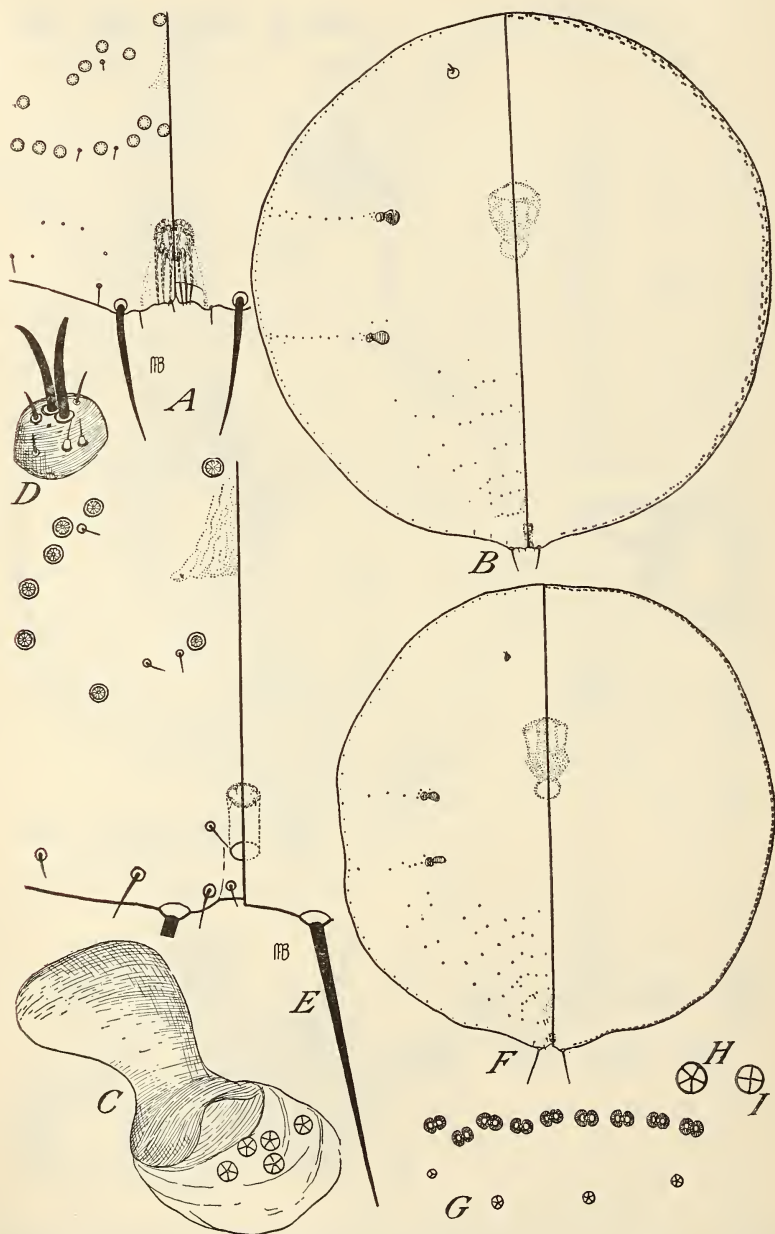


FIGURE 79.—*Asterolecanium ventuosum*: A, genital and anal area,  $\times 460$ ; B, outline,  $\times 60$ ; C, spiracle,  $\times 900$ . *A. victoriac*: D, antenna; E, genital and anal area,  $\times 650$ ; F, outline,  $\times 60$ ; G, section of margin,  $\times 330$ ; H, quinquelocular pore; I, quadrilocular pore.



