

NOTES ON THE MORPHOLOGY OF MOSQUITO LARVAE

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While studying mosquito larvae the writer has observed a number of characters not easily discerned on mounted larvae. These are the gula, gular sutures, maxillary spines, and certain hairs on the thorax, abdomen and air tube which are often best observed in a lateral or ventral view of the body.

The gular sutures are practically entire in most genera, extending from the margin of the buccal cavity to the margin of the occipital foramen, in which they become obsolete (Plate I, figs E-I). Anteriorly and inwardly they anchor the mentum, while on the posterior part of the head a pair of apodemes arise from them (ga, figs. A and E). In *Mansonia* the sutures are not prolonged beyond the apodemes (fig. D); in *Megarhinus* and *Anopheles* they do not attain the apodemes (figs. B and A); in *Uranotaenia* they are entirely lacking (fig. C).

The gula may be long or short with parallel sides or otherwise, depending on the shape of the head and the course of the gular sutures (cf. figs. F, H, and I). Laterally it is defined by the gular sutures, or, when the sutures are lacking as in *Uranotaenia* (fig. C), by the position of the gular apodemes. Anteriorly the gula may be angularly produced as in *Anopheles* and *Mansonia* (figs. A and D), evenly rounded as in *Megarhinus* (fig. B), produced into a spinous process as in *Culex* (fig. E), or truncate as in *Orthopodomyia* (fig. I). Posteriorly it is split from the occipital foramen (of, fig. D) for a varying distance along the mid-ventral line, except in the first three instars of *Anopheles* and the first instar of each of the other genera studied.

In the Chaoborinae the gula is present in *Corethrella*, but lacking in *Mochlonyx*, in which case the buccal cavity is contiguous with the cervical membrane. The other genera are probably all similar to *Mochlonyx* with respect to the gula. The gular apodemes are absent in this subfamily.

Small, vestigial spiracles, first noticed in *Megarhinus* are present laterally on abdominal segments 1-7 (sp, fig. O), the mesothorax and usually the metathorax in all species of culicines examined. In *Anopheles* they are extremely small, if present, and their presence has not been detected in the Dixinae or Chaoborinae.

Uranotaenia.—This genus is strikingly different from other genera in both the larval and adult stages. Larvae of the two species occurring in the southeastern states, *U. sapphirina* and *U. lowii*, possess two salient distinguishing features (the elongate head and spinous head hairs) which are common in the genus but not present in all species.

¹Contribution of the Georgia Department of Public Health.

The African *U. pallidocephalis*, for example, has the head much wider than long, and larvae of the species of the subgenus *Pseudoficalbia* usually have normal head hairs. Other characters common to the genus are the lateral plate of the eighth abdominal segment and the pecten teeth fringed on both margins, but here again several species do not conform to the rule and the lateral plate is a character of the fourth instar only. In two respects the two species studied differ from other North American genera and the first especially may possibly separate this from all other genera. These characters are the absence of lateral sutures in all instars, already referred to, and the reduction of the lateral hairs of abdominal segments 3-6 in the later instars (fig. O).

Specific identification of mature *U. sapphirina* and *U. lowii* has heretofore been based on the upper lateral hair of abdominal segments 1-2², which is double in *lowii* and triple (though occasionally double or 4-branched) in *sapphirina*. Prothoracic hairs 3 and 13 offer characters to separate the two species in all the later instars. In *lowii* hair 3 is 5- to 7-branched and about a third shorter than hairs 1 and 2; in *sapphirina* hair 3 is 7- to 11-branched (4- to 8-branched in the second

²Since this was written an article has appeared in the *Journal of Economic Entomology*, Vol. 37, No. 4, pp. 543-4, by J. E. Pryor and R. W. Chamberlain, in which distinguishing characters of these two species are set forth. Prothoracic hair 3 is mentioned and figured, but hair 13 is not.

