however, that, in taxonomic studies of genera such as *Culex,* the L/S index is very useful tool and should therefore be included in larval descriptions.

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APPENDIX

It is pointed out that absolute values of the standard deviation cannot be validly used for comparing the "variability" of the two indices. Where, as is frequently the case, the two means differ in magnitude, their standard deviations are measured in different scales. To take an extreme example, a standard deviation of cm. of stature would indicate remarkable uniformity in a herd of elephants but considerable variability in a swarm of bees. If such comparisons are to be made, the relevant statistic is the Coefficient of Variation (Relative Standard Deviation), which is the standard deviation divided by the mean, usually expressed as a percentage. Applying this method to the authors' figures, omitting series of less than 10 larvae, we find:

Coefficient greater for L/B in 23 cases.
" " " L/S " 10 "
Coefficients equal " 6 "

Moreover, if we count only those cases where the coefficients differ by 5 percent or more, we find:

Coefficient greater for L/B in 16 cases.
" " " L/S " 3 "
Coefficients differ by less than 5 percent in 20 cases.

Once again, there is a clear indication that the L/S index is inherently less variable than the L/B index.

SUPERGENERIC GROUPS OF MOSQUITOES

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True mosquitoes comprise the family Culicidae. For practical purposes there are two groups (subfamilies), the Anophelinae and the Culicinae. They may be distinguished by the novice by the attitudes assumed by the larvae and adults. Anopheline larvae lie parallel to the surface of the water whereas culicine larvae hang from the surface by their air tubes. Anopheline adults "stand on their heads," the proboscis and body forming a straight line at an angle to the surface upon which they are resting or biting, whereas culicine adults stand with the body more nearly parallel to the surface.

Actually there are three easily recognized subfamilies of mosquitoes and the largest of these, the Culicinae, is divisible into four tribes. They may be identified and separated in most stages of their development by the accompanying key.

KEY TO MAJOR GROUPS OF MOSQUITOES

1. EGG boat-shaped, with lateral floats, darkening soon after being laid;
LARVA without air tube; with palmate hairs on certain body segments;
PUPA with peg-like setae at hind

angles of abdominal segments 3–7; ADULT with abdomen devoid of scales, at least ventrally; female palpi as long as the proboscis ..... ANOPHELINAE, *Anopheles*

EGG without lateral floats; LARVA with air tube on 8th abdominal segment, without palmate hairs; PUPA without such peg-like spines; ADULT with abdomen scaled; female palpi shorter than proboscis 2

2. EGG ovoid, chalky white; LARVA with some extremely stout, spinulose hairs; most body segments with 3 pairs of sclerotized lateral platelets; mouth brushes reduced to 10 stout rods; PUPA paddle with outer part extending beyond midrib; ADULT proboscis tapering, flexed downward on apical half ..... TOXORHYNCHITINAE, *Toxorhynchites*

EGG elongate, darkening soon after being laid; LARVA without extremely stout hairs and 3 pairs of platelets laterally; mouth brushes of very numerous hairs; PUPA paddle with outer part not extending beyond the midrib; ADULT proboscis straight, not tapering ..... CULICINAE 3

3. EGG subcylindrical, laid individually on or above the water level in water-holding plants; LARVA with a pair of ventrolateral hairs but no ventral brush on anal segment; PUPA with large, equal, multifid hairs on hind angles of abdominal segments 7–8; ADULT squama not fringed; pronotal lobe larger than meron; postnotum with a tuft of scales .... SABETHINI, *Wyeomyia*

EGG described in couplet 4; LARVA with ventral brush on anal segment; PUPA without such multifid hairs *on hind angles* of both segments; ADULT squama fringed with hairs (except *Uranotaenia*); pronotal lobe larger than meron; postnotum without a patch of scales .....

4. EGGS rather spindle-shaped, tapering at both ends, with surface sculpturing commonly of hexagonal pattern, laid individually and usually hatch after prolonged drying; LARVA with dorsal submedian prothoracic hair groups moderately separated, not arising from platelets; PUPA paddle with a single terminal seta; ADULT female abdomen tapering, the cerci exposed; male basistyle usually membranous along its length on inner margin (*Aedes,* at least) ..... AEDINI, *Aedes, Psorophor*
Haemagogus and *Orthopodomyi*

EGGS cylindrical, non-sculptured, laid usually in rafts on water's surface and usually hatch in a few days; LARVA with dorsal submedian prothoracic hair groups close set and each arising from a platelet (platelet absent in subgenus *Mansonia*); PUPA paddle with 2 or no terminal setae; FEMALE abdomen blunt-tipped, with cerci concealed; MALE basistyle completely sclerotized ....

5. LARVA head ovoid, longer than wide, with gular sutures absent; elongate lateral hairs absent on abdominal segments 3–6; PUPA paddle with inner part wider than outer part; ADULT wing with apical (second marginal) cell less than half as long as its petiole; proboscis slightly swollen apically ..... URANOTAENIIN
Uranotaeni

LARVA head rounded, wider than or as wide as long, with gular sutures present; PUPA paddle with inner part narrower than outer part; ADULT wing with apical cell more than half as long as its petiole; proboscis not swollen ..... CULICINI, *Mansoni*
Culiseta, Culex and *Deinocerite*

Of importance to the North American mosquito control worker are the Anophelinae, the Culicini and the Aedini. These groups comprise all the pest mosquitoes in the United States and Canada. The Toxorhynchitinae are actually beneficial because their larvae destroy other mosquito larvae and the adults do not suck blood; native Uranotaeniini feed only on amphibians, as far as known; the Sabethini (sometimes elevated to subfamily rank) are very important in the tropics where there are many genera and species, some of which transmit diseases. Our pitcher plant Sabethines, genus *Wyeomyia,* are not known to take a blood meal, but the bromeliad breeders in southern Florida are said to bite man readily.

