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# THE MALE GENITALIA OF AEDES AS INDICATIVE OF NATURAL AFFINITIES

(*Diptera, Culicidæ*)

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The genus *Aëdes,* treated in the broad sense, shows interesting modifications in the male genitalic structures. These have been brought out in the main in the monograph of the mosquitoes of North America by Howard, Dyar and Knab, but certain details may be here revised. The present author is mainly responsible for the genitalic table there adopted, and the main divisions still seem to him sound. Certain details, however, were clearly given undue prominence.

As regards the development of the genus in America, two elements may be distinguished. The first, and far larger one, represents what we may call the native element. It presents a complete graduation in the evolution of the organs called by us harpagones, from the rudimentary condition of a seta on a prominence to the highest development into a long strap-shaped appendage. Accompanying this development is that of the lobes of the side piece. Originally without lobes, the basal lobe evolves first, beginning as a condensation of hairs, then the hairs elevated on a prominence, then differentiated by shortening or some becoming spines, the final result being a membranous clasping organ studded with short papillæ, bearing minute setæ. The outer lobe follows much the same course of evolution, but in only one species has it reached the final stage shown by the basal lobe.

As would naturally be expected, where the lobes of the side piece show the most specialization, the harpagones are comparatively undeveloped; that is, the highest development of the lobes and harpagones is not shown in the same species. For example, in *canadensis* the lobes are highly developed, but the harpagones are of a comparatively simple type. Conversely, in *trichurus,* the lobes are simple and the harpagones highly modified. This is natural, since if one set of organs comes into prominence for a special use, in this case that of prehension, another set must remain comparatively in abeyance.

The clasp filament in these American *Aëdes* does not come much into use and remains throughout unmodified and simple. The divisions, therefore, which we will recognize among these American forms are mainly those of progressive specialization along one general line and not dichotomous divisions.

The second element in our fauna is what may be called the foreign element. It comprises three species only, not closely related, but all agreeing in the total absence of the harpagones. These organs have not only been unelaborated, but they do not exist in a rudimentary state. The side piece shows the development of a basal lobe, but of an independent order, not homologous with the basal lobe mentioned above for the American forms. The development is not marked, however, for in these species specialization has primarily affected the clasp filament, which has been adopted as the principal organ of prehension. Use also has been made of modifications of the basal membrane, which is entirely unknown to the American forms. These three species, *cinereus* Meigen, *vexans* Meigen and *argenteus* Poiret, as has long been known with the last and recently shown for the other two, all have a wide distribution outside of North America. The first two are of temperate distribution, the last of tropical distribution. The first two are presumably endemic with us, having an originally holarctic distribution; the latter has probably been spread by commerce within historic times. In the monograph we argue for the American origin of the yellow fever mosquito, but it must be admitted that the genitalia lend no support to this view. No near relatives of *argenteus* occur in America, but there are plenty of them in the East Indian region.

The division into New World and Old World series is not shown in the larvæ, which retain a uniform type; only in the genitalia, which are obviously more plastic structures, indicating a more exact degree of relationship.

To return to the native fauna, in contradistinction to the above, the species do not exhibit a wide range. Some few may be found to be common to America and the north of Europe, although this has not been shown as yet in any case. Still, there are some suspicious approximations. But, in general, the species are local, sometimes unexpectedly so, as I found in the mountains of California and Washington.

Considering the North American species in detail, the following groups may be recognized:

*Group I.*—Harpago a stout seta arising from a conical base; side piece without lobes.

This comprises *walkeri, albonotata, aureostriata, busckii* and *fulvithorax,* and probably also *septemstriatus* D. & K., *quadrivittatus* Coq., *sexlineata* Theob., *ioliota* D. & K., and *aurites* Theob., the males of which are unknown. All of these species have the claws of the female simple and correspond to the genus *Howardina* Theobald. It is, however, simply a section of *Aëdes* in a primitive condition. All the known larvæ live in tree-holes or leaves of Bromeliaceæ.

*Group II.*—Harpago with a distinct stem, the seta forming a more or less filamentous appendage; side piece without lobes.

