ON ACROCERCOPS STRIGIFINITELLA CLEMENS.

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AND
Rev. J. J. DeGryse.

HISTORICAL.

This interesting microlepidopteron was first described by Clemens in 1860 under the name *Gracilaria strigifinitella* and again by Chambers in 1872 as *G. duodecemliniella.* In 1875 Chambers redescribed it as *Ornix quercifoliella,* appending the following note: "a single specimen received from Miss Murtfeldt who informs me that the larva curls down the edge of oak leaves (sic!). In its earlier stages it is probably a leaf miner." Busck in 1902 established the above synonomy and referred the species to Walsingham's genus, *Dialectica* with the further information that he had reared a single specimen from oak leaves collected at Washington, D. C. Meyrick has since proved *Dialectica* to be a synonym of *Acrocercops* and has placed *strigifinitella* in Group C (Gen. Ins. Fasc. 123) of that genus with another North American species, a single European and several Australian forms.

In the spring of 1913 one of the authors (Heinrich) found at Falls Church, Va., a lepidopterous larva mining the midribs of chestnut, chinquapin and oak leaves. Adults reared from these and from similar larvæ in leaves of *Fagus americana*,[1] were determined by Mr. Busck as *Acrocercops strigifinitella.* Further investigations were continued by the authors during the past summer. Chestnut appears to be the favorite food plant and during mid-summer the work of the species is very common, few of the young leaves escaping infestation, some bearing as many as four separate mines. When the proper food supply is abundant, however, there is rarely more than one or two to the leaf. There are a number of generations with considerable overlapping so that larvæ are to be found any time from May till well on into October. The first larval brood appears in spring as soon as the leaves are formed. During July and August the dominant period in the seasonal life of the species is reached. Towards fall there is a gradual diminution in numbers, and during October a partial dying out of the species, due in great measure to the scarcity of new leaves which are necessary to the successful maturing of the larvæ. In the neighborhood of Washington, D. C., the last larval brood appears early in October. The manner in which the species overwinters has not been definitely

[1] Elkmont Tenn., T. E. Snyder, U. S. Bur. of Ent., Collector.

determined but our observations lead to the belief that the few larvæ which are able to feed up during October, make their cocoons before the leaves fall and pass the winter as pupæ, developing into moths early in spring.

SYNONOMY.

Gracilaria strigifinitella, Clemens—Proc. Acad. Nat. Sci. Phil., 6, 1860.
Gracilaria duodecemliniella, Chambers—Can. Ent., IV, 11, 1872.
Ornix quercifoliella, Chambers—Cin. Quart. Jn. Sci., II, 116, 1875.
Dialectica strigifinitella, Busck—Proc. Ent. Soc. Wash., V, 3, 195, 1903.
Acrocercops strigifinitella, Meyrick—Gen. Ins. 123 Fasc., 17, 1912.

EGG.

The eggs (pl. 1, fig. 3) are laid singly on the under surface of the leaves, usually near the base and between the branching ribs. They average about 0.1 mm. in length, are elliptic in circumference, flattened below and convex above, shining pearly white and minutely faceted. The period of incubation for those specimens under observation was from 4 to 6 days.

LARVA.

Upon emergence from the egg the young larva makes a short irregular linear mine just beneath the cuticle of the leaf on the under side (pl. 2, fig. 4). In this mine it passes the first two instars during both of which it is of the flat specialized gracilariid type (pl. 2, fig. 5), whitish, without legs, abdominal feet or discernible body tubercles or setæ. The head-capsule (pl. 3, figs. 1, 2) is wedge-shaped with the greatest width just forward of the tentorial bridge; the diameter of occipital foramen at dorsal extremity of hind margin $\frac{1}{2}$.[1] The frons extends a trifle more than $\frac{1}{2}$, the frontal ridges diverging slightly to the juncture of the tentorial arms, and then converging to form a short bridge (*ob*) with the hind margin which projects into head-capsule $\frac{1}{4}$. The adfrontal sclerites are fused with the frontal ridges. The tentorial bridge is a trifle less than $\frac{1}{3}$ in length, straight and thickened somewhat in the middle; the upper attachment of tentorial arms well back of middle of frontal ridges. Ocelli dorsally placed, well back from base of antennæ; strongly but unevenly pigmented; lenses absent. Antennæ 3-jointed, the basal joint short and only seen under oil immersion; the larger papilla on second joint extending nearly to apex of antenna, papillæ otherwise normal; setæ absent. Post-labrum approximately tri-

[1] In the description of the head-capsules all measurements are expressed in proportion to the greatest width of the head.

angular with apex forward of the median incision of the labrum. Labrum (pl. 2, fig. 2) rather narrow, with two setæ-bearing tubercles; median incision deep and strongly chitinized on the edges; between these and extending outwardly a small oval epipharyngeal shield (*es*) visible only under oil immersion; distal edge of median incision serrate. Mandible (pl. 2, fig. 1) flat; three-toothed; distal fourth of median edge projecting and dentate. Labium (pl. 2, fig. 3) thrust well forward, spoon-like with distal margin serrate and anterior concavity rounded; no labial palpi; under oil immersion a well defined stipes; labium extending far back into head, with no apparent articulation between mentum and sub-mentum. Salivary ducts plainly visible and joining to the front to form what appears to be a very rudimentary spinneret, seen only under oil immersion. Hypopharynx finely haired on forward portion only. Maxillæ with palpus absent; origin of lacinia in palpiger not defined; lacinia bearing two bristle-like digiti; no distinct joint between palpiger and stipes, the latter considerably elongated; cardo small and triangular. Triangular plates of hypostoma (pl. 3, fig. 1) small and separated by slightly less than $\frac{1}{2}$. On the ventral side of the head-capsule approximate to each antennal ring is a pair of hairless tubercles. Otherwise the head-capsule is smooth. Length of larva before first moult 0.75 mm.; before second moult 1.25 mm.

