Indian Museum notes

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SCALE INSECTS IN MADRAS.

BY R. NEWSTEAD, F.E.S., CURATOR OF THE GROSVENOR MUSEUM, CHESTER, ENGLAND.

(*With two plates.*)

All the insects described in this paper were collected by Miss. L. E. Tomlin, Chester, England, during her visit to Madras, 1892-93. At least two of the species are of economic importance, viz., *Icerya ægyptiacum*, Doug., and *Dactylopius ceriferus*, n. sp., the rest do not appear to be injurious, but they may at any time present themselves as such, therefore it is as well to publish what is known of them at once. The discovery of the male of *Ceroplastes ceriferus*, Anderson, is of great interest and scientific value, and I have much pleasure in appending the description and figures.

It must also be added that Miss Tomlin made careful coloured drawings from life of all the insects ; these have been very helpful to me in the preparation of my descriptions. Some of the figures have been reproduced on the plates, and are gratefully acknowledged.

For the names of the food-plants, so far as it was possible to obtain them from the inadequate material available, I am considerably indebted to Prof. Oliver, Kew, England.

"THE INDIAN WHITE WAX INSECT."

Ceroplastes ceriferus, Anderson.—Plate II, Fig. 1.

In this publication (Volume II, pp. 91-97) Mr. E. C. Cotes has given a most interesting account of the female of this species, and the uses of its white wax. So far, however, no one has given any detailed description of the female and nothing has hitherto been ascertained as to the transformations of the insect. Miss Tomlin, however, was fortunate in obtaining many examples in various stages, from a low bushy shrub (*Asclepiadrom*), growing in sandy soil at seven Pagodas, Madras, in February 1893, which were carefully packed and forwarded to me. There were many examples of the adult female on the stems of the food-plant, with their thick, irregular coverings of white wax, but there were neither eggs nor larvæ in them ; judging from the colour and condition of the wax, I should say that the females had been dead some time, and this is what one would expect as the young females were when taken at the period of fecundation. On the leaves, and more rarely on the stems, were numerous examples of the young females (second stage), and scales of the male, all of the latter were apparently empty. On looking carefully over the *debris* at the bottom of the packet, I found many examples of the perfect male which delighted me, for hitherto not a single male of any of the known species of the genus *Ceroplastes* has been discovered. Undoubtedly the males must have hatched during transit, and it is well that Miss Tomlin collected them when she did, or we should have had but their empty scales to tell that they had existed.

Below I append a description of the different stages :— ♀ Adult (fig. 1*a*), gives off a rich reddish-brown, or purple-brown stain in caustic potash; covered with a thick layer of dirty yellowish white wax, of a more or less hemispherical form, often cracked and irregular in outline, and apparently varying according to the age of the individual. Body (fig. 1*b*.) denuded of the wax, elongate ovate, shining reddish brown, with a blunt horn-like prominence at the abdominal extremity, at the apex of which are the true caudal scales; surface with fine punctures arranged wide apart. Dermis when viewed from *above* with a transmitted light, faintly tessellated in portions only (fig. 1*c*.), in the centre of each tessellæ an elongated pore, or spinneret of the shape shown at fig. 1*d*.; these latter are always present in all parts of the dorsal dermis, but to be seen as shown in the fig. 1*d*., they must be viewed from above and they are not clearly defined in all cases. On the margins near the spiracles are numerous short conical spines. Antennæ (fig. 1*e*.) of 6 joints, of which the 3rd is longest, and forms more than one-third of the antenna; 4th as long as the 5th and 6th together; 5th shortest; three last with deeply gradated sides. Legs (fig. 1*f*.) with the coxæ large, trochanter with a long hair; tarsi a little shorter than the tibiæ, with two short slender digitules, those of the claw uneven, *i.e.*, one much larger than the other: both dilated at base and extremity.

Long with waxy covering 3½-8 mm., wide 3-6 mm., high 2·5 mm.

Long without waxy covering 5 mm., wide 2½ mm., high 2½ mm.

The latter is the measurement of a single ♀ only.

In the Gardener's Chronicle, 1853, page 484, Professor Westwood figures the adult female, and I may say that the illustrations agree with several specimens taken by Miss Tomlin. The description of the female, however, is very poor, and without the illustrations would be useless.

♀ Young (fig. 1*g*.), dorsum evenly covered with a layer of pure white wax; margin all round with broad, lateral, projecting plates of the same material; and there are two small ones placed close together over the anal orifice. In this stage the insect is very pretty, and forms a very interesting microscopic object. Long ½-1 mm.

