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REPORT UPON SCALE INSECTS COLLECTED IN CHINA (HOMOPTERA: COCCOIDEA). PART I.

Figures 1-20

by

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INTRODUCTION

Following upon the Second World War the United States sold surplus war materials to a considerable number of nations. Under an Act introduced into the Senate by Senator Fulbright of Arkansas, it was provided that payment for these materials should be utilized for the purpose of an exchange of scientific and scholarly personnel between these nations and the United States. This Act is commonly known as the Fulbright Act and the funds involved as the Fulbright Funds. The funds have been administered through agencies set up by the Department of State of the United States, cooperatively with each of the nations involved.

The first two countries with which agreements were concluded were China and Burma, the agreements being announced early in 1948. Shortly thereafter I presented to the Division of Exchange of Persons of the State Department a project involving a grant for the purpose of collecting scale insects in China and was accorded such a grant. The papers to be presented in this series will represent some of the results of the work thus made possible.

Through the kindness of Dr. J. L. Gressitt, of Lingnan University at Canton, China, arrangements were made by which an association with that University was established and facilities were offered by the University for the furtherance of my work. I arrived at Lingnan on the 17th of October, 1948, and left the political boundaries of China on May 23, 1949.

It is the intention in this paper to perform first of all the very pleasant duty of acknowledging the assistance from various sources which made possible my work in China. Following this a brief account of my journey will be given. Third, a brief summary will be presented concerning what has previously been known concerning the scale insects of China. And last, a beginning will be made in reporting upon the material secured by me.

ACKNOWLEDGMENTS

I wish first to express my appreciation to the Division of Exchange of Persons of the Department of State of the United States, through which the grant for my work in China was made and to the representatives of the United States Educational Foundation in China through whom the funds were

administered. I may especially mention the courtesies of Mr. George L. Harris, then attached to the United States Embassy in Nanking.

Second only to the acknowledgments due to the Department of State are those due to the authorities of Lingnan University, specifically to Dr. Henry Frank, Provost of the University and Director of the American Foundation which then looked after the interests of Americans associated with the institution. Acknowledgments are due not only for the laboratory and living facilities provided for me but also for the kindness with which I was received as a member of the community and for aid extended in connection with the involved financial transactions which, during the period of my residence, were encountered by all who had occasion to deal with Chinese money.

Dr. J. L. Gressitt—in addition to the assistance previously noted—gave unstinted aid by accompanying me on various expeditions and acting as interpreter and in many other ways. Without his help but little would have been accomplished.

Professor Tsing-chao Maa, of the Agricultural Research Institute at Taipeh, Taiwan, devoted a month of his vacation to accompanying me about Taiwan, acting as interpreter and general business manager and assisting very materially in my collecting, as well as according me the hospitality of his home for several days.

Mr. I. P. Tamworth, of the Forestry Department of Hong Kong, assisted me in numerous ways, most especially by arranging with Mr. and Mrs. A. O. Barretto, of Fanling in the New Territories, to take my wife and myself into their home for several days at a time when it was difficult to secure accommodations in Hong Kong. I am greatly indebted to Mr. and Mrs. Barretto for their kindness and many courtesies.

Professor Yun-chun Hsu, of the Department of Forestry of Yunnan University, accompanied us for two weeks as interpreter while we were at Kunming, and his knowledge of the trees and shrubs of Yunnan Province made it possible to obtain identification of most of the hosts from which scale insects were secured in that area.

Dr. and Mrs. Carl Fredericks, of the Forman Memorial Hospital at Yeung Kong, accorded to us the hospitality of their home, this making possible a productive period of collecting in an area that could not have otherwise been visited.

Mr. Robert Yoder, junior Vice-Consul at Kunming, and Mrs. Yoder are especially to be remembered and thanked for the many courtesies extended to us while we were in Kunming.

Mr. J. K. Cochran, at Canton, and Mr. Richard Conlon, at Taipeh in Formosa, both members of the United States Information Service and acting as representatives of the United States Educational Foundation in China, aided me in numerous ways—Mr. Cochran especially so in the transmission of funds.

It is only through the kindness and hospitality of persons such as those mentioned that a collector like myself, unacquainted with the languages or the customs of the country and required by the nature of his work to get about as much as possible, can accomplish anything in a country such as China. However much he may desire to stand upon his own feet and not to impose upon others, he is compelled to rely in large measure upon the aid of those of long residence in the country. That aid was given to me ungrudgingly and I can only express my hope that I did not at any time unduly strain the kindness of anyone or leave any debt unpaid. There still remains, however, the enduring debt of appreciation which can only be paid by an attempt to make the results achieved of value to others in the future.

ITINERARY

The following account of the various places at which collecting was done is not intended as a mere travelogue. The material which was obtained represents one of the largest collections of scale insects that has come out of Asia and it is to be expected that a very considerable extension of our knowledge of the scale insects of that continent will eventually result from it. Consequently, future workers may very well desire to know where the material came from and perhaps something of the conditions under which it was collected. The principal emphasis in this account will be on the identification of the places from which material was secured.

A collector, entering southeastern China for the first time, cannot fail to be impressed by the extent to which most of the country has been stripped of its woody vegetation and by the barrenness of the mountains, even to their tops. The country has been thickly populated by man for some thousands of years and the pressure for fuel has been so extreme that even the coarse grasses and the smaller shrubs have been largely cleared away even on the nonagricultural lands. It is only because of certain religious customs and beliefs that any noteworthy representation of the woody plants has been preserved. In connection with almost every village there exists a small "feng shui" or divination grove in which at least a few of the native tree and shrub species remain. But the most important collecting areas are about the temples, both Buddhist and Taoist, for the native forest is to at least some degree preserved on the lands belonging to and immediately surrounding them. The original builders of these temples in many cases seem to have sought for relatively inaccessible areas on which to build and have preserved the immediate surroundings, as far as possible, from destruction. In connection with this they have incidentally preserved many of the natural beauties of China. It is quite true that there exist areas far up in the mountains where extensive areas of native vegetation still remain, but visits to such areas present a very difficult problem to the collector, especially to one whose time is limited.

One other factor enters into determining the points at which collecting may be done. Most of the temples will take in a traveler and afford him a place where he can sleep and eat. So the temple areas represent the most important points toward which activities must be directed; and since these temples are at times far removed from cities, the efficiency of collecting is reduced by the various exigencies of travel, especially in troubled times such as those which prevailed during my visit to China.

During the greater part of my stay in China, Lingnan University served as headquarters from which trips of various lengths could be made to favorable localities. Fortunately, the campus of the University itself constituted such a locality. The University is just outside of Canton on Honam Island, one of the hundreds of islands of the Canton Delta. The campus of the University occupies nearly a square mile and for perhaps thirty years the process of planting it with trees and shrubs has gone on, so that now it is beautifully wooded with both native and introduced vegetation. The vegetation has now been there long enough to have acquired a large scale insect fauna and very extensive collections were possible.

A few short expeditions were made from Lingnan to places relatively near by. To the northeast of Canton, distant about 25 miles, is the village of Lo-kong-tung, about which a considerable amount of vegetation is preserved, especially in the rather extensive village grove, and two trips were made to this village. Also two minor trips were made by outboard motor-boat to areas at a distance of perhaps fifteen miles in the Canton Delta, although these expeditions were not especially profitable.

Two trips were made to the Buddhist establishment, technically a combined temple and nunnery, at Fei-ha, on the North River, (Pei-kiang) northwest of Canton at a distance of perhaps 65 miles. Here is a very nice area of forest, which, however, has suffered from the cutting of the smaller shrubs which are sold for fuel. The first trip to Fei-ha lasted for but two days and was interfered with by bad weather but the second trip extended over four or five days and was extremely profitable.

Returning from Fei-ha it was necessary on one occasion to wait for several hours at the station of Ngan-tsan-an on the railway perhaps thirty or forty miles northwest of Canton and the opportunity was taken for collecting. While the total amount of vegetation left in that area is not large, some very satisfactory collecting was possible.

Another area visited from Canton was the temple at Deng-wu Shan on the West River (Si-kiang) almost a hundred miles west of Canton, the trip being made by river boat. Here is a quite extensive area of apparently almost undisturbed forest and excellent collecting was obtained over a period of five days.

On March 27, 1949, accompanied by my wife who had joined me on March 3, we left Canton and went by river-boat and motor-bus to the town of Yeung Kong which is on the coast to the westward of Macao. It had been hoped that this locality would be within the northward extension of the more tropical Indo-China flora but this hope was not realized. The region is almost completely stripped of trees and shrubs and only the small village groves remain to give any indication of the native woody vegetation. The road to the westward, which in ordinary times might have been followed almost to the Indo-China border, was cut off by banditry and it was impossible to proceed further. In spite of its limitations, however, the collecting in such groves as remained at Yeung Kong was good and a rather considerable collection was obtained. We

left Yeung Kong on March 27 to return to Canton.

On April 22 we left Canton by plane for Kunming in Yunnan Province. Even here, in the very interior of China, the conditions concerning the vegetation are much the same as at Canton—most of the country has been stripped of trees and shrubs to the very tops of the surrounding mountains. Furthermore, owing to the troubled times, it was impossible to reach any points along the Burma Road which in quiet times might have been reached by bus or other transportation and we were restricted to areas close to the city. Fortunately, however, there were two areas which could be reached and where native forest still remained.

About thirty miles to the west of Kunming is the hot spring area of An-lin-wen-chian where there was at the time of our visit a very excellent hotel set in a surrounding area of forest. This forest has in the past undoubtedly been cut over, but it contained a considerable representation of native trees and shrubs from which excellent collecting was obtained. This point is slightly lower than Kunming, its altitude being probably slightly over 6000 feet, the altitude of Kunming being given as 6400 feet. Collecting was done at this point from April 27 to May 3.

Also, about fifteen miles to the west of Kunming is the temple area of Si-shan, on the certain hills which come down to the lake in quite precipitous slopes. Here there are three groups of temples surrounded by an extensive forest, much of which is relatively undisturbed. We secured accommodations at the middle of these temples and remained there from May 7 to May 13, with excellent collecting.

A small amount of collecting was done also in the parks and in private gardens at Kunming.

The forests about Kunming are composed largely of oaks and pines and other trees of a generally northern type. Scarcely more than five species of scale insects have been recorded from Yunnan, these having been collected by Silvestri, and it is to be expected that the fauna will present much of interest when the collection has been examined.

These areas mentioned comprise the points at which collecting was done on the mainland of China, outside of the British Crown Colony of Hong Kong, which will be referred to later.

On January 20, 1949, accompanied by Dr. J. L. Gressitt, I went by plane to the island of Taiwan (=Formosa) landing at Tainan and thence proceeding directly by train to Taipei at the north end of the island.

Conditions in Formosa are much more favorable for a collector of insects than they are on the mainland of southeastern China. The land has not been stripped of its woody vegetation and under the Japanese administration roads and railways were built so that access to the less inhabited places is much facilitated. Furthermore, under the Japanese, hotels were established at various places, especially at the hot springs which are quite numerous in the island, and accommodations could be obtained at the time of my visit. The scale insect fauna of this island has been explored by Dr. Ryōichi Takahashi, who has published several reports dealing with something more than 250 species. It had been my hope to search especially for the species described from the island by Takahashi, but unfortunately it was impossible to secure identifications of the trees and shrubs in more than a few cases and no specially discriminating collecting could be done.

It should be noted that when the Chinese re-established their government over Taiwan in 1945 the names of many places were changed. These name

changes will make difficulties for future students of the scale insect fauna. Some of them will be mentioned in the following account of my collecting.

The period from January 22 to January 29 was spent at the hot spring area about fifteen miles north of Taipei. This is the area called by the Japanese Sozan and by the Chinese Tsao-shan. Part of this period was unproductive, because of bad weather, but on the whole the collecting was good.

On January 29 I returned to Taipei (Taihoku of the Japanese), where, through the courtesy of Professor Maa, I became a guest at his home on the campus of the University. A considerable amount of collecting was done on the University grounds, on the little hills within walking range of the University and in the Botanical Garden.

On February 2, accompanied by Professor Maa, I proceeded by train to Takao at the south end of the island and thence by bus and on foot to the Animal Husbandry Station at Ken-teng about five miles from Cape Garambi at the outermost point of the island. Through the courtesy of the Director of this station we remained at this place until February 3 and then moved up the hill to the Forestry Station of Kuraru about three or four miles away, remaining here until February 9.

I may remark that in all my rather extensive experience in the collecting of scale insects I have come upon no area richer in them than was this area near Cape Garambi.

On February 10 we left Kuraru, going by motor bus to Chi-pen, near the town of Taitung, on the east coast. Chi-pen was known to the Japanese as Chipon and is not far from the mountain called Chipon-san, from which Takahashi recorded a few scale insects. Chi-pen is a hot spring with a small hotel, at which we remained until February 16. The collecting was good, although somewhat interfered with by rain.

We left Chi-pen on February 16, going by motor-bus and train to the Karoko Gorge, a few miles from the town of Hua-lien-keng, known to the Japanese as Karenko. This gorge is one of the beauty spots of Taiwan and had been developed by the Japanese as a park, with trails cut around the cliffs and several suspension bridges over the gorge. At the date of our visit these bridges had all disappeared and the trails had broken down, so that it was impractical to work in the area and only the day of February 18 was spent there, this close to the mouth of the gorge.

We returned from Karoko Gorge to Hua-lien-keng to secure transportation and then proceeded by motor-bus along the highly scenic but extremely narrow road built by the Japanese up the east side of the island to the town of Lo-kong.

At Lo-kong, application by Professor Maa to the authorities of the Taiping Provincial Forest for permission to enter that area resulted in our receiving passes on their railway and the privilege of staying at their various houses in the forest area. On February 21 we went by logging railway to the station of Tu-chang, at an altitude of about 1200 feet and about 30 miles west of Lo-kong. On February 22 we went on by logging railway, overhead tram and on foot to the station of Taiping Shan at an altitude of about 6000 feet. We collected about Taiping Shan on February 23 and then returned, mostly on foot, to Tu-chang, collecting along the way.

We then returned to Taipei from whence we went on February 26 to Wulai, a hot spring resort about 25 miles south. This is the Urai of the Japanese and various scale insects are recorded here by Takahashi. On February 28 we returned to Taipei and

on March 3 I left Taiwan to return by plane to Canton.

On May 23, after the trip to Kuning already recounted, it became evident that it would be impossible to accomplish anything more in China because of the disturbed conditions, and we left Canton on May 23, going to Hong Kong, thus severing my connection with the United States Educational Foundation in China. On May 25 we went to the village of Fanling, in the New Territories, collecting there and about the village of Taipo until June 1, when we returned to Hong Kong. There followed a few days in which some collecting was done on Victoria Peak at Hong Kong and on June 8 we left Hong Kong by plane to return to the United States.

In certain respects, the outcome of the time spent in China was disappointing. Owing to the disturbed conditions I was precluded from visiting certain areas, such as Hainan Island, where collecting would have been especially desirable, and much time was lost in waiting for opportunities to get about the country. I estimate that the collections made might very well have been twice as large as they were if the freedom of movement permitted by peaceful times had prevailed.

However, in spite of these conditions, slightly more than 950 collections of scale insects were secured, and adding to these certain collections for which arrangements were made while I was in China will bring the total number of collections resulting from my trip to somewhat more than 1000. The number of species contained in these collections cannot now be estimated with any definiteness, but may very well be as many as 400.

It will be many years before all this material can be reported upon. I have elected to begin my report by attacking the material collected near Kuning. Almost nothing is at present known about the scale insects of the interior of China, and as the Kuning region represents a biographical area quite distinct from that of the lowlands of southeastern China it may very well be treated by itself.

SUMMARY OF EXISTING KNOWLEDGE CONCERNING THE SCALE INSECTS OF CHINA, INCLUDING TAIWAN

The total amount of information concerning the scale insect fauna of China is at present extremely small, both actually and relatively. As far as published records are concerned scarcely more than 175 species are known from the mainland. Because of the activities of Dr. Ryoichi Takahashi in Taiwan (=Formosa) about 250 species are known from that island and a comparison of this number with what is known concerning the fauna of the mainland will emphasize the paucity of our knowledge concerning the latter area.

A few species have been known from China for a long time. Thus—if there was no error in its attribution—at least one species was described from China by Linnaeus. But there could scarcely have been more than a dozen species known until the collecting done by Albert Koebele in 1896 about Hong Kong and in Formosa. From this collection, Maskell recorded about 50 species and this remained as almost all that was known about the scale insects of China until 1921 when Ferris reported 34 species collected by M. Maki and S. Inamura in Formosa, three species collected by C. R. Kellogg at Foochow, China, and one species taken at quarantine from China in the United States.

In 1927 Kuwana presented a list of 76 species from China, this being based upon published records and on unpublished records in the quarantine bur-

eau in Japan. Shortly thereafter, Hoffmann presented an amplified list including 61 additional names from the collections of Lingnan University and from records in the Bureau of Entomology at Washington. The two lists together total 137 names, some of which are probably synonyms. Apparently these lists included only species known from the mainland. A few species from the mainland have since been described, these including four recorded by Chen from Chekiang Province, three or four from Yunnan Province based on material collected by Silvestri, a few from about Hong Kong which were reported by Takahashi during the last war and an occasional species reported by other authors.

In this connection it should be noted that a very large number of economic and ornamental plants have been introduced from China into other parts of the world and that certain economically important species of scale insects seem originally to have come from there. We may mention, for example, *Aonidiella aurantii* (Maskell) and *Quadraspidiotus perniciosus* (Comstock). It is entirely possible that *Pseudococcus citri* (Risso) is of similar origin and there are several species of lesser importance of which this is probably true. It may be emphasized that activities directed toward the biological control of such forms depend very greatly upon a knowledge of the geographical distribution of the scale insects and that such knowledge of geographical distribution depends almost entirely upon a knowledge of the species which have not been distributed about the world and have not become of economic importance.

It follows that the filling up of the great blank space in our knowledge of the scale insects of continental China should eventually become a matter of very considerable importance, not merely as an evidence of what actually occurs in that area but also as an indication of what does not occur there and consequently need not be sought. It is primarily toward the extension of our knowledge of the geographical distribution of the scale insects that the journey to that area was undertaken and that the future reports on the collections will be directed.