EXPLANATION OF PLATE I

A-I—Ventral view of head of representatives of nine genera of mosquitoes, showing the nature of the gula and maxilla. The antennae, mentum, mouth brushes and usually the mandibles are not represented. The base of the mentum is usually represented by short dotted lines near the anterior end of the gular sutures. All heads are drawn to the same scale; A and C are fourth instar, B and H are second instar, and the remainder are third instars.

A. *Anopheles quadrimaculatus*. gs—Gular suture, ga—Gular apodeme.

B. *Megarthinus septentrionalis*.

C. *Uranotaenia sapphirina*. The origin of the gular apodeme in B and C is represented by a dot.

D. *Mansonia (Mansonia) titillans*. mx sp—Maxillary spine, sa s—Sub-antennal spine, a f—Antennal foramen, o f—Occipital foramen.

E. *Culex (Melanoconion) erraticus*. mx sp—Maxillary spine, g s—Gular suture, g a—Gular apodeme.

F. *Culiseta (Climacura) melanura*.

G. *Aedes mitchellae*.

H. *Psorophora (Psorophora) ciliata*.

I. *Orthopodomys signifera*.

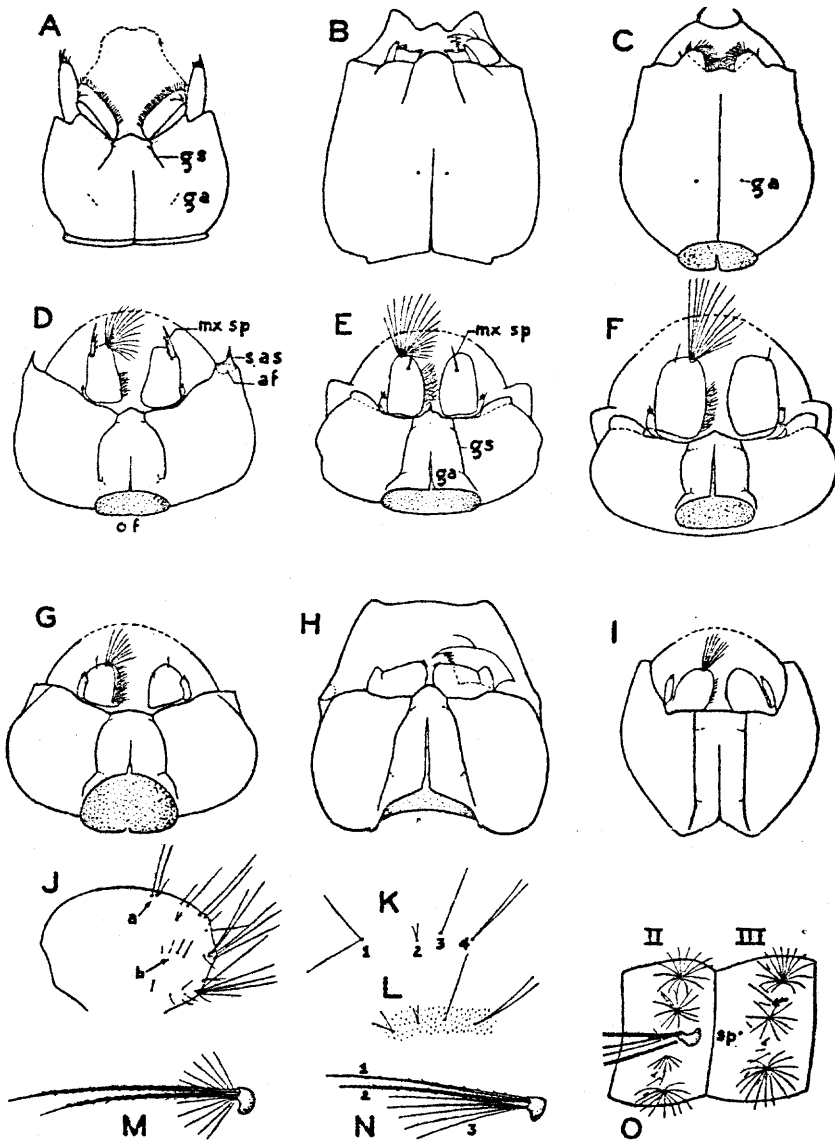
J. Thorax, dorsal view, showing (a) the dorsal submedian prothoracic hair group and (b) mesothoracic hairs 1-4. Prothoracic hair 13 is situated ventrally, below (a).