♂ (Fig. 1*h*.) Reddish brown (restored specimens), body rather short, wide; eyes black, large and prominent; the two ocelli beneath small; antennæ of 10 joints (fig. 1*k*.), 3rd longest, all with many long fine hairs, and deeply notched sides. Legs (fig. 1*l*.) ordinary.

Wings rather short. Genital armature (fig. 1*m.*) somewhat triangular with a large, thin, projecting funnel-shaped organ. Anal lobes each with one very long hair, and one or more short ones; lobes with numerous circular discs. The long anal seteæ in life would no doubt be covered with white wax forming long white filaments, common in all the males belonging to this division of the Coccidæ. In all the specimens examined the white covering was wanting and no doubt was broken away during transit.

Scale of the ♂ (fig. 1*n.*) opaque glassy white, with a broad central and three lateral carinæ, the central ones meeting form a complete loop.

Long 2-2½ mm.

The form of the genital armature of the ♂ is unique, and may be of generic importance. In other respects the ♂ does not differ from the ♂ of the genus *Lecanium,* and the scale of the ♂ is also very like those of the latter, but there is no central " coronet " or ring.

So far then we have the description of the species in nearly all stages, but there is yet much to learn of its habits. I have no hesitation in saying that it would not be a difficult matter to work out the life-history, but rather a pleasant task for some resident Entomologist, and it would add much to our knowledge of these minute beings.

P.S.—Since completing the above description Mr. Maskell of New Zealand has sent me his paper on Coccidæ for 1892 (Trans. N. Z. Int., Vol. XXV) in which the author has described and figured the female of the above species. Mr. Maskell's figure of the female of the second stage is, however, very different to mine, but this must be due to the age of the insects; probably his examples were much older than mine, which will account for the discrepancy as to the arrangement of the waxy covering.

Pulvinaria obscura, n. sp.

Pl. III, Fig. 3.

♀ At period of fecundation (fig. 3*a.*) yellowish brown, short ovate, narrowed in front, with a central carina extending from the anal dorsal scales to anterior margin, or nearly so. Segmentation more or less distinct; after egg-laying the body becomes tilted, and contorted, as is usual with the ♀ of this genus. Antenna (fig. 3*b.*) of 8 joints, of which 2 and 3 are longest, and in length nearly equal; 4, 5, and 8 shorter, 6 and 7 shortest and equal. Could only find hairs on the fifth and eighth. Legs apparently ordinary, but could not be plainly traced. Rostral filaments unexpanded, about half the length of the antenna. Anal dorsal scales long, each with two small dentations on outer margin. Long 2½-3 mm., wide 2 mm.

Ovisac long, narrow, composed of the ordinary close white cottony material. Long 5-7 mm., wide 2 mm.

Larva normal, with 3rd joint of antenna longest; anal emargination wide.

All the females seen were located behind the whorls of flowers of the food-plant; none were found in exposed situations; in order to see them it was necessary to remove the flowers, etc., from the stem, but on doing this the sacs were much broken, and it was difficult to obtain perfect examples.

Hab.—On *Hygrophila spinosa* at Nungumbaukum, Madras. March 14th, 1893.

Described from several females and one perfect sac. ♂ unknown.

Dactylopius ceriferus, n. sp.

Pl. III, fig. 2.

♀ Adult immediately prior to gestation (fig. 2, *a.* & *b.*), elongate ovate, narrowed behind from the thoracic segment; beneath olivaceous, above paler, with the black viscera, etc., showing through the dermis; there are two very long white filaments at the anal extremity, but marginal plates are entirely wanting; radiating from all parts of the body above are numerous very long, delicate, waxy filaments; these latter in the more advanced stage, and when egg-laying has taken place, become very dense, and matted below, completely covering the insect; projecting from the thick matted mass, are very numerous, and exceedingly long, delicate filaments, varying in length from 5 to 10 mm.; these superficially have much the appearance of sponge spicules, as many are perfectly straight and cross each other in all directions; all the specimens received were aggregated together in masses completely covering the under sides of the leaves (fig. 2*c.*). Antenna (fig. 2*d.*) of 8 joints, of which 3 and 8 are equal and longest, 2 shorter, 4 to 7 shortest and equal: all with fine hairs. Legs long, hairy; hairs at apex longest; tarsi a little less than one-third the length of the tibiæ; the latter with a short spine at apex; digitules of tarsi slender, those of the claw stouter and much dilated at extremity (fig. 2*e.*). Rostrum biarticulate with many long hairs; unexpanded filaments about three times the length of the rostrum, not quite reaching the insertion of the intermediate legs. Anal ring with 6 short hairs, intervening spaces with clear circular spaces, or slightly raised discs. Anal lobes normal, each with a very long hair, and two or three strong spines. Dermis: ventral surface between antennæ in front with numerous long hairs and clear circular spaces, or spinneretts, surrounded with from 3 to 5 hairs, these occur again near the oval lobes; the rest of the dermis with a few scattered hairs. Long 3-3½ mm., wide 2-2½ mm.