It will need to be remembered, however, that, even when all the collections made have been reported upon and when the results have been coordinated with those arising from the work of Kuwana in Japan and Takahashi in Taiwan, our knowledge of the scale insects of eastern Asia will still be actually quite small and that an enormous amount of work will still need to be done in the field, collecting, before we shall have the knowledge that is needed. A botanist, Ernest Wilson, who spent eleven years collecting plants in central China, has expressed the opinion that China has the greatest temperate flora in the world, this far exceeding anything to be found in North America north of Mexico, without mentioning the northward tropical extensions into southern China. Not until someone has been able to spend a somewhat comparable time in the collecting of scale insects will we have anything more than the faintest concept of the accompanying scale insect fauna.

SPECIES FROM YUNNAN PROVINCE

Prefatory Note

As has already been noted, not more than three or four species have been reported from Yunnan Province, these having been collected by Silvestri, so the scale insect fauna of this highland area is practically unknown. Since the flora of the high-

land areas is very different from that of the lowlands in Kwangtung Province about Canton, it is to be expected that the scale insect fauna will be to a large extent distinct and will to some degree constitute a distinct faunistic unit. It may therefore be treated separately from the remainder of the collections.

For this first paper a small group of species has been selected for treatment. These belong to genera which are more or less isolated and do not require the review of all the species belonging to large genera before they can be considered. They are also forms of some special interest in themselves.

BEESONIDAE, new family

TYPE GENUS. *Beesonia* Green, the only included genus.

CHARACTERS. The original description of *Beesonia dipterocarpi* Green, the type of the genus, is incomplete and consequently the characterization of the family is based upon the only other species of this genus, which is here described as new.

Coccoidea distinguished in part by the absence of certain structures which are found in other families, thus: with no abdominal spiracles; without brachiae or brachial plates; without dorsal ostioles or cerarii; without anal cleft or an operculum composed of two plates and covering the inner end of this cleft; with the terminal segments of the abdomen not fused into a compound pygidium; without terminal ducts having an inner, laterally placed filament; thus excluded from the Margarodidae and Ortheziidae, the Tachardiidae (Lacciferidae), the Pseudococcidae, the Kermidae, the Coccidae and the Diaspididae.

With setigerous anal ring in all stages, except perhaps the adult female. First stage with 3-segmented antennae. Second and subsequent stages of the female with no vestiges of either legs or antennae. Body of second and third stages composed chiefly of the head, the thorax small and with its spiracles displaced far toward the posterior extremity of the body, the abdomen very much reduced. Posterior pair of spiracles in the third stage borne each at the inner end of an elongated, curved chamber. Adult female in one species and most probably in the other retained within the third stage and membranous, but retaining the mouthparts. In the one species in which conditions are definitely known, the end of the abdomen of the third stage is invaginated, carrying the external opening of the last two spiracular chambers and the opening of the anal tube with it, the anus being borne at the inner end of a slender tube which is continued from this invagination. The inner end of the invagination is closed by a sclerotized operculum which permits the egress of the larvae.

NOTES. Unfortunately, information concerning the type species of *Beesonia* is quite incomplete, but it is so evidently related to the second species, herein described as new, that there can be no hesitation in believing that the two species have essentially the same structure.

It is very undesirable to multiply unduly the small families of the Coccoidea, naming a new family for every peculiar genus, but this genus *Beesonia* is so utterly different from anything else that there seems nothing to do with it other than to assign it to a family by itself. Green, in his description of the genus, remarked that he could not connect it with any of the groups at that time called subfamilies.

Genus *BEESONIA* Green

1926. Green, Bulletin of Entomological Research 17:55.

GENERIC TYPE. *Beesonia dipterocarpi* Green.

CHARACTERS. The characters given for the family will be adequate for the recognition of the genus.

Beesonia dipterocarpi Green

1926. *Beesonia dipterocarpi* Green, Bulletin of Entomological Research 17:55; figures 1-4.

1928. *Beesonia dipterocarpi* Green, Green, Bulletin of Entomological Research 19:205; figures 1-3.

HOSTS AND DISTRIBUTION. From *Dipterocarpus tuberculata*, somewhere in Burma, the precise type locality not being more closely indicated.

HABIT. A gall-making form. The galls are described by Green as "large, irregularly foliaceous, but of a ligneous texture, and appear to be composed of aborted buds and leaves, massed together with a dense woody base within which are situated the cavities occupied by the insects." The males are said to issue from these galls.

NOTES. The description being in a readily accessible journal will not here be repeated. It is evidently incomplete and somewhat confused. In view of the close general similarity to the new species herein described, it may be assumed that certain features not noted by Green are present in *dipterocarpi*. Thus it is clear that the stage described by him as the adult female is pre-adult and it is probable that the end of the body is invaginated, with an operculum at the inner end of this invagination, since certain structures are indicated which are evidently similar to those found in connection with the posterior extremity of this stage in the new species.

Beesonia quercicola, new species Figures 1-3

HOSTS AND DISTRIBUTION. Type from *Quercus acutissima* and paratypes from *Quercus schottkyana* at Si-shan, near Kunming, Yunnan Province, China, April 28, 1949. Taken also from an undetermined oak at Deng-wushan, on the West River above Canton, China.

HABIT. Occurring in cracks and roughenings of the bark of the host, on both twigs and trunk. The insects are almost completely concealed, merely the sclerotized posterior extremity projecting slightly and their presence is revealed chiefly by the white threads of wax which are extruded. These waxen threads issue from the posterior end of the body, there being a single large median thread which presumably issues from the anal ring, and a large number of very fine threads making two bundles which issue alongside the large thread.

FIRST STAGE. Antennae 3-segmented, the first two segments short, the third slightly elongate and broadened. Legs with the tibia very short, only about one-fourth as long as the tarsus. Thoracic spiracles each surrounded by a quite large sclerotized plate which bears a large rosette-like pore at one side. Anal ring slightly retracted into the body, bearing four short, very blunt setae. Margins of the body with a single row of short and quite stout setae, the last abdominal segment with the usual pair of very long setae. Dorsum and venter almost bare, with but a very few small, slender setae. Here and there over the body appear slightly raised circular areas. Ducts and

pores almost lacking, there being a very few tubular ducts near the margins dorsally and ventrally on the thorax. Each of these ducts is partially divided by a median partition, so that in end view a figure 8 appearance is presented. The tracheae divide into bundles of fine tubes.

As this larva develops, the head becomes enormously enlarged and elongated. Exuviation occurs by a splitting around the anterior end and the exuvia remains enveloping the apex of the second stage.

SECOND STAGE. In this stage the antennae and legs are entirely lacking. The body is elongate and is composed mostly of the head and thorax. When fully grown the derm becomes more or less sclerotized throughout. Anal ring somewhat invaginated into the end of the body, bearing four stout setae. The four thoracic spiracles are borne in two furrows toward the apex of the body and are at the end of short tubes invaginated from these furrows. The spiracle bears a ring of pores. From it there extends a single tracheal tube, which finally divides into a bundle of very fine tubes. Toward the posterior end of the body are numbers of small ducts which seem to be of the same type as those found in the first stage.

Passing across the body just posteriorly to the spiracular furrows there is a distinct raphe which extends forward for some distance on each side of the body. At the time of exuviation the derm splits along this raphe and the posterior end of the next stage extrudes from the shed skin. The anterior end also ruptures and the head of the next stage grows anteriorly, so that the exuvium of the second stage remains partially enveloping the body of the third stage.

THIRD STAGE. In this stage the body is elongate, usually very irregular, swollen anteriorly and attenuated posteriorly, but terminating in a slightly swollen region. This region bears a considerable number of tubular ducts of the same form as in the first stage, but sclerotization begins very early and these ducts become obscured. There are no traces of antennae or legs. The mouthparts remain very much in the normal position and possess a distinct labium. Close to the posterior end of the body are the openings of the first pair of thoracic spiracles. These openings lead into a chamber at one side of which is the spiracle, which bears a ring of pores.

The apex of the body is invaginated into a short, broad tube. Just within this tube lie the openings of a second pair of spiracles. The tube continues for a short distance and its inner end is closed by a heavily sclerotized circular operculum which breaks away at maturity to permit egress of the larvae. Between the openings of the posterior spiracles is the opening of a slender tube which extends into the body and bears the anal ring at its extremity. The anal ring bears two very heavy and long setae which project apically from the mouth of the tube and about the rings are the openings of numerous pores. It seems clear that this anal tube produces the large median thread of wax.

The posterior spiracles present structures that appear only in this genus. Each of the external openings which have been mentioned leads into a long chamber that is curved laterally. From the walls of the inner end of this chamber is formed the spiracle. About halfway along the chamber, on the anterior side, there is given off a slender diverticulum at the base of which arises a considerable number of slender tubular ducts, while the extension of the diverticulum is beset with pores. It seems most probable that the fine threads of

wax issuing from the end of the body alongside the central thread arise from these ducts and pores.

One of the most peculiar features of this insect has to do with the relation of the spiracles of this third stage to the spiracles of the second stage. The end of the tracheal trunk from each spiracle of the second stage becomes involved with and included in the spiracle of the third stage. But this trachea does not pass out of the body through the spiracular chamber of the third stage. Instead, it issues through a separate opening but is surrounded by a tube which arises from the spiracular chamber of the third stage and connects with this opening. These secondary openings—if we may call them that—on each side of the body lie close together just outside the apical invagination. This is altogether a most peculiar phenomenon.

FOURTH STAGE (adult female). The adult female remains within the exuvium of the third stage and is entirely membranous. It is difficult to dissect this stage from its envelop and only somewhat damaged specimens are available so it is possible that not all structures have been noted. However, in the specimens examined there seem to be no structures other than the mouthparts and the two pairs of thoracic spiracles on the body in this stage. The mouthparts are fully developed, with the labium present, and seem to be fully functional. The mouthparts are exerted through the skin of the third stage by way of an opening slightly forward of the swollen posterior extremity of this stage. The spiracles are conical structures which seem to afford attachment for a large number of delicate tracheal tubes.

MALE. No indications that this species has a male were found in the material examined.

NOTES. From the writer's point of view this species and its congener present the most remarkable morphological developments to be found anywhere in the Coccoidea. The strange arrangement of the spiracles in the third stage and their entanglement with the tracheae of the second stage is quite unique.

Family ASTEROLECANIIDAE

Genus *LECANIODIASPIS* Targioni-Tozzetti
Lecaniodiaspis elongata, new species
Figure 4

HOSTS AND DISTRIBUTION. From *Lithocarpus spicata* at An-lin-wen-chian, near Kunming, Yunnan Province, China, April 28, 1949.

HABIT. Occurring on the under side of the leaves. The female generally lies with one side against a vein, the males are more scattered about. Scale of the female 5-6 mm. long, elongate-oval and acute at each end, moderately flat, yellowish or light brown. In color and form it very closely resembles some of the species of the genus *Coccus*. Scale of the male about 1 mm. long, paler than that of the female, almost cylindrical with an operculum at one end. The male is winged.

CHARACTERS. Length about 3-4 mm., in somewhat shrunken specimens, as mounted on the slide. Body elongate-oval. Derm remaining membranous or very slightly sclerotized at full maturity and minutely wrinkled throughout. Antennae 4-segmented, the first segment very short, the second elongate and forming one-half or more of the length of the whole, the third and fourth about equal to each other and forming somewhat less than half of the total length. Legs entirely lacking. Stigmatic clefts bordered by a narrow, sclerotized band, the anterior clefts each with two clavate setae, the

posterior with but one. Stigmatic furrows with small numbers of very small, quinquelocular pores. Anal cleft deep, bordered at its base by the sclerotization that is typical of the genus. Margin of the body with a continuous single row of 8-shaped pores, each of which is set in a slight depression in the derm. Dorsum with numerous, much smaller, 8-shaped pores, the halves of which are arranged to form a V. Dorsum also with great numbers of long tubular ducts of the form characteristic for the genus. On the dorsum of the abdomen, close to the midline, there is on each of five abdominal segments a pair of small cribriform plates, these somewhat irregular in size and at times in part divided into two or more small plates. Venter of the abdomen with moderately numerous multilocular pores in its posterior half. Spiracles presenting no distinctive features.

NOTES. In appearance of the scale this species does not at all suggest the genus *Lecanodiaspis* but in its morphological characters nothing appears that offers a basis for a generic separation.

Family KERMIDAE

Genus *ERIOCOCCUS* Targioni-Tozzetti
Eriococcus corniculatus, new species
Figure 7

HOSTS AND DISTRIBUTION. From *Ternstroemia japonica* var. *wightii* at An-lin-wen-chian, near Kunming, Yunnan Province, China, April 27, 1949.

HABIT. Occurring on the stems of the host. Sac of the usual type of the genus, white.

RECOGNITION CHARACTERS. Adult female about 1.75 mm. long on the slide. Body of the normal ovoid form. Dorsal body-setae numerous, occurring over the entire dorsum, somewhat variable in size but all of the same shape, elongate, tapering and with bluntly rounded apex, those of the margins not distinguished by size from those of the dorsum. Mingled with these setae are about an equal number, or perhaps slightly more numerous, tubular ducts of the type characteristic of the genus, these all of one size, with the cup relatively broad and shallow and symmetrical. Also the dorsum is beset with numerous, very small processes terminating in a pair of little diverging horn-like points, with a small, sclerotized duct extending into the body from the center of the structure. The width across the apex of the horns of one of these structures is equal to scarcely half the diameter of the tube of one of the tubular ducts. In number they probably equal double that of the tubular ducts. Anal lobes slender, cylindrical, sclerotized, with the mesal margin very slightly toothed. Between the bases of the anal lobes is a small, very slightly sclerotized, cauda-like lobe which covers the apex of the anal tube and is apically irregularly toothed. Anal ring with 8 setae. Ventral side with numerous very small circular pores in the abdominal region and with a few of these in the head and thoracic regions. Spiracles borne each in a little oval, sclerotized plate which has no especially characteristic developments and is not accompanied by pores. Antennae 7-segmented. Legs with no distinctive characters, the tarsus with a slight tooth on its plantar surface.

NOTES. Perhaps the most distinctive characteristic of this species is that of the minute horns of the dorsal surface. Since the really distinctive characters of very few of the species of this genus are adequately described no significant comparison with other species is possible and the species is simply assumed to be undescribed.

FULBRIGHTIA, new genus

GENERIC TYPE. *Fulbrightia gallicola*, new species.

CHARACTERS. Coccoidea referable to the family Kermidae (=Eriococcidae). Antennae in the adult female reduced to a single segment, the legs extremely vestigial. Adult female without prominent anal lobes. Adult female apparently without tubular ducts, but these present in the second stage and of the type common to the family. Anal ring present in the adult female, small, strongly sclerotized and bearing six small setae. Adult female almost without setae except for a few that are short, stout and somewhat acorn-shaped.

NOTES. This genus unquestionably belongs to the family Kermidae (=Eriococcidae). No comprehensive review of the genera of this family has ever been made, but as far as the writer is aware there is no genus to which the species here described could be referred. It has no close resemblance to *Olliffiella*, which is a gall-making form of the same family that occurs on *Quercus emoryi* in southwestern United States. One may suspect both these genera, however, to be derivatives from *Kermes*.

The genus is named to commemorate the Fulbright Act, which made this collecting expedition possible and in honor of Senator Fulbright, the author of that Act.

Fulbrightia gallicola, new species
Figures 8, 9

HOST AND DISTRIBUTION. From *Quercus delavayi* at An-lin-wen-chian (Hot Springs), near Kunming, Yunnan Province, China, April 28, 1949.

HABIT. Causing the formation of galls on the host. The insect apparently attaches itself at the base of a twig bud, causing the entire twig to be distorted in such a manner that all the lateral twigs which would arise beyond this point are greatly shortened, the leaves are reduced in size and each twig with its leaves forms a short cone. The area shared by the bases of several of these cones becomes swollen and buried among the bases of the cones is the insect which induced the formation of the gall. When the bases of the cones are pulled apart the body of the insect may be seen. As far as noted there is but one insect associated with the gall.

FIRST STAGE. Antennae 6-segmented. Legs and spiracles presenting nothing in any way unusual. Apex of the body with one pair of very long and one pair of shorter setae on the anal lobes, which are practically obsolete. Dorsum without setae, except that along the margins of the body there are small, more or less acorn-shaped setae which are arranged in groups of two to three on each segment of the abdomen and in a row along the head and thoracic areas. Venter practically destitute of setae except for a median pair on each abdominal segment and one just in from the lateral margin on each side, with a few on the thorax.

There seem to be no tubular ducts and scarcely more than a half dozen irregular pores are present on the venter of the abdomen, these sometimes lacking.

Anal ring definitely developed, cellular, but small, with six small setae.

SECOND STAGE. What appears to be the second stage has the antennae 7-segmented and of the form characteristic of the Kermidae. The legs present nothing unusual. The anal ring is retracted into the ventral side of the apex of the abdomen and it has not been possible to determine its character. Venter of thorax and abdomen and dorsum of the ab-

domen with considerable numbers of quinquelocular pores and both dorsum and venter with great numbers of tubular ducts throughout, both dorsally and ventrally. These ducts are of the type that is characteristic of the Kermidae, having the inner extremity expanded with its apex reflexed to form a cup, from one wall of which arises a delicate, tubular prolongation. The cup is more or less asymmetrical.

ADULT FEMALE. Oval or more or less circular, the derm membranous throughout or becoming slightly sclerotized. Length attaining 5-6 mm. Antennae reduced to a single segment. Legs extremely vestigial, perhaps at times entirely lacking, or in part lacking. Body almost without setae except for a few very slender setae and a few short, stout, somewhat acorn-shaped setae that occur especially on the head region in front of the antennae, scattered over the dorsum of the abdomen and along what may be considered as the margin of the body. There seem to be no tubular ducts whatsoever. Small, multilocular ducts occur in some abundance on the midregion of the abdominal venter and in the lateral ventral regions as far forward as the anterior spiracles and sparingly in the lateral regions of the abdominal dorsum. Scattered over the body, especially in the lateral regions and the dorsum, are numbers of extremely small pores with a strongly sclerotized rim and apparently with a cross-bar which gives them the shape of a figure 8. Anal ring present, quite strongly sclerotized, bearing six small, slender setae.