This comprises *mediovittata, thorntoni, podographicus, oswaldi* and *triseriatus* and probably also *knabi* Coq., *hortator* D. & K. and *leucomelas* Lutz, the males of which are unknown. The known larvæ live in tree-holes. Three subgroups appear. In *mediovittata* a very peculiar basal spine has been developed, inserted below the base of the side piece. A dichotomous line has plainly started here, but seems to have been carried no farther. The other species form a compact section with the characters of the group, except *triseriatus,* in which there is an indication of the formation of lobes on the side piece, by a basal and median collection of hairs. No lobes are formed, nor is the location of the hair-tufts exactly that in which the lobes later appear. We have here simply an indication.

*Group III.*—Harpago well developed; side piece with a basal lobe, small, not prominent, with a collection of long hairs; no apical lobe.

This includes *varipalpus, atropalpus, epactius, fluviatilis, niger, taeniorhynchus, epinolus, sollicitans, mitchellæ,* and *nigromaculis* and probably *zoösophus* D. & K. One of the species lives in tree-holes, three in rock-holes, three in salt tidal pools, and two in temporary ground puddles inland. In this series we have the advance from breeding in the restricted water in plant-tissues to the ground puddle, in which the species of the highest groups so much rejoice.

*Group IV.*—Harpago well developed, sometimes enormously; basal lobe varying from a conical elevation with coarse hairs to a flattened expanded membrane with short papillæ and fine setæ; apical lobe present, always conical, setose or bare.

This includes the remaining species of *Aëdes,* with the single exception of *canadensis,* whose males are known, and probably the rest as well, somewhat over 60 species. All live in temporary ground pools. Some of the species are of tropical distribution, but the majority are boreal, breeding in the water formed by the melting snow and having but a single annual generation, overwintering in the egg. One species is confined to salt tidal pools and one invades this domain, though breeding also in fresh water inland. The habit of being confined to tree-holes or rock-holes is wholly lost. Moreover, not only has this extension of breeding places been accomplished, but the primitive tropical distribution has been extended and even the arctic regions invaded.

Two subgroups appear, indicating an incipient dichotomy. Four species have altered the structure of the basal lobe, namely, *impiger, diantaeus, pullatus,* and *aurifer.* The lobe is large and conical, the hairs reduced to two, which have become very stout and followed by a spine. Apparently this modification did not prove a very happy one, for, in *pullatus,* the lobe is reduced to a small stem, bearing the two stout hairs, while, in *aurifer*, the structure is absent, hairs and all, there being no basal lobe in this species, though the spine persists.

Of the following North American species the male genitalia are unknown: *decticus* Howard, Dyar and Knab, *centrotus* Howard, Dyar and Knab, *cataphylla* Dyar, *fisheri* Dyar, *ventrovittis* Dyar, *provocans* Walker, *acrophilus* Dyar, *niphadopsis* Dyar and Knab, *bracteatus* Coquillett,[1] *balteatus* Dyar and Knab,[1] *angustivittatus* Dyar and Knab,[1] *obturbator* Dyar and Knab,[1] *condolescans* Dyar and Knab,[1] *nubilus* Theobald, *gonimus* Dyar and Knab, *aloponotum* Dyar, and the imperfectly identified names, *fulvus* Wiedemann, *testaceus* van der Wulp, *excrucians* Walker, *borealis* Ludlow, and *punctor* Kirby. I am afraid that *euochrus* Howard, Dyar and Knab is *vexans* in a dilapidated condition, the yellow color of the single specimen not being natural.

*Group V.*—Harpago well developed; both lobes consisting of flattened membranous papillose prominences with small setæ.

The group comprises one species, *canadensis*, the larvæ living in ground pools in forest, having more than one hatching in the year.

In comparison with the table based on adult coloration, no parallelism appears. The black-legged and ring-legged forms are developed in all the groups. This has served to completely conceal the species of Old World derivation, which are inextricably mixed up in the table. No one would ever suspect their relationship, which is so apparent in the genitalia.

