Mosquitoes

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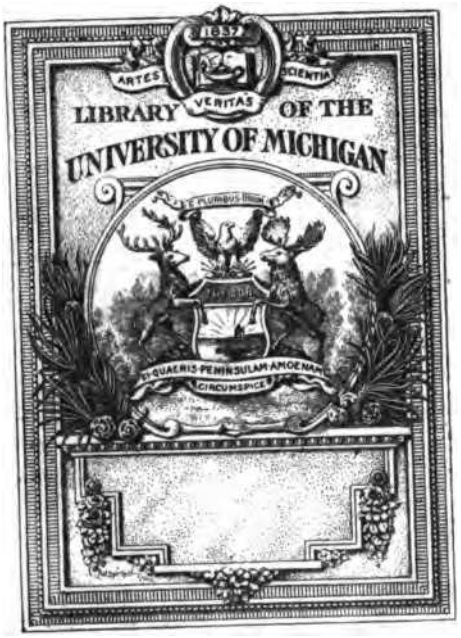

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SYSTEMATIC DESCRIPTION

PART I

INTRODUCTION.

According to the conclusions here adopted, the mosquitoes comprise a subfamily of the order Diptera, and are divisible into two tribes. In our region, covering the North American continent from the southern edge of Canada to the Isthmus of Panama, and including the Antilles and Trinidad, we treat in this work 382 species, included in 25 genera: 8 genera with 85 species in the tribe Sabethini and 17 genera with 297 species in the tribe Culicini. To this should be added 7 species recently described but not included here, namely, *Wyeomyia rolonca, Wyeomyia intonca, Aëdes thibaulti* (Dyar & Knab, Proc. Ent. Soc. Wash., xi, 173–174, 1910), *Aëdes ioliota* (Dyar & Knab, Ins. Insc. Menstr., i, 77, 1913), *Lesticocampa espini, Culex prasinopleurus* and *Culex chalcocorystes* (Martini, Ins. Insc. Menstr., ii, 65–76, 1914). Only a few parts of our region have been at all adequately explored, many large areas not at all, so that many more species doubtless await discovery.

Fortunately, an unusually large proportion of the material before us consists of bred specimens with larvæ associated, so that we have been able to base our conclusions upon comprehensive studies of the larvæ as well as upon the adults. The two of the present authors, Messrs. Dyar and Knab, who have made the detailed studies for the taxonomic part of the present work, in fact began their studies with the larvæ alone, thus arriving at an independent view. Further research has abundantly justified these conclusions, although a more extensive study has naturally led to some modifications in details.

We have had prepared mounts of the male genitalia of a large majority of the species and present herewith figures of them; they enable us to draw general conclusions from much more abundant material than has been before gotten together. We find the characters of the male genitalia of the greatest value and supporting the conclusions obtained with the larvæ.

Some confusion in systematic work has been brought about by the employment of certain terms and the worker must be cautioned against them as a source of error in using the original descriptions. It has been repeatedly pointed out by eminent dipterists that the structure commonly called metanotum belongs to the mesothorax; yet the error is being constantly perpetuated. In our descriptions we call the part postnotum. The use of the term metatarsus for the first tarsal joint is not only incorrect but has led to considerable confusion. In such descriptions the second tarsal joint is called the first and so on. In descriptions where neither a metatarsus nor a fifth joint is mentioned it is impossible to decide which joints are indicated.

Concerning species previously described from our region, we have been able to recognize a majority of them in the material before us. Some are still unrecognized and probably unrecognizable, owing to the descriptions having been based upon imperfect material. In a few cases we have adopted arbitrary designations

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of certain species the descriptions of which covered a number of species and of which the types were not recognizable. All species from our region, whether recognized or not, are treated in the following text.

The two of the present authors who have undertaken the preparation of the systematic portion of the work have not had the opportunity to personally examine the types in European collections, but have been obliged to rely upon descriptions and examinations made by others. For this reason, and from lack of adequate South American collections, we have not been able to recognize certain species described by Theobald from the Guianas and elsewhere, some of which may prove to be the same as species subsequently described by us from Trinidad or Panama.

In the paper above referred to, by two of the present authors, a number of species were described from the larvæ only.[1] With a few exceptions we have now described the adults of these and placed them in our tables in their proper places. Nearly all of them prove to be valid species, distinct from those previously founded upon adults alone.

In questions of priority and synonymy we have followed the code of the International Zoological Congress as elaborated by Dr. C. W. Stiles. While some of the changes in names have been adopted by us with reluctance, it has seemed necessary to treat the subject consistently and to follow the latest authority.