After the larva has moulted for the second time it bores into one of the branching ribs which it mines during the whole or greater part of the third instar. The later instars, two of which we are able to account for, are passed in the mid-rib within which the larva mines (pl. 1, fig. 5) up or down, as the case may be, and from which it emerges when ready to spin its cocoon. As a rule the path of the mine is upward, the larva emerging from the upper side of the rib near the tip (pl. 1, fig. 2). In some cases where the leaf is too small for the mid-rib to afford sufficient nourishment, the larva continues to mine from there into the fleshy part of the leaf making a large irregular blotch (pl. 1, fig. 1) quite similar to that of *Mnemonica*. This habit however is quite abnormal.

The first two instars are the only ones in which the larvæ are of the flat gracilariid type.[1] The third instar larva is transitional between these and the typical cylindrical gracilariid form of the following instars, but with pronounced affinities to the latter. It is cylindrical, has well developed spinneret, labial and maxillary palpi and appreciable body setæ. There are, however, no noticeable legs or abdominal feet and the head-capsule while

[1] During these stages they are what Trägardh designates as sap-feeders. Comp. Trägardh: Archiv. for Zoologi., Band 8, No. 9, 1913.

rounded inclines somewhat to the flattened wedge shape. The tentorial bridge and the ocelli are as in the flat instars, the latter however more strongly and evenly pigmented. The mandibles in shape approach those of the last stage.

The larva of the fourth instar does not differ essentially in structure from that of the last.

The mature larva (pl. 4, fig. 1) is in general body characters typical of the family. It is whitish, or, when it has fed up in the blotch mine, greenish, without color markings. The abdominal feet bear seven crochets in two curved rows all pointing backward (pl. 4, fig. 3). Tubercles and setæ of abdominal segment as figured (pl. 9, fig. 1); using Dyar's numbers, we would say that I is lower than II with I, III and V nearly in a straight line, IV absent or coalesced with V, VI absent; anal segment as figured (pl. 9, fig. 2). The head-capsule (pl. 5, figs 1, 2) is rounded, the dorsal side projecting over the ventral $\frac{1}{3}$; greatest width slightly lower than middle of head, well forward of tentorial bridge. Diameter of occipital foramen at dorsal extremity of hind margin $\frac{1}{2}$, at ventral extremity a trifle under $\frac{1}{2}$. Length of frons slightly over $\frac{1}{2}$; the frontal ridges converging in curved lines to a longitudinal ridge ($\frac{1}{8}$ long) connecting them with the hind margin, which projects $\frac{1}{4}$ into the head; adfrontal sclerites conspicuous but folded under frontal ridges. Tentorial bridge as in first instar; slightly less than $\frac{1}{3}$ in length; upper attachment of tentorial arms at middle of frontal ridges. Ocelli, five, in two longitudinal rows; 1, 2, 3, dorso-laterally placed; 1 and 2 grouped approximate to antennal ring; 3 back $\frac{1}{4}$; 4 and 5 grouped opposite of 3 on ventral side; all with well developed lenses; pigmented area broad and continuous under all the ocelli. Antenna (pl. 4, fig. 5) distinctly three-jointed; second joint with two papillæ and two hairs, the longer hair not extending beyond the extremity of the antenna; third joint as in *G. syringella*.[1] Post-labrum normal. Labrum (pl. 7, fig. 2) curving well down to the sides over the upper edge of the mandibles; median incision concaved and moderately deep; four pair of setæ, V and VI absent;[2] sides very thin, the lateral edges strengthened by a chitinous bar with six branches projecting inwardly for a short distance and giving a somewhat scalloped appearance to the margin. Epipharynx (pl. 7, fig. 1) densely tufted with hair-like filaments; the paired epipharyngeal plates tooth-like; epipharyngeal shield, heart-shaped, strongly chitinized and projecting beyond the median incision of the labrum. Mandible

[1] Comp. Trägardh: l. c., pp. 16–17.

[2] We have followed the system of numbering used by W. T. M. Forbes (Ann. Ent. Soc. Am., vol. III, No. 2, p. 96, 1910).

(pl. 4, fig 4) with five teeth, one ventrally compressed; when closed the toothed edge is vertical. Labium normal with short membrana articularia; in some specimens mentum and sub-mentum appear to be fused, in others the articulation is distinct. Cardo pear-shaped with small, irregular, strongly chitinized plate at the base. The triangular plates of the hypostoma meet approximately, their hind margins forming a rounded arch which projects for $\frac{1}{4}$ into the head-capsule. Maxillary palpus three-jointed with large palpiger; lacinia has three two-jointed digiti and two setæ; the base of the lacinia bears four or five overlapping plates connected by a chitinous band with similar plates on the maxillulæ[1] (pl. 6, fig. 1; pl. 7, fig. 3). Epicranial setæ eleven on the dorsal and seven on the ventral sides; there are also a varying number of punctures and small setitious tubercles on the basal half of the dorsal side. Length of full grown larva, 6–7 mm.

The last instar is a feeding one, the species differing in this regard from *Marmara* and the true *Gracilaria* which have a final specialized stage during which the larvæ are active and have functioning mandibles but do not use them for feeding.

The entire larval period is about twenty days.

COCOON.

