NOTES ON THE LARVAE OF THE CHALCIDOIDEA.

H. L. Parker,
Assistant Entomologist, Bureau of Entomology, U. S. D. A.
and
W. R. Thompson,
Entomologist, Bureau of Entomology, U. S. D. A.

I. Larval Types in the Chalcidoidea.

During recent years students of the biology of the parasitic Hymenoptera have made several attempts to classify the larvæ of these insects in groups based on certain striking features of the external anatomy. Thus Richardson ('13) in his paper on Spalangia, and Wheeler ('23) in her account of the braconid parasites of aphids, distinguish respectively 9 and 10 types of hymenopterous larvæ distributed among the several parasitic families. Up to the present, however, so far as the writers are aware, no efforts have been made to define such larval types within the individual superfamilies of the parasitic Hymenoptera, although in almost every group a considerable number of larvæ have been described.

Extensive investigations of the larvæ of the Chalcidoidea, the results of which will be published at an early date in detail, taken together with the data previously available, have demonstrated the existence within the superfamily Chalcidoidea of a number of well defined larval types. As is the case in most of the other groups, these types are readily recognizable only in the primary larvæ; in the later stages the morphological differences become much less apparent.

The ectophagous larvæ of the Pteromalidæ and certain Callimomidæ (Torymidæ), Eulophidæ, and Elasmidæ (Dibrachys, Spalangia, Pseudocatolaccus, Pachycrepoideus, Pachyneuron, Mormoniella, Megastigmus, Ormyrus, Melittobia, Solenotus, Eulophus, Tetrastichus, Perissopterus, Elasmus) (Fig. 2) present a head and thirteen well developed segments, both head and body being feebly chitinized and unpigmented; the head capsule bears a number of relatively short sensorial hairs or papillæ, and one pair of short conical truncate antennæ; the mandibles are gently curved; the body segments under low

magnifications appear glabrous, though a careful examination with a high power objective will reveal the presence on each segment of an anterior band of minute spines together with two or three pairs of very small sensorial hairs; in this stage the tracheal system presents four pairs of open spiracles situated on segments II, IV, V, and VI.

The ectophagous larvæ of the Callimomidæ (in part) Eupelmidæ, Leucospidæ, and Eurytomidæ (Callimome, Ditropinotus, Eurytoma, Eupelmus, Cerambycobius, Leucospis) (Fig. 5) possess also a well developed head followed by thirteen segments; the body is feebly chitinized and unpigmented, but the head is brown in color and strongly chitinized; the mandibles are more powerful than in the first group mentioned and are more strongly curved, being approximately comma-shaped; each body segment presents two or three pairs of long sensory hairs easily visible under the low powers of the microscope, or even under a hand lens; in addition each segment bears a median or submedian girdle of large and conspicuous cuticular spines; these larvæ, like those of the previous group, bear four pairs of open spiracles.

The sexual larvæ of the polyembryonic chalcids, all of which belong to the family Encyrtidæ (Copidosoma, Litomastix, Encyrtus) (Fig. 1) constitute another well characterized group. The external anatomy here is extremely simply; no spines or sensoria are present; the mandibles are very feeble, poorly developed, and practically invisible; the tracheal system is closed.

Another group of very curious and interesting first stage larvæ also found in the Encyrtidæ and represented by the Genera Microterys, Blastothrix, Schedius, Phænodiscus (Fig. 3) and certain species of the genus Encyrtus, (e. g. (Encyrtus) *Microterys ferrugineus* Nees) are those which are attached to the outer wall of the host (or egg shell in the case of Schedius, parasite in the eggs of *P. dispar*) by means of the eggshell of the parasite itself. The pedicel of the chalcid egg transverses the body wall of the host, and in some cases it is hollow and appears to act as a respiratory tube, comparable to the integumental and tracheal sheaths of the dipterous parasites of insects. The bodies of these larvæ are composed of a head and ten segments instead of a head and thirteen usually present in chalcid larvæ.

This difference is due in all probability to the fusion of the last four segments during the embryonic development but in the later stages these segments are clearly differentiated. Most of the individuals of this group are metapneustic, like first-stage tachinid larvæ, possessing only a single pair of open spiracles situated on the posterior extremity. Many larvæ of this type have been described by Silvestri.