Genus *PSEUDOPULVINARIA* Atkinson

1889. *Pseudopulvinaria* Atkinson, Journal of the Asiatic Society of Bengal 58:2:1:1.
 1908. *Lefroyia* Green, Memoirs of the Department of Agriculture in India, Entomological Series 2:2:21.
 1922. *Pseudopulvinaria* Green, Coccidae of Ceylon 5:345.

GENERIC TYPE. *Pseudopulvinaria sikkimensis* Atkinson. *Lefroyia castaneae* Green, type of *Lefroyia*, was considered by Green himself to be a synonym of this.

CHARACTERS. Referable to the family Kermidae (=Eriococcidae), although not entirely characteristic of that family and in some respects resembling both the Coccidae and the Asterolecanidae. Adult female retaining legs and antennae, these somewhat reduced in size but in other respects normal, the antennae 6-segmented. Anus retracted to the dorsal side and lying at the base of a dorsal furrow, covered by a pair of sclerotized plates, the mesal margin and apices of which are free from the body wall. Posteriorly, the plates are connected with each other by a sclerotized band that passes across posterior to the anal opening. Anal ring well developed, cellular, underlying the anal lobes, bearing six setae and apparently not extrusible. Dorsum thickly beset with quinquelocular pores. Venter with numerous, extremely minute, 8-shaped pores, with circular, multilocular pores in the region of the vulva and with quite numerous tubular ducts. These ducts have the inner extremity reflexed into a cup, from the rim of which extends a filamentous prolongation. Spiracles, especially the posterior pair, developing an elongate, sclerotized plate which bears few or no pores.

First stage with a pair of prominent, somewhat sclerotized lobes and with the anal ring borne at the apex of a slight median prominence but possi-

bly not retractible. Body with very few setae and with all these very small and slender. Apparently without pores or ducts except for a single multilocular pore associated with each spiracle.

Adult female covered with a mass of white, cottony secretion, males developing in a cottony case, but no adult males present in the material examined.

NOTES. This is a very peculiar genus. The anal lobes of the adult female almost duplicate in form and position the anal plates of the Coccidae, but the apex of the body is not cleft. Furthermore, these plates are connected by a sclerotized band, posterior to the anus, which does not appear in any known species of Coccidae and which is similar to that seen in such Asterolecaniids as *Lecanodiaspis* (see Figure 4). The form of the tubular ducts is that which occurs commonly in Kermidae, but the antennae of the adult female do not have the characteristic form of this family.

The family assignment of the genus is therefore somewhat debatable. Green, in describing *Lefroyia*, considered the genus to belong to the Eriococcinae (here considered the same as the family Kermidae) and upon balancing the various characters involved it seems that this assignment is probably correct. Nevertheless, there are still some grounds for doubt concerning the proper position of this genus. It may be hoped that future collecting will reveal forms which will aid in the understanding of it.

Pseudopulvinaria sikkimensis Atkinson
 Figures 5, 6

1889. *Pseudopulvinaria sikkimensis* Atkinson, Journal of the Asiatic Society of Bengal 58:2:1:1.
 1908. *Lefroyia castaneae* Green, Memoirs of the Department of Agriculture in India, Entomological Series 2:2:21; figures 5-8.
 1922. *Pseudopulvinaria sikkimensis* Atkinson, Green, Coccidae of Ceylon 5:345.

HOSTS AND DISTRIBUTION. First described by Atkinson as from *Quercus incana*, *Castanea indica* and *Castanea tribuloides* in Sikkim. Later recorded by Green from *Castanea* species at Shillong, Assam. Specimens are at hand from *Quercus schottkyana* at Si-shan, May 12, 1949, and *Quercus variabilis* at An-lin-wen-chian, April 30, 1949, both these places being near Kunming, Yunnan Province, China.

The Fernald Catalogue recorded this species as from *Cinchona* in India, without mention of Atkinson's records from *Quercus* and *Castanea*. Dr. Harold Morrison has very kindly looked up the original description of the species for the writer and indicates that the bibliographic record as given in the Fernald Catalogue is garbled and that the original description contains no mention of *Cinchona*.

HABIT. Occurring on the twigs. The adult females each secrete a mass of pure white, cottony material which may reach a length of 1.5 cm. and entirely envelops the body, to which it adheres closely. These individual masses may be clustered together in great numbers upon the twigs. What is apparently the puparium of the male occurs upon the leaves in the form of a little lump of cottony wax. Unfortunately, the males had all issued before the dates of collecting.

RECOGNITION CHARACTERS. As of the genus. Adult female reaching a length of as much as 1 cm., broadly oval or almost circular as mounted on the slide. Derm of the dorsum tending to become slightly sclerotized at full maturity. In early

adult individuals the derm is entirely membranous except for an area about the anal plates and in specimens which have become more generally sclerotized this area can still be recognized. Scattered over the midregion of the dorsum of the abdomen are small, sclerotized spots, which, however, do not appear to be cribriform plates. Dorsum thickly beset throughout with quinquelocular pores with quite thick and strongly sclerotized boundary walls. Marginal areas bearing a few small, slenderly conical setae, the dorsum otherwise hairless. Anal lobes borne at the base of a strongly defined dorsal furrow which extends in a short distance from the apex of the body, their mesal margins and apices free and irregularly toothed, apically with two or three setae. Extending between the lobes is a distinct, sclerotized area, which seems to attach to the under side of the lobes and passes posteriorly to the anal opening. Anal ring slightly retracted into the body, well developed, cellular and bearing six setae.

Ventral side of the body with a few multilocular pores about the genital area, with quite numerous but scattered tubular ducts, with numerous, very minute, 8-shaped pores and with a few quinquelocular pores along the margins. Antennae 6-segmented, relatively short but slender, the terminal segment about equaling the third segment in length. Legs presenting no distinctive characters. Spiracles without any cluster of associated pores and in no way unusual except that at full maturity the posterior pair especially develops an enclosing sclerotized area that is transversely elongate.

First stage larva with a very few small, slender setae, especially along the lateral margins. Anal lobes definitely defined, bearing the usual long, apical setae and enclosing between them the protruding and perhaps somewhat retractable anal sac at the apex of which is the very small anal ring, this with six small setae. There seem to be no pores or ducts except for a single, large, multilocular pore which is borne upon a sclerotized prominence that is attached to the sclerotization about each of the spiracles. Dorsum marked with somewhat squamate areas, which at the margins of the body form small, projecting, sclerotized teeth. Antennae 6-segmented, of the same form as in the adult. Legs with no specially distinctive characters.

NOTES. Material identified by Green as *Pseudopulvinaria sikkimensis* Atkinson, indicated simply as from India, is at hand and together with the excellent description given by Green of his *Lefroyia castaneae* makes the identification definite.

Family PSEUDOCOCCIDAE

Genus *PHENACOCCLUS* Cockerell
Phenacoccus prodigialis, new species
Figure 10

HOSTS AND DISTRIBUTION. Type from *Prunus mume* in a garden near the hotel at An-lin-wen-chian, near Kunming, Yunnan Province, China, May 1, 1949. Also on *Berberis wilsoniana*, at Si-shan, near Kunming, May 9, 1949.

HABIT. Occurring near the tips of the twigs. A very conspicuous species, the adult female sitting in a circular cup of yellowish wax which extends upward around the sides but does not cover the dorsum. The dorsum is somewhat purplish and is dusted over with white, powdery wax. The length of the cup may attain as much as 6 mm.

RECOGNITION CHARACTERS. Adult female as mounted on the slide almost circular or very broadly

oval, reaching a length of as much as 5 mm. Derm at full maturity tending to become slightly sclerotized and pigmented, thus obscuring details of structure.

Antennae with the normal number of nine segments and the tarsal claw with a very distinct tooth. Apparently the normal number of 18 pairs of cerarii present. Three circuli present on the venter of the abdomen, the middle circulus somewhat larger than the others and—in one specimen at least—partially surrounded by a sclerotized area. Anal lobes very low, each dorsally with four to five somewhat lanceolate setae of differing sizes and with a few scattered trilocular pores, all enclosed within a slightly sclerotized area. Anterior to this, the cerarii contain but two small lanceolate setae and three to four trilocular pores until those of the head region are reached, these having three to four small, lanceolate setae and three to four pores. Entire dorsum beset with trilocular pores among which there is an occasional small tubular duct, and with an occasional small, lanceolate seta. Toward the lateral margins of the body the trilocular pores seem to be displaced almost entirely by tubular ducts and these extend around to the ventral side of the body. These ducts are quite small, the orifice being smaller in diameter than a trilocular pore and the ducts being perhaps four times as long as wide. On the ventral side of the abdomen there is a very small and indistinct sclerotized area at the base of each anal lobe seta. Multilocular pores, perhaps twice the diameter of the trilocular pores, are present in small numbers from the region of the vulva forward to the last circulus. Throughout the entire venter the trilocular pores are largely displaced by tubular ducts of the same size and type as those of the dorsum.

NOTES. The sclerotization of the derm at full maturity renders the species somewhat difficult to study as the minute details of distribution of pores and ducts are obscured. Unfortunately, no early adult females, taken before this sclerotization sets in, are available and consequently some departures from the details shown in the accompanying illustration may appear when such specimens become available.

In life this is an extraordinary species. The large size, the purplish color of the body and the conspicuous cup of yellowish wax are unlike anything described in this genus. However, structurally, the species is quite ordinary except for the presence of three circuli. This character is shared with *Phenacoccus aceris* Signoret, which may have two to three circuli, but from this it differs at least in the fact that the latter has large numbers of tubular ducts over the entire dorsum.

Family ACLERDIDAE

The members of this family are all grass-infesting forms. Mr. H. S. McConnell is at present engaged in a revision of the species and all my material collected in China will be turned over to him for study and description, excepting only the two species at hand from Yunnan. These are here treated because of the desire to consider the Yunnan material as a faunistic unit.

Genus *ACLERDA* Signoret
Aclerda takahashii Kuwana
Figures 11, 12

1930. *Aclerda japonica* Newstead, Takahashi, De-

partment of Agriculture, Government Research Institute, Formosa, Japan, Report 43:36 (Misidentification).

1932. *Aclerda takahashii* Kuwana, Philippine Journal of Science 48:62; figure 3.

HOSTS AND DISTRIBUTION. Recorded by Takahashi and by Kuwana as from sugar cane at Kori, Shinka, Formosa (=Taiwan). Specimens at hand, believed to be this species, are from an undetermined grass at An-lin-wen-chian, near Kunming, Yunnan Province, China, April 29, 1949, and from undetermined coarse grass near Tainan, Taiwan (=Formosa), Feb. 2, 1949.

HABIT. Recorded by Takahashi as occurring on both roots and stalk. The specimens from China occur on the stalks, under leaf-sheaths, especially just above the nodes, imbedded in a small amount of white wax.

RECOGNITION CHARACTERS. In the specimens at hand, which are all fully mature, the body becomes strongly sclerotized and pigmented over the entire dorsum. Length attaining as much as 7 mm. Posterior end of the body marginally minutely scalloped for a short distance on each side of the anal cleft. Marginal setae occupying a narrow zone entirely around the body except for a short distance on each side of the anal cleft. In this zone the setae are arranged irregularly. They vary greatly in size and to some degree in form, at times being almost hemispherical, at other times slightly elongated and at other times terminating in a slight point and having somewhat of an acorn shape. On the ventral side, just mesad of this zone of setae and only in part mingled with it is a zone of quinquelocular pores, these of somewhat varying sizes and all with strongly sclerotized border. This zone extends forward to slightly past the first spiracle and then disappears. Mingled in part with the zone of quinquelocular pores but extending much farther toward the midregion of the body is a zone of very small pores which extends also into the head region. These pores are circular but apparently project slightly, forming a minute cone when viewed from their sides. Also included in the marginal zone are a comparatively small number of the characteristic tubular ducts. At the posterior end of the body these ducts occur on the dorsum as far as the midline. Because of the dense pigmentation it has not been possible to determine their exact distribution in this apical area but they appear to be mingled with a number of small pores or setae of the dome-shaped type which occurs commonly in this genus. Occasional small setae appear in the zone of pores and ducts. Anal plate more or less triangular and moderately acute at the apex. Antennae damaged in all available specimens, but apparently presenting nothing distinctive, consisting of but one definite segment. Spiracles of the normal form for the genus, presenting apparently nothing distinctive.

First stage larva with slender 6-segmented antennae which present no peculiar characters. Marginal setae including a few which are slightly lanceolate, but with the majority short and stout, as broad or broader than long and apically truncate, the apex bearing as many as six to seven minute points. The last two setae at the apex of the body are conspicuously stout and somewhat elongate, projecting prominently from the margin of the body. Spiracles usually with a single small, apparently quinquelocular pore within the atrium and another just at the margin of the atrium.

NOTES. The identification of this species depends upon the quite good original description and figures given by Kuwana and upon comparison with specimens from an undetermined grass, near Tainan in Formosa (=Taiwan), collected by G. F. Ferris,

February 2, 1949, which agree very closely with the description. The only apparent differences between the specimens from Formosa and the illustrations given by Kuwana lie in the fact that he illustrates the tubercle-like marginal setae as being for the most part acorn-shaped; that is, with the apex drawn out into a slight point; while in the specimens at hand this is apparent in only an occasional seta. The specimens from Kunming agree quite closely with those from Formosa.

Aclerda yunnanensis, new species
Figures 13, 14

HOSTS AND DISTRIBUTION. From an undetermined, small perennial grass growing on the dry hill above the hot spring at An-lin-wen-chian, near Kunming, Yunnan Province, China, April 28, 1949.

HABIT. Occurring under the leaf-sheaths above the surface of the ground and embedded in a small amount of white wax.

RECOGNITION CHARACTERS. Adult female variable in form but always elongate, attaining a length of 7 to 8 mm. on the slide. Derm very strongly sclerotized and pigmented in at least the posterior fourth and partially around the margins, with the anterior portion remaining membranous. The so-called anal plate, which is actually the dorsal wall of the basal portion of the anal tube, is very slightly emarginate apically, while the ventral plate or ventral wall of the tube is apically truncate. Margins of the body somewhat crenulate for a short distance from the anal cleft. A narrow zone of pores, ducts and setae extends entirely around the body from the anal cleft to the head. The marginal setae are of somewhat variable size but are all of much the same shape, that of a strongly prolate spheroid and the band of setae is three or four setae wide, except in the head region where it seems to comprise a single row. In this marginal area are numbers of extremely minute circular pores and an occasional duct with expanded inner end and with a filamentous prolongation. In the areas between the spiracles and the margin, especially in connection with the anterior spiracles, are small numbers of very small pentagonal pores. The dorsal side of the sclerotized posterior portion of the body is beset with numbers of little, clear areas, each of which surrounds a pore. Some of these pores seem to lead into tubular ducts of the type found around the margins and some seem to be small, dome-shaped structures (pores or modified setae?) but the exact character is in general very difficult to determine because of the dense pigmentation. Spiracles borne on a sclerotized plate, the lateral half of which forms a pocket and is beset with numerous pores. Antenna composed apparently of two segments, the basal segment membranous, the second sclerotized and bearing several setae. The mouthparts are set at about the middle of the length of the body and consequently the body is composed to a considerable extent of the much produced head.

First stage of the type common to the genus, but with some peculiar characters. Antennae 6-segmented, the third segment with its posterior margin longer than the anterior margin and the fourth with the posterior apical angle prolonged into a very pronounced spine. Marginal setae of several forms. Some are merely ordinary setae somewhat swollen toward the base; some are almost like thick buttons and some are similar to this but have a flat, pointed prolongation.

NOTES. I am unable to connect this with any described species. Mr. H. S. McConnell, who is

working with this genus, states that he has seen specimens from the Philippine Islands having somewhat the characteristics here described but does not at present attach them to any named species.

Family MARGARODIDAE

Genus *MARGARODES* Guilding
Margarodes niger Green

1913. *Margarodes niger* Green, Records of the Indian Museum 9:1:1:5; plate 3, figures 22-35; plate 4, figures 36-45.

HOSTS AND DISTRIBUTION. Originally described as from Honnali, Shimoga District, Mysore State and from Bellary, Madras Presidency, India, in both instances being ascribed to the grass, *Cynodon dactylon*. The specimens at hand are from a very small, undetermined perennial grass, growing on the dry hilltop above the hot spring at An-lin-wen-chian, near Kunming, Yunnan Province, China, April 28, 1949.

HABIT. In the specimens at hand, occurring on the base of the stems and among the bases of the roots, forming little, spherical bodies which in their undisturbed condition are covered with a thin shell of white wax that falls off very easily. The original description indicates a similar habit and appearance for the types.

NOTES. The original description of this species and the accompanying figures are excellent and make the identification so nearly certain that no doubt is here felt concerning it, especially as the species has exceedingly distinctive characters. Adult females were dissected from immature stages and all stages agree with the description and figures with much exactness. Because of the excellent original description it is not felt necessary to present a re-description or new figures.

This is apparently the first record of any member of this genus from Asia, outside of India.

Genus *MATSUCCUS* Cockerell

The members of this genus are, as far as known, confined strictly to conifers of the genus *Pinus*. The type of the genus was described from Japan, one species is known from Europe, a considerable number of species occur in North America, and one species has been described from China. In the course of my collecting I directed a considerable amount of attention to searching for members of the genus on any pines that were encountered, but found none other than the two species here recorded. No specimens were found on the common *Pinus massoniana* of the coastal regions of southeastern China and none could be found on *Pinus armandii* in the Kunming region nor on any pines encountered in Taiwan, although they almost certainly occur on all these species.

Of the two species collected, one can be referred to the species previously described from China and the other is apparently new.

Matsuccus sinensis Chen
Figures 15, 16

1937. *Matsuccus sinensis* Chen, Entomology and Phytopathology 5:19:382; plate 1.

HOSTS AND DISTRIBUTION. Described as from *Pinus* sp. at Hwangyen (Chi-lon-shan), Chekiang Province, China. Collected on *Pinus yunnanensis* at An-lin-

wen-chian, near Kunming, Yunnan Province, China, April 28, 1949.