After it leaves its mine the larva lets itself down by a strand of silk to a more secluded place where it spins a cocoon, nearly always on the under side of a leaf near the edge or against one of the ribs. The cocoon is a double affair consisting of a thin outer layer built up from the leaf, and a second, similar, inner layer, everywhere separated from the first by from 1 to 1.5 mm. The cocoon (pl. 1, fig. 4) is 14 mm. long, white, rather flattened, oval and transparent. The outer covering is decorated along the middle with from four to ten small, pearl-like globules similar to those on the *Marmara* cocoons, but fewer in number and less brilliant. This decorating of the cocoon is quite characteristic of several Gracilariidæ. Meyrick[2] mentions two Indian species (*A. austeropa*, Meyr., and *Epicephala chalybacma*, Meyr.) which have the same habit. These bubbles are also common to the cocoons of all the species of *Marmara*. Their purpose is considerable of a mystery but, as they have the appearance of eggs, they are presumably of some protective value to the pupa. At

[1] The presence of these organs in other Lepidopterous larvæ was pointed out by Busck and Böving in their recent paper on *Mnemonica auricyanea* (Proc. Ent. Soc. Wash., XVI, 4, pp. 153, 161, 1914).

[2] Jn. Bomb. Nat. Hist. Soc., p. 118, June 1914.

a former meeting of this society[1] Mr. Busck has given an account of the manner in which they are made. His observations were on *M. salictella* Clem., but, inasmuch as there is no reason for supposing the method to be different for the other Gracilariidæ having a similar habit, we may note his remarks here. In substance he says: after the outer covering of the cocoon is completed a slit is bitten through by the larva. A small globule secreted from the anus is then forced into the opening by the mandibles, fastened by a loop of silk and the slit sewn together. This process is repeated until the bubble content of the alimentary canal is exhausted.

PUPA.

Within its silken enclosure the pupa (pl. 9, fig. 3) is plainly visible. Throughout the pupal period it is noticably active, revolving rapidly on the axis of the body when disturbed; greenish brown and structurally normal according to Chapman's classification of the Gracilariidæ.[2]

Pupal period; six to ten days in summer.

ADULT.

The imago has steely-greyish-white palpi with two black rings on the terminal joint and two, and a faint third, on the second joint. Head and face whitish, streaked with black or blackish brown, the appressed scales falling well over the eyes and front. Thorax steel grey streaked with black, the dark portions more crowded towards the center. Forewings grey, suffused with brown giving the ground color a light, rather even, brownish tint; from the costal and dorsal margins several oblique white streaks interspersed with irregular patches and lines of black scales, these markings varying considerably in intensity and distinction of definition in different specimens but averaging as shown in the drawing (pl. 8, fig. 1); the apical area dark brown shading to black; apical cilia greyish white with a median band of black or blackish brown, white at the base, this white band forming with the costal and dorsal streaks of the apical portion a nearly complete white circle about the darkened area; costal cilia brownish; dorsal cilia brownish grey. Hind wings brownish grey; cilia concolorous, darkening toward apex. Abdomen brownish grey above, silvery beneath; the segments diagonally streaked along the sides with black, the streaks meeting obscurely on the dorsum. Legs whitish, striped with black. Anal tuft black, slightly marked with grey. Viewed from below the entire insect

[1] Proc. Wash. Ent. Soc., v, 102, 1902.

[2] The Entomologist, Lond., vol. xxxv, pp. 141–142, 1902.

has a striking black and white striped appearance. The venation is given in figures 2, 3 and 4 (pl. 8). A marked feature of this species is the costal fold in the hind wing of the male shown in figure 4 (pl. 8).

Alar expanse 8 mm.

In summer the entire life cycle of the insect from egg to imago, is completed in a trifle over a month.

It is very improbable that this species should ever prove of much economic importance. Though common, its feeding does not kill or seriously disfigure the infested leaves. As we have noted the larvæ only attack the newer leaves at the ends of branches and leaders. This specialized food habit coupled with the scarcity of their proper food supply during fall effectively prevents them from becoming overabundant for more than a short period during mid-summer. Parasites and predators also play their part. Four species of Hymenoptera,[1] parasitic on the larvæ have been reared, and on two occasions *Chrysopa* larvæ were found attacking the gracilariid in its mine, piercing the mid-rib with their mandibles and sucking the juices of the larva within. While wandering about after leaving their mines a number also fall victims of the spiders and birds; but these factors of natural control are of secondary importance as compared with the failure of large numbers of the fall larvæ to secure a proper food supply.

In conclusion the writers wish to thank their good friends August Busck and Drs. Adam Böving and Charles R. Ely for many helpful suggestions. Mr. Busck has also contributed the drawings of the wing venation (pl. 8, figs. 2, 3, 4) for this paper. All the other drawings are the work of J. J. DeGryse.

Explanation of Plates.

Plate I. Egg, work and cocoon.

Fig. 1, blotch mine made by larva after it leaves the mid-rib in search for more food.

Fig. 2, opening out by the larva on leaving mid-rib in order to pupate.

Fig. 3, egg (greatly enlarged).

Fig. 4, cocoon decorated with globules.

Fig. 5, normal mode of feeding in chestnut leaf; egg (*O*); point where larva emerges from mid-rib (*ep*).

Plate II. Larva in the first and second instars.

Fig. 1, mandible (ventral view).

[1] *Sympiesis flavipes* Ashmead, *Pseudopanteles nigripes* Roh., an *Arthrolytus* sp. and a single undeterminable male of the tribe Omphalini. (Det. by S. A. Rohwer.)

Fig. 2, Labrum (*lr*); Post-labrum (*pl*); Epipharynx (by transparency) (*ex*); Epipharyngeal shield (*es*).

