Trombicula microti, new species.

[illegible] first palpal seta simple, without as much as a [illegible] inner accessory

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(Brumpt), and probably [illegible] form. It has fewer dorsal setae than the Kedani mite.

THE MANNER OF OVIPOSITION AND THE PLANIDIUM OF SCHIZASPIDIA MANIPURENSIS N. SP. (HYMEN., EUCHARIDAE).[1]

By CURTIS P. CLAUSEN, *Entomologist, Bureau of Entomology, U. S. Department of Agriculture.*

In 1923 the writer (2) published an account of the biology of *Schizaspidia tenuicornis* Ashm., parasitic upon the mature larvae and pupae of *Camponotus* in Japan. In the case of this species the eggs are laid en masse in the buds of certain deciduous trees and the winter is passed in that condition. The planidia which continue the generation are from eggs enclosed in buds which die during the winter. These buds, therefore, do not expand at the time growth starts in the spring but gradually dry out, the scales then separating sufficiently to permit of the later escape of the planidia.

An opportunity was recently presented of observing the habits of another eucharid near Imphal, Manipur State, Assam, India. Specimens referred to Mr. A. B. Gahan of the Bureau

[1]Contribution No. 41 of the Japanese Beetle Laboratory, Moorestown, N. J.

of Entomology were determined as a new species of *Schizaspidia*, which is here described by the writer under the name of *Schizaspidia manipurensis*. This species was first observed in September, 1926, when several individuals were seen flying about the foliage of various shrubs in a lightly forested area. A more intensive search of the locality finally resulted in the finding of several females ovipositing in the large and loosely formed buds of *Flamingia latifolia* var. *grandiflora*. Unlike *tenuicornis*, however, *manipurensis* deposits its mass of eggs under the outer scales rather than in the interior of the bud. Collections were made of buds of this shrub at random, and a considerable proportion were found to contain eggs. An extended examination of the nests of various species of ants in the immediate locality failed to yield any evidence of parasitism such as was found in collections early in May, 1927.

Oviposition takes place much after the manner of *S. tenuicornis*. The eggs, about one thousand in number, are all inserted under the bud scale at one operation, a process covering a period of twenty or thirty minutes. A surprising amount of force is employed by the female at this time, as the space beneath the bud scale is frequently too small to accommodate that number of eggs without pressure. In one instance a ribbon of eggs 2.5 mm. in length and 1 mm. in width was seen to be forced out from beneath the edge of the scale at a distance of 2 mm. from the point of insertion of the ovipositor.

The egg masses collected in September, 1926, were taken to Shillong, the writer's headquarters at that time, and set aside for supposed hibernation. Upon examination two weeks later, a number of planidia were observed moving about among the eggs. All of the eggs hatched within a period of three weeks even under the relatively low temperature conditions prevailing at Shillong in October. It is probable that under the climatic conditions existing during that season of the year at the lower elevations this stage would extend over a period not exceeding two weeks.

It was possible, because of more material being available, to make a closer examination of the habits of the planidia of *S. manipurensis* than was the case with *tenuicornis* in Japan. Because of their minute size they are indistinguishable to the naked eye even upon a white surface. Under the binocular they were observed to move about readily in a looping manner, the sucker-like organ of the last abdominal segment and the mouth serving alternately to maintain a hold upon the surface. When in a resting position the body remains nearly horizontal with the surface, but when awaiting the approach of the host it is at right angles to the plane of attachment, with the caudal sucker functioning and the terminal abdominal segments braced by the long ventral spines (see fig. I, C.).

In this stage the larvae are positively phototropic and move rapidly towards the source of light. This reaction under normal conditions would tend to bring them largely to the upper sides of the leaves and buds, in which position the chances of coming in contact with the host are enhanced. They readily attach themselves to any object which comes in contact with them, in fact seem able to sense the presence of moving objects in their neighborhood, as the placing of a bristle or needle in their immediate vicinity always results in increased activity and a swaying of the body back and forth as though endeavoring to find the moving object.

The chances of the planidium becoming attached to the adult of the host species and being transported to the nest are largely dependent upon the length of time it is able to exist in this mobile stage without feeding. Experiments in the laboratory upon this point gave twenty-four days as the maximum length of life possible without food.

In the case of *S. tenuicornis* it was shown that the transformation from the planidium to the second larval stage occurred while the host was still in the larval stage, and that transference of the parasite from the cast skin to the host pupa took place in the parasite's second larval stage. With *manipurensis, however*, such experiments as were possible indicate that this change of position is accomplished by the planidium itself. Individuals of this stage were placed upon a series of ten mature larvae of *Camponotus* which had already formed cocoons and consequently were approaching transformation to pupae. Attachment took place invariably in the thoracic regions, usually dorsally, and feeding progressed until the moulting of the host, though without noticeable increase in size. The change in position was observed in each case under the binoculars, and it was seen that, as the larval skin of the host was split dorsally and was drawn backwards over the body of the propupa, the planidium was for a time carried with it. The point of previous feeding had produced a well-defined hole in the derm of the host, and as this was stretched successively over the spaces between the legs and between the thorax and abdomen the aperture became enlarged and the planidium dropped through upon the propupa beneath. In nine out of the ten cases observed the transfer took place in this way, while the tenth planidium maintained its attachment to the cast skin.