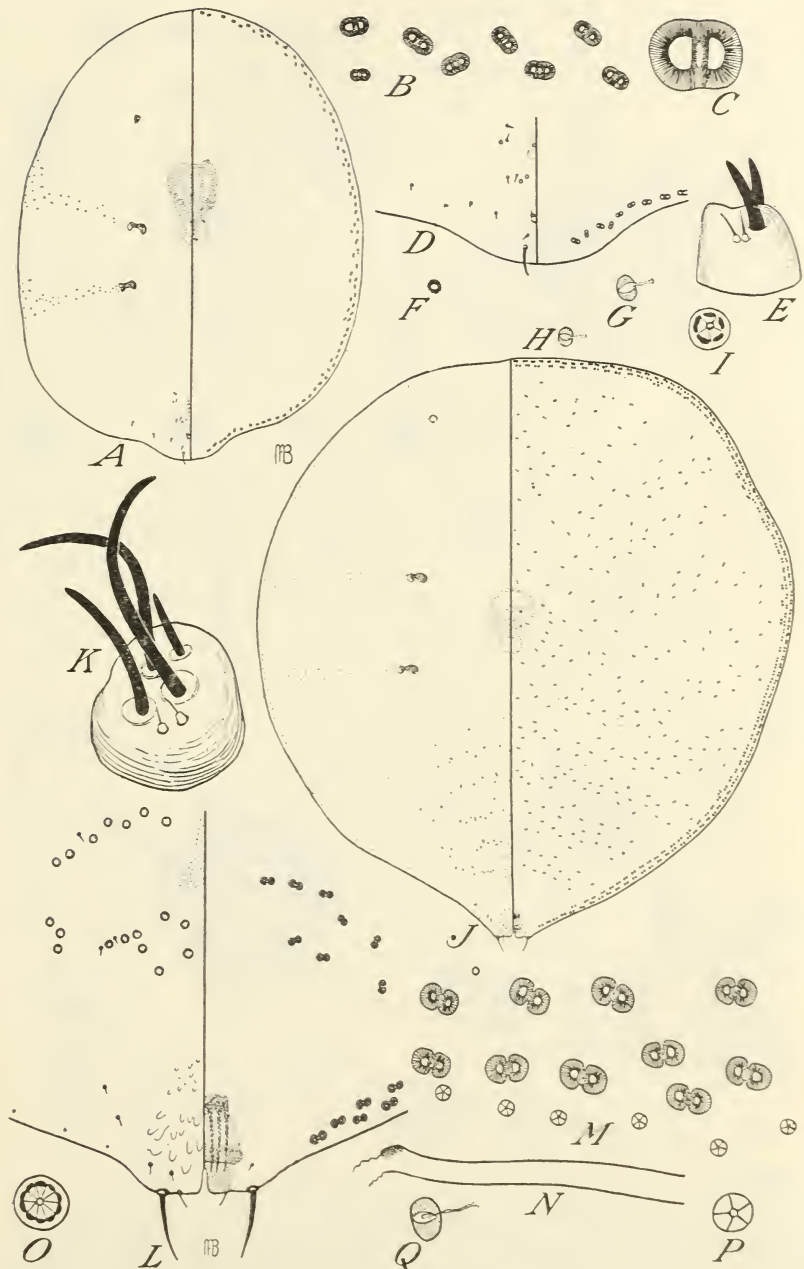


FIGURE 80.—*Asterolecanium viennae*: A, outline,  $\times 87$ ; B, section of margin,  $\times 230$ ; C, 8-shaped pore; D, genital and anal area,  $\times 165$ ; E, antenna; F, disk pore; G, submarginal 8-shaped pore; H, minute dorsal 8-shaped pore; I, ventral quinquelocular pore. *A. viridulum*: J, outline,  $\times 50$ ; K, antenna; L, genital and anal area,  $\times 165$ ; M, section of margin,  $\times 700$ ; N, tubular duct; O, multilocular pore; P, quinquelocular pore; Q, submarginal 8-shaped pore.