Fig. 3, Labium (*li*); Hypopharynx (by transparency) (*hx*); Salivary duct (*sd*); Stipes labialis (*sl*); Digiti laciniæ (*dl*); Palipiger (*pgr*); Stipes maxillaris (*s*).

Fig. 4, mine made by larva in the first and second instars; dotted line indicates path of later stage larvæ through branching rib into the mid-rib.

Fig. 5, dorsal view of larva of the first and second instars; Antenna (*at*).

Plate III. Head-capsule of larva in the first and second instars.

Fig. 1, ventral side of head: Epicranium (*epc*); Labium (*li*); Salivary ducts (*sd*); Stipes labialis (*sl*); Maxilla (*mx*); Stipes maxillaris (*s*); Cardo (*c*); Hypostoma (*h*); Tentorial bridge (*tb*); Mandible (*md*).

Fig. 2, dorsal side of head: Epicranium (*epc*); Frons (*f*); Frontal ridge fused with adfrontal sclerite (*adfr*); Tentorial arms (*ta*); Bridge formed by meeting of frontal ridges with hind margin (*ob*); Rudimentary ocellus (*ocl*); Labrum (*lr*); Post-labrum (*pl*); Mandible (*md*); Hypopharynx (*hx*); Antennal ring (*an*); Antenna (*at*).

Plate IV. Mature larvæ.

Fig. 1, lateral view of mature larva.

Fig. 2, thoracic leg.

Fig. 3, abdominal leg: diagram showing arrangement of hooks.

Fig. 4, mandible (ventral view).

Fig. 5, antenna (segments indicated by Roman numerals).

(If Dampf's interpretation of the antennal joints is accepted, our joint II would become joint I and the seta bearing papilla at the top, joint III. —Comp. A. Dampf: Zoolog. Jahrb. Supp. 12, Heft. 3, p. 525, 1910).

Plate V. Head capsule of mature larvæ.

Fig. 1, dorsal view of head: Epicranium (*epc*); Frons (*f*); Frontal ridge with adfrontal sclerite (*adfr*); Tentorial arms (*ta*); Ocelli (*ocl*); Antennal ring (*an*); Antenna (*at*); Labrum (*lr*); Mandible (*md*); Maxilla (*mx*); Spinneret (*sp*).

Fig. 2, ventral view of head: Epicranium (*epc*); Maxilla (*mx*); Hypostoma (*h*); Tentorial bridge (*tb*).

Plate VI. Trophi of mature larva.

Fig. 1, lateral view of labium and hypopharynx: Labial palpi (*lp*); Spinneret (*sp*); Salivary duct (*sd*); Stipes maxillaris (*s*); Stipes labialis (*sl*); Point of attachment of lacinia (*atl*); Maxillulæ (*mxl*).

Fig. 2, labium and maxillæ (ventral view): Spinneret (*sp*); Labial palpus (*lp*); Stipes labialis (*sl*); Mentum (*m*); Submentum (*sm*); Cardo (*c*); Maxilla (*mx*); Stipes maxillaris (*s*); Membrana articularia (*mb*).

Plate VII. Labrum, Epipharynx, and Hypopharynx of mature larva.

Fig. 1, Epipharynx (*ex*); Epipharyngeal shield (*es*); Internal and external epipharyngeal plates (*ep*); Epipharyngeal tufts (*et*); Sensory puncture (*spt*).

Fig. 2, labrum (*lr*); Postlabrum (*pl*); Epistoma (*e*).

Fig. 3, maxillæ, maxillulæ and hypopharynx: Basal (*mp* I), median (*mp* II) and apical (*mp* III) joints of maxillary palpus; Palpiger (*pgr*): Right lobe of maxillulæ in situ (*mxl*); Left lobe of maxillulæ dissected at base and extended (*mxl'*); Overlapping plates on outer edge of maxillulæ (*pp*) analogous plates (*pp'*) at base of lacinia (*l*); Hypopharynx (*hx*); Hypopharyngeal plate (*hp*).

Plate VIII. Adult and wing-venation.

Fig. 1, adult.

Fig. 2, venation of forewing.

Fig. 3, venation of hindwing of female.

Fig. 4, venation of hindwing of male.

Plate IX. Larvæ and pupa.

Fig. 1, abdominal segment of mature larva.

Fig. 2, anal segment of mature larva.

Fig. 3, pupa.

In the discussion of this paper Dr. Böving complimented the authors on their careful work and called attention to the rather scant literature dealing with the epipharyngeal and hypopharyngeal structures and especially to the work of the Danish author, H. F. Hansen, who first observed the so-called maxillulæ in insects and homologized them with corresponding structures in the Crustacea.

Dr. Böving expressed his particular satisfaction in having been able to call the attention of the authors to the very valuable paper by Dr. A. Dampf [Zur Kenntnis gehäusetragender Lepidopterenlarven (Zool. Jahrb. Suppl. Bd. 12, pp. 513–608, 54 figs. 1910.)] which deals with the same morphological problems as the present paper and as the recent paper by Busck and Böving [On Mnemonica auricyanea, Wlsm. (Proc. Ent. Soc. Wash. v. xvi, pp. 151–163, pl. ix-svi, 1915)].

He regretted very much, that he and Busck by an inexplicable slip of memory had overlooked the paper, of which Dr. Dampf had presented him a complimentary copy, when it appeared. It is a very important contribution and deserves careful consideration by all students of the morphology of Lepidoptera.