♀ Second stage (described from Miss Tomlin's coloured drawings) very elongate, ends equally rounded, ochreous, dorsum darker; legs reddish. Caudal filaments long, those of the body long, slender, and straight.

Hab.—On croton at Nungumbaukum, Madras, Jan. 10th, 1893. This very interesting species is allied to the *D. filamentosus* of Cockerell, Jour. Inst., Jamaica, Vol. I, page 254, but this latter has a seven-jointed antenna. I know of no species of Dactylopius secreting such a quantity of waxy material as this, and the species appear in other respects to be quite distinct and I venture to describe it as new. It is a most injurious species infesting crotons in the compound. In her notes Miss Tomlin says:—"Also found on leaves of trees, but not so plentiful there." Whether these are the same as those which occur on the croton I am unable to state as the specimens were not forwarded for investigation.

Dactylopius viridis, n. sp.

Pl. III, fig. 1.

♀ Adult prior to gestation (fig. 1*a.*) covered with white mealy wax, margin all round thickly set with narrow white waxy appendages, except at anal extremity where there is a slight division; in the more advanced stage the insect covers its body with a thick layer of white waxy felting which forms a complete oval sac in which the eggs are laid. When treated with potash it is of a beautiful emerald green, which is retained to a certain extent after mounting in Canada Balsam. Antenna (fig. 1*b.*) short of 7 joints, last joint the longest, and in length equal to 2 and 3 together; the rest are of nearly equal length: all with very fine short hairs; Legs (fig. 1*c.*) short, very little longer than antenna; tarsi much shorter than tibiæ; digitules of claw and tarsus slender: all are often wanting. Rostrum biarticulate, basal joint with two stiff hairs at apex, and two more on the middle of the apical joint. Anal ring with six hairs. Anal lobes obsolete with one long hair: often broken away, and two or three short spines. Dermis with a few short delicate spines, more numerous beneath in front near the antennæ.

♀ Long 2-3 mm., wide 1-1½ mm., Sac long 3½ mm.

Larva, anal lobes nearly obsolete, each with one long and two or more short hairs. Antenna of 6 joints, 1 to 5 short and sub-equal, 6 about one-third the length of the whole. Anal ring with 6 hairs. Rostrum biarticulate, filaments very long.

Hab.—On *Hygrophlia spinosa* at Madras, collected March 14th. All the specimens received were located and partly hidden in the whorls of the spines, leaves, and flowers of the food-plant. Quite fifty per cent. of the specimens were infested with a large dipteron, and some small Hymenopterous insects.

In its green colour it is like *Dactylopius virgatus*, Cockerell, M. S., but this has an eight-jointed antenna, and the "tibia about three times as long as the tarsus" (in lit.).

Two specimens of what I take to be mere varietal forms of the above were found on *Pithecolobium dulce.* Externally they differ materially, as are shown at pl. iii, fig. 1*d*., female's nat. size, and at fig. 1*e*., the same magnified; structurally, however, they do not appreciably differ, and I hesitate in describing them as new with the limited material at hand.

Aspidiotus orientalis, n. sp.

Pl. III, fig. 4.

♀ Scale (figs. 4*a*., 4*b*.) circular, or nearly so, but varying according to position on the food-plant; brownish yellow, or straw colour, sometimes tinged with reddish-pink; exuviæ a little to one side, covered with a nipple-like prominence which is darker than the rest; following this are three concentric circular depressions: the first small and near the "nipple," second well defined and about midway between the two, third often wanting, or but slightly indicated; margin much interrupted and paler than the rest. Diam. 1-1½ mm.