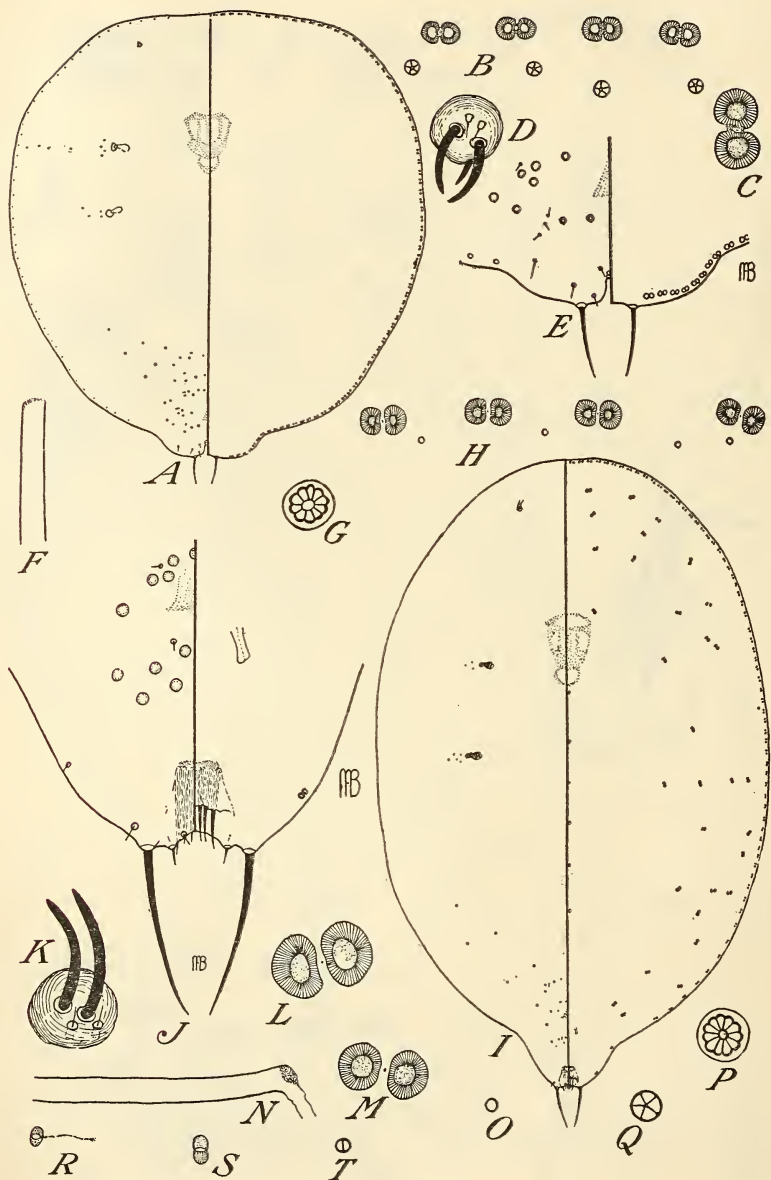


FIGURE 81.—*Asterotelecanium vitreum*: A, outline,  $\times 60$ ; B, section of margin,  $\times 650$ ; C, 8-shaped pore; D, antenna; E, genital and anal area,  $\times 230$ ; F, tubular duct; G, multilocular pore. *A. vulgare*: H, section of margin,  $\times 900$ ; I, outline,  $\times 60$ ; J, genital and anal area,  $\times 460$ ; K, antenna; L, dorsal 8-shaped pore; M, marginal 8-shaped pore; N, tubular duct; O, disk pore; P, multilocular pore; Q, quinquelocular pore; R, submarginal 8-shaped pore; S, minute dorsal 8-shaped pore; T, dark-rimmed 8-shaped pore.