The early hatching previously mentioned was a development entirely unlooked for, as it had been anticipated that development would follow much the course of that of *S. tenuicornis*. While the host was not known it was felt that, because of the size of the parasite, one of the several species of *Camponotus* would most probably fill this rôle. Laboratory nests were made,

and colonies of two of these secured, as well as of several other genera of sufficient size, and one to four planidia of *S. manipurensis* placed upon each of four hundred or more mature larvae. They were observed to attach themselves to the host quite readily, usually in the thoracic regions. These overwintering cages were then set aside for development and observation. Some of the planidia upon *Camponotus* larvae remained alive and healthy, though without apparent growth, until April 1, 1927, a period of nearly six months from the time of hatching and attachment to the host larvae. The *Camponotus* and other ant larvae upon which planidia had been placed formed their cocoons early in the spring, but not a single *Schizaspidia* developed beyond the primary stage. The life history studies were thus brought to a close and it was not possible to secure specimens of the latter larval stages for examination.

From these experiments, and from such observations as it was possible to make in the field, it appears that *S. manipurensis* must have several generations each year, and that the winter is passed in the primary larval stage upon the host rather than in the egg stage in the buds of trees. Although the above experiments did not prove this latter point conclusively, the known very short duration of the succeeding stages in related species makes this course of development the most probable.

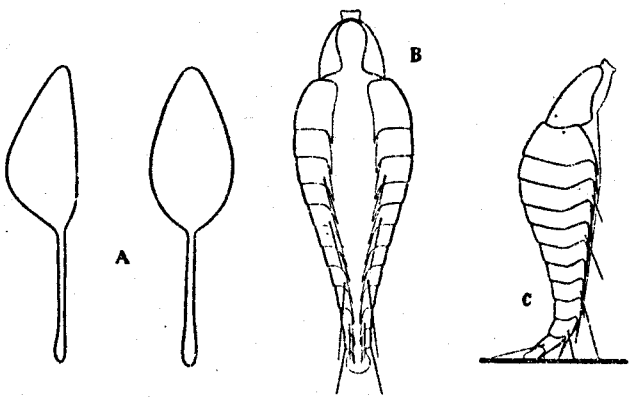

Fig. 1.—Schizaspidia manipurensis

DESCRIPTIONS OF THE EGG AND PLANIDIUM.

The body of the egg proper is 0.17 mm. in length and 0.08 mm. in maximum width, with the stalk 0.15 mm. in length. The ventral side of the egg is nearly flat, with the dorsum greatly arched and the anterior end quite pointed (Fig. 1, A). The egg is white when laid but later becomes a jet black due to the developing larva within. The stalk remains turgid at all times until hatching.

The planidium (Fig. 1, B and C) is twelve-segmented, the length when fully extended 0.16 mm., when resting 0.12 mm. and with the maximum width 0.06 mm. The body is jet black by reflected light and a deep amber by transmitted light, with the head capsule slightly lighter in color than the body. A single pair of spiracles is situated at the anterior margin of the first thoracic segment.

The head bears two pairs of light spots dorsally, which may represent sensoria. The mouthparts with a sucker-like disk and the usual comma-shaped mandibles. The posterior margin slightly emarginate.

The body segments with chitinized plates, which extend ventrally and terminate in pleural plates, the tips of which are prolonged into a point extending caudad, these points increasing in length upon the successive segments. The first body segment much the longest, with the remainder subequal. The caudal segment bearing a sucker-like disk, which is ambulatory in function. Five pairs of heavy ventral spines are situated on the third thoracic and the second, fifth, seventh, and eighth abdominal segments, respectively, the first pair being shortest and the third longest. The third and fourth pairs serve as braces for the body when in the upright position. In this position the ventral surface of the body between the ventral margins of the chitinized plates is distinctly convex, the extrusion of the head and mouthparts apparently necessitating a pronounced constriction of the body segments.

Comparison of the Planidium With That of Other Eucharidae and Perilampidae.