Still another group presenting well-defined morphological characters is constituted by the primary larvæ known as "planidia" (Fig. 6) in which the dorsal surface of the head and body segments is heavily pigmented and strongly chitinized, so that the larvæ resemble miniature armadillos. All of the larvæ of this group which have been identified up to the present belong to the genera Orasema, Perilampus, Psilogaster, Schizaspidia, and Stilbula, included in the families Perilampidæ and Eucharidæ. In the perilampid larvae so far known the body is composed of twelve segments in addition to the head, while in the eucharids the head is followed by eight segments in the genera Schizaspidia and Stilbula, with eleven in Psilogaster. All these larvæ, with the exception of Schizaspidia, bear numerous spines, varying in disposition, and which probably are ambulatory in function. They likewise bear a limited number of sensory setæ. They are very active, although not more so than are those of the Torymidæ, Eupelmidæ, Eurythomidæ, and Leucospidæ in their more restricted environments. These larvæ are extremely interesting on account of their varying parasitic habits and modes of existence.

As already stated, all of the groups just mentioned, with the exception of the two forms of Encyrtidæ, are composed of ectophagous parasites; the Encyrtidæ are, while endophagous, either attached to the body wall or are enclosed in the epithelial cyst characteristic of the polyembryonic forms.

There are, however, a certin number of endophagous forms which float freely in the body cavity of the host egg, larva, or pupa. These larvæ in most cases are strikingly different from even their nearest relatives, systematically speaking, in that they possess a more or less elongate caudal appendage or tail. The only free-living internal chalcid larvæ not of the caudate type are those of *Pteromalus puparum* L., the common parasite of lepidopterous chrysalids, and a species of Miscogaster, par-

asite in an agromyzid larva. The former, except for the fact that it is apneustic, does not differ from the ectophagus forms such as *Dibrachys boucheanus* Ratz., etc. The latter, whose anatomy is rather remarkable, will be described later in this paper.

The various members of the group of caudate larvæ (Fig. 4) have much in common anatomically, often being almost exactly alike in construction although widely separated systematically. Larvæ which have already been studied can usually be identified specifically when subsequently encountered, but an unknown larva of this group cannot at present be referred with certainty even to its family on morphological characters alone. Such a larva might be a tetrastichine, a chalcid, an encyrtid, or an aphelinid.

The known larvæ of this type belong to the following species: *Cerapterocerus mirabilis* Westw. (Encyrtidæ); *(Chalcis Brachymeria jonscolombei* Duf. (Chalcidæ); *Tetrastichus xanthomelænæ* Rond., and *Aspidiotiphagus citrinus* Craw. (Eulophidæ); *Copidosoma thompsonii* Mercet (n. sp. in litt.) and *C. boucheanum* Ratz. (Encyrtidæ)—a sexual larva only; and *Anastatus sp.* (Eupelmidæ). They are characterized principally by the presence of a caudal appendage, usually of very simple form, though in the case of *T. xanthomelænæ* and *Anastatus* it is bifurcate; the head is longer than wide, somewhat pointed anteriorly, and bears two strongly uncinnate mandibles; the cephalic sensoria are mostly inconspicuous and few in number. The body is distinctly segmented and generally armed with cuticular spines, true sensorial hairs, however, appearing to be usually lacking or at least very poorly developed. All the larvæ of this group heretofore described are apneustic in the first instar.

In view of the relative morphological uniformity presented by the free-living endophagous chalcid larvæ, it seems interesting to record the existence of a transitional type between these larvæ and the ectophagus forms of the second group described above. This transitional form is represented by the larva of Anastatus sp., which in this stage, is an internal parasite in the egg of an undetermined pentatomid.*

*The eggs of the pentatomid from which this parasite was reared were collected on the bark of fig trees at Puget-Ville, Var, France, by P. Genieys of the European Parasite Laboratory, in June, 1924.

II. Two New Forms of Caudate Chalcid Larvae.

Anastatus sp.* (Eupelmidæ).

Unlike the endophagous forms mentioned above, the first-stage Anastatus larva resembles fairly closely in its morphological characters the primary larvæ of the species to which it is systematically related; i. e., the species comprised in the families Callimomidæ, Eurytomidæ, Eupelmidæ, and Leucospidæ. Like the other members of this group, the larva of Anastatus bears on the head and body segments numerous elongate conspicuous sensorial hairs, the cuticular spines on the body segments are arranged in definite dorsal and ventral areas, much as in Callimome, Eupelmus, Leucospis, and Eurytoma. The head is brownish in color and heavily chitinized and the body bears four pairs of open spiracles. By certain other characters, however, this larva resembles the members of the small heterogeneous group of caudate larvæ. Like these latter it possesses a well developed "tail," in this case bifurcate. Only two pairs of cephalic sensorial hairs exist, as against 6 or 8 in the larvæ of Callimome, Eupelmus, Eurytoma, and Leucospis.