TABLE OF NORTH AMERICAN AEDES BY THE MALE GENITALIA

1. Harpago developed, with filamentous seta and columnar base... 2
Harpago rudimentary, a stout seta from a conical base......... 46
Harpago absent ........................................ 49

*New World series*

2. Side piece with an apical lobe................................. 3
Side piece without an apical lobe.............................. 38

[1] Placed provisionally in the table, in parentheses.

Group V (*Culicada* Felt)

3. Apical lobe flattened, papillose-tubercular.....*canadensis* Theobald
Apical lobe conical........................................ 4

Group IV (*Ochlerotatus* Arribálzaga)[1]

4. Basal lobe bearing only two stout spines, or absent.............. 35
Basal lobe conical or expanded, setose........................... 5
5. Basal lobe more or less expanded and tubercular, short-haired, with or without an adjacent spine........................... 6
Basal lobe unmodified, uniformly long-haired................... 37
6. Basal lobe expanded tubercular; two stout spines on the margin, at least one in the middle.................................. 7
Basal lobe with a spine at the margin........................ 8
Basal lobe without stout spine, though the marginal hair may be somewhat enlarged ......................................... 30
7. Both spines on basal lobe well developed.........*curriei* Coquillett
Only the spine on middle of lobe distinct, *campestris* Dyar and Knab
8. Basal lobe expanded, elongate; one stout spine on the margin of the lobe, elevated from the base and free...................... 9
Basal lobe more or less expanded; one stout spine on the margin adjacent to the side piece, not separated from the setæ...... 15
9. Basal lobe setose on two-thirds of inner margin................ 10
Basal lobe setose only on the bulbous tip..................... 11
10. Basal lobe widened; stem of harpago very stout, sinuate; filament broadly fusiform.....................*atlanticus* Dyar and Knab
Basal lobe finger-shaped; stem of harpago ligulate; filament angularly widened at base...........................*oligopistus* Dyar[2]

[1] *Heteronycha* Arribálzaga has precedence and is an *Aëdes*; but I have not been able to recognize the type, *dolosa* Arrib., so do not know to which section *Heteronycha* should apply. Blanchard and others refer *dolosa* to the synonymy of *Culex quinquefasciatus* Say, a proceeding negatived by Arribálzaga's original description.

[2] **Aëdes oligopistus**, new species.

Apical lobe of side piece finger-shaped, bare but for one rather stout seta at tip and another at the side; basal lobe produced into a finger-shaped process, reaching to three-fourths of the side piece, finely setose; a stout spine inserted at one side. Harpago with long, slender stem, reaching nearly to middle of side piece; filament long, angularly expanded at the base. Side piece, harpe and clasp filament normal; basal appendages small, each with three setae.

An adult male, taken by Mr. A. Busck, Trinidad, West Indies, June, 1905, has the dorsum of mesonotum broadly silvery nearly to the lateral margins. Legs black.

Type, male, No. 21550, U. S. Nat. Mus.

The specimen is recorded in the monograph (page 781) under *A. dupreei*, which it resembles in coloration.

11. Basal lobe broadly capitate with many setæ.................... 12
Basal lobe narrowly capitate with few setæ...................... 13
12. Stem of harpago short, filament longer than it..*dupreei* Coquillett
Stem of harpago long, filament shorter than it..*serratus* Theobald
13. Harpago long, sinuate; filament sickle-shaped,
*tormentor* Dyar and Knab[1]
Harpago moderate; filament calla-lily-shaped.................. 14
14. Filament of harpago broadly oval with very short recurved tip,
*pertinax* Grabham
Filament of harpago narrowly oval with long recurved tip,
*polyagrus* Dyar[2]
15. Filament of harpago with retrose spine.........*scapularis* Rondani, *infirmatus* Dyar and Knab, *euplocamus* Dyar and Knab, (*condolescens* Dyar and Knab); *tortilis* Theobald, *plutocraticus* Dyar and Knab, (*balteatus* Dyar and Knab), (*bracteatus* Coquillett); *trivittatus* Coquillett, *cuneatus* Dyar and Knab, (*angustivittatus* Dyar and Knab), (*obturbator* Dyar and Knab).
Filament of harpago not so modified.......................... 16
16. A tuft of similar spines accompanying the spine of basal lobe... 17
Spine of basal lobe without accompanying similar spines.........23

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[1] **Aëdes tormentor** Dyar and Knab.