The planidium of *Perilampus hyalinus* and *P. chrysopae* var. are well known through the studies of H. S. Smith (4, 5) and several of undetermined relationship have been recorded from various hosts. Of the Eucharidae, they have been described for *Orasema viridis* Ashm. by W. M. Wheeler (6), *Psilogaster fasciiventris* Brues by C. T. Brues (1), *Schizaspidia tenuicornis* Ashm. by the writer (2) and recently that of *Stilbula cynipiformis* Rossi by H. L. Parker and W. R. Thompson (3). In the cases of *Stilbula* and *Psilogaster* the descriptions are from cast skins only. A comparison of the planidia of these species as well as of a number presumably belonging to the Perilampidae show a fundamental similarity in structure, with the variations within each family as great as that which separates the two. In both groups a marked difference occurs in the form of the pleural plates and the teeth and spines borne by them.

The number of body segments seems to be quite variable with *P. hyalinus* and several other perilampids having thirteen, *P. chrysopae* var. twelve, *Orasema viridis* fourteen, *Psilogaster fasciiventris* twelve, *Stilbula synipiformis* nine, *Schizaspidia tenuicornis* nine and *S. manipurensis* twelve segments. From what is known of the primary larvae of the Chalcidoidea in general, thirteen may be taken to represent the normal number.

The planidia of both families have the characteristic looping

manner of locomotion and stand in an erect position when awaiting the approach of the host. In the case of the Eucharidae the planidia attach themselves to the worker ants and are thus carried to the larvae in the nests, whereas *Perilampus* upon its first attachment has reached its goal, though still, when in the rôle of a secondary, under the necessity of searching about through the body of the secondary host for the parasite larva which it attacks.

Oviposition in the Eucharidae and Perilampidae.

In the single case in which oviposition by *Perilampus* (*chrysopae* var.) has been observed (Smith, 5) this took place upon foliage in the immediate vicinity of the host, and the eggs hatched in approximately twenty days. *Schizaspidia tenuicornis* deposits its eggs en masse in the buds of trees, wherein they pass the winter, while *S. manipurensis* on the contrary places its mass of eggs under the outer bud scales, and these hatch in two to three weeks. Thus in the latter case a closer approach to the habit of Perilampus is presented, both as to position and to duration of the stage, and it is probable that further forms will be found which will tend to bridge the gap separating the two families.

Of interest in this connection is the recent note by W. M. Wheeler (7) recording the observation by W. M. Mann of the mating of *Orasema* sp. in the nests of *Pheidole* sp. in Lower California, which is believed by Dr. Wheeler to support the theory of oviposition within the nest. In 1923 the writer collected a number of females of *Orasema* sp. upon vegetation at Mukden, Manchuria, but an extended search failed to reveal oviposition upon plants. The point at which this species was found most abundantly was more than one hundred yards distant from the nearest trees or shrubs. Unfortunately the limited time available made an extended search for ovipositing females impossible. An examination of the ovipositors of various species of *Orasema* in the collection of the United States National Museum reveals them as having this organ heavy, curved and strongly barbed, thus fitting them for penetration of bud scales or other plant tissue.

Schizaspidia manipurensis, n. sp.

This species differs from *S. tenuicornis* Ashm. in the uniform pitting of the parapsides and episternum, the presence of a pubescence on the thorax, the heavy longitudinal striations on the petiole of the abdomen, and the presence of hairs uniformly over the costal cell of the fore-wing. More closely related to *S. convergens* Walk. from Ceylon, but separable by the striations on the petiole.

Male.—Length 4.5–5.0 mm., and alar expanse 11–12 mm. Head, thorax, coxae and petiole of abdomen metallic green in color, the abdomen black, the antennae brownish with the basal segments yellowish, and the legs yellowish.

Head three times wider than long, the post-ocellar line equaling the ocell-ocular line, face with fine longitudinal striations, the front smooth, with the vertex, occiput and between the eyes and the scrobes rugose. Antennal scrobes deep. Antennae 12-segmented, 5.0 mm. in length and filiform, scape twice longer than wide, pedicel as wide as long, first flagellar joint longest.

Thorax foveopunctate, including parapsides and episternum, and with a sparse, fine white pubescence. The bifurcate scutellum with the prongs short, flat and broad. Fore-wing 4.2 mm. in length and 1.5 mm. in width, with the veins in the ratio of 3:2:1. Stigmal vein at right angles to the marginal, with the terminal knob very small. Costal cell broad and uniformly hairy. A very slight darkening in color in the region beneath the stigmal vein.

The abdomen compressed, triangular, and with only two visible segments. The petiole equal in length to the rest of the abdomen and to the hind femora, with pronounced striations extending the full length, and not dilated at the middle.

Female.—Length 4.5 mm., and alar expanse 10.5 mm. Head, thorax, coxae and petiole of abdomen metallic blue-green in color, the abdomen black, with the posterior margins of the segments brownish. Petiole of abdomen shorter than the hind femora. Ovipositor barbed on the distal half.

Other characters as in the male.

Type locality.—Imphal, Manipur State, Assam, India.

Type.—Cat. No. 40973, U. S. N. M.

Described from 5 males and 1 female (antennae broken) collected by C. P. Clausen, October, 1926.

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