In view of these peculiar characteristics one might be tempted to consider the larva of Anastatus as a form which has recently adopted the habit of endophagous parasitism and whose morphology is now undergoing the changes which lead from the ectophagous to the endophagous type; at present, however, no convincing reasons in favor of such a hypothesis really exist.

The morphological characters of the species of Anastatus here considered are as follows:

Egg.

Length of egg, 0.4 mm.; length of pedicel, 0.4 mm. (Fig. 18). Color, white; approximately oval in shape; without armament or tubercles; provided at one end with a short, slightly twisted pedicel, at the other end with a long pedicel.

First-Stage Larva.

Length, 0.6 mm.; width, 0.15 mm. (Fig. 7).

Cylindrical, segmented, slender; head brown, heavily chitinized; body white, provided with a bifurcate caudal appendage; body segments bearing long sensory setae and many shorter cuticular spines.

*Determined by Dr. Luigi Masi, who says "L'espece que vous [illegible] obtenu des oeufs d'un hémiptere ressemble a celles decrit par Bolivar sous le nom de A. *bifasciatus* Fonscol. et parasite du lepidoptere Dendrolimus pini"

The head (Fig. 17) is somewhat thimble-shaped, a little drawn out at the anterior end, and slightly bent ventrally; it is strongly chitinized and brownish in color, and bears a pair of prominent bristle-like setae situated anteriorly and somewhat laterally, although above the lateral line; another pair of setae is situated ventrally and towards the anterior portion of the head; the mouth is located at the extreme anterior end of the head and is a small circular opening in the middle of the unchitinized buccal area; the mandibles are simple, sharp, and comma-shaped, black distally, lighter in color toward the base; there are four pairs of sensory organs on the upper lip and three pairs on the lower; the tentorium, or inner skeleton of the head, can be seen from the ventral surface and is, in form, approximately horseshoe-shaped.

The body segments are thirteen in number, distinctly delineated, approximately equal in length, but those near the anterior end are distinctly wider than are those of the posterior end, as the figure shows (Fig. 7); the thoracic segments each present three pairs of prominent sensory hairs disposed as indicated in the drawing, the second and third in addition present cuticular spines located as follows: a small area dorsally situated near the anterior margin, and a somewhat more extensive area located ventrally toward the anterior margin; the spines in the dorsal area are short and stout, while those in the ventral areas are considerably longer; the abdominal segments present but two pairs of sensory hairs each, situated one pair about on the lateral line, the other pair more dorsally; these segments are likewise armed with tegumentary spines, those of the dorsal area becoming longer on the posterior segments; progressively from segment to segment posteriorly the cuticular spines become more abundant and the sensory hairs diminish in size so that they are not readily distinguishable from the cuticular spines; we believe, however, that there are two pairs on each of the first nine abdominal segments; the last segment is adorned with a bifurcate caudal process which bears on each prong near the base smaller spines identical in shape with those found on the more forward portion of the segment. (Fig. 19).

The tracheal system is well developed; there are four pairs of open spiracles situated on the second thoracic and first to third abdominal segments inclusive; each spiracle is connected by its canal to the main tracheal trunk that passes down the side of the larva. These main tracheal trunks are joined together anteriorly by a tracheal commissure traversing the body dorsally of the oesophagus in the first thoracic segment, and posteriorly by a like commissure passing ventrally of the hind intestine in the eighth abdominal segment; in each segment, from the first thoracic to the eighth abdominal, the main tracheal trunk gives off several fine, ramifying branches which distribute themselves dorsally and ventrally in the body cavity among the several organs and tissues.

Changes in External Characters During Development.

When the larva sheds its first skin it loses its brown, heavily-chitinized head capsule, its tegumentary spines, its bifurcated tail appendage, and its long sensorial hairs; the head becomes more spherical (Fig. 8) and white in color, less heavily chitinized than before; the body becomes wider and shorter in proportion owing to the absorption of food, and, save for the minute sensoria where once the long hairs existed, it is naked; five additional paris of spiracles appear. Such changes have often been noted in part by students of the Perilampidæ, the Eucharidæ, the Braconidæ, and other parasitic hymenoptera (and indeed to go further, analagous changes are well known in the Coleoptera, the Diptera (tachinids), the Strepsiptera, and even among certain groups of parasitic marine Crustacea (Cryptoniscidæ). Spines and teeth which are purely tegumentary are lost with the molted skin; sensorial organs, whether they be bristles, hairs, roundish disk-like, or conical processes, are always retained throughout the life of the larva; they are often indeed generally reduced in size but they can be located by a careful examination.*

The full-grown larva of this species is short, thick, and grublike in general appearance, similar to that figured by Howard and Fiske ('11) from eggs of the gipsy moth.