Side piece long, slender; apical lobe prominent, narrowly conical, setose; basal lobe expanded, long, narrow, setose on the outer third; a single spine inserted at basal third. Harpago long, reaching to middle of side piece, slenderly columnar, flexuous; filament rather small, broadly sickle-shaped.

Bred specimens sent by Dr. W. V. King, collected at New Orleans, Louisiana, September 15, 1914.

[2] **Aëdes polyagrus**, new species.

Apical lobe of side piece conical, straight on inner side, sparsely setose; basal lobe elongate, with a capitate rounded setose tip, the basal part bare; a stout spine inserted at the middle of the margin. Harpago with long, slender stem, reaching nearly to middle of the side piece; filament elliptical, with long, recurved tip, the base rounded and projecting and marked with lines. Other structures normal; basal appendages short, each with five setæ.

Adult male, Taboga Island, Panama, July 1, 1907 (A. Busck). The specimen is denuded and moldy, no trace of the thoracic vestiture remaining. Probably there was a narrow median silvery stripe as in *pertinax*. Legs black.

Type, male, No. 21551, U. S. Nat. Mus.

The original larval skin was preserved by Mr. Busck, but the bottle was not examined at the time and has become dried out during the ten years that it was sitting on the shelf. Therefore some of the finer characters are lost. It falls in the table with *serratus*, rather than with *pertinax*, with which latter the genitalia would place it.

Air tube short, conical, hardly twice as long as wide; pecten of 11 evenly spaced teeth, followed by a 7-haired tuft well beyond the pecten. Lateral comb of the eighth segment of about 10 smooth thorn-shaped scales in a nearly straight row. Anal segment ringed by the plate. Anal gills apparently moderate. Head

17. Apical lobe almost bare, with few setæ,
*squamiger* Coquillett, *grossbecki* Dyar and Knab[1]
Apical lobe setose .................................................. 18
18. Filament of harpago angularly expanded near base ............. 19
Filament of harpago fusiform, without expansion ............... 21
19. Spine of basal lobe stout, exceeding the accompanying tuft ...... 20
This spine weak, not exceeding the tuft,
*hirsuteron* Theobald, *aestivalis* Dyar
20. Spine and tuft weak, indistinct ............ *aldrichi* Dyar and Knab
Spine and tuft strong ...... *spencerii* Theobald, *idahoënsis* Theobald
21. Apical lobe with the setæ curved and more or less appressed .... 22
Apical lobe with the setæ unmodified,
*abserratus* Felt and Young, *auroides* Felt
22. Side piece not modified at base .................. *hexodontus* Dyar
Base of side piece strongly chitinized, the tubercles forming transparent dots ................................ *aboriginis* Dyar
23. Apical lobe weakly and sparsely setose ........................ 24
Apical lobe more strongly setose ................................. 25
24. Basal lobe conical with many fine setæ ............. *prodotes* Dyar
Basal lobe small with few coarse setæ.. *lazarensis* Felt and Young
25. Filament of harpago with double angular basal membrane; spine of basal lobe situated distally.... *tahoënsis* Dyar, *altiusculus* Dyar
Not so formed ............................................ 26
26. Filament of harpago sickle-shaped ............... *cantator* Coquillett
Filament of harpago expanded or notched ...................... 27
27. Basal lobe of side piece conical, concrete ..................... 28
Basal lobe expanded, diffused outward ......................... 29
28. Filament of harpago large, triangularly expanded near base,
*bimaculatus* Coquillett
Filament sickle-shaped, notched at base ................ *fitchii* Felt
29. Harpago stout; filament angularly expanded near base,
*fletcheri* Coquillett
Harpago slender; filament angularly expanded near middle,
*stimulans* Walker
30. Basal lobe flat ................................................ 31
Basal lobe conical, concrete ...................................... 33
31. A long rugose-papillose area reaching up nearly to apical lobe,
*abfitchii* Felt and Young[2]
Basal lobe tubercular and diffused, not forming a rugose area ... 32

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hairs lost in the finished mount, but one single one was observed during preparation.