K. *Culex salinarius*, mesothoracic hairs 1-4.

L. *Culex nigripalpus*, mesothoracic hairs 1-4 and showing also some of the thoracic spicules.

M. and N. *Uranotaenia sapphirina* and *U. lowii*. Lateral view of the dorsal submedian prothoracic hair group (prothoracic hairs 1-3) and the platelet from which they arise.

O. *Uranotaenia sapphirina*. Lateral view of abdominal segments 2 (II) and 3 (III), showing the strong lateral hairs on segment 2. The corresponding hairs on segment 3, in the opinion of the writer, are indicated by an arrow. sp—Vestigial spiracle.



instar) and less than half as long as hairs 1 and 2. Or it may be said that hair 3 is larger and coarser than the stellate hairs on the thorax and abdomen in *lowii* and equal to the stellate hairs in *sapphirina*. Prothoracic hair 13, situated under the thorax near the head, is single (rarely double in the fourth instar) in *lowii* and multiple in *sapphirina*. Because of its protected position on the body, hair 13 is seldom or never lacking, no matter how mutilated or denuded the specimen.

Culex (Melanoconion).—Two characters separate this subgenus from other North American *Culex* in all instars. These are (1) the presence of two pairs of small lateral hairs on the air tube, in addition to the usual ventro-lateral hairs and (2) the maxillary spine is situated subapically on the ventral surface of the maxilla, instead of on the outer apical margin (fig. E, mx sp). The spine is also larger and heavier than in the other *Culex* studied. Species studied: *Culex (Melanoconion) erraticus*, *C. (M.) peccator* and *C. (M.) pilosus*.

Mansonia (Mansonia).—The maxillary spine is serrate in this subgenus, as has been previously noted.³ This is true in all instars. In the first instar both margins are serrate; in the later instars only the inner margin is serrate (mx sp, fig. D). In the later instars the head capsule is produced into a spinous process below each antennal foramen (sas, fig. D). Species studied: *Mansonia (Mansonia) titillans*.

Culex nigripalpus and *C. salinarius* can be distinguished from each other in all the later instars by the nature of mesothoracic hair 1. In *nigripalpus* this hair is sub-equal in size to hair 2, and hairs 1, 2, 3 and 4 are sub-equally spaced (fig. L). In *salinarius* hair 1 is much larger than and more remote from hair 2 (fig. K). In the reduction of mesothoracic hair 1 *nigripalpus* differs not only from *salinarius* but from all other *Culex* known to the author. In *salinarius* hair 1 is single in the second instar and single to 4-branched (usually double) in the fourth instar.

The dorsal submedian prothoracic hair group ("inner shoulder hairs" of Edwards, 1932) comprises prothoracic hairs 1-3. In *Culex*, *Culiseta* and *Uranotaenia* they arise from a sclerotized platelet in the latter instars, with hairs 1 and 2 long, strong and single. Hair 3 is variable, and sometimes provides good specific distinctions, as previously described in *Uranotaenia*. Hairs 1 and 2 are usually as long or longer than the head in all instars. The platelet is sometimes ill-defined or divided in the first instar. *Deinocerites* belongs to this group. Hairs 1-3 are quite similar to the above in *Mansonia* but the platelet is lacking. In *Wyeomyia*, *Aedes*, *Psorophora* and *Orthopodomyia* the platelet is lacking, and none of the hairs are long, strong and single (at least in the fauna of the Southeastern States), though one hair is very long and fine in *Orthopodomyia*. That the aforementioned is not applicable to all *Aedes* is shown by the Indian *Aedes (Finlaya) elsiae*, in which the platelet is present.⁴

³King, Bradley, and McNeel, 1939, "The Mosquitoes of the Southeastern States," U. S. D. A. Misc. Publ. No. 336, p. 77.