*A striking example of this is to be seen in the later stage larvae of Perilampus. These planidia bear slender setae arranged in pairs on the heavily chitinized dorsal plates. After the hard skin of the first-stage larva has been shed one may still see on the now fleshy larva (at points homologous with those which formerly bore the setae) a tiny button bearing at its summit a fine short seta which exists throughout the life of the larva, and which persists on the last larval skin when this is thrown off by the pupa. A variation on this scheme is to be observed in the case of certain Callimomids notably in the genera Callimome and Ditropinotus. In this case the second stage sensorial hairs, though somewhat reduced in size, are not inconspicuous. As the larva grows and changes its skin their relative length increases until at the last stage such hairs are as conspicuous and as long in proportion to the size of the larva as they were during the first stage. Furthermore, in the last stage of these larvae, there exist, especially on the ventral surface, many long brownish setae similar in every way to the sensorial hairs, though whether they be sensorial in function or simply tegumentary hairs has not yet been determined. Again, the larva of Podagrion (Callimomidae), parasite upon the eggs of the mantid, *M. religiosa*, commences life deprived of conspicuous setae or spines but at the last stage the body as well as the top of the head, is practically covered with brownish hairs of a moderate length. The well-known hornlike processes on the head of *Perilampus hyalinus* Say (primary larva) serve as another example. These two pairs of organs are lateral sensorial organs and are the homologues of similar sensoria found on the heads of other chalcid larvae; they exist on the second-stage larva in a somewhat diminished state at a point near the lateral edges of the chitinous portion of the head where it gives place to the soft buccal region.

Miscogaster sp.* (Miscogasteridæ).

This chalcid is parasitic internally in the larva of a species of *Agromyza* (Diptera) mining in the leaves of alfalfa at Hyeres, Var, (France). The adults are found in the fields rather early in the spring, and deposit their eggs through the surface of the leaf into the body cavity of the host larva. A certain proportion of the parasites appear to emerge in late spring, producing another generation, but the majority seem to remain in the puparia of the host until the following spring (or in any event throughout the entire summer, as we have on hand at the moment of writing—October 10—a considerable number of unissued parasites appearing to be in the pupal stage). The presence of the parasite larva in the host larva does not prevent it from forming its puparium. The adult parasite issues through an opening which it makes with its mandibles in the puparial wall. From one to six eggs may be deposited in a single host larva, but only one parasite comes to maturity.

The morphological characters of the species are as follows:

EGG.

Length, 0.25 mm.; width, 0.12 mm. (Fig. 15).

When taken from the body of the host the egg of this species is blackish in color and apparently rather heavily chitinized. It is roughly oval in form and is attached to the body wall of the host by a rather thin pedicel which is about half of the length of the egg proper. This pedicel protrudes outside the host cuticle for a short distance, but does not seem to be aeroscopic in function, nor does it retain the parasite larva after hatching, for this larva floats freely in the body cavity of the host.

FIRST-STAGE LARVA.

Length, 0.55 mm.; width, 0.175 mm. (Figs. 13, 14).

Rather slender; white in color, possessing a head and thirteen segments; no conspicuous caudal appendage, but a last segment of bilobed appearance terminating in two rather large spines; sides of body segments ornamented with long cuticular spines arranged in an encircling line at about the mid-portion.

Head (Fig. 16) slightly wider than long, in color white, not especially strongly chitinized, bearing a pair of short button-like antennae, but no conspicuous sensorial hairs; it is roughly conical in shape but rounded at the anterior end; ventrally can be observed three pairs of sensory circles, situated along either side of the buccal area, while on the upper lip are two small pairs of similar sensoria; the mandibles are brownish in color, long, sharp, but not greatly hooked; the tentorium is visible and is semicircular in form.

* Determined by Dr. Luigi Masi.

The body is widest at the first thoracic segment, tapering gently caudad; the segments all bear, on the pleural region, a line of rather long cuticular spines, situated on the middle of the segment; those of the first segment are less numerous and shorter than those which appear on the middle of the body; the exact nature of the terminal segment is rather difficult to discern; viewed from the ventral surface it appears to be bilobed; each lobe seems to terminate in a stout spine apparently differing from the many surrounding spines in being longer and wider at the base; these two spines are analogous to the posterior processes in certain forms of caudate larvae. This larva thus conforms to the general type of the group of internal parasitic free-living forms found scattered among the Chalcidae.