[1] Doubtfully placed in the absence of a slide.

[2] *A. euedes* Howard, Dyar and Knab, is a synonym of *abfitchii*.

32. Filament of harpago angularly expanded at basal third, *sansoni* Dyar and Knab
Filament of harpago angularly expanded beyond middle, *increpitus* Dyar
33. Basal lobe highly conical, setose on basal aspect; filament with a broad knife-blade expansion............. *riparius* Dyar and Knab
Basal lobe low-conical, a stout seta on inner margin; filament small, sickle-shaped ........................................ 34
34. Spines of basal appendages long...................... *palustris* Dyar
Spines of basal appendages moderate................ *mimesis* Dyar
35. Basal lobe large with two stout spines.........................36
Basal lobe small with two stout spines.......... *pullatus* Coquillett
Basal lobe absent; no basal spines................ *aurifer* Coquillett
36. A slight hairy area distal of apical lobe............ *impiger* Walker
A strong hairy area proximal of apical lobe, *diantaeus* Howard, Dyar and Knab
37. Harpago rather long; filament sickle-shaped with double dorsal membranous ridge...................... *innuitus* Dyar and Knab
Harpago long, the filament bud-shaped.............. *trichurus* Dyar
Harpago short, branched; filament sack-shaped, *thibaulti* Dyar and Knab
38. Basal lobe small with long setæ............................ 39
Basal lobe undeveloped........................................ 43

Group III (*Taeniorhynchus* Arribálzaga)

39. Filament of harpago with central retrose spine, *epinolus* Dyar and Knab, *taeniorhynchus* Wiedemann, *niger* Giles
Filament of harpago without such spine......................... 40
40. Side piece short; basal lobe with a secondary area of short setæ beside it.................................. *varipalpus* Coquillett
Side piece moderate; basal lobe small, unmodified............... 41
41. Harpago short, the filament longer than it..................... 42
Harpago longer, the filament shorter......... *nigromaculis* Ludlow
Harpago distinctly long, the filament much shorter, *atropalpus* Coquillett, *epactius* Dyar and Knab
42. Filament much longer than harpago................. *fluviatilis* Lutz
Filament slightly longer than harpago, *sollicitans* Walker, *mitchellæ* Dyar

Group II (*Gualteria* Lutz)

43. An articulated spine at base of side piece...*mediovittata* Coquillett
Without this structure at base of side piece.................... 44
44. A hair-tuft at middle of side piece.................. *triseriatus* Say
Without this structure.......................................... 45

45. Harpago with very long subapical seta................*oswaldi* Lutz
Harpago with subapical seta minute,
*thorntoni* Dyar and Knab, *podographicus* Dyar and Knab

Group I (*Howardina* Theobald)

46. Basal appendages absent........................*walkeri* Theobald
Basal appendages present.................................. 47
47. Seta of harpago as long as its conical base..................... 48
This seta twice as long as its short base...........*fulvithorax* Lutz
48. Clasp filament slender, longer than side piece,
*albonotata* Coquillett
Clasp filament stouter, shorter than the side piece,
*busckii* Coquillett, *aureostriata* Grabham

*Old World series*

49. A modified structure representing the clasp filament, furcate at tip and with a projection at base................*cinereus* Meigen
Clasp filament normal or subnormal............................ 50
50. Clasp filament flattened, with claw inserted subapically,
*vexans* Meigen
Clasp filament simple, normal.....................*argenteus* Poiret

To turn now to the Old World forms. My knowledge of these is limited; but, fortunately, a valuable paper by F. W. Edwards[1] is available. Edwards accepts the wide interpretation of *Aëdes* as proposed by Mr. Knab and myself; but he does not make the distinction between the New World and Old World types here suggested. This difference is certainly not obvious in the female adult, with which Mr. Edwards was largely dealing; but I am not entirely hopeless that some character may be found, now that attention has been directed to the matter.