In questions of classification we have adopted the system suggested by ourselves and have not followed the arbitrary systems based on the relative length of the palpi in the two sexes and the scale characters proposed by Mr. F. V. Theobald, nor the subdivisions into numerous subfamilies.

A number of European species have been credited to the American fauna from time to time, but all such cases that we have been able to investigate have proven to be fallacious, the fact being that closely allied and representative species inhabiting the separate continents have been mistaken for each other. We have therefore excluded all European references except in the case of *Culex pipiens*, which we have reason to believe has been actually introduced.

The drawings contained in Volume II of this work, which illustrate the present systematic portion, were prepared by the following artists:

Plate 1 by Miss Mary Carmody, after Circular 72, U. S. Dept. Agr., Bur. Ent.

Plates 2–40 by Miss Carmody from microscopic slides, except the enlarged details on plates 17, 18 and 19, which are by Mr. Frederick Knab from Proc. Ent. Soc. Wash., xi, plates i–iii, 1909.

Plate 41 from photographs by Mr. H. S. Barber.

Plates 42–85 by Mr. Knab from living larvæ.

Plates 86–131 by Mr. Knab, partly inked in by Miss Carmody.

Plates 132-144 by Miss Carmody.

Plate 145 by Mr. Knab.

Plates 146–147 by Miss E. G. Mitchell.

Plates 148–150 by Miss Mitchell, except figures 699 and 713, which are by Mr. Knab.

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[1] The larvæ of Culicidæ classified as independent organisms. Journ. N. Y. Ent. Soc., xiv, 169-230, pls. 4-16, 1906.

MOSQUITOES, THEIR DEFINITION AND POSITION IN THE CLASSIFICATION OF INSECTS.

Mosquitoes are small two-winged flies belonging to the order Diptera. For a general view of this order the student is referred to Prof. S. W. Williston's Manual of North American Diptera, of which the third edition was published in 1908. The following paragraphs, extracted from this work, define the family Culicidæ, and separate it from all other flies:

Flies of a softer texture, not ectoparasites upon warm-blooded animals.
Mesonotum never with a complete V-shaped suture, rarely with any distinct suture. For the most part small flies.
No ocelli.
Antennæ not composed of three joints and an arista or terminal style . . . .
Wings with more than a few longitudinal veins and with apparent cross-veins . . . .
No discal cell.
The marginal vein encompasses the wing; second and fourth longitudinal veins furcate; many veined.
Anterior cross-vein near middle of wing, distinct; second basal cell large and distinct; wings not folded roof-like when at rest.
Wings tomentose; fringed on the hind margin; antennæ of male usually bushy plumose; the second and third veins separate at an acute angle. For the most part blood-sucking flies; mosquitoes.....CULICIDÆ

The wing venation of the Culicidæ is remarkably homogeneous throughout the family. It consists of a well-developed auxiliary or mediastinal vein, six longitudinal veins, of which the second, fourth and fifth are furcate, and humeral anterior and basal cross-veins. The details of structure and their modifications will be found discussed in the chapter on the anatomy of mosquitoes in the first volume of this work.

The Culicidæ, according to Williston, are divided into two subfamilies, separated as follows:

Proboscis short, not adapted for piercing..... CORETHRINÆ
Proboscis much longer than the head, firm, adapted for piercing..... CULICINÆ

The genus *Dixa,* which Williston and others treat as a distinct family, under the name Dixidæ, should, in our opinion, be considered as a third subfamily of the Culicidæ, the Dixinæ.

The larvæ of the Culicidæ are characterized by the presence of a complete, well-chitinized and completely exposed head with well-developed mouth-parts. In nearly all the forms the respiratory system is well-developed and there are two main tracheal trunks extending from the anterior part of the thorax to the eighth abdominal segment. Here the system opens outwardly, either through two spiracles directly upon the dorsum, or, more frequently, through a chitinous tube. The larvæ are therefore metapneustic, all the other spiracles being closed. In further adaptation to the aquatic life the tracheal openings are protected by a variously developed closing mechanism. Pseudopods are absent, except on some

of the abdominal segments of *Dixa*. In some of the Corethrinæ the respiratory system is represented by two pairs of air-bladders or "floats." The shape of the thorax, being composed of 3 segments closely consolidated, is a good diagnostic character, except in the Dixinæ. Imms says (Parasitology, i, 122, 1908): In the Chironomidæ "the first three post-cephalic segments become greatly swollen towards the end of larval life, in consequence of the developing imaginal organs contained within them. However, there is no fusion into a compact thorax, though the limits between the second and third segments may become partially obliterated." The presence of long setæ, particularly laterally on the thorax and abdomen, is also characteristic and fails only in a few Corethrinæ.