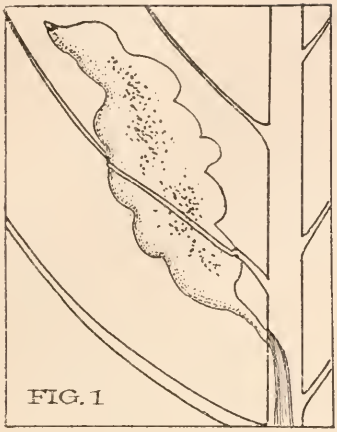
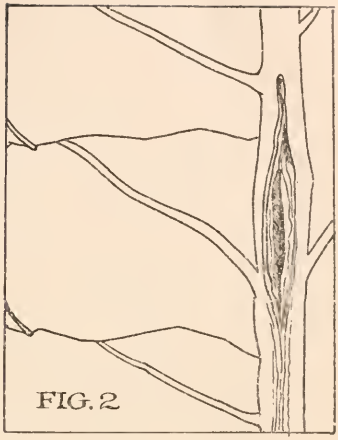


FIG. 1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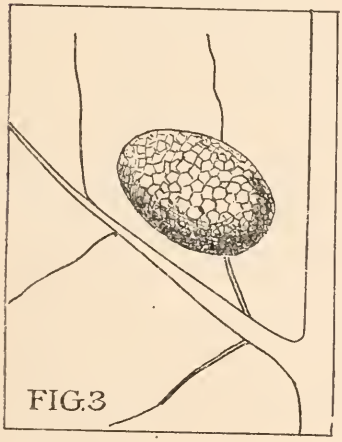
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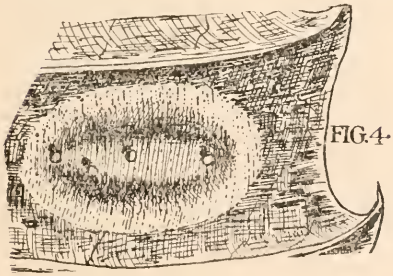
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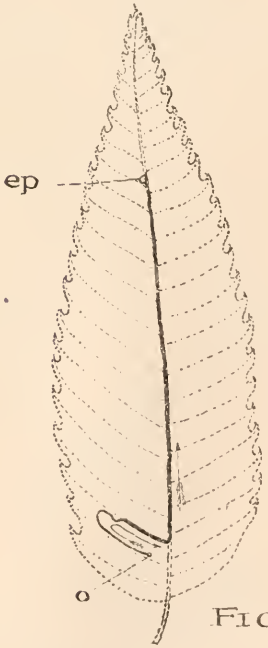

FIG. 5

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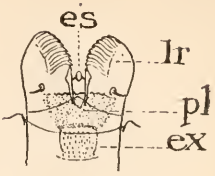

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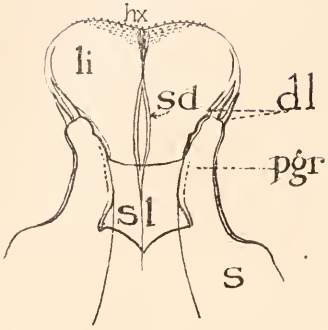

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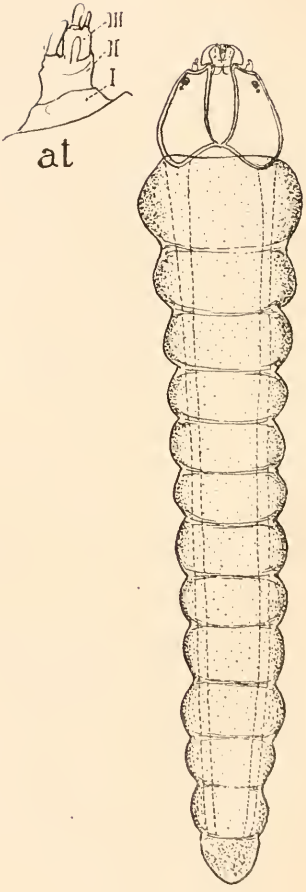

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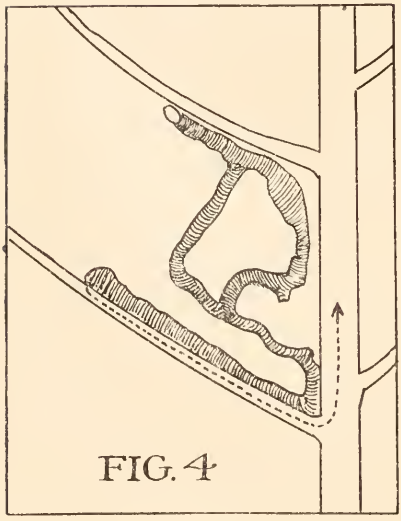

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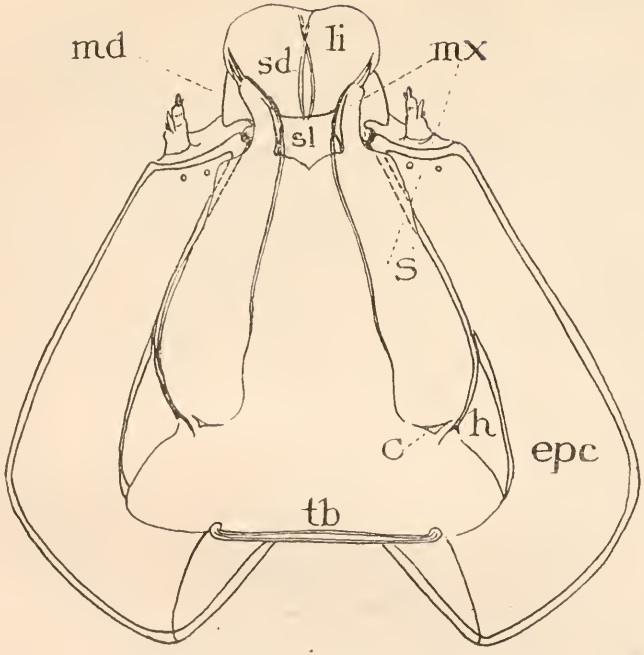