III. The Primary Larva of *Stilbula cynipiformis* Rossi (Eucharidae).

All of the members of the family Eucharidæ whose habits are known are parasitic in the larval condition on ants. Until recently, if we except Wheeler's well known study on *Orasema viridis* Ashm. in his paper on "The Polymorphism of Ants, etc." ('07) and the later contribution on *Psilogaster fasciventris* Brues. by Brues ('19), very little detailed information has been available as to the habits of this family. In 1923 a most interesting and very complete paper on the biology of the Japanese eucharid *Schizaspidia tenuicornis* Ashm. was published by C. P. Clausen.

According to Clausen, *S. tenuicornis* is a parasite in the larval stage upon the pupa of the ant *Camponotus herculaneus* in Japan. The adults issue from the ants' nests during August and mate, and the females are ready to oviposit at once; this they do in the buds of several trees and bushes, notably mulberry, chestnut, etc.; each female oviposits from a thousand to twelve hundred eggs all in one batch in the bud of the host plant. The larvæ mature in the eggs, remain there all winter, and hatch during the following spring; they then attach themselves to the feet of passing ants and are transported to the ants' nests where they release the ants and fix themselves to the ant larvæ, feeding and later completing their development on the ant pupæ.

The egg of *S. tenuicornis* is tiny, oval in shape, white in color, and bears a long filiform appendage on one end. The first-stage larva is dark in color, composed of heavily chitinized rings, and has a head and eight body segments; the head and segments apparently bear neither true setae nor cuticular sensoria, but the fifth, sixth, and seventh segments each bear

one pair of stout spines laterally, while the eighth bears two pairs; the larva possesses two small hooked mandibles. This larva is an excellent example of the planidium type.

Some years ago the writers discovered in the valley of the Gapeau river at Montrieux (Var, France) a colony of adults of the European eucharid *Stilbula cynipiformis* Rossi, the biology of which had apparently never been investigated. On August 27, 1923, about twenty-five specimens of the adults were collected from oak bushes and brought alive to the laboratory, where they were placed in cages. By the end of the third day all of the individuals taken were dead without having fed. The females paid no attention to oak leaves or to ant cocoons placed in the cages with them; the possibility of their ovipositing in buds did not occur to us at that time; dissection of the females showed the forty ovarian tubes of the reproductive system to contain a thousand or more eggs apparently ready to be deposited. These eggs, like those of Schizaspidia, were very minute, oval in shape, white in color, and bore a long filiform appendage at one end. (Fig. 9-a).

The following spring, on June 11, about five hundred cocoons of Camponotus were collected in the vicinity. During the month of August following there issued two adult Stilbula from these cocoons. An examination of one of the cocoons showed that the cap had been neatly and smoothly cut off to allow for the emergence of the Stilbula; that the inside of the cocoon was filled with the cast larval and pupal skins of the parasite, and that the remains of the ant, apparently a newly formed pupa, were reduced to a small, irregular, hardened mass of material and pushed down into the opposite end of the cocoon from which the parasite had issued.

By cautious manipulation the skin of the first-stage larva was located. It was attached to a bit of membrane which we believe to be a part of the last larval skin of the Stilbula; the head had become separated from the body, and the segments themselves were widely separated one from the other; they retained, however, their relative positions. The figure drawn from the preparation of this moulted skin (Fig. 9) will give some idea as to the original form of the primary larva of Stilbula.

The head (Fig. 10) is dark in color and more or less rectangular in shape and apparently bears no sensoria or setae; apart from the internal circular opening of the salivary duct common

to all chalcid larvae, we are able to distinguish nothing save a pair of sharp brownish mandibles of the usual comma shape.

The segments are eight in number, all dark in color, being heavily chitinized; the first one is twice as wide as long and bears two pairs of filiform setae situated in light colored circles; the second is four times as wide as long and bears one pair of setae; the following segments are about equal in length, the fourth bearing a pair of setae, while the fifth, sixth, and seventh bear laterally a pair of stout spines at the posterior margin; the eighth bears two pairs on each side and terminates in a bifurcate median spine. The ventral terminations of the chitinous rings were not visible in our preparation.

On a morsel of skin we believed to be a part of the second-stage larval skin, we are able to distinguish irregular rows of fine tegumentary spines (Fig. 11) probably situated on the anterior margin of each segment; these structures probably are analogous to the spines found on the second-stage larva of Perilampus; in addition, on this piece of tegument are visible two spiracles, one of which we have illustrated, (Fig. 12). The condition of the remains is not such as to enable us to state whether the adult larva possesses mandibles.