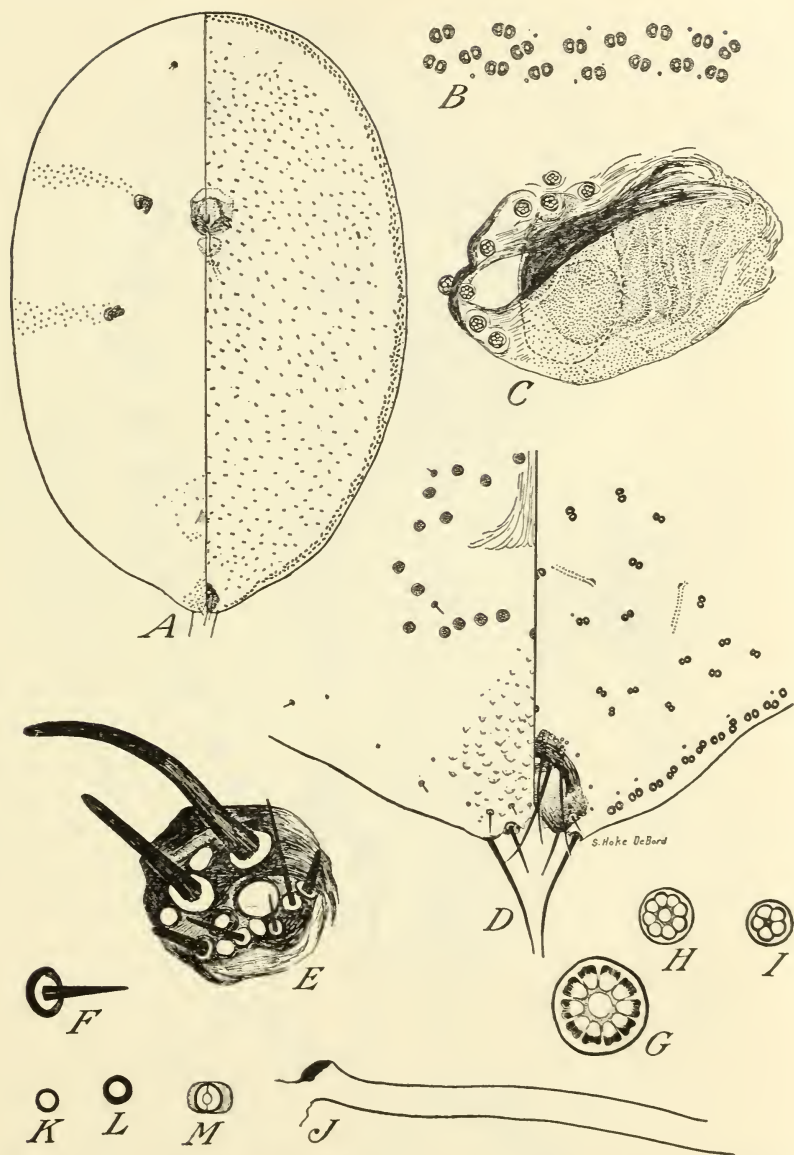


FIGURE 82.—*Asterolecanium zanthenes*: A, outline,  $\times 50$ ; B, section of margin,  $\times 230$ ; C, spiracle,  $\times 650$ ; D, genital and anal area,  $\times 165$ ; E, antenna; F, submarginal seta; G, abdominal multilocular pore; H, spiracular multilocular pore; I, spiracular quinquelocular pore; J, tubular duct; K, L, disk pores; M, submarginal 8-shaped pore.



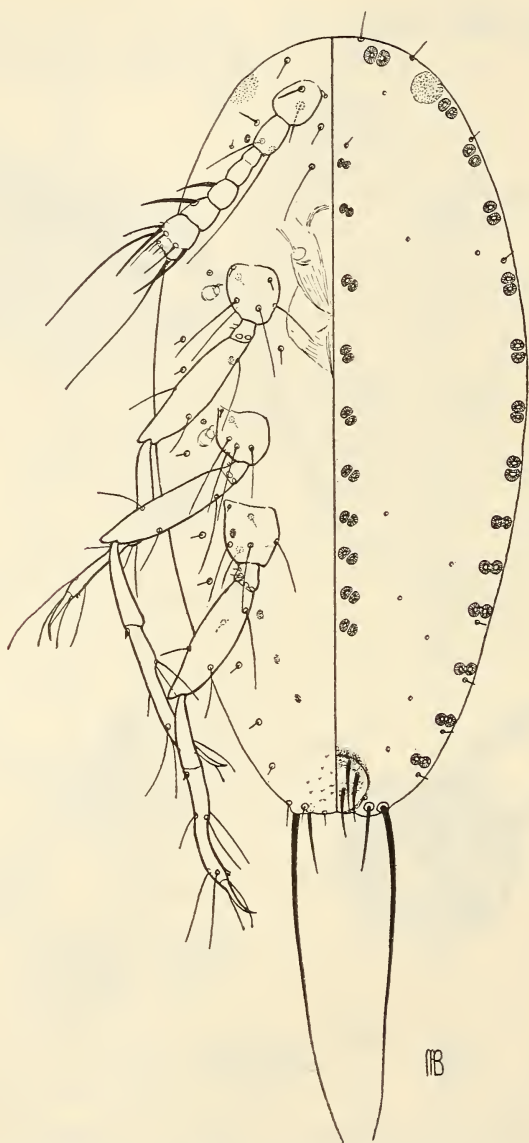


FIGURE 83.—*Asterolecanium zanthenes*, larva: A, outline,  $\times 220$ .