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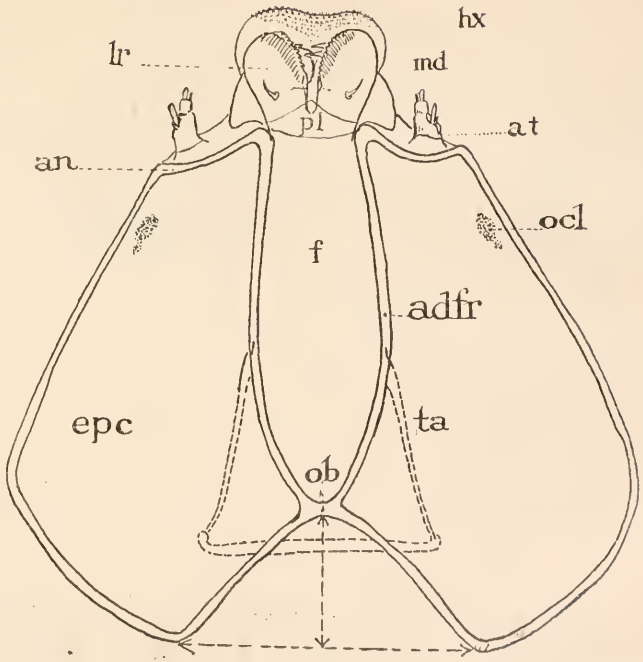

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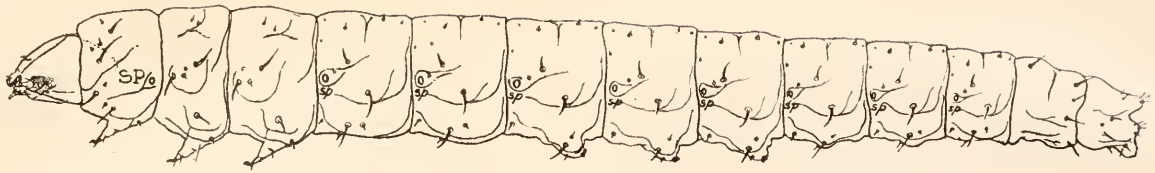

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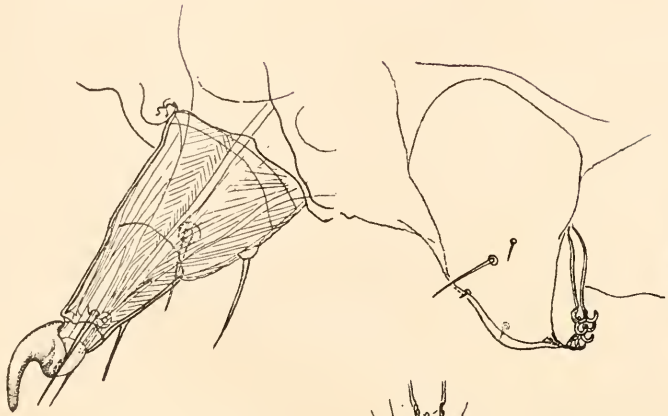