The separation of the Culicidæ into its subfamilies on larval characters depends upon the presence of the mouth-brushes in the Culicinæ and Dixinæ, which are not developed in the Corethrinæ, besides which in general appearance the larvæ are quite unlike, and an experienced collector will never mistake them. The Corethrinæ are a small group, but possess remarkable diversity of form. All the species known are predaceous, usually upon the larvæ of the true mosquitoes. In general, all the larvæ that seize their prey with the antennæ instead of the mandibles or maxillæ belong to the Corethrinæ. This character is least developed in the genus *Eucorethra* (=*Pelorempis*), but its position may be recognized by the absence of the mouth-brushes. This form, *Eucorethra underwoodi* Underwood, leaving aside its predaceous habit, is near to the generalized ancestor of the Culicinæ, and it is interesting to note its general resemblance to the culicine genus *Anopheles*, which we here place the lowest of the true Culicinæ. The larvæ of the Dixinæ are easily distinguished by having the three thoracic segments not widened and unconsolidated.

The subfamily Culicinæ, or true mosquitoes, are the subject of the present work. They may be divided into two tribes, as follows:

TABLE OF TRIBES OF THE SUBFAMILY CULICINÆ

1. Occiput with a pair of coarse bristles, well differentiated from the setæ along ocular margins, projecting forward at the vertex; mesonotum without setæ on the disk, clothed with scales only except around the margin; postnotum with a group of small setæ posteriorly..... SABETHINI (p. 19)
   Bristles on the vertex present or absent, rarely in a single well differentiated pair; mesonotum usually with two rows of coarse setæ longitudinally across the disk; postnotum usually without setæ, a few forms with from one to three bristles present..... CULICINI (p. 189)

These tribes are also well characterized as larvæ and pupæ:

TABLE OF TRIBES OF THE LARVÆ OF CULICINÆ.

1. Anal segment without ventral brush, the hair tufts all paired..... SABETHINI
   Anal segment with unpaired ventral median brush..... CULICINI

TABLE OF TRIBES OF THE PUPÆ OF CULICINÆ.

1. Abdominal segments 7 and 8 with ample hair tufts at angles; paddles small SABETHINI
   Abdominal segments 7 and 8 with hairs or small tufts; paddles large and broad CULICINI

STATEMENT OF SOME OF THE CHARACTERS USED IN THE TABLES.

The Sabethini and Culicini may be separated at once by the presence of a small group of setæ on the posterior portion of the postnotum and of a pair of very coarse bristles projecting forward between the eyes in the former, which combination of characters is absent in the latter. Most Culicini may be recognized by the longitudinal rows of coarse setæ across the disk of the mesonotum, but these fail in a few genera. In the Culicini, the postnotum is usually without setæ, but two exceptions occur. In *Dinomimetes* one or two coarse bristles are present on the postnotum, but its position in the Culicini is at once apparent by the coarse bristles on the disk of the mesonotum. Many specimens of *Hæmagogus* have from one to three minute hairs well back on the postnotum, but the position in the Culicini is indicated by the absence of the two coarse setæ of the vertex. The small setæ on the postnotum are sometimes difficult to see, so that a compound microscope is necessary for certainty, though in the larger forms they are generally recognizable with a hand-lens.

In the Sabethini we separate the genera by the character of the prothoracic lobes, whether large and closely approximated dorsally or well separated; by the proboscis, whether long and slender or short and swollen at the tip; by the eyes, whether large and closely touching on the vertex of the face or smaller and separated by a narrow area of integument, and on the shape of this area, whether wedge-shaped or parallel-sided; on the claws of the hind tarsi, which in one genus have but a single claw, all others having two claws, though occasionally one is reduced in size; by the presence or absence of setæ on the clypeus.

In separating the species of Sabethini, we rely upon the coloring of the scales on different parts. The coloration of the prothoracic lobes is an important character, followed by the distribution of white scaling on the occiput. There is generally a border of white scales behind the eyes, but these may be partly or wholly replaced by dark scales, giving various specific modifications. Next in importance comes the scaling of the wings, whether the scales (particularly on the forks of the second vein) are narrow or broad. Finally, we have the markings on the legs, which are more diversified, but must be used with caution, as they are frequently subject to sexual dimorphism. Care must therefore be used with these characters to be sure of the sex of the specimen under observation, which is not always obvious with the smaller sabethids, as they often have practically identical antennæ in the two sexes. The abdomen is generally colored dark above, silvery below, the colors separated on the sides in a straight line; but in some species this separation is in an irregular or undulating line, affording a useful character. A few of the species have curious, paddle-shaped masses of vestiture on the legs, the distribution and coloration of which afford specific separations.