The several points in which Stilbula resembles Schizaspidia are: the shape of the egg; the morphology of the primary larva; the period of emergence of the adults and brevity of the adult life; the remarkable fecundity of the female; and the probability that the eggs are all deposited in a single batch—indicated by the condition of the female ovaries. These resemblances would seem to indicate that the life history of Stilbula is very similar to that of Schizaspidia. It is hoped that a further investigation which we intend to make next season will permit us to verify this conclusion and clear up the obscurities in the biology of this interesting parasite.

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EXPLANATION OF PLATES.

PLATE XXVI

Fig. 1. First stage larva of Copidosoma thompsonii Mercet in lit. removed from its envelope in the developing chain. This design represents the larvae of Group III*; Polyembryonic encyrtids, Copidosoma and Litomastix.

Fig. 2. First stage larva of *Dibrachys boucheanus* Katz. Representing larvae of Group II Dibrachys, Spalangia, Pseudocatalaccus, Pachyerepoideus, Pachyneuron, Mormoniella, Megastigmus, Ormyrus, Melittobia, Solenotus, Eulophus, Tetrastichus (ectophagous Tetrastichines) Perissopterus, Elasmus.

Fig. 3. First stage larva of (*Encyrtus*) -*Microterys ferrugineus* Nees. Representing larvae of Group IV: Microterys, Phaenodiscus, Encyrtus, Aphycus, Blastothrix.

Fig. 4. First stage larva of (Chalcis) *Brachymeria fonscolombei* Duf. Representing larvae of Group V: (Chalcis) Brachymeria, Cerapterocerus, Aspidiotiphagus, Tetrastichus (T. xanthomelaenae), Anastatus, and Miscogaster.

Fig. 5. First stage larva of Callimome (Torymus) sp. (near *C. phyllyreae* Rush.). Representing larvae of Group VI: Callimome (Torymus), Ditropinotus, Eurotoma, Eupelmus, Cerambycobius, Leucospis. The tracheal system is not shown in this drawing, but it is identical with that of Fig. 2.

Fig. 6. First stage larva of *Perilampus hyalinus* Say. Representing larvae of Group VII: Perilampus, Psilogaster, Schizaspidia, and Stilbula. The two circular spots on segment II are the only open spiracles on this larva, on the others mentioned in this group there are apparently none.

PLATE XXVII

Fig. 7. First stage larva of *Anastatus bifasciatus* (Fonsc) Bolivar.

Fig. 8. Second stage larva of same.

Fig. 9. The several segments comprising the first stage larva of *Stilbula cynipiformis* Rossi. drawn in situ from the cast larval skin.

Fig. 9-a. Egg of same taken from ♀.

Fig. 10. Head capsule of same viewed from the ventral surface.

Fig. 11. Minute spines found on second (?) stage larval skin, *S. cynipiformis*.

Fig. 12. A spiracle of same drawn from second (?) stage larval skin.

PLATE XXVIII

Fig. 13. First stage larva of Miscogaster sp., viewed from the ventral surface.

Fig. 14. Same viewed from the side (slightly more enlarged).

Fig. 15. Egg of same.

Fig. 16. Head of same ventral view.

Fig. 17. Head of first stage larva of *Anastatus bifasciatus*.

Fig. 18. Egg of same.

Fig. 19. Last segment of first stage larva of *A. bifasciatus* viewed from ventral surface showing bifurcate caudal appendage.