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FIG. 3

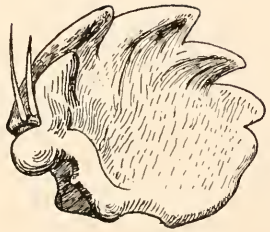

FIG. 4

FIG. 5

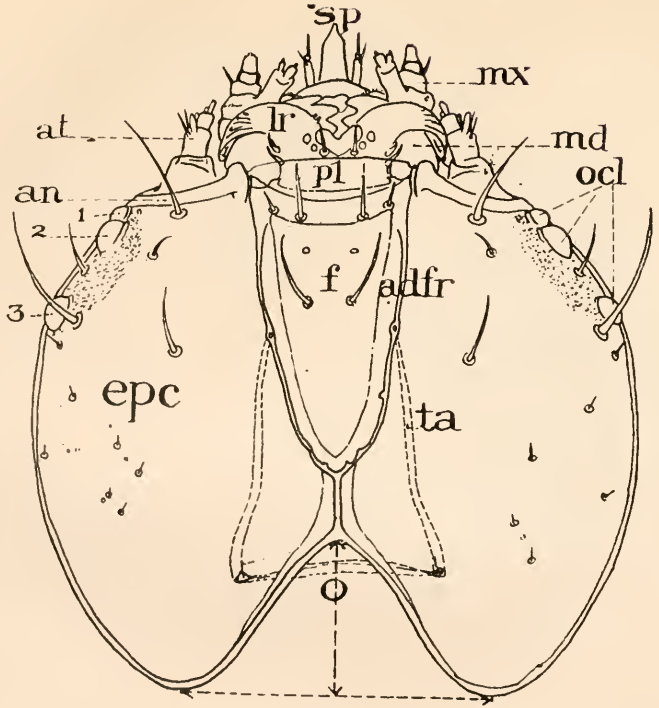

FIG. 1

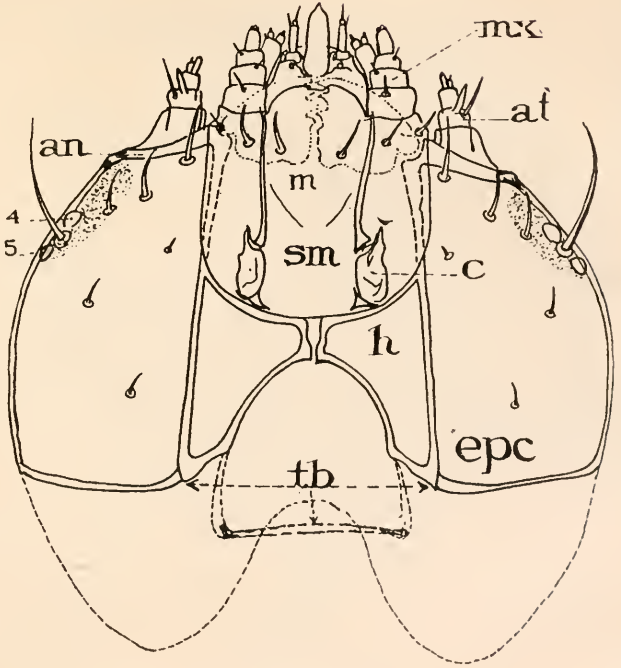

FIG. 2

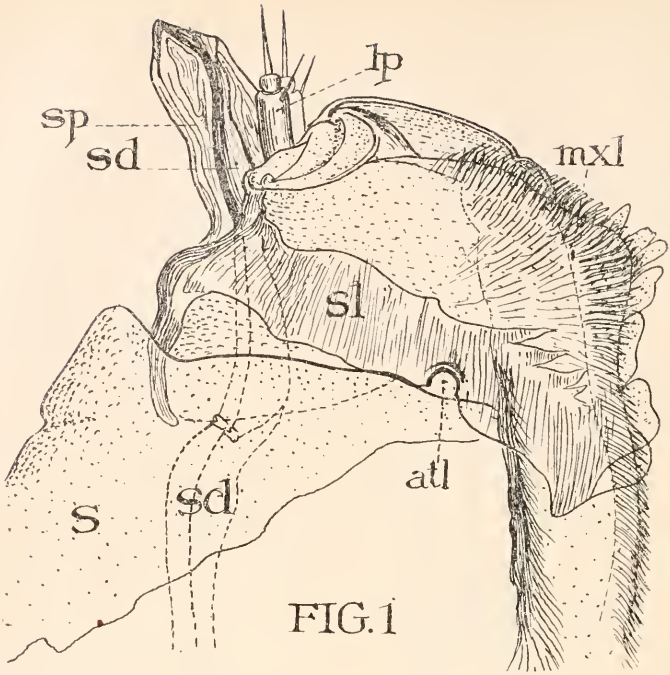

FIG. 1

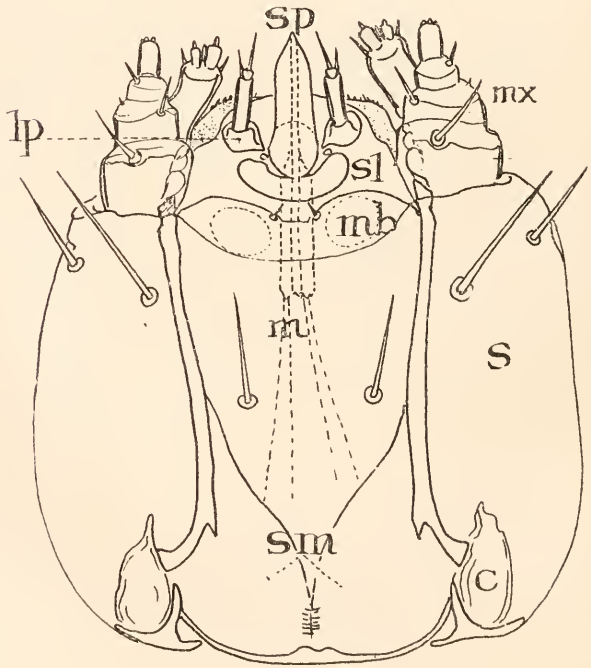

FIG. 2

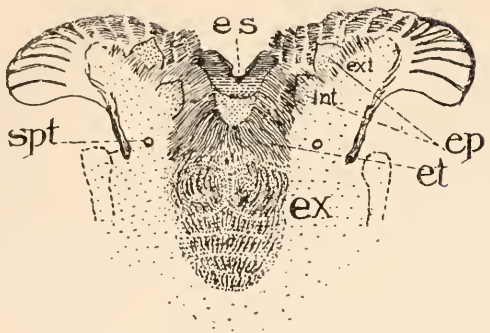

FIG. 1