♀ Adult widely ovate (fig. 4*c*), almost circular; last segment (fig. 4*d*., 4*e*.) with three pairs of well-defined lobes: 1st and 2nd each with a deep equal notch at apex on each side; 3rd smallest, narrow, and notched at apex on the anterior margin only: posterior margin straight; between each lobe are two slender plates, and immediately preceding the 3rd lobe there are three; there is a single spine on the dorsal surface immediately over the 3rd plate, and one or more on the margin at the base.

There are four groups of spinnerets: the anterior laterals consist of 5, the posterior laterals of from 3 to 5: usually 5; the anterior group is represented by a single spinneret: no trace of more in any of the many examples examined. There are also very numerous elongated and ovate pores arranged as shown in fig. 4*d*. The plates are very difficult to trace, but the lobes are very distinct.

♂ Scale (fig. 4*b*.) similar to that of the ♀ but smaller.

♂ Unknown.

Hab.—Seven Pagodas, Madras. Name of the food-plant unknown, but evidently a species of Panicum, or grass. The scales were frequently aggregated together behind the leaf-sheaths, and could only be seen on removing the latter.

THE "EGYPTIAN COTTONY CUSHION SCALE."

Icerya ægyptiacum.

Pl. II, fig. 2.

Crossotosoma ægyptiacum, Douglas. Ent. M. M. S. S., Vol. I, p. 79.
Icerya ægyptiacum, Riley. Insect Life, Vol. III, p. 97.

Hitherto this most destructive pest was only known to occur at Alexandria, Egypt, where it has for the last eight years caused the greatest alarm.

In a letter dated September 10th, 1892, Rear Admiral R. W. Blomfield, R. N., writes of this pest as "an eleventh Egyptian plague, which made its appearance at Alexandria in 1885, and has since proved most destructive to all kinds of vegetation. Origin unknown." (In lit.)

It was unknown to naturalists until the year 1890 when Mr. J. W. Douglas of Lewisham, England, described it for the first time as *Crossotosoma, N. G., ægyptiacum,* n. sp. (l. c.). The specimens from which Mr. Douglas made his descriptions, were "received from Mr. D. Morris, Assistant Director of the Royal Gardens, Kew, to whom they had been sent from Alexandria, Egypt, where they were causing immense injury to fruit trees" (Doug. l. c.).

Later Dr. C. V. Riley (l. c.) refers the species to the genus *Icerya,* to which it undoubtedly belongs. Several other interesting accounts of this pest are given by Dr. Riley in "Insect Life," and as they may not be accessible to the general public, I venture to quote some of them. At Vol. II, p. 256, is the first record, as follows:—"During the past four years the gardens in Alexandria have been infested by a coccus which destroys all of the trees, and is causing the greatest alarm. . . . . Admiral Blomfield[1] noticed it in quantities on the under-side of the leaves of the Banyan tree, but it soon spread with extraordinary rapidity, and some of the most beautiful gardens of the city full of tropical trees and shrubs have been also destroyed. A breeze sends the cottony pest down in showers in all directions. It seems to attack almost any plant, but the leaves of *Ficus ruginosa* and one or two other kinds of fig seem too tough for it, and it will not touch them. He states that it seems

[1] Spelt in error Blunfield.

almost impossible for a few Horticulturists to try to eradicate the pest while their indifferent neighbours are harbouring hot beds of them, and there will have to be some strong measures taken by law to put it down." Referring to the statement that "a breeze sends the cottony pest down in all directions," it is evident that it is the white waxy appendages that are blown about, and not the insects themselves; so fragile are the former that it is difficult to obtain perfect examples of the insects.

Again Dr. Riley writes (Vol. III. p. 423). Through the kindness of Mr. Louis B. Grant, Acting Consul-General at Cairo, and of the Department of State, this Department has received copies of publications from Alexandria and Cairo, from which it seems that the insect is even more injurious than our previous information, through Mr. D. Morris, led us to suppose. It is by no means confined to fig trees, but has attacked oranges and lemons. Dr. Riley then suggests the collecting of the white wax, which he says "is absolutely pure and, we should say, of equal quality with the white Chinese wax secreted by *Ericerus Pé-la*, having the advantage of not being mixed with the bodies of the insects."