HABIT. Occurring exposed on the needles of the host. The second stage forms little elongate-oval, jet black objects on the inner surface of the needles. For a time the exuvium of the first stage remains clinging to the posterior extremity of second stage, but finally the posterior extremity of the second stage breaks away and this exuvium is pushed off, leaving the second stage truncated. The second stage is covered with a very thin coating of white wax which tends to form into little lumps and plates. No free adult specimens were found, but empty exuvia of the second stage indicate that the adult pushes out of this stage through the opening at the posterior end. All adults found were dissected from the second stage and were accompanied by first stage larvae.

ADULT FEMALE. Length about 2 mm. Somewhat fusiform, the antennae close together at the anterior end, the posterior end forming two broad lobes which are separated medially by a notch of varying depth. Legs reduced in size and more or less distorted, the femur and tibia apparently fused; tarsus 2-segmented, the second segment somewhat swollen, the claw stout and strongly curved. Neither legs nor antennae show the transverse markings or striations which occur in some species of the genus. Posterior end of the body, both dorsally and ventrally, with moderately large (10-13 microns) cicatrices. In specimens at hand the total number of these is about 25-30 and they are almost entirely confined to the terminal lobes, which seem to contain two segments. In specimens from type material the number is two or three times as great and they extend forward over two more segments. Over the posterior portion of the abdomen, including the last 4-5 segments, both dorsally and ventrally there occur numerous small ducts. Each of these ducts is borne at the apex of a sclerotized tubercle. Because of the sclerotization of the tubercle it is difficult to determine the exact nature of the duct, but apparently it is divided by a median wall in such a manner that viewed from the end it presents an 8-shaped appearance. These tubercles become slightly smaller and more sparse toward the anterior part of the area occupied by them. There appear to be six pairs of abdominal spiracles, these being slightly smaller than those of the thorax and all being simple and unaccompanied by pores.

Antennae variable. The first segment, or possibly 2 segments fused, is elongated and stout, mostly membranous, the second small and short. In some specimens the third and fourth segments are fused into a single elongated segment, in others they are separated, the fourth being short and broad with 3 segments of similar shape beyond it.

SECOND STAGE. About 1.5 mm. long, becoming strongly sclerotized and jet black, slightly attenuated posteriorly. At full maturity the derm is so black that it is difficult to see any structures in a preparation, but in specimens taken before this pigmentation has been completed some details can be determined. There seem to be no pores or ducts of any kind and the only structures represented are the spiracles, there being no traces of antennae or legs. In specimens at hand there appear to be five pairs of abdominal spiracles. These seem to differ from the thoracic spiracles only in their slightly smaller size. Each spiracle is borne at the inner end of a short tube and the spiracle itself forms a sclerotized ring that seems to be beset with pores.

FIRST STAGE. There is no evidence in the available material of more than one stage with legs and

antennae. The first stage, just from the egg, is somewhat fusiform, with the antennae borne at the extreme forward end. Antennae 6-segmented, of the form indicated in the accompanying illustration. Legs presenting no unusual characters, except perhaps for the form of the claw, which has a basal projection on the plantar side. Body entirely without setae, except for the very long terminal pair and a much shorter pair accompanying these. There appear to be seven pairs of abdominal spiracles, with the possibility of an eighth close to the bases of the apical setae. These spiracles differ from those of the thorax only in being slightly smaller and in being set each in a small, circular, slightly sclerotized area. None bears any pores. There are no apparent pores or ducts anywhere on the body, although evidently wax is secreted.

The fully grown first stage becomes black and strongly sclerotized and bears a coating of wax at its posterior end. The margins of the abdomen are beset with short tubercles which correspond in number to the number of spiracles and may possibly bear the spiracles. Exuviation occurs by splitting at the head end.

NOTES. Specimens are at hand from the type material collected by Mr. Chen in 1936 and received from him. These differ from the specimens at Kunming, as already noted, in the much greater number of cicatrices in the adult female, but the examination of a much greater range of specimens would be necessary before any conclusion would be justified that two species are represented.

Matsucoccus yunnanensis, new species

Figure 17

HOSTS AND DISTRIBUTION. From *Pinus yunnanensis* at An-lin-wen-chian, near Kunming, Yunnan Province, China, April 29, 1949.

HABIT. Occurring in and beneath the bark of the host, the apodous stage flattened between the layers of bark.

RECOGNITION CHARACTERS. Adult female, as represented by a somewhat wrinkled specimen, about 5 mm. long. Antennae of the normal type of the genus, the basal segment elongate and conical, occupying slightly less than half the total length of the antennae and probably compounded of two or perhaps three segments; next six segments about equal to each other, all piriform, with narrow base, the terminal segment ending in several small hairs and one stout, unpigmented hair, the three preceding segments each with two unpigmented hairs at the anterior distal angle. Eyes quite large and sclerotized. Mouthparts represented at the most by slight vestiges. Legs of what may be considered the normal type and size of the genus, even in well stained specimens showing but the slightest trace of the transverse squamate markings which appear very strongly in some other species, trochanter with one short seta. Small, tubular ducts are present in some numbers on the dorsum of the abdomen toward the posterior end of the body and in a more or less single row along the margins of the body and in small numbers on one or two terminal segments ventrally. Viewed from the end these ducts present an 8-shaped appearance. Each duct is borne at the apex of a conical projection. Multilocular pores of any kind apparently lacking. Cicatrices relatively few, apparently confined to a single dorsal row on each of four or five segments about the middle of the abdomen, the total number attaining at least about 30 and possibly somewhat more; all of about the same size and

measuring about seven microns in diameter. It is probable that the normal number of seven abdominal spiracles are present, but not more than five can be recognized in the scanty and unfavorable material available. These are apparently moderately large but are very weakly sclerotized and are somewhat smaller than the thoracic spiracles. Derm of the dorsum, especially toward the end of the abdomen, with a mosaic of small, weakly sclerotized areas.

The flattened second stage is almost circular and measures about 2.75 mm. in diameter. It is heavily sclerotized around the margins and more or less membranous in the central area. No structures other than the spiracles can be recognized. There are apparently seven pairs of abdominal spiracles, these only very slightly smaller than the thoracic pairs and all very small, with a small number of irregular pores.

First stage and male not represented in the available material.

NOTES. This species is quite of the same type as such North American species as *californicus*. The principal recognition mark seems to lie in the small number of cicatrices and their arrangement in segmental rows.

The available material is scanty and from only one moderately good preparation, fragments of two specimens and several others filled with fungus have been obtained to represent the adult female. Consequently, the accompanying description and illustrations of this stage are not as precise or complete as might be desirable, it being uncertain, for example, as to just how many cicatrices or abdominal spiracles are present and the exact arrangement of the very few setae on the body not being determinable. Nevertheless, the species should be definitely recognizable from the accompanying description and illustrations.

SISHANIA, new genus

GENERIC TYPE. *Sishania nigropilata*, new species. The only included species.

CHARACTERS. Margarodidae referable to the subfamily Monophlebiniae and the tribe Drosichini, as defined by Morrison. Free living forms, occurring exposed upon the host. Adult female with obscurely 8-segmented or very possibly at times 7-segmented antennae, the division between segments three and four being but slightly developed; tapering, the terminal segment elongated, all segments with numerous fine hairs but without enlarged sensory hairs. Body elongate-oval, thickly covered with slender spines (see note below) with which are mingled a few longer setae and with long, conspicuous setae along the margins of the body, each seta being borne upon a distinct tubercle. Dorsum of the abdomen with a conspicuous median area and with smaller submarginal areas of black spines and the dorsum of head and thoracic segments likewise with submarginal areas and with submedian areas of such spines. These black spines differ only in color from those of the remainder of the body. Thoracic spiracles enlarged, with a band of pores just within the atrium and with a sclerotized bar or apodeme. Abdominal spiracles apparently in seven pairs, these borne on the dorsum well in from the margin, simple, consisting of a short, deeply ringed tube which expands into a somewhat bell-shaped chamber, entirely without any associated pores. Anal opening borne on the dorsum at some distance from the apex of the abdomen and set in a pit, which is surrounded and almost concealed by a cluster of quite long setae. Anal ring definitely

developed, somewhat triangular, bearing several pores. Anal tube definitely developed in the penultimate stage and probably present in the adult female also, being merely a more or less sclerotized tube without a ring of pores at its inner end. Penultimate stage with three quite large cicatrices on the ventral side of the abdomen at the position occupied by the vulva in the adult, these cicatrices either not present in the adult or inconspicuous and perhaps obscured by folds of the body. Legs presenting no distinctive characters, the claw simple and bearing two slender, acutely pointed digitules.

Penultimate stage essentially like the adult female.

NOTES. After a careful review of the genera of the Margarodidae as described by Morrison in his excellent monograph, and after comparison with all the genera represented in the collections at hand, this genus is here named as new. It seems without much doubt to be most closely related to the two genera *Drosicha* and *Drosichiella*, but differs from both most conspicuously in the dorsal patches of black spines. It differs from *Drosichiella* also in the absence of any pores associated with the abdominal spiracles and from *Drosicha* in the presence of a pore band just within the atrium of the thoracic spiracles.

We may at this point indicate that there are certain differences of usage concerning the words "spine", "seta" and "hair", which may cause some confusion. Thus Morrison describes the genus *Drosicha* as "without spines", but from the point of view of the present writer the body in this genus is thickly beset with spines. Apparently the distinction drawn by Morrison between spines, hairs and setae is based upon shape, a short, relatively stout structure being a spine and a longer, more slender structure being a hair or seta. The morphological distinction, which is that here employed, rests upon the fact that a seta always has a sclerotized ring about its base, being separated from the ring by a membranous area, while a spine lacks such a ring. This distinction holds without regard to size or form of the structure in question.

On the basis of this distinction the body of *Drosicha* and of the species here being described is to be characterized as "thickly beset with spines among which there is an intermingling of setae."

Sishanta nigropilata, new species
Figures 18, 19

HOSTS AND DISTRIBUTION. Known only from a small collection from *Prunus pseudocerasus*, near the lowest temple at Si-shan, Kunming, Yunnan Province, China, May 12, 1949.

HABIT. Occurring on the trunk and limbs of the host, beneath bark-scales. The insects as collected—all then being in the penultimate stage—devoid of secretory covering, brown. A single adult female issued from the penultimate stage after collection and judging from the number and distribution of the pores on its body, it seems probable that at full maturity a fluffy ovisac will be secreted.

CHARACTERS. Length of the penultimate stage and of the single teneral female about 6 mm. Body elliptical. In addition to the characterization given for the genus, the following points may be noted. Vestiture of spines quite uniform over the entire body, the spines becoming somewhat longer at the margins and those of the venter being no-

ticeably smaller and more slender than those of the dorsum, but otherwise similar. The black setae in the dorsal patches differ only in color from the remainder of the dorsal vestiture and at the margins of the patches they tend to be intermediate in pigmentation. The patches of the submarginal abdominal areas vary somewhat in extent in the few available specimens of the penultimate stage. Hairs of varying length, some quite long and all borne each upon a quite conspicuous tubercle, fringe the entire body margin. Shorter hairs of similar type are interspersed among the spines, both dorsally and ventrally. In the single available adult female pores are more numerous in the region of the vulva than elsewhere, in general the pores in this stage as well as in the penultimate stage being relatively few and scattered. All the pores seem to be of the same basic type, the central loculus normally being elongated but at times circular and normally surrounded by six peripheral loculi. Anal tube inconspicuous, weakly sclerotized, this being true in the single teneral adult, but it is very probably always present. Even in well-sclerotized specimens there is no observable trace of pores at the inner end of the tube.

NOTES. Unfortunately no first stage larvae and no males of this species were obtained.

Family ORTHEZIIDAE

Genus *ORTHEZIA* Bosc d'Antic
Orthezia quadrua, new species
Figure 20

HOSTS AND DISTRIBUTION. From *Ambrosia* sp., along the road across the river from the hotel at An-lin-wen-chian, near Kunming, Yunnan Province, China, May 2, 1949.

HABIT. Occurring on the leaves and stems of the host. Body of the adult female entirely concealed beneath the usual tufts of pure white wax, the tufts along the lateral margins of the abdomen being quite long and curving. In a specimen which seems to be fully developed the ovisac is rather short and stout, being but little longer than the body; however, it may perhaps become longer.

CHARACTERS. Adult female, as mounted on the slide, about 2.5-3 mm. long. Antennae 8-segmented, legs presenting no distinctive characters, the claws with 2-3 minute teeth. Eyes unusual in having a single large facet surrounded by three shorter and smaller facets like tubercles. Eight pairs of abdominal spiracles present. Thoracic spiracles each with a very definite, slightly sclerotized collar which bears numbers of spines that are distinctly smaller than the body spines but are of essentially the same shape. Ovisac band of spines very strongly developed and broad, its inner margin with two to four rows of pores outside the setae and two to four rows which are mingled with the setae. The posteriormost section of the band, in the region of the vulva, has pores mingled with the setae throughout most of its area. These pores are circular or at times slightly quadrate and are formed of a strongly sclerotized rim which encloses a space that is almost completely filled by four central loculi which are arranged in a square. Area enclosed by the ovisac band with distinct, transverse series of spines and pores, the spines somewhat smaller than those of the band and the pores somewhat smaller and with the enclosed loculi occupying less of the enclosed space.

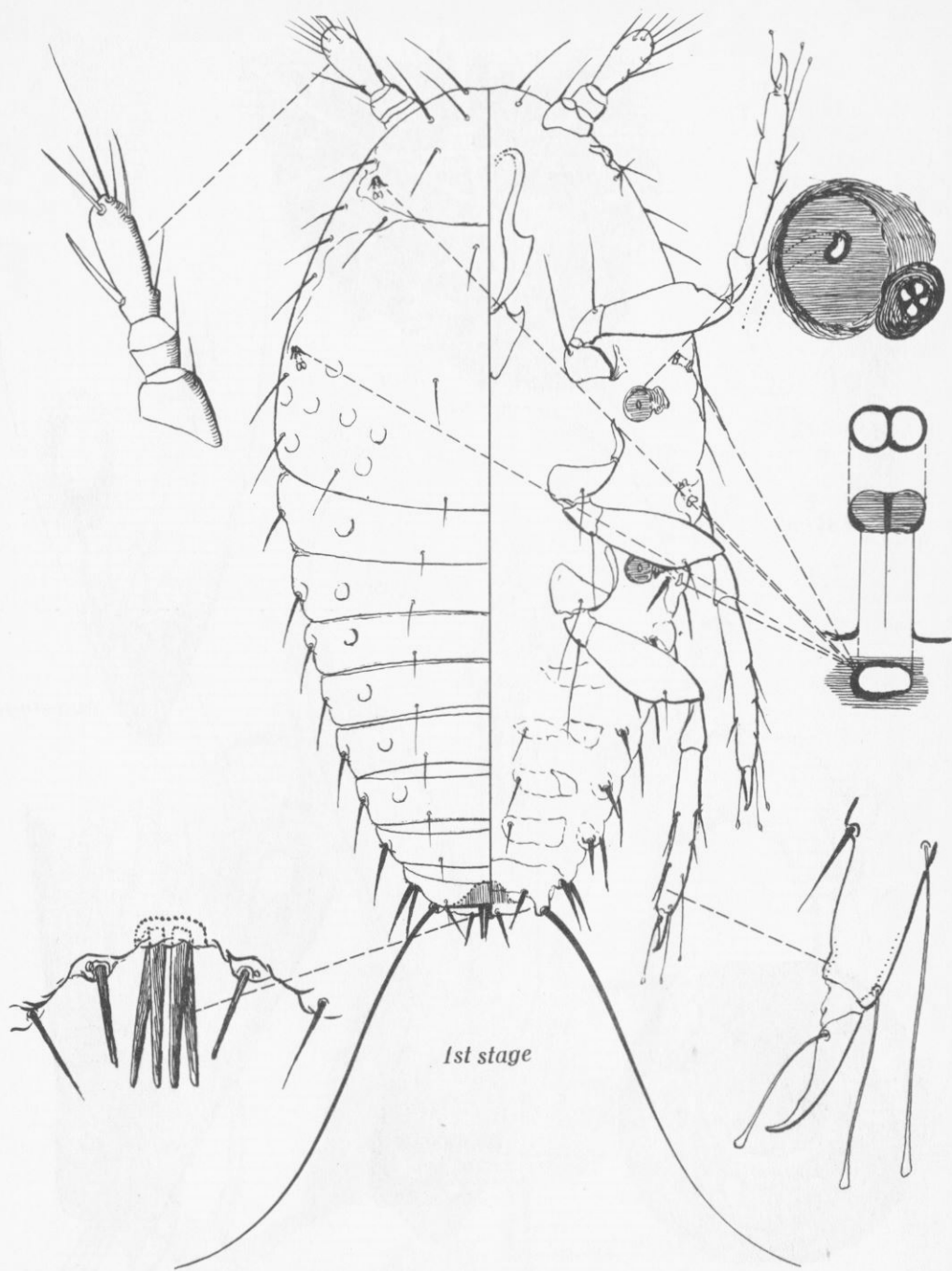
Dorsum with the spine areas covering almost the entire surface, except on the abdomen, where the transverse bands are separated from each other by

extensive bare areas. Pores similar in type to those of the ventral area enclosed by the ovisac band occur in single or multiple rows in the areas and furrows between the spine areas, especially on the anterior borders of the spinous areas. Scattered among the spines are numerous exceedingly minute, sclerotized points which are perhaps pores. Anal ring without lateral, sclerotized extensions and with no unusual developments.