The above classification is in accordance with the Stone *et al.* (1959) catalogue, except that *Uranotaenia* and *Aedes* and their allies are split from the Culicini and elevated to tribal rank. Belkin (1962) reduces mosquitoes to subfamily rank and divides them into 12 tribes of equal variance, of which 9 are represented in the North American fauna. The monotypic tribes based on *Orthopodomyia, Mansonia* and *Culiseta* are not recognized here. The writer believes *Culiseta* to be very closely allied to *Culex;* there is better reason to elevate *Orthopodomyia* and *Mansonia* to tribal rank.

URANOTAENIINI

MORPHOLOGY. Worldwide, the Uranotaeniini comprise but one well-marked genus, *Uranotaenia,* chiefly tropical in distribution. Galindo *et al.* (1954) give an excellent revision of Panamanian species, in which they point out the unsuccessful nature of efforts to split this large genus into subgenera.

ADULTS. Apical wing cell less than half as long as its petiole; proboscis swollen at tip; microtrichiae of wing very minute. The short apical cell allies this genus with *Toxorhynchites;* the absence of a fringe in the squamae is typical of the Sabethines.

LARVAE. Head "prognathous," in contrast to other culicine genera, which may be termed "hypognathous." The elongation of the gula and total absence of gular sutures in all instars sets this genus apart from all other genera of mosquitoes known to the writer. The gular sutures are entire in other culicine tribes; strongly abbreviated in Anophelinae and Toxorhynchitinae (Dodge, 1945). Corresponding with reduction of the gular sutures and elongation of the gula, the Uranotaeniini, Anophelinae and Toxorhynchitinae all have the maxilla greatly reduced in size, not exceeding the maxillary palpus and lacking the usual apical brush of strong hairs. The reduction of the lateral hairs of abdominal segments 3–6 to short, tufted hairs is unparalleled in other genera of mosquito larvae.

HABITS. The adults are not known to feed on mammalian blood; one report of *U. geometrica* feeding on man has been discredited (see Galindo *et al.* 1954). Apparently the only precise record of feeding habits of any species is by Remington (1945), who experimented with *U. lowii.* They fed upon frogs, toads and a lizard (genera *Rana, Hyla, Bufo* and *Desmognathus*) but refused reptilian and mammalian hosts. However, *Uranotaenia* is reported to feed upon birds (see Belkin, 1962).

U. sapphirina (Osten Sacken), though one of our smallest mosquitoes, lays a raft of relatively few (45–50) large eggs. The first stage larva which results has a head capsule as large as or larger than a second instar *Anopheles.* Some *Uranotaenia* lay eggs individually, not in rafts (Belkin, 1962).

The larvae of *U. sapphirina* are inveterate and indiscriminate browsers. When closely confined with other mosquito larvae they will reduce the major body hairs to stubs. Probably filamentous algae are their preferred diet—surely a tastier and more nutritious fare!

AEDINI

The Aedine genera *Aedes, Psorophora* and *Haemagogus* comprise some of the most vicious mosquito pests of man. *Aedes,*

especially, is a pest from the tundra to the tropics. The tapering female abdomen, with exposed cerci is characteristic. Aedines seem allied to the Sabethines in their habits (many tropical species share the same breeding habitat of tree holes, bromeliads, and artificial receptacles) and larval morphology (dorsal submedian prothoracic hair group without platelet). However, *Aedes (Finlaya) elsiae* and possibly other exotic species have three pairs of large platelets on the thorax, including the dorsal submedian prothoracic hair group. The writer suspects that this is an acquired character, not typical of the first instar larvae.

SUMMARY

The North American genera of mosquitoes, with their respective subgenera, may be arranged in the following sequence:

ANOPHELINAE
- *Anopheles*, with 14 species of 3 subgenera:
  - *(Anopheles)*, *(Coelodiazesis)* and *(Nyssorhynchus)*.

TOXORHYNCHITINAE
- *Toxorhynchites*, with 2 subspecies of one subgenus *(Lynchiella)*.

CULICINAE

SABETHINI
- *Wyeomyia*, subgenus *(Wyeomyia)*, 4 species.

AEDINI
- *Orthopodomyia*, 4 species.
- *Psorophora*, with 3 subgenera and about a dozen species.
  - *(Psorophora)*, *(Grabhamia)* and *(Janthinosoma)*.
- *Aedes*, with 5 subgenera and many species.
  - *(Ochlerotatus)*, *(Finlaya)*, *(Stegomyia)*, *(Aedimorphus)* and *(Aedes)*.
- *Haemagogus*, with 2 species in one subgenus *(Longipalpifer)*.

URANOTAENIINI
- *Uranotaenia*, 4 species.

CULICINI
- *Mansonia*, with 3 species in 2 subgenera:
  - *(Mansonia)*, *(Coquillettidia)*.
- *Culiseta*, with 8 species in 3 subgenera:
  - *(Culiseta)*, *(Culicella)* and *(Climacura)*.
- *Culex*, with 28 species in 4 subgenera
  - *(Culex)*, *(Neoculex)*, *(Melanoconion)*, *(Mochlostyrax)*.
- *Deinocerites*, with 2 species.

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