Miss Tomlin found all her specimens on the under-sides of the leaves of a purple-leaved plant very like a coleus, in the compound at Nungumbaukum, Madras, December 13th, 1892, where it was very abundant but local. All the specimens Miss Tomlin forwarded to me were immature females, except two or three which had partly formed their ovisacs, but there were no eggs in them. Lying alongside the females, were numerous examples of the male sacs, but I failed to find a trace of the perfect insect amongst them; all had undoubtedly hatched some time before the sacs were collected, which is unfortunate as the male of this species is unknown, and its discovery would be of great interest and value.

Fortunately I had specimens of the females from Egypt in all stages, and was therefore able to compare them with the Indian specimens, which I did and found them to agree in every particular with the immature examples : both as to the arrangement of the waxy plates and structurally. Below I append a description of the second stage, female and male sac, which has not hitherto been described.

♀ Second stage (fig. II, 2*a.*; 2*b.* 2*d.*) bright orange, but only seen on the under-side, or in other parts when denuded of the waxy covering. Dorsum in perfect specimens covered with pure white, conglomerate, waxen plates, irregular in shape; margin all round with long narrow curly plates. Fig. 2*a.* represents the insect's natural size on leaves of the food-plant; fig. 2*b.*, 2*d.* the same magnified. Dorsal and ventral view, with the appendages more or less imperfect; fig. 2*c.* dorsal view of perfect specimen; all of the same age. The antennæ vary in the number of joints according to the age of the individual; generally, however, there are eight joints, but some have seven and others nine joints; the rest of the characters do not appreciably differ from the adult female. Long 3-7 mm., wide 2½-6 mm. including filaments.

♂ Sac elongate, composed of a rather close white waxy felting. Long 2½-3 mm. Specimens much broken, therefore the measurements may not be quite correct.

The adult female is very similar to that of the second stage, but is much larger, has the marginal appendages much longer, and a large projecting bag or sac attached to the abdominal segments in which the eggs are laid.

Parasites.

The first consignment of coccids reached me on February 20th; in the packet containing the Iceryas were a number of what I took to be chalcid parasites; thinking that they might be of economic importance, I forwarded specimens to Dr. C. V. Riley of the United States Department of Agriculture, Washington, who very kindly replied as follows:— "The fact of the occurrence of *Icerya ægyptiacum* in India is very interesting and important, and the parasites were examined with bated breath. Most unfortunately, however, instead of being primary parasites, they are secondary, and the whole series belongs to an apparently undescribed species of *Tetrastichus*, all of the species of which are hyper parasites so far as I know." (In lit. Ap. 20, 93.)

Miss Tomlin has now returned to England, and I fear there is little chance of obtaining the true parasite: unless some competent Entomologist visited the locality early in December, when it ought not to be a difficult matter to work the whole subject out, and to breed out the true parasite. Judging from the number of sub-parasites, which undoubtedly hatched during transit, the true parasite must be very numerous.

Remedies.

I am not in position to judge what is best as an application to the *Icerya* should it be found injurious, but no doubt the same application recommended for *Icerya purchasi*, Mask., would be effectual in destroying this pest. (See *Insect Life*, Vol. II.)

The most successful remedy adopted in America against the *Icerya purchasi* has been the introduction of an Australian "Lady-bird" beetle (*Vedalia cardinalis*), where it has cleared thousands of orange trees of the destructive coccids. This *Vedalia* has also been imported into Alexandria by Dr. Riley for the destruction of the Egyptian *Icerya*, where they have done excellent work. Admiral Blomfield, who had the management of the *Vedalias,* told me that it was wonderful to see how soon these small beetles cleared off the *Iceryas,* but I believe they are but a small colony at present. It is hoped, however, as they increase the *Iceryas* will diminish.

The following are some interesting letters addressed to Mr. Coquillett at Los Angeles upon the subject of *Vedalia* beetles. They are quoted from *Insect Life,* Vol. II, p. 190 :—

"* * * The *Vedalias* that you brought to my place about the 20th of last March, and which we colonized on four large orange trees that were covered with Fluted Scale, have spread in all directions, although to begin with they followed the direction of the wind most readily. From those four trees they have multiplied so rapidly that in my orchard of 3,000 trees it is seldom that we can now find a Fluted Scale ; I find a few of them on some weeds in spots, but I can also find the beetles there. The trees have put on a new growth and look altogether different; even the black fungus on the old leaves has loosened its hold and begins to fall to the ground. Besides having cleaned my orchard, they spread also to the orchard of my cousin and to my father's orchard ; the latter was also re-enforced by colonies from Mr. J. W. Wolfskill and from Colonel J. R. Dobbins. As my father has some 10,000 trees, and mostly all were more or less infested, the *Vedalias* had a grand feast ahead of them, and they have done their work most wonderfully. What I have said of my orchard applies to my father's also, and really to all our neighbours. When the *Vedalias* first began to multiply we took colonies of fifty or more in the pupa state and placed them in different portions of the orchard, and even had we not done so the *Vedalia* unaided would itself have reached there in almost the same time.