NOTES. It is entirely possible that this is actually *Orthezia yashushii* Kuwana, which was described as occurring on chrysanthemum and *Artemisia vulgaris* in Japan. However, Kuwana's species is not definitely identifiable from his original des-

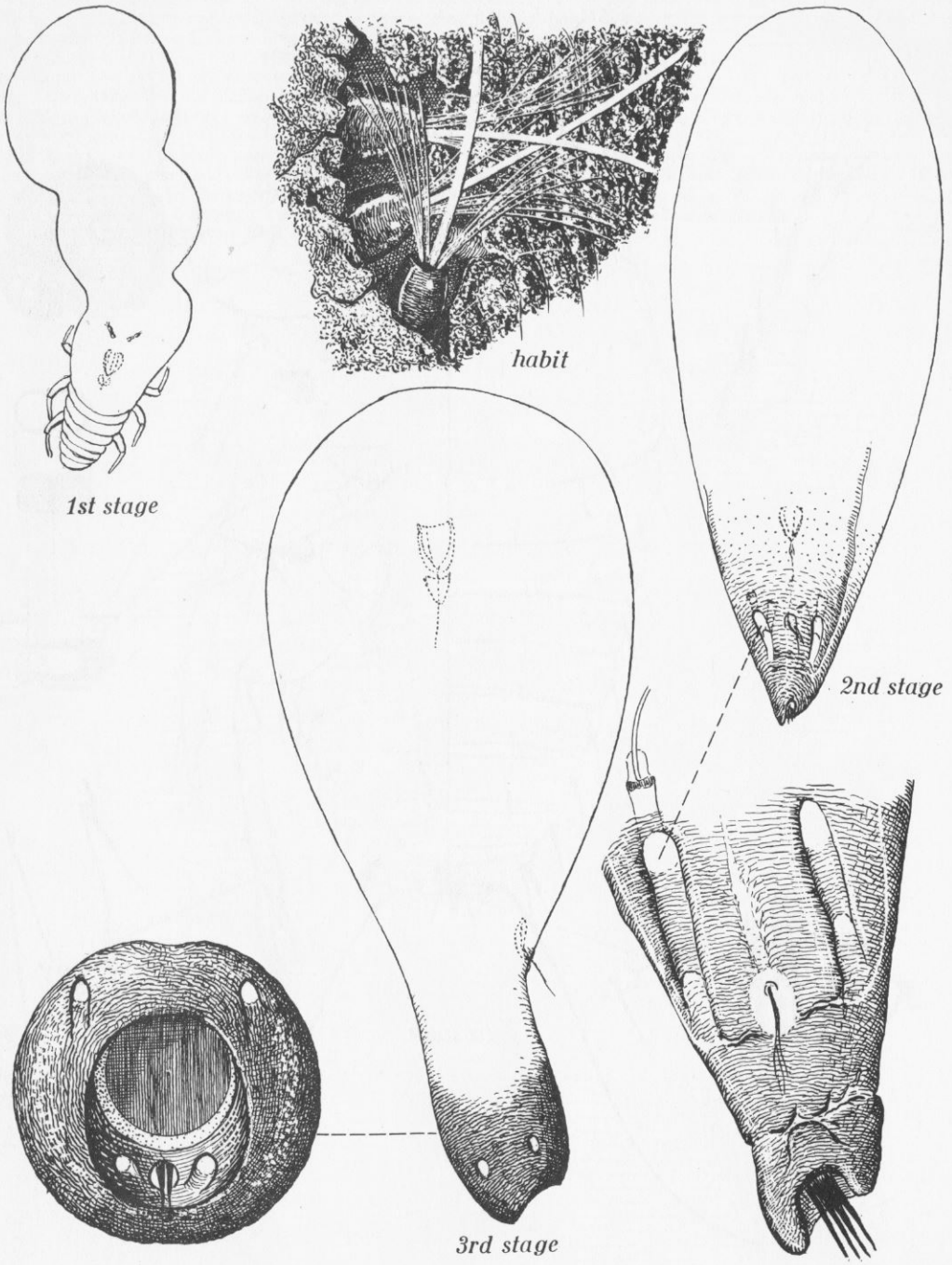
cription and illustrations and his types were presumably lost in the destruction of his collection during the last war. It seems best to describe the species at hand as new.

In the very excellent key to the species of *Orthezia* given by Morrison this species runs to the couplet which includes *urticae* and *solidaginis*. It differs from both, however, in having four facets in the eyes and in the details of the ovisac band and its components. It seems actually to approach *solidaginis* most closely, especially in the arrangement and size of the spine patches on the dorsum but is clearly distinct.