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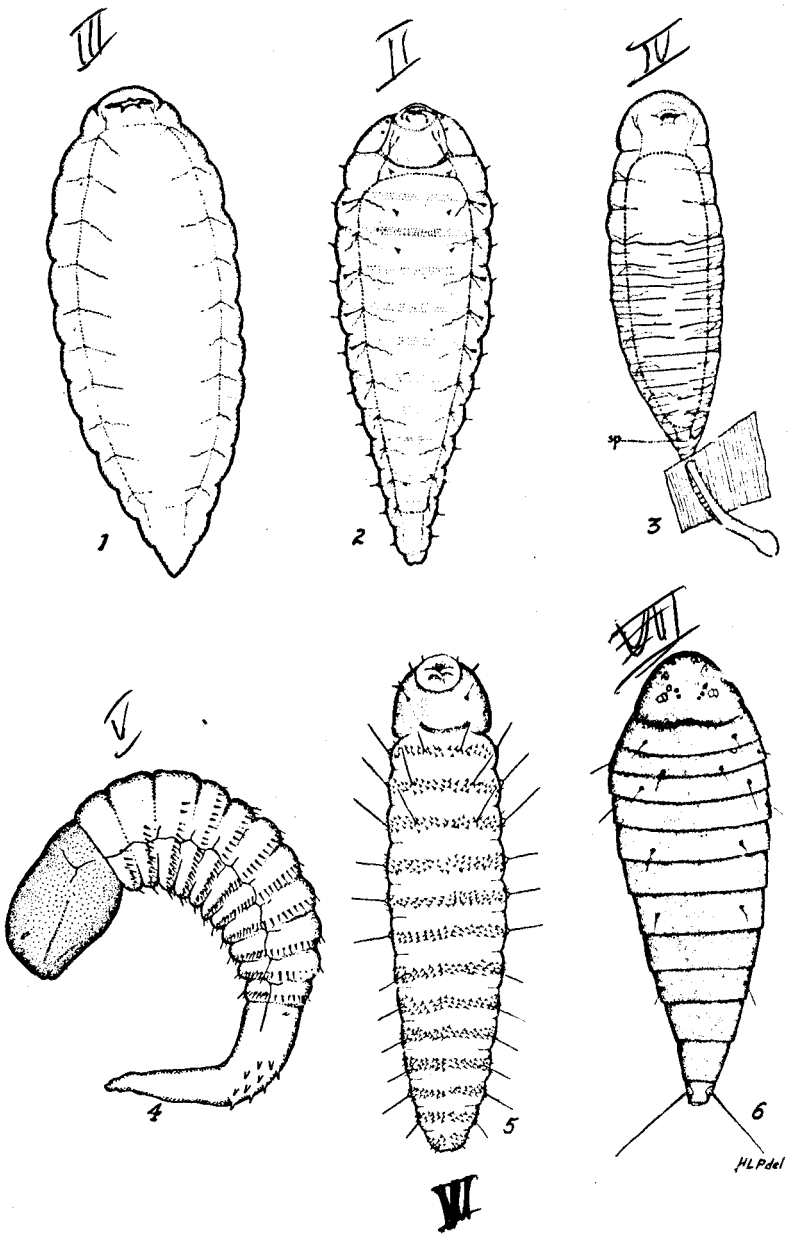
* The arbitrary numbering of these groups has no significance here.



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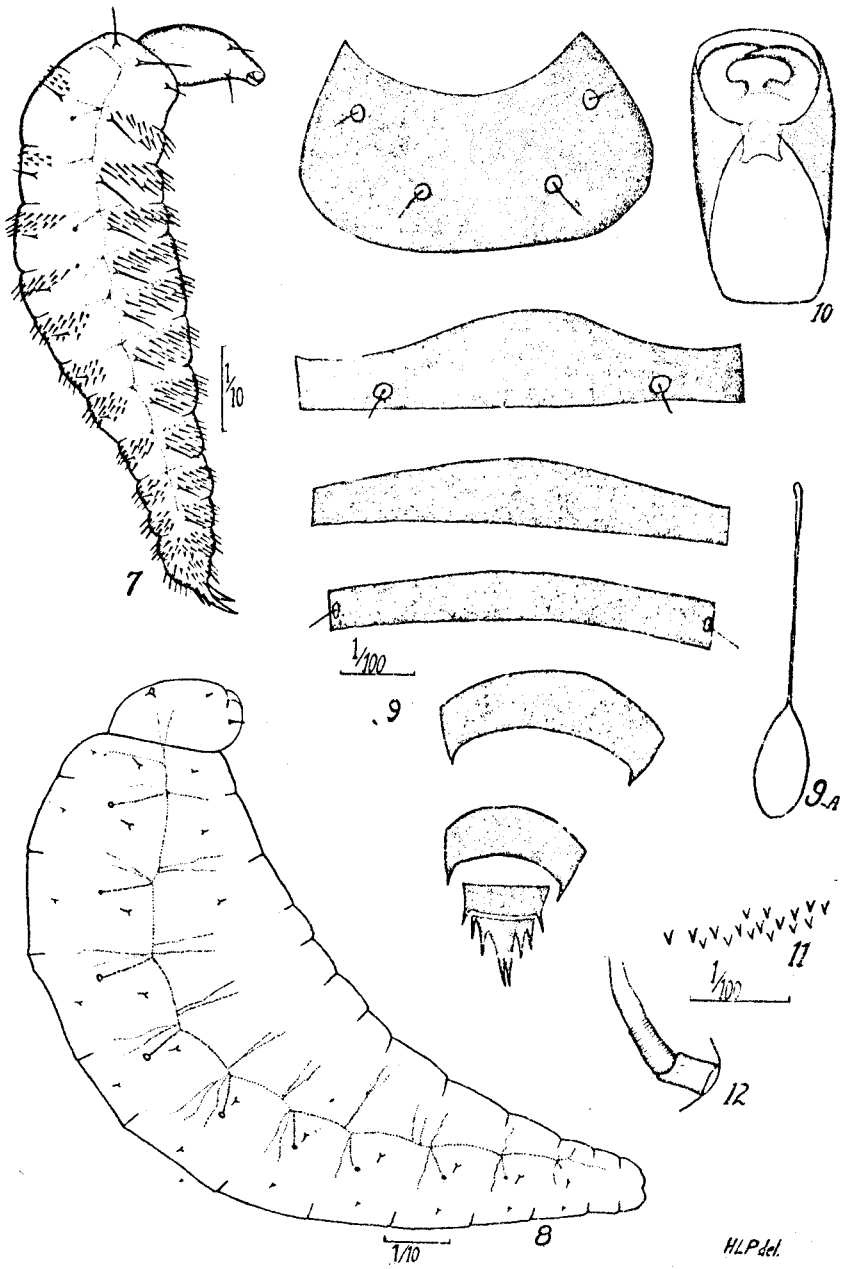