"On the Chapman place the *Vedalias* have cleaned the Fluted Scales off of the 150 acres of land. They have taken more than an oppressive burden off of the orange grower's hands, and I for one very much thank the Division of Entomology for the *Vedalia cardinalis,* the insect that has worked a miracle.—[A. Scott Chapman, San Gabriel, Cal., October 18, 1889.]

"* * * The *Vedalia* had practically freed my orchard of *Iceryas* on the 31st of July. It was on that date that I was obliged to post a notice at the entrance to my place, saying that I had no more *Vedalias* for distribution. The scale and lady-bird had fought out the battle, and while the carcasses of the vanquished were everywhere present to tell of the slaughter, the victors had disappeared almost entirely from the field. I have 35 acres in orchard, some 3,200 trees in all. I never colonized any *Vedalias* in my grove, excepting the two consignments which you brought to me yourself, one box on February 22nd and two boxes March 20. I noticed the first increase from the lot No. 1 on the 15th April, and from lot No. 2 on the 24th of the same month. On the 25th of April I found larvæ upon several adjacent trees. These facts are from memoranda made at the time. I have a list of the names of fruit growers, 226 in number, to whom I personally distributed over 120,000 *Vedalias* in colonies of various sizes between May 31st and July 31st. * * * [J. R. Dobbins, San Gabriel, Cal., October 22, 1889.]

"I am glad to report that the lady-birds you sent me are doing good work and increasing in this neighbourhood, and as soon as all are supplied, I will establish some on the mountain where the brush is full of them, also a small patch near the Ocean, and hope the Cottony Cushion Scale will soon be a scarce article in this section.—[Joseph Sexton, Goleta, Cal., August 12, 1889.]"

As it is of the greatest importance that this pest should not spread to cultivated crops, I would recommend the destroying of all the infested plants by burning. From what I can gather the food-plant at present known is but a weed, so there need be no compunction about the matter. December would be the best month for destroying the pest, as they will not then have laid their eggs.

Below is a list of other species sent:—

Lecanium hemisphericum—On leaves and stems of a climbing rose, in the Nilgiri Hills.

Lecanium sp.?—Scales of the ♂, and perfect ♂; food-plant not identified. In absence of the ♀ I do not think it wise to describe the species, which is probably new.

? Chionaspis—On rose leaves. Scales of the ♂ only. Nungumbaukum, Madras.

Aleyrodes sp.—On a low creeping plant, very like our British "Bindweed" (Convolvulus). Insects in all stages. The white wings of the imagines are spotted with black.

Aleyrodes sp.—On same plant as *Aspidiotus orientale*, and same locality. The pupa is rather large and black; dorsum and margin with very long white waxy fringe; that on the dorsum erect, and matted together, forming a large mass, but does not completely cover it.

Description of figures.

Plate II, fig. 1, *Ceroplastes ceriferus*; (*a*) adult females, natural size, on food-plant; (*b*) female with waxy covering removed; (*c*) portion of dermis magnified; (*d*) spinneret or gland magnified; (*e*) antenna magnified; (*f*) leg magnified; (*g*) young female magnified; (*h*) male magnified; (*k*) antenna of male magnified; (*l*) leg of male magnified; (*m*) genitalia of male magnified; (*n*) male scale magnified.

Plate II, fig. 2, *Icerya ægyptiacum*; (*a*) young females, natural size on under-surface of leaf; (*b*) and (*c*) the same, dorsal view, magnified; (*d*) the same, ventral view, magnified.

Plate III, fig. 1, *Dactylopius viridis*; (*a*) adult females magnified; (*b*) antenna of same magnified; (*c*) leg of same magnified; (*d*) females, natural size, on food-plant; (*e*) the same magnified.

Plate III, fig. 2, *Dactylopius ceriferus*; (*a*) female, dorsal view magnified; (*b*) the same, ventral view, magnified; (*c*) the same, covered with filaments on a croton leaf, natural size; (*d*) antenna magnified; (*e*) foot magnified.