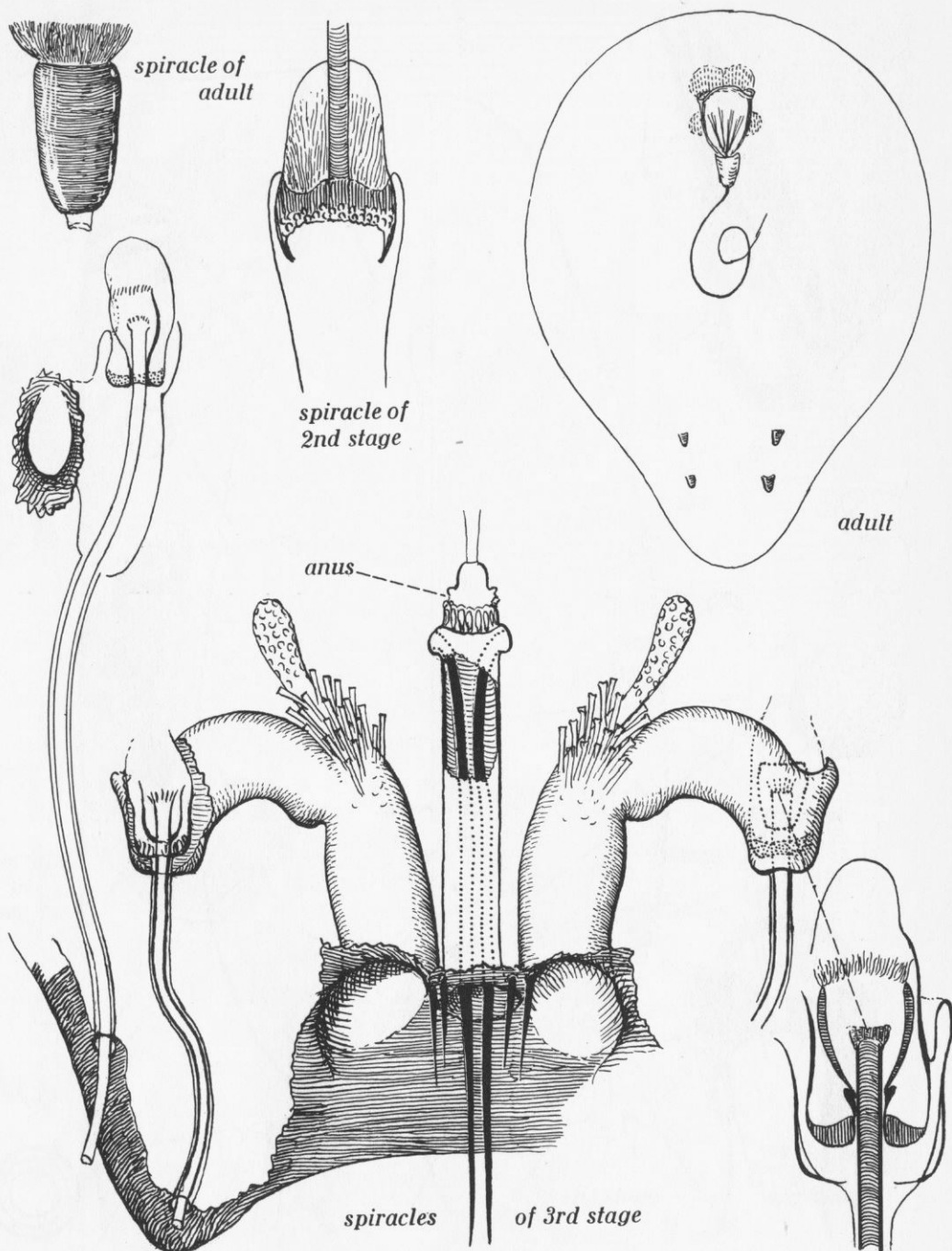
Beesonia quercicola, new species

Figure 1



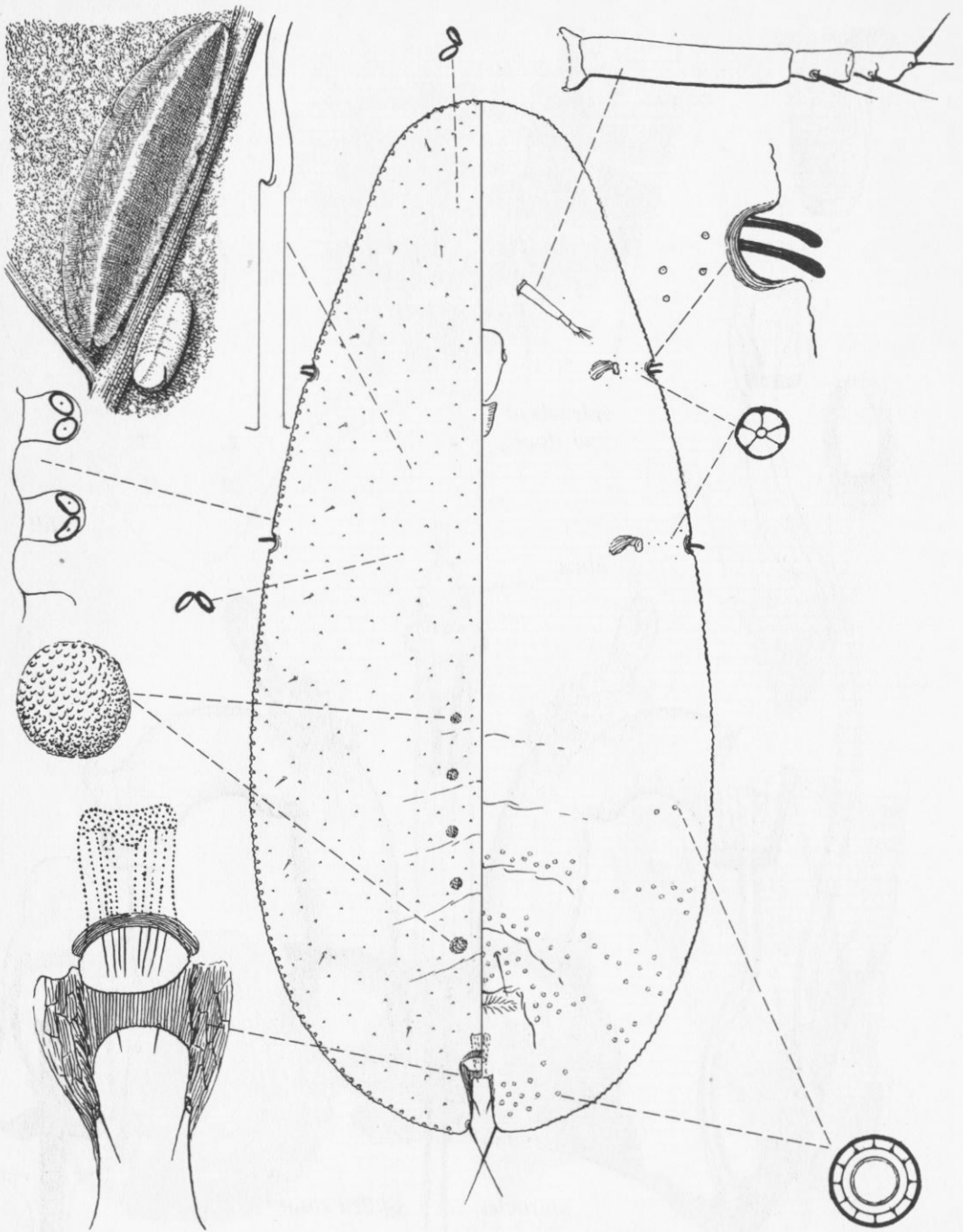
Beesonia quercicola, new species

Figure 2



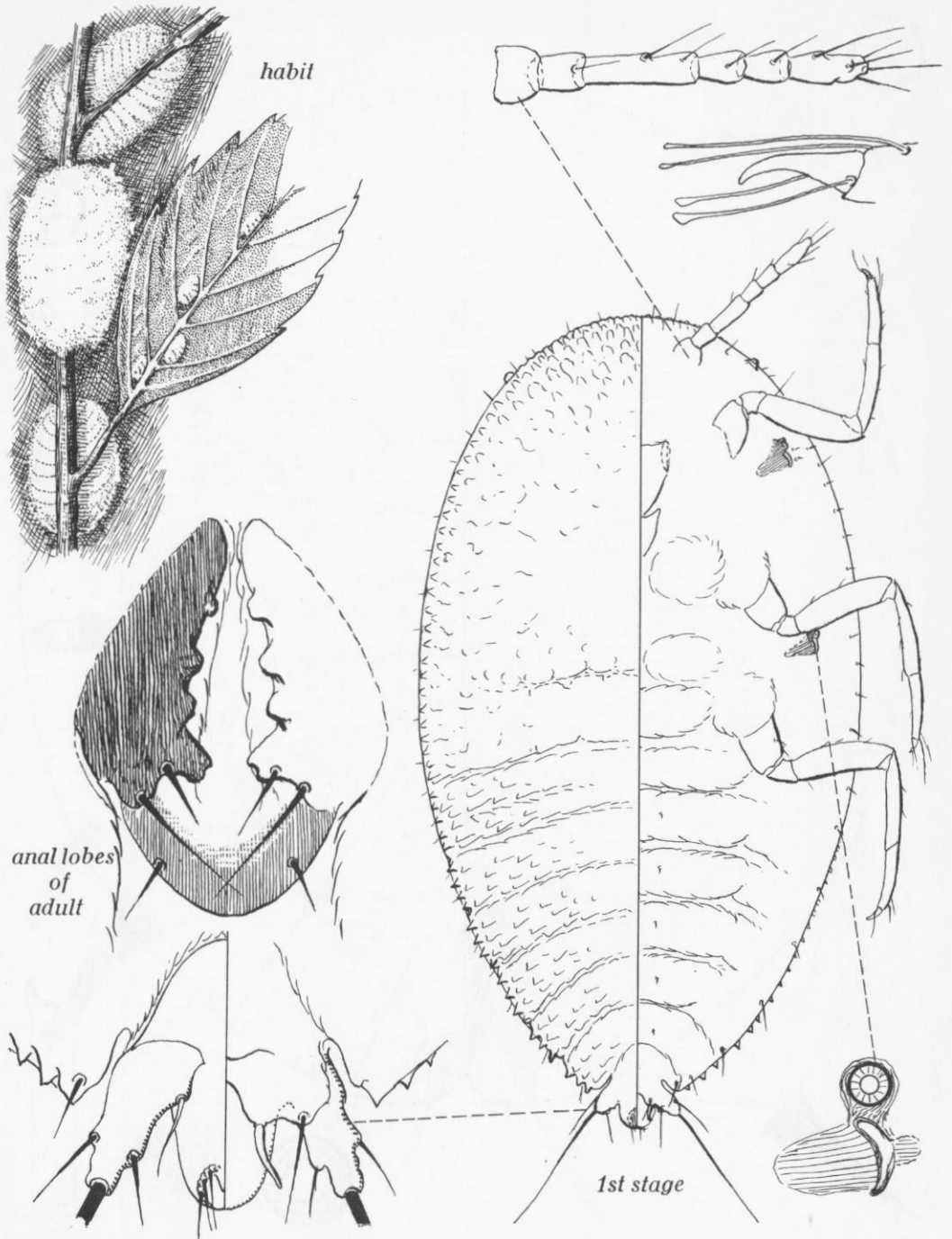
Beesonia quercicola, new species

Figure 3



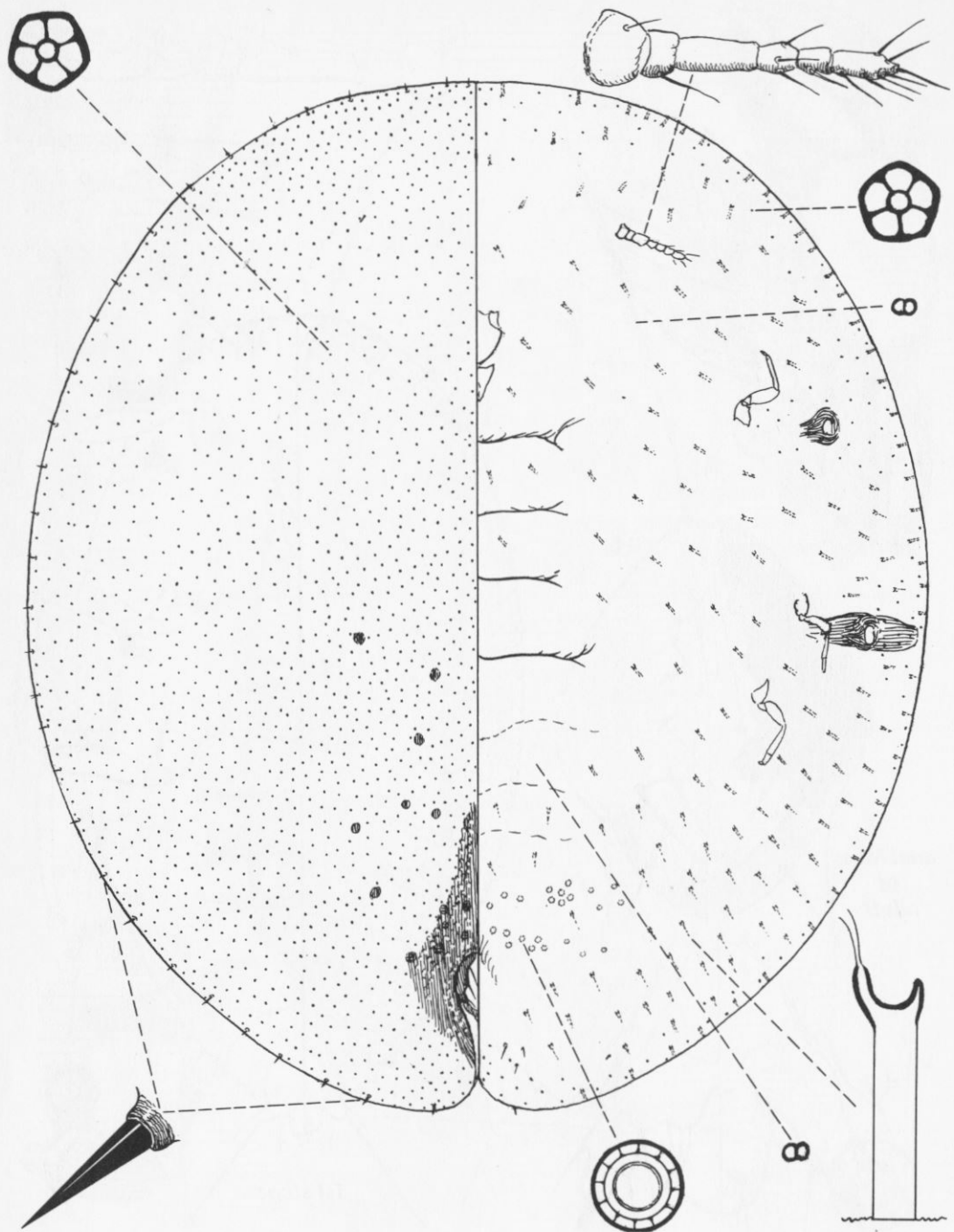
Lecaniodiaspis elongata, new species

Figure 4



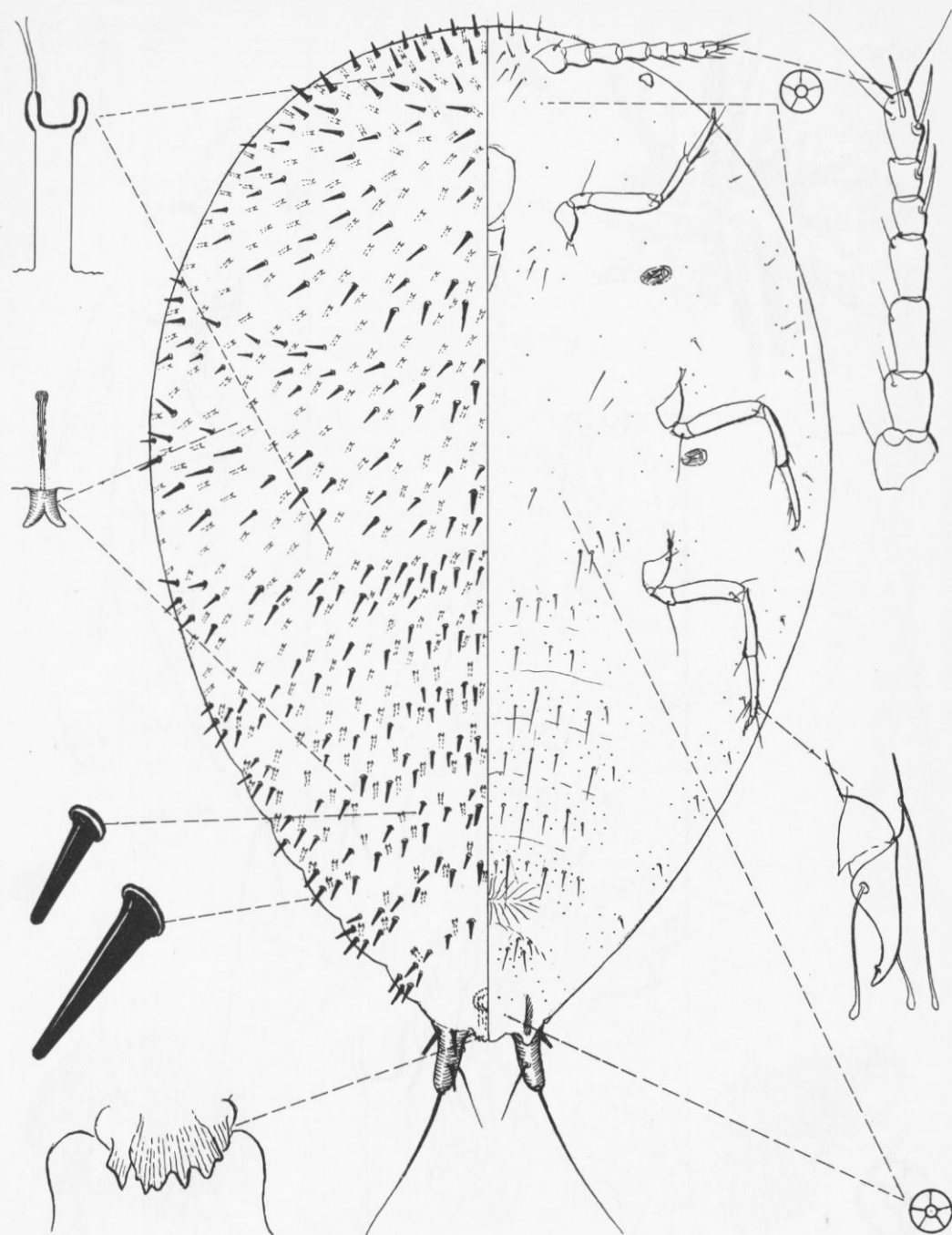
Pseudopulvinaria sikkimensis Atkinson

Figure 5



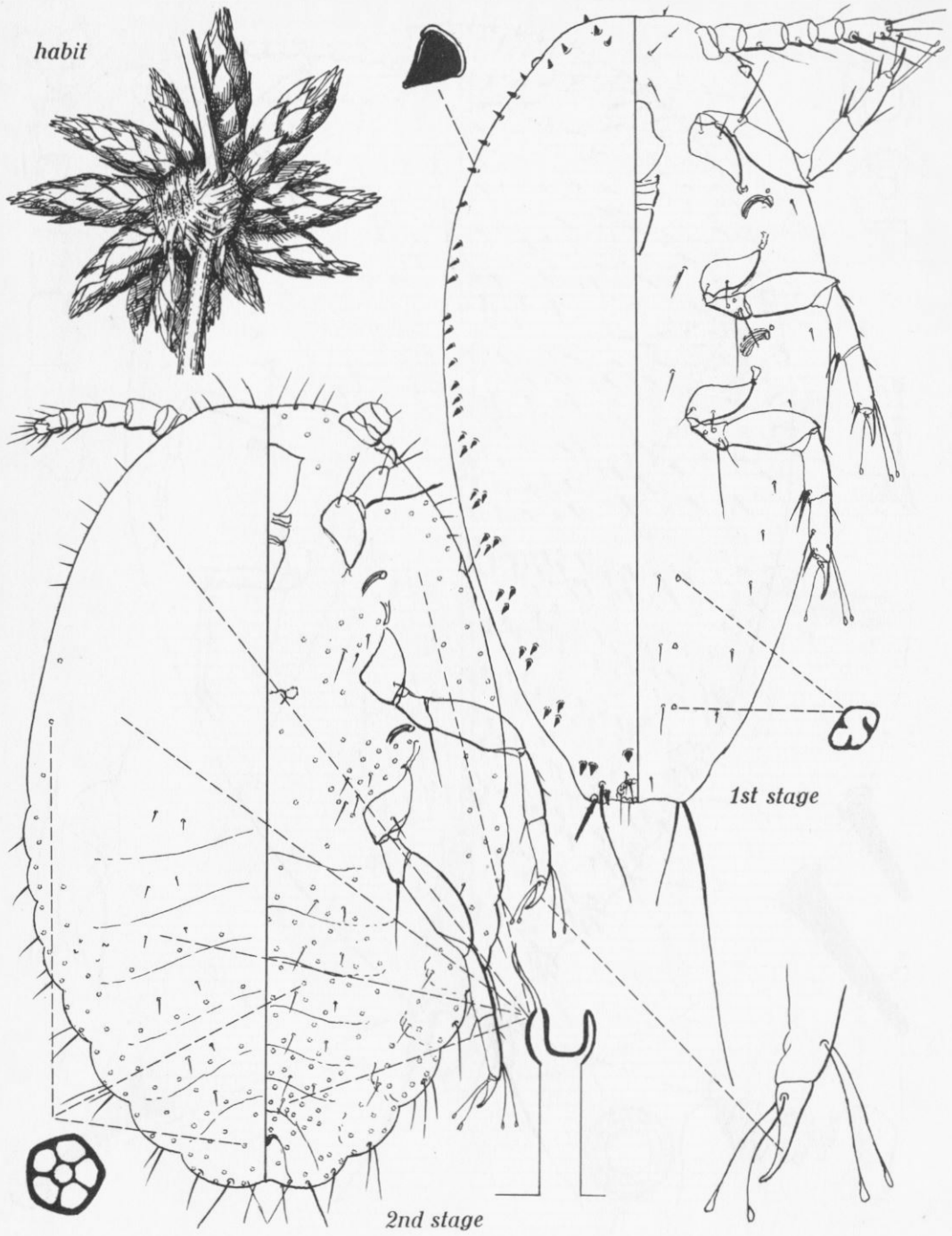
Pseudopulvinaria sikkimensis Atkinson

Figure 6



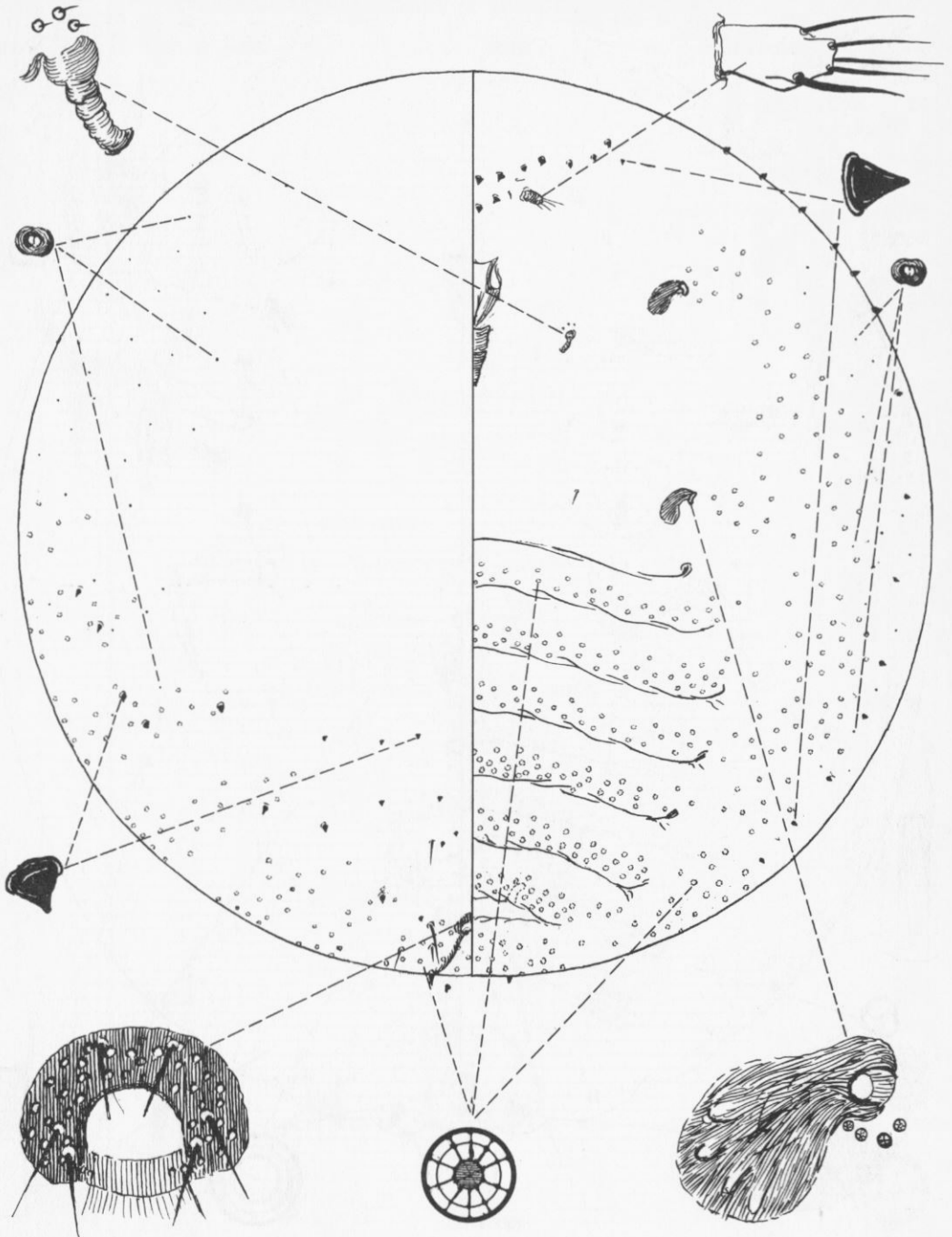
Eriococcus corniculatus, new species

Figure 7