Edwards uses genitalic and other adult characters, the genitalic being supplementary. His classification is as follows:

Genus *Aëdes* Meigen.
- Subgenus 1. *Armigeres* Theobald.
- Subgenus 2. *Stegomyia* Theobald.
- Subgenus 3. *Ochlerotatus* Arribálzaga.
  - Group *a*. *Finlaya* Theobald.
  - Group *b*. *Diceromyia* Theobald.

[1] Bull. Ent. Research, vii, 201-229, 1917.

Group *c*. *Ochlerotatus* Arribálzaga.
Section 1. *Ochlerotatus* Arribálzaga.
Section 2. *Ecculex* Felt.
Section 3. *Aëdimorphus* Theobald.
Subgenus 4. *Aëdes* Meigen.
Subgenus 5. *Skusea* Theobald.

Taking the groups seriatim without regard to the rank assigned:

*Armigeres* Theobald. Edwards tabulates 13 species and figures the genitalia of 4. The harpes and unci are well developed, normal; no harpagones; a basal lobe is present, but I cannot tell whether it is a development of the side piece or the basal membrane. I think it is derived independently of the side piece as in the Old World type in general. The clasp filament has generally a whole row of teeth. This is clearly an Old World group.

*Stegomyia* Theobald. Five species are here referred to besides the well known *argenteus* Poiret, namely:

*variegata* Doleschal (= *scutellaris* Walker).
*albopicta* Skuse (= *scutellaris* Theobald, not Walker).
*vittata* Bigot (= *sugens* Theobald, not Wiedemann).
*fraseri* Edwards.
*thomsoni* Edwards.

Three of these are before me. Side piece without a basal lobe; harpes not especially modified; unci small; the basal membrane is simple or moderately modified; clasp filament generally simple, rarely expanded. This is clearly an Old World group.

*Finlaya* Theobald. Besides the European *geniculatus* Olivier, which represents the American *triseriatus* Say, Edwards lists the following:

*eatoni* Edwards.
*pulchriventer* Giles.
*togoi* Theobald.
*longipalpis* Grünberg.
*flavipennis* Giles.
*melanopterus* Theobald.
*trilineatus* Theobald.
*niveus* Ludlow.
*greeni* Theobald.
*notoscriptus* Skuse.
*kochi* Donovan.
*oreophilus* Edwards.
*japonicus* Theobald.
*macfarlanei* Edwards.
*poicilia* Theobald.
*gubernatoris* Giles.

*lophoventralis* Theobald.
*albotaeniatus* Theobald.
*pseudotaeniatus* Giles.
*leucomeres* Giles.
*australiensis* Theobald.

The description agrees with my Group II of the New World stock, and undoubtedly it is this as far as the European *geniculatus* is concerned. But I think there is some misapprehension or confusion here. The type of *Finlaya* is *poicilia,* the male unknown to me; but I think it is not allied to *geniculatus.* I have before me *Finlaya samoana* Grünberg, which proves to be structurally distinct from any New World type. There are no harpagones, but the harpes are drawn out in strap-shaped form with widened membranous tips, thus simulating the structure of the harpagones. If this is the case in the other species listed, we have in *Finlaya* an Old World group, from which *triseriatus* and *geniculatus* should be removed.

*Diceromyia* Theobald.[1] This includes only *furcifer* Edwards and *adersi* Edwards. The male genitalia are without harpagones and therefore this is an Old World group. I do not perceive any essential distinction from *Ecculex,* but I know neither of the species in nature.

*Ochlerotatus* Arribálzaga. Side piece of the genitalia with basal and apical lobes; harpagones well developed, the filament flattened. This corresponds to Group IV of the New World stock. The species are said to be dominant in North America, Europe and, curiously enough, in Australia. The statement is perfectly correct and I have before me an Australian species the genitalia of which have not been previously described.[2]

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[1] Fourth Report, Wellcome Lab., 151, 1911.

[2] Aëdes labeculosus Coquillett.

*Culex labeculosus* Coquillett, Ent. News., xvi, 116, 1905.

*Ochlerotatus labeculosus* Edwards, Ann. Mag. Nat. Hist., (8), ix, 522 and 524, 1912.