Plate III, fig. 3, *Pulvinaria obscura;* (*a*) adult female on portion of food-plant magnified; (*b*) antenna of same still further enlarged.

Plate III, fig. 4, *Aspidiotus orientalis;* (*a*) female scales, natural size, on food-plant; (*b*) females and males, dorsal view, magnified; (*c*) female, ventral view, magnified; (*d*) posterior segment of same further magnified; (*e*) fringe of same yet more enlarged.

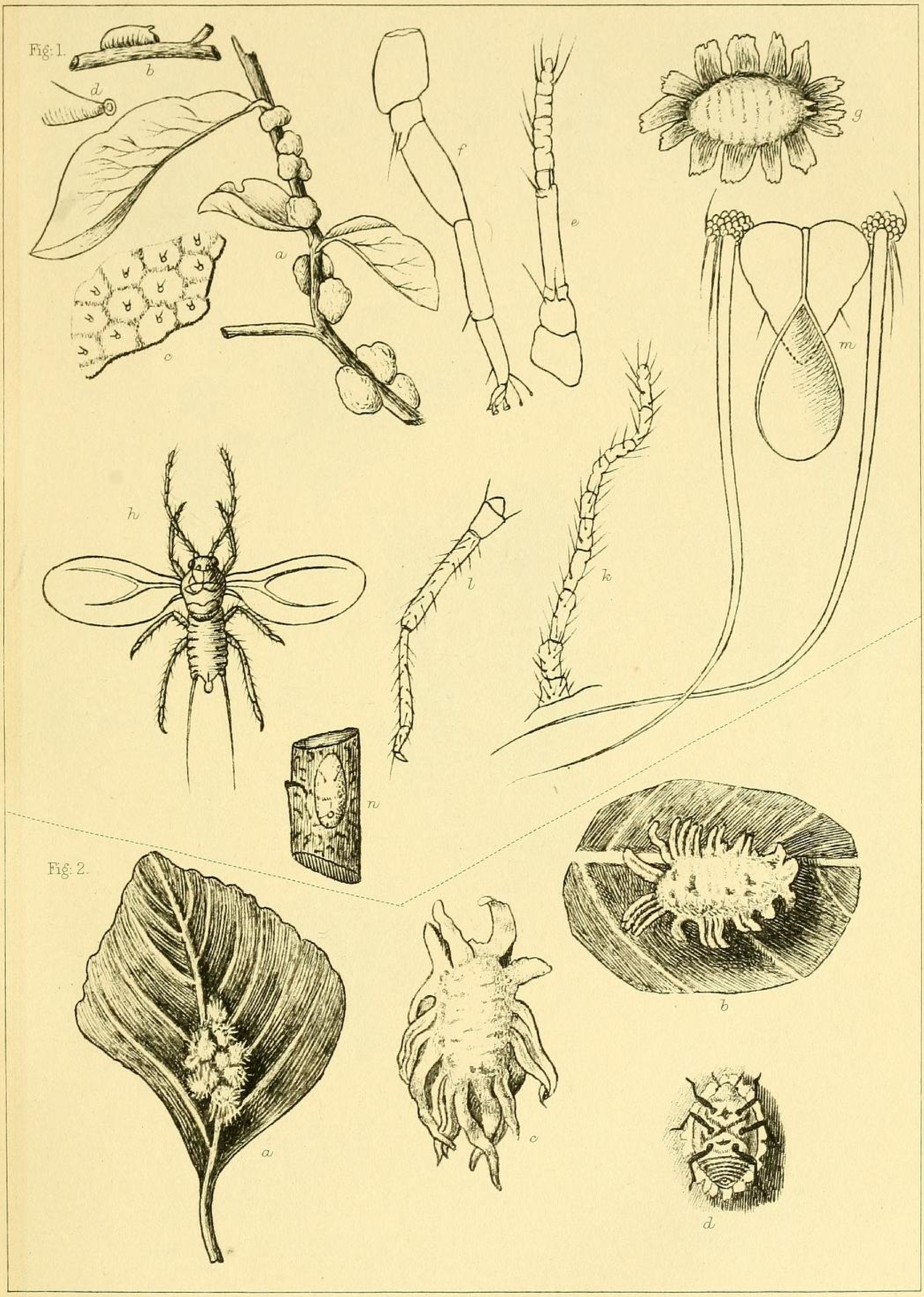

FIG: 1. CEROPLASTES CERIFERUS. FIG: 2. ICERYA AEGYPTIACUM.