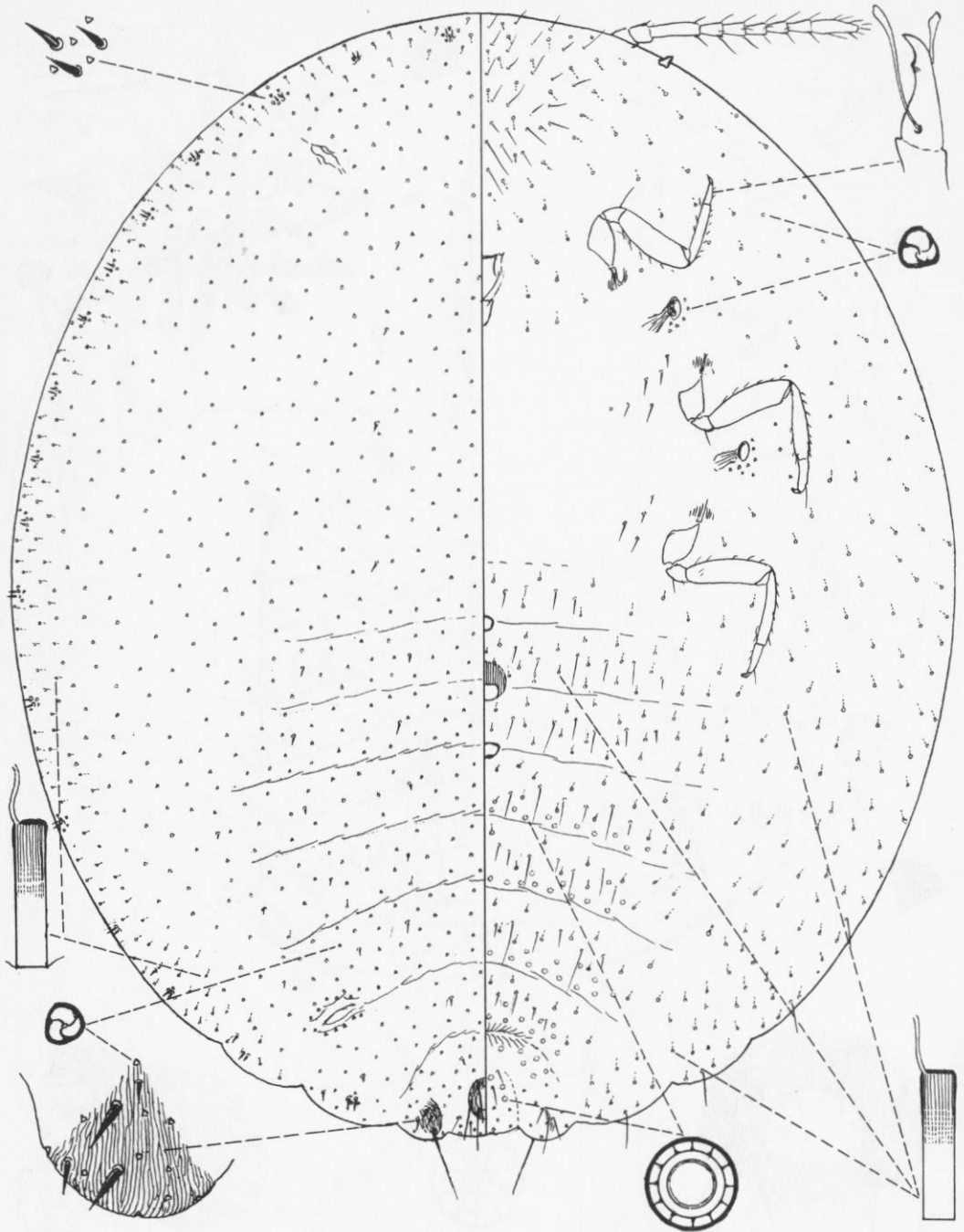
Fulbrightia gallicola, new species

Figure 8



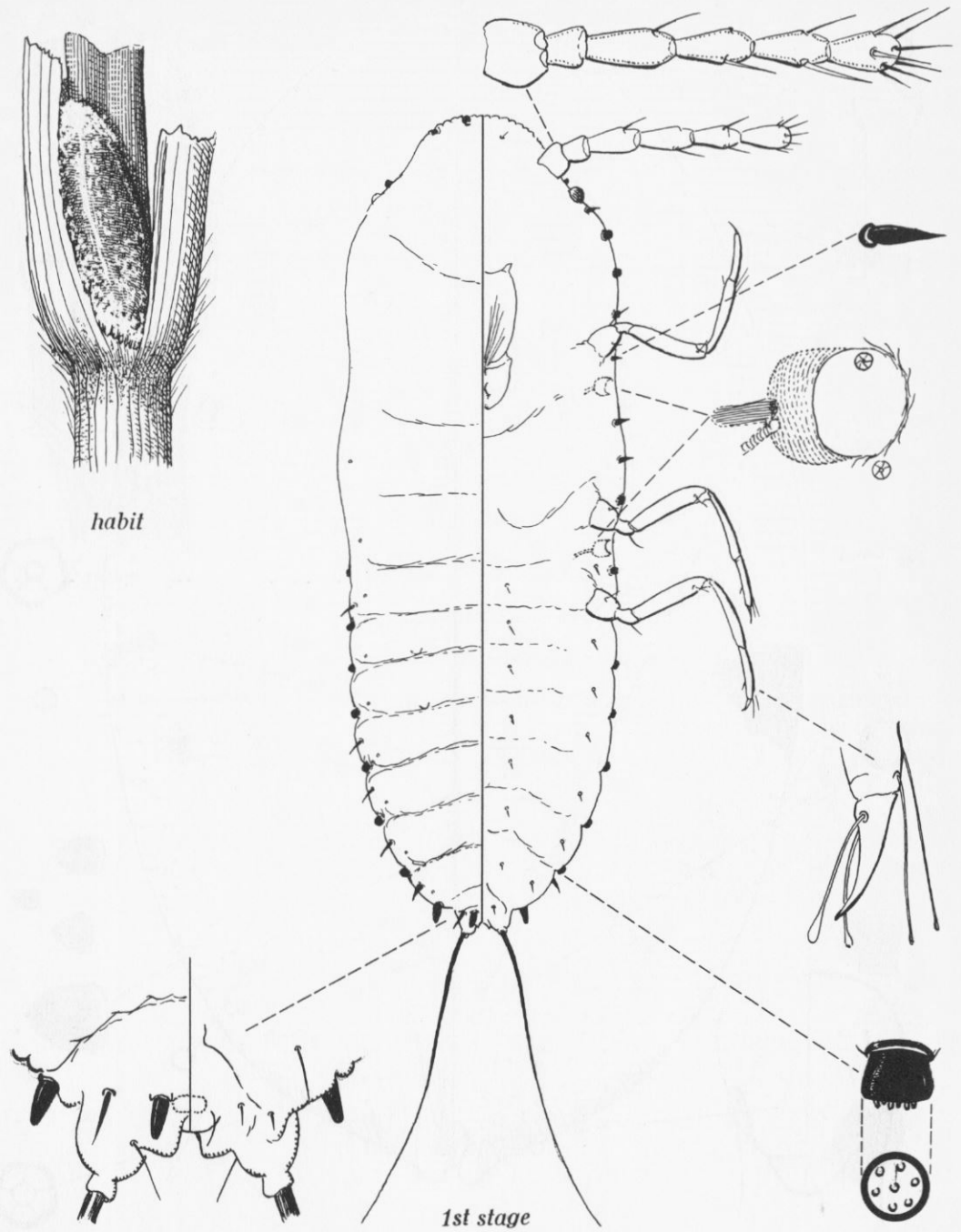
Fulbrightia gallicola, new species

Figure 9



Phenacoccus prodigialis, new species

Figure 10

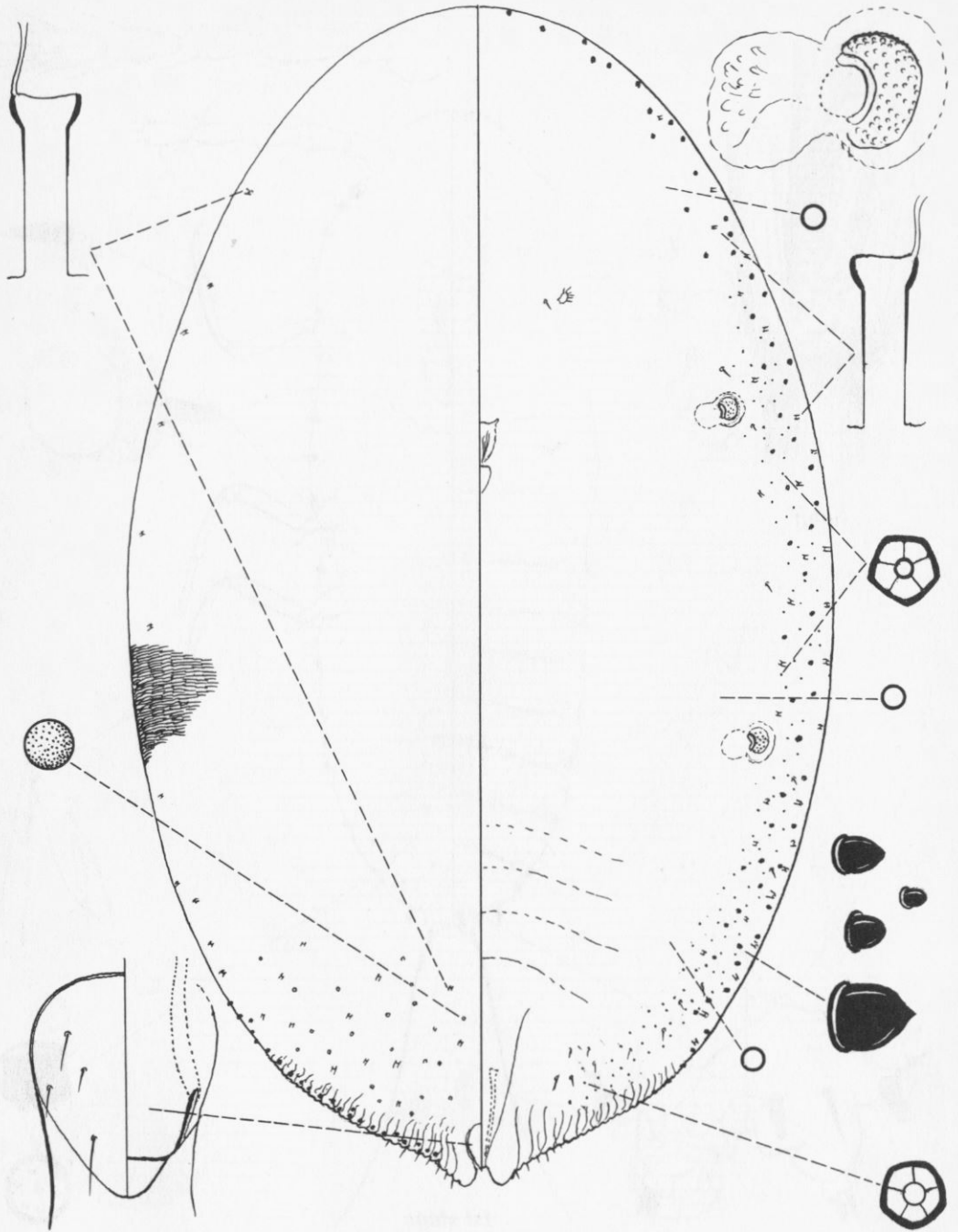


habit

1st stage

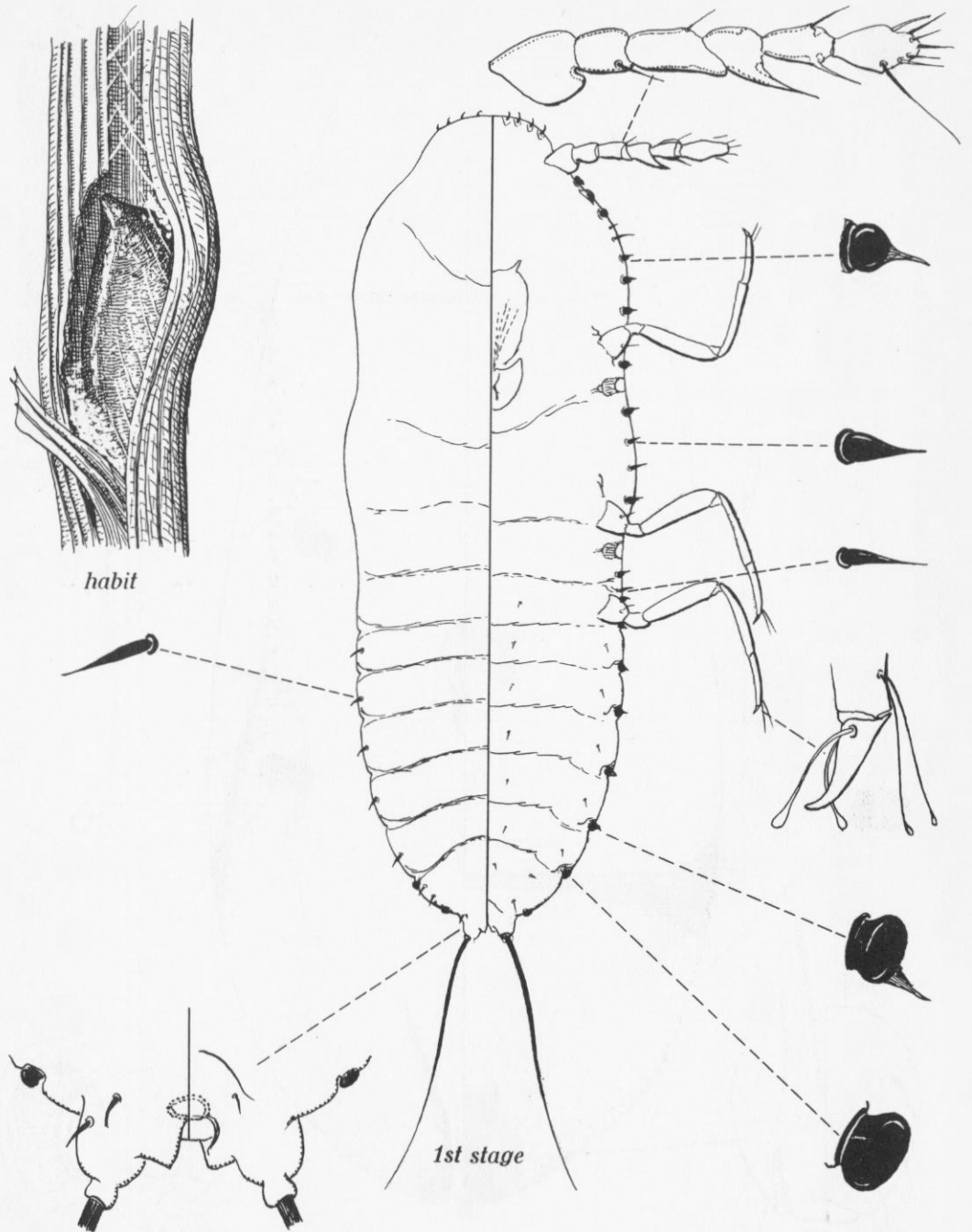
Aclerda takahashii Kuwana

Figure 11



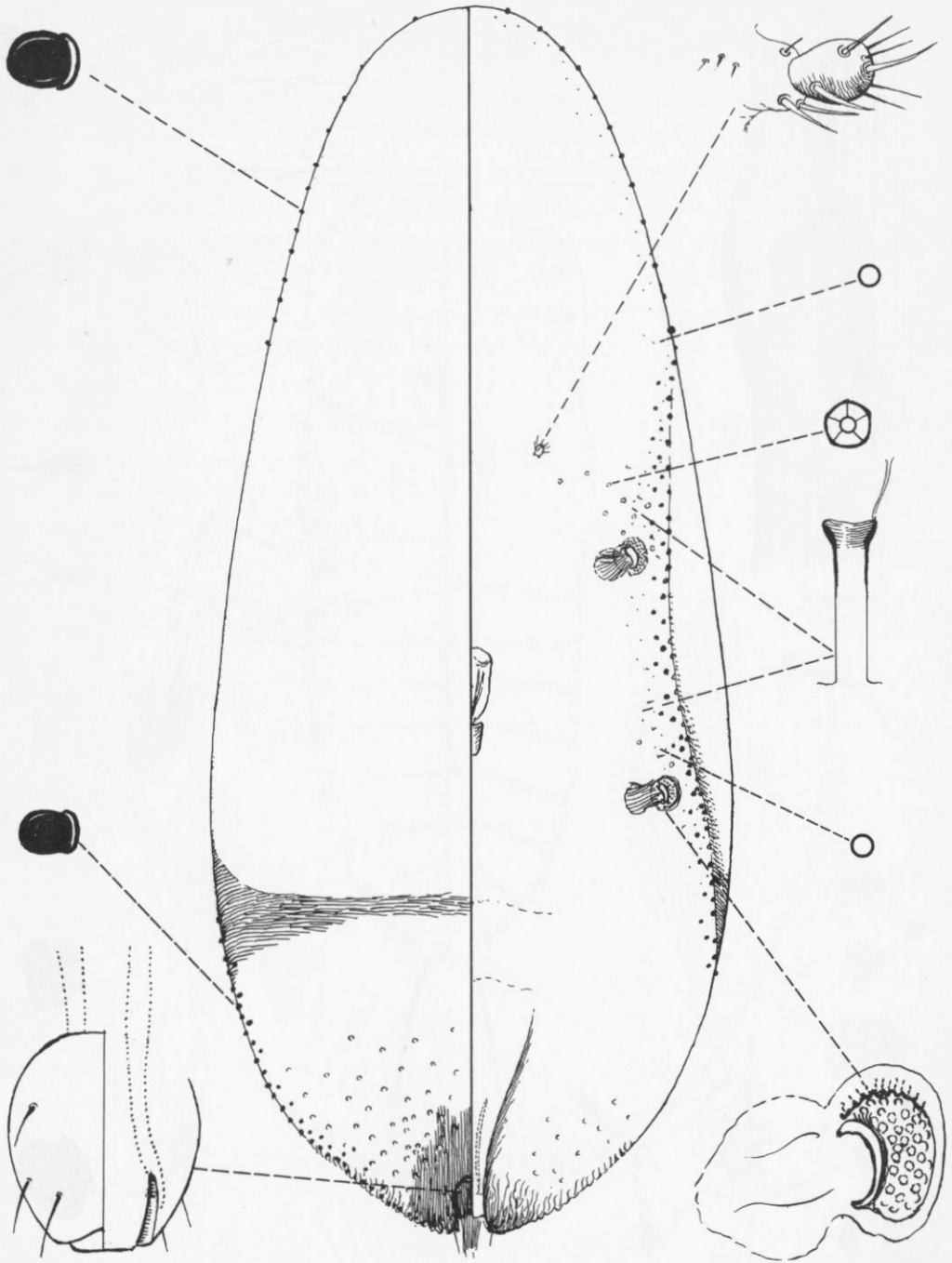
Aclerda takahashii Kuwana

Figure 12



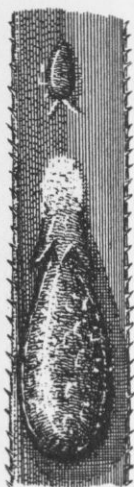
Aclerda yunnanensis, new species

Figure 13

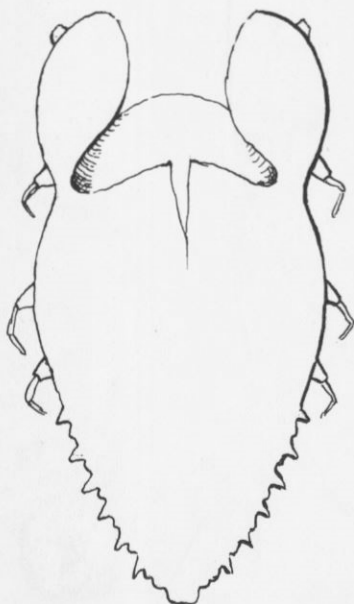
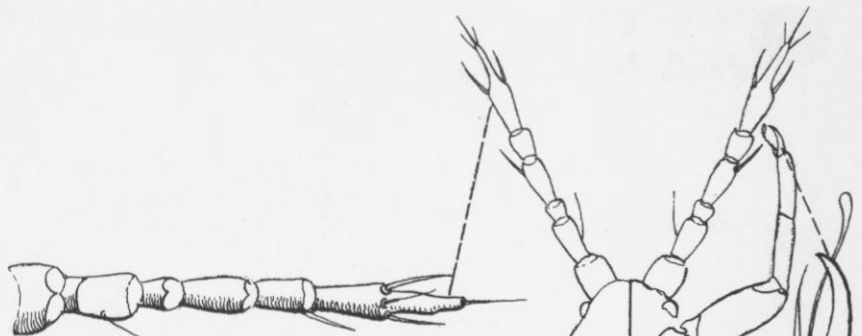