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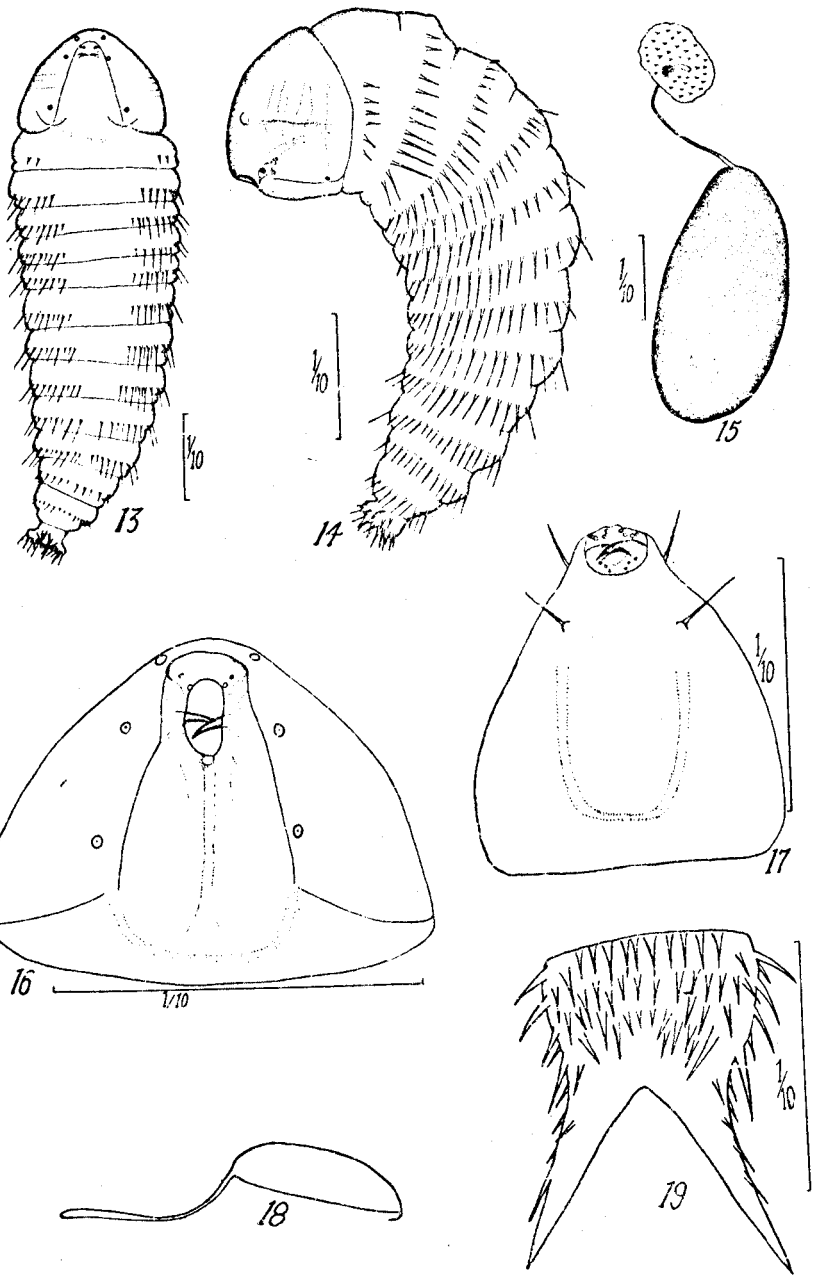

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