*Genitalia.*—Side piece over three times as long as wide, grooved within; apical lobe conical, oblique, setose, the setæ pointing toward the side piece; basal lobe rounded, prominent, with three short spines toward the dorsal aspect, the central one hooked, and fine setæ on the ventral side. Clasp filament slender, moderate, curved at tip, with a long terminal inserted spine and two setæ on the outer side before tip. Harpago moderate, slender, the terminal inserted filament longer than the stem, widely angularly expanded in the middle. Harpes conical, moderate, each with a pointed recurved tip. Unci large, columnar, basally situated, the slender tips pointed inward. Basal appendages moderate, with rather irregular tip and about four short setæ.

Edwards mentions two species as transitional to *Ecculex*, namely *annuliferus* Ludlow and *fryeri* Theobald. He says the basal lobes are developed into small harpagones, which have a short straight terminal spine. Without seeing specimens, no opinion can be rendered. I shall be surprised, however, if these species do not fit into place in the Old World series without any relation to *Ochlerotatus*.

*Ecculex* Felt. Founded on *vexans* Meigen and including also a large number of allied species. This is a typical Old World group.

*Aëdimorphus* Theobald. Side piece without lobes; clasp filament various; harpagones absent. The species are unknown to me, but, on the definition, clearly an Old World group. Edwards states that it seems to merge on the one hand into *Ecculex* and on the other into *Stegomyia*. This I can readily believe.

*Aëdes* Meigen. Twelve species are referred here, having short palpi in the male. Sketches are given of the genitalia; but Edwards does not attempt a definition on account of their diversity. After studying the remarkable development shown, I believe that the processes of the side piece do not represent the clasp filament, which is absent. The harpes are variously modified and the basal membrane as well. We have here a very distinct group of the Old World type. It is unfortunate that this aberrant group must give its name to the whole genus.

*Skusea* Theobald. Five species are mentioned, of which the genitalia are sketched. All the species are unknown to me. They seem peculiar and modified. Edwards describes them thus: "Male genitalia with five or six long processes which have apparently been derived from the basal lobes of the side piece, but in some cases have become nearly apical, resembling the somewhat similar structures of *Culex*." In the discussion, he speaks of an harpago, but it does not appear that that structure is really present. It is difficult to deal with these aberrant forms on second-hand information; but, as far as I can see, this is an Old World group.

Taking Edwards's data in conjunction with the few forms known to me, I would divide the Old World *(Aëdes)* stock as follows:

*Group I.*—Side piece without a basal lobe; harpes not especially modified; unci small *(Stegomyia)*. A skeleton arrangement of the species might be as follows:

1. Clasp filament simple .......................................... 2
   Clasp filament expanded at tip with the spine subterminal, long and curved .......................................... *vittatus* Bigot
2. Basal membrane expanded into a false lobe .......................................... 3
   Basal membrane not forming such a lobe, (*fraseri* Edwards), (*thomsoni* Edwards)
3. The false lobe free to the base, *pseudoscutellaris* Theobald, (*variegata* Doleschall)
   False lobe attached to the side piece, *albopicta* Skuse, *argenteus* Poiret

*Group II.*—Side piece without a basal lobe; basal membrane modified, bearing five papillæ, which may pass up the lobe, becoming subapical; clasp filament various *(Skusea)*.

I do not know this group at all, and my interpretation of Edwards's figures may not be correct.

*Group III.*—Side piece without a basal lobe; harpe strongly produced, ligulate, widened at tip and resembling an harpago; unci large.

I have only one species for this group. Edwards does not define it, although he must have observed it if, as I suppose, part of the species grouped under *Finlaya* belong here. A reëxamination of these species from the new point of view would be instructive.

**Aëdes samoana** Grünberg.

*Finlaya samoana* Grünberg, Ent. Rundschau, xxx, 130, 1913.

*Genitalia.*—Side piece three times as long as wide, conical, without lobes; clasp filament apical, simple and rather short, with a long terminal spine, half as long as the filament; an area near base of side piece densely setose, followed by a row of very large scales crowded together. Unci large and prominent, conical, contracted centrally, the tips incurved. Harpes modified, a long ligulate curved stem, expanded in fan-shape at the tip and radially marked, without any joint as occurs in the harpago at the insertion of the filament.