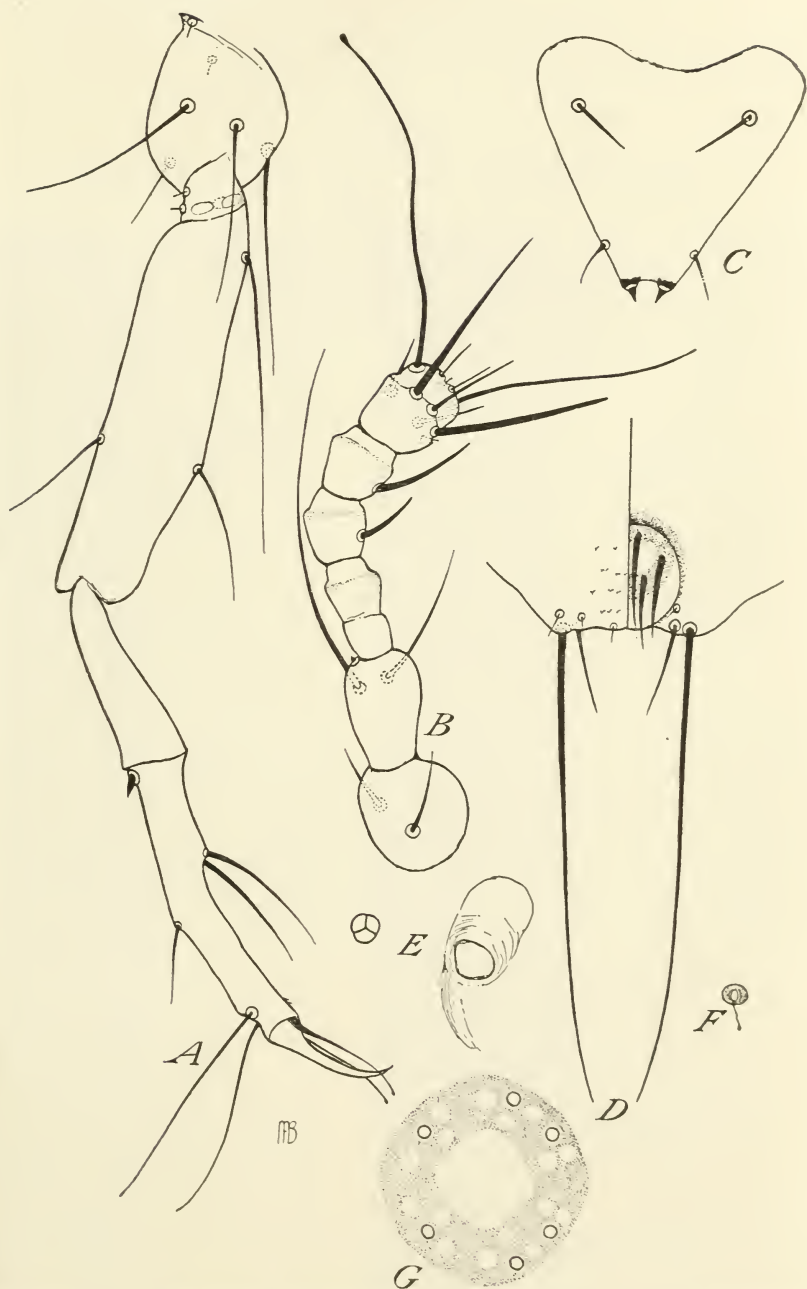


FIGURE 84.—*Asterolecanium zanthenes*, larva: A, posterior leg; B, antenna; C, beak; D, apex of abdomen; E, spiracle and pore; F, submarginal 8-shaped pore; G, anal ring.





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(Valid names are in roman type, synonyms and nomina nuda in italics.)

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