Aclerda yunnanensis, new species

Figure 14



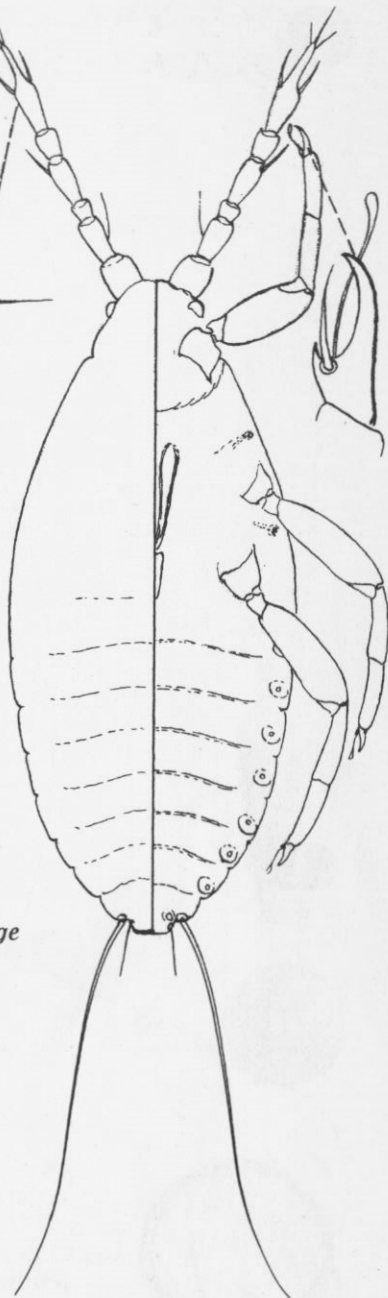
habit



exuvium of 1st stage



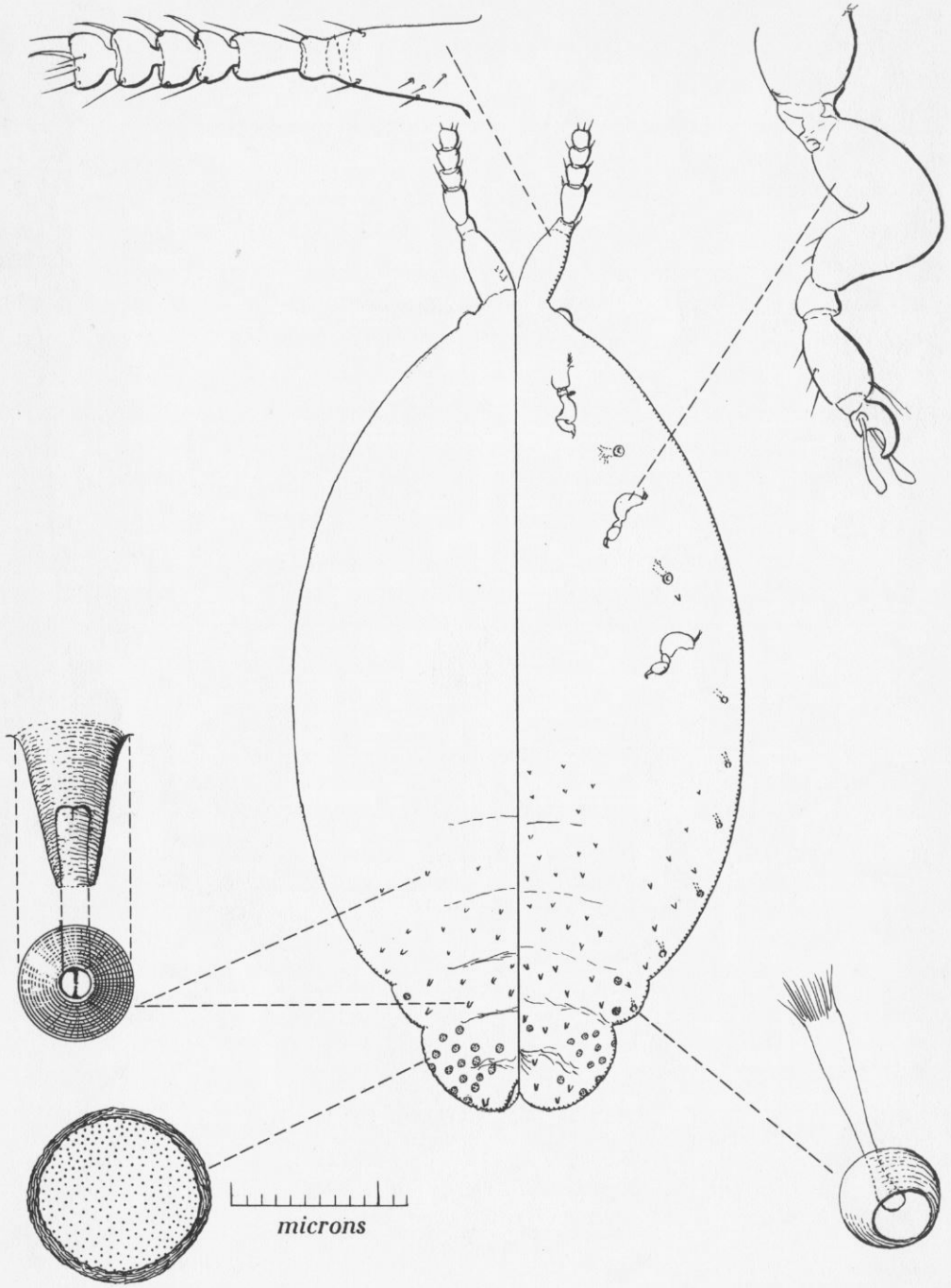
spiracle of 2nd stage



1st stage

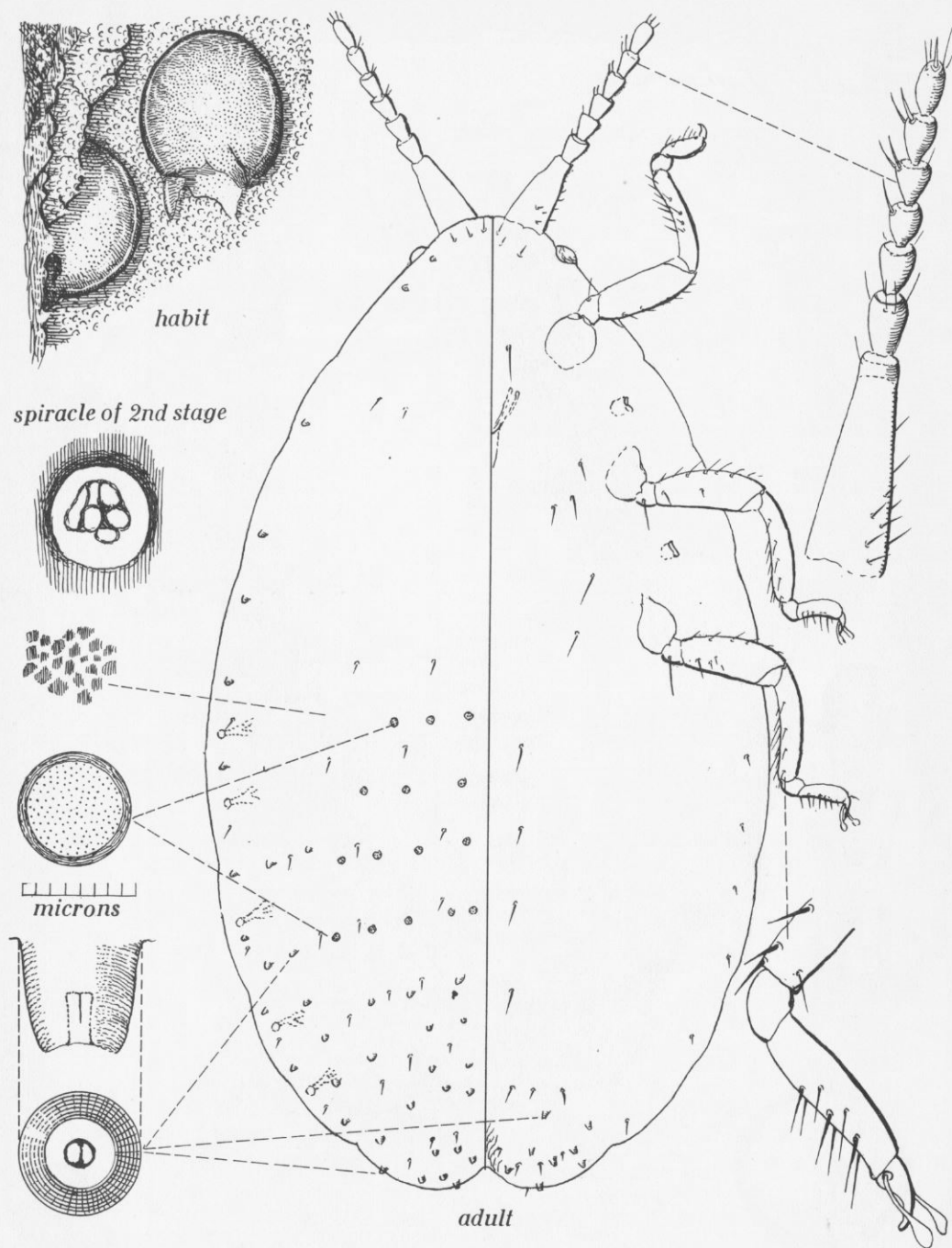
Matuscoccus sinensis Chen

Figure 15



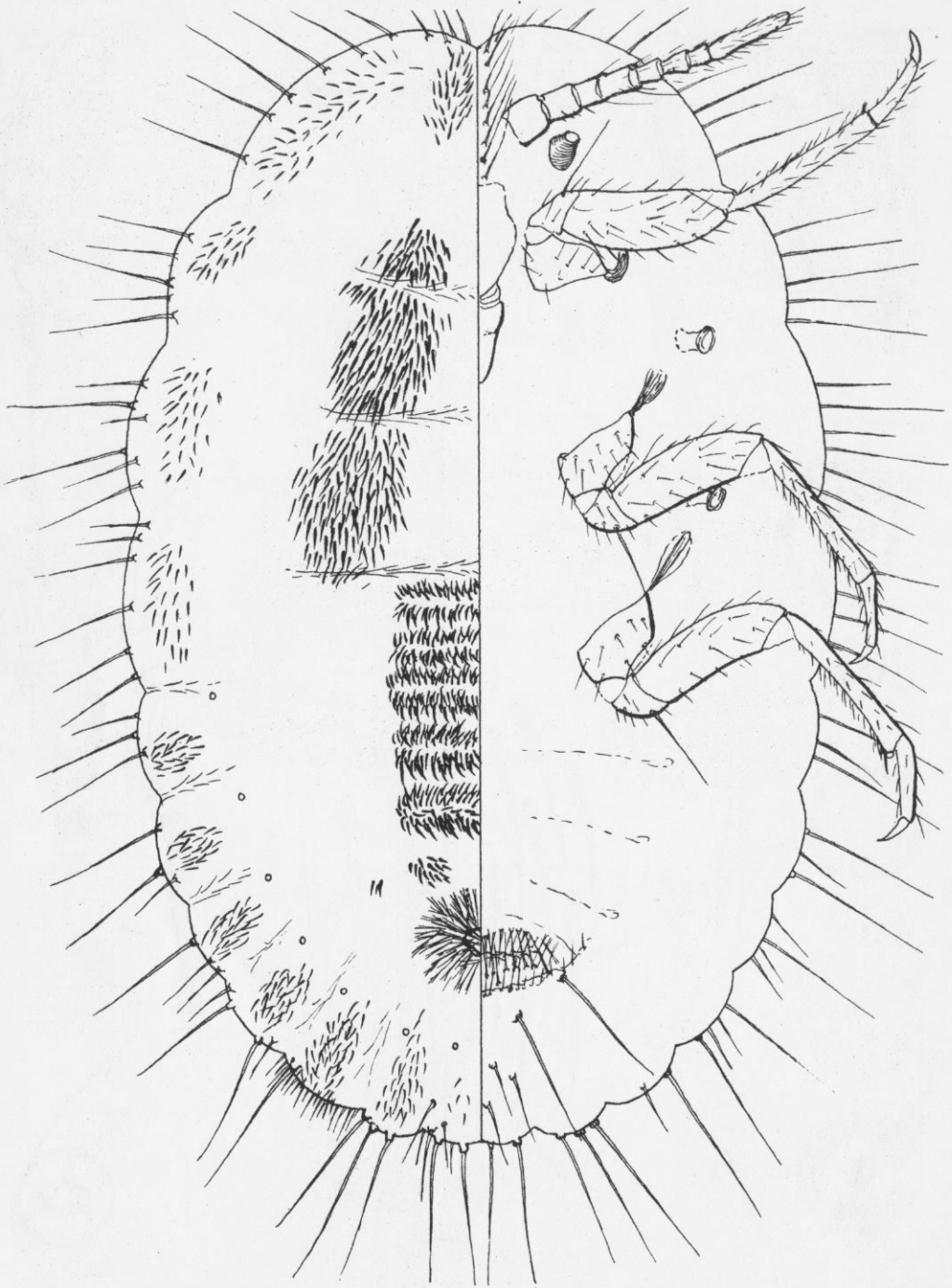
Matsucoccus sinensis Chen

Figure 16



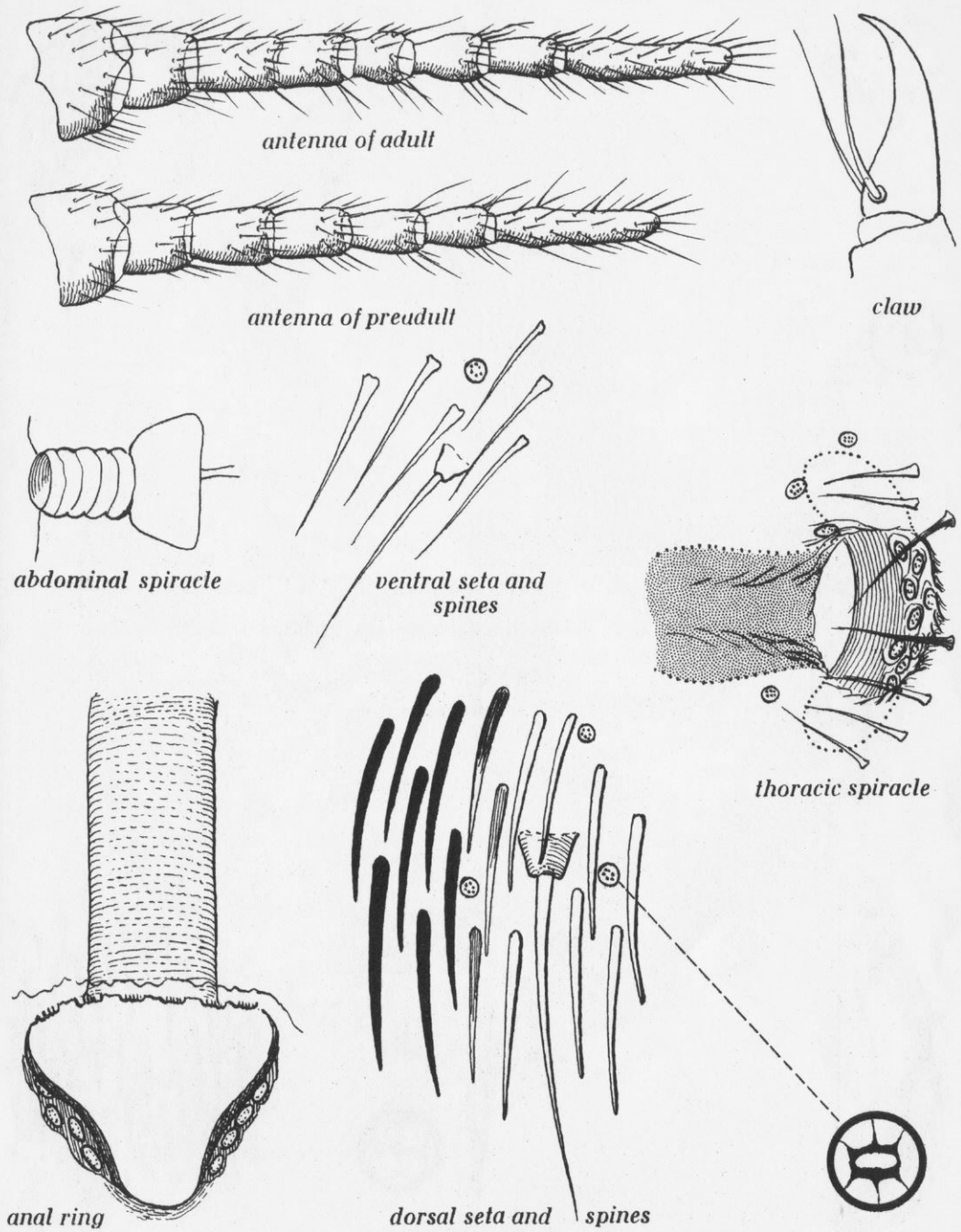
Matsucoccus yunnanensis, new species

Figure 17



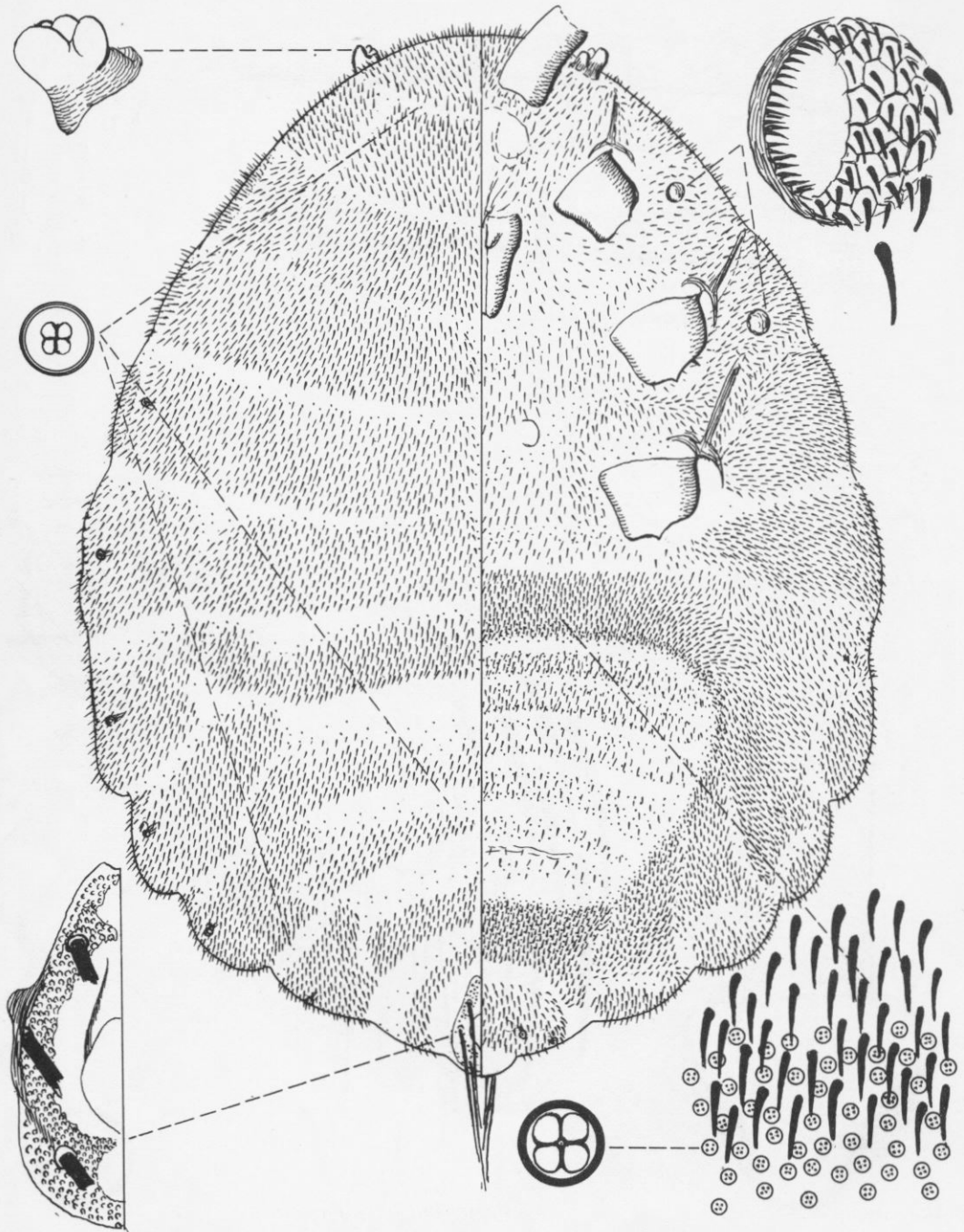
Sishania nigropilata, new species

Figure 18



Sishania nigropilata, new species

Figure 19



Orthezia quadra, new species

Figure 20