Photo-etching from the Original Drawings - Survey of India Offices, Calcutta, July, 1894

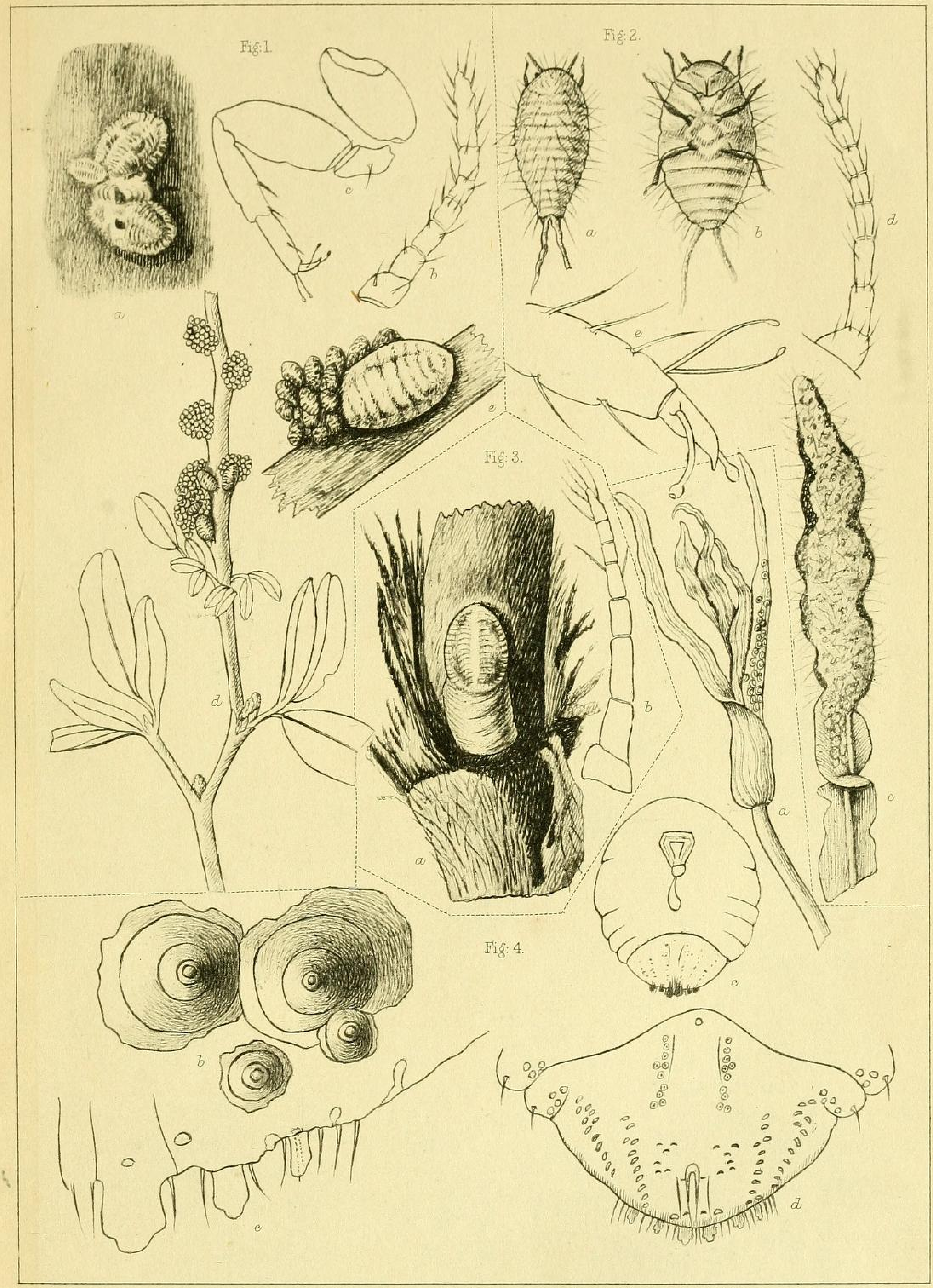

FIG: 1. DACTYLOPIUS VIRIDIS.
FIG: 2. DACTYLOPIUS CERIFERUS.
FIG: 3. PULVINARIA OBSCURA.
FIG: 4. ASPIDIOTUS ORIENTALIS.

Photo-etching from the Original Drawings—Survey of India Offices, Calcutta, July, 1894.