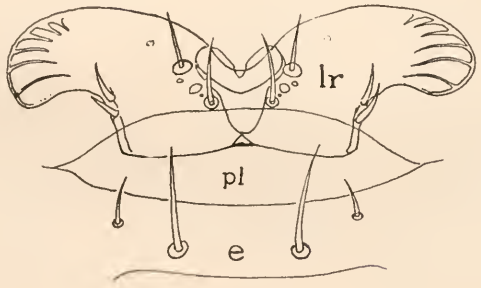

FIG. 2

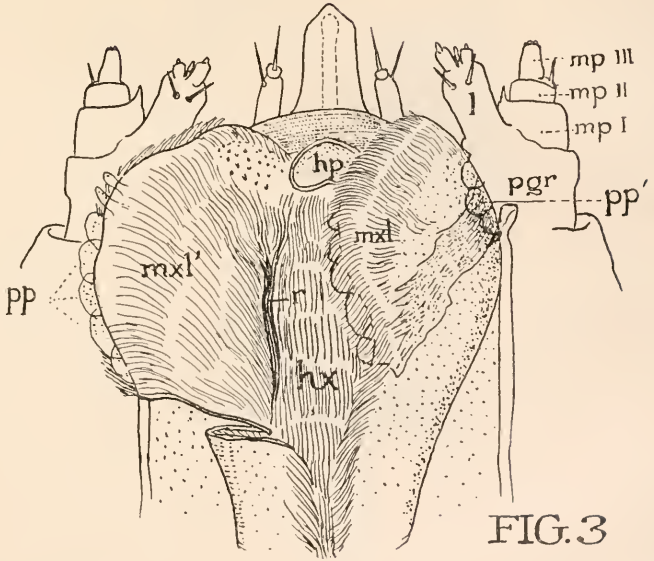

FIG. 3

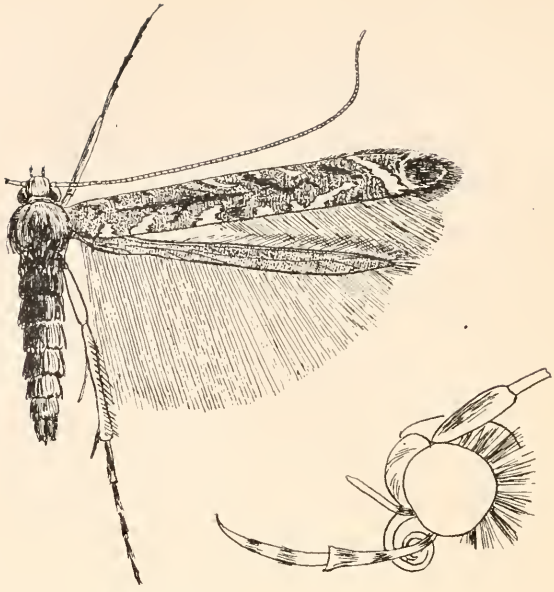

FIG. 1

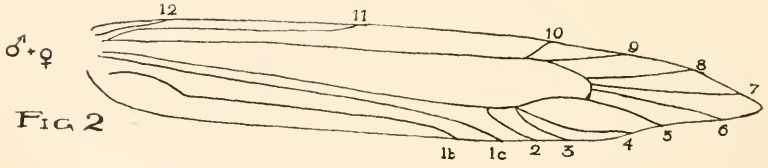

FIG 2

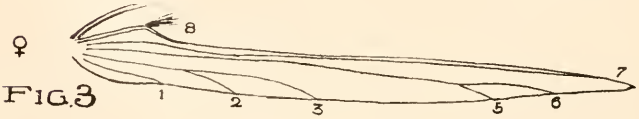

FIG. 3

FIG 4

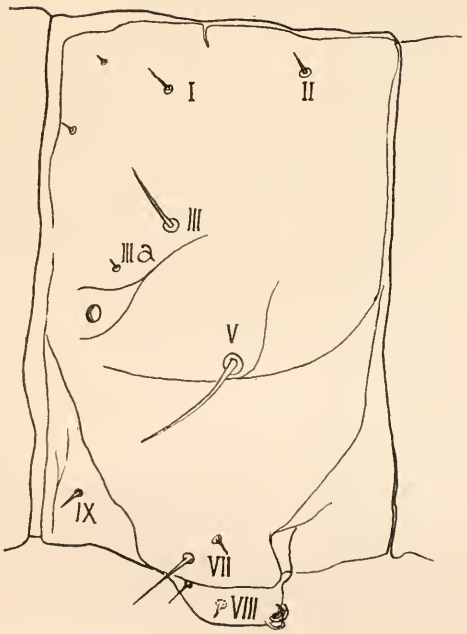

FIG. 1

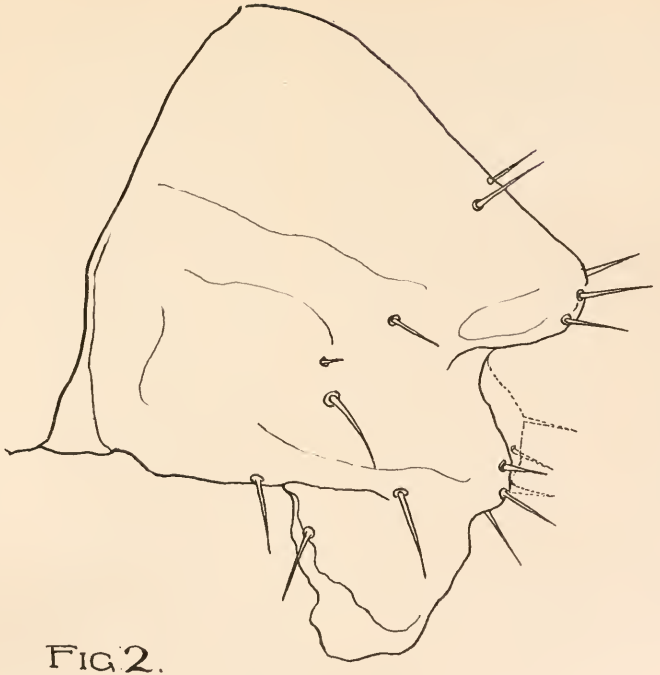

FIG. 2.

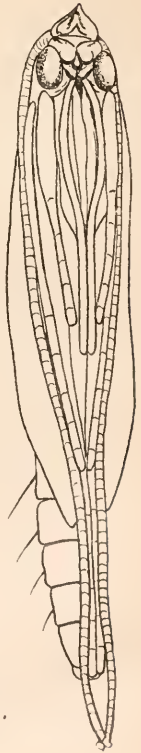

FIG. 3.