⁴Barraud, 1938. Fauna of British India, Diptera, Vol. V, p. 182, fig. 39c.

SUMMARY

Several larval characters of mosquitoes not usually referred to are set forth, principally the gular sutures and the dorsal submedian prothoracic hair group. Distinctive characters of *Mansonia* (*Mansonia*), *Culex*, (*Melanoconion*) and *Uranotaenia* are discussed. New characters for separation of *Uranotaenia lowii* from *U. sapphirina* and *Culex nigripalpus* from *C. salinarius* in the later instars are proposed. The presence of vestigial spiracles on the sides of the thorax and abdomen is noted.

SPIDERS OF THE GEORGIA REGION OF NORTH AMERICA, by RALPH V. CHAMBERLIN and WILTON IVIE. December 10, 1944. Bull. of the University of Utah, 35(9): 1-267, 217 figs. on 14 pls., four of which are colored. (Also listed as University of Utah, Biol. Ser. 8(5): 1-267, etc.) Published by the University of Utah, Salt Lake City.

"This paper was developed from a study undertaken initially to determine, as far as possible from available evidence, the proper application of the names based by Walckenaer upon Abbot's drawings of the spiders of Georgia. The validity of these names has not been seriously questioned since the recovery of the Abbot drawings in the Kensington Museum of Natural History at London in 1887 and the discussion among zoologists that ensued immediately thereafter."

"We have had available a set of photographs in black and white as well as Kodachrome color slides made by the senior author on the occasion of a visit to the South Kensington Museum, London, where the originals have long been preserved."

"The material from the Georgia region is exclusively that of the University of Utah Collection. Some of our specimens were collected by the junior author on brief stops and on a more extensive trip in April, 1943. At this time thirty days were spent in the vicinity of Sylvania and Savannah with a brief excursion into the more mountainous territory between Gainesville and Clayton. Sylvania in Screven Co. is near the place where Abbot lived and did most of his collecting. * * * On this last expedition 350 recognizable species were taken. Some specimens taken in the autumn of 1943 have been received from Dr. D. Elden Beck, who collected at Fort Benning near Columbus. * * * The present list contains the considerable number of 552 species, of which number, however, 55 are at present of uncertain status, being mostly species described by Walckenaer. Sixty-nine forms are described as new."

Pages 7-24 of the Introduction are given to a critical discussion of Abbot's life and works and a list of 580 spiders collected by Abbot, many of which were named by Walckenaer. An excellent portrait of John Abbot is included. Abbot's date of birth and of death are not known, nor the place of birth. "He is known to have established himself in Georgia as a collector about 1776, apparently about 20 years old. Thereafter for something like 65 years he lived as schoolmaster, soldier in the Revolutionary war, for long as a prosperous planter and throughout as a keen observer, naturalist and gifted artist. During life Abbot maintained his connections with naturalists in Europe where he became widely known through the collection of insects, birds and plants. His paintings of birds and Lepidoptera were particularly famous." He sold chiefly through the agency of John Francillon, a silversmith on the Strand in London. Abbot's famous drawings are to be found in long series in the British Museum, 548 in the Boston Society of Natural History, 122 bird plates in the De Renne Library near Savannah, and in Europe at Paris, Zurich and Oxford.

This fine volume, beautifully illustrated, thus is a study of Abbot's work and is of as much interest in its notes on Abbot as in its careful study of spiders. It is at the usual high level of Chamberlin and Ivie spider papers.—C. H. K.