*Group IV.*—Side piece with a basal lobe, possibly as a development of the basal membrane; harpes and unci moderate; clasp filament generally with a long row of inserted spines (*Armigeres*).[1]

*Group V.*—Side piece with a basal lobe, sometimes rudimentary, derived at the base of the side piece; clasp filament often modified; harpes and unci not strongly modified; harpagones absent (*Ecculex, Aëdimorphus* and *Diceromyia*). A skeleton table of the species would run as follows:

1. Clasp filament inserted terminally.................................. 2
   Clasp filament inserted subapically..........*luteolateralis* Theobald
2. Filament entire, the spine subapical.................*vexans* Meigen,
   (*dentatus* Theobald), (*hirsutus* Theobald), (*cumminsi* Theobald)
   Clasp filament further modified.................................. 3
3. Filament simply cleft......................(*punctithorax* Theobald)
   Filament divided, one arm hooked and toothed,
   (*abnormalis* Theobald), (*alboventralis* Theobald)
   Filament expanded and lobed, with two terminal spines,
   (*minutus* Theobald), (*tarsalis* Newstead), (*irritans* Theobald)

*Group VI.*—Clasp filament apparently absent or at least modified out of all homology, inserted subapically, without terminal spine; basal lobe present (in *cinereus*); harpes and unci variously developed; basal membrane modified (*Aëdes*). In *cinereus* Meigen the end of the side piece is rounded and blunt, and apparently this is the case also in *butleri* Theobald, *pseudomediofasciatus* Theobald and *fragilis* Leicester. The other species illustrated by Edwards have the side piece more or less hollowed at tip, the corners drawn inward into spines of various lengths. In *ceylonicus* Edwards the clasp filament is single and small; in *singularis* Leicester it is bent and forked; in *virilis* Leicester and *uncus* Theobald there are two long separated processes. Other modifications may be noted in Edwards's figures.

Certain improvements can be made to the table of genera of the tribe by genitalia, given by us in the monograph (vol.

[1] This probably represents a distinct genus, as with *Leicesteria* Theobald. See Edwards, Bull. Ent. Res., iv, 255-263, 1914.

iii, p. 195). Without going into the homology of the parts in the Culicines and Deinoceratines at the moment, as I will deal with them later, it is obvious that the parts called harpagones in *Mansonia* really correspond with the basal lobes of *Culiseta* and others. Therefore the table, beginning with dichotomy 5, can be amended as follows, bringing in the relationship of the New World and Old World divisions of *Aëdes* as here defined:

5. Harpagones present .......................................... 6
   Harpagones absent .......................................... 8
6. Apical appendages of harpagones multiple..............*Psorophora*
   These appendages single........................................ 7
7. A fringe of broad scales on inner edge of side piece...*Haemagogus*
   No such fringe present..................*Aëdes* (New World stock)
8. Side pieces without a conical basal lobe, open within,
   *Aëdes* (Old World stock)
   Side pieces with such a lobe........................................ 9
9. Basal lobe with a single terminal rod, often situated at the end of a process ..........................................*Mansonia*
   Basal lobe conical, with several terminal setæ..........*Megarhinus*, *Orthopodomyia*, *Culiseta*, *Culicella*, *Climacura*

## A REVISION OF THE AMERICAN SPECIES OF CULEX ON THE MALE GENITALIA

(*Diptera, Culicidæ*)

By HARRISON G. DYAR

On a previous page I gave some notes on the relationship of the species of *Aëdes* as shown by the male genitalia. In a review of the other genera with the object of ascertaining the origin of *Culex*, it appears that the *Anopheles* are very distinct. In these the ædœagus is present, simple or with a crown of spines or flattened appendages, and there are no basal chitinous organs whatever. The side pieces are slightly modified, bearing certain stout spines or with small basal lobes; but we find no homology with *Culex* and must leave the *Anopheles* aside. In *Aëdeomyia*, the ædœagus has disappeared, and there is a basal chitinous structure, composed of paired