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A REVISION OF THE MOSQUITOS OF THE PALAE-
ARCTIC REGION.

Mosquitoes
London

BY

E. W. EDWARDS,

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A REVISION OF THE MOSQUITOS OF THE PALAEARCTIC REGION.

By F. W. EDWARDS.

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For some years after the intensive study of mosquitos began in tropical countries, surprisingly little interest was taken in the European species, particularly those of Northern Europe. Ficalbi had published his monographic revision in 1896-99, but from then until 1914 very little further had been done; the adults were assumed to be more or less known, though very few of the larvae had been described. Since 1914, however, a great deal of work has been done all over Europe, bionomic as well as systematic, and considerable advances have been made in every branch of our knowledge of these insects.

The present paper was commenced early in 1919, with the study of a number of large collections received at the British Museum from Italy (Mr. E. Hargreaves), Macedonia (Capt. J. Waterston), Palestine and Mesopotamia (Capt. P. J. Barraud), and Egypt (Major E. E. Austen). Shortly afterwards a correspondence with Dr. Wesenberg-Lund, of Copenhagen, made it evident that there were many more species in Northern Europe than had previously been supposed. I therefore determined to attempt a revision of the Palaearctic mosquito fauna, and with this end in view wrote to the Dipterists in charge at various continental museums, as well as some private collectors, for the loan of material for determination or re-determination. Collections were sent in response to my requests by Dr. R. Frey, Helsingfors Museum; Dr. E. Bergroth, Jämsä, Finland; Dr. Y. Sjöstedt, Stockholm Museum; Dr. Wesenberg-Lund, Hillerød, Denmark; Dr. G. Enderlein, Berlin Zoological Museum; Dr. W. Horn, Berlin-Dahlem Entomological Museum; Herren L. Oldenberg and B. Lichtwardt, Berlin; M. E. Séguy, Paris Museum; Dr. H. Zerny, Vienna Museum; Dr. K. Kertész, Budapest Museum; Prof. M. Bezzi, Turin; and odd specimens were also received from Dr. Lundbeck, Copenhagen Museum; and Dr. E. Martini, Hamburg. A further valuable collection was sent by Mr. S. Yamada from Japan in 1916, and additional Japanese and Chinese collections were made by Dr. W. A. Lamborn in 1921. To all who have helped me in this way I wish to express due thanks, as also to other correspondents and colleagues for help in other ways.

The publication by Dr. E. Martini of his admirable paper, "Über Stechmücken," in August 1920, and by Dr. Wesenberg-Lund of his equally excellent treatise on Danish mosquitos early in 1921, have to a great extent covered the ground which it was intended to investigate in this paper, and have also gone much further in giving an account of the life-history of the majority of the European species. The present paper, while not claiming to make any very considerable further contribution to our knowledge of these species, will serve to correlate and summarise the results of these and other workers, and by including the whole Mediterranean region give a rather more comprehensive view of the subject.

The geographical limits adopted here are those most usually given to the Palaearctic region, *i.e.*, Europe, North Africa, as far south as the tropic; the Atlantic Islands; Asia Minor; North Arabia, including the head of the Persian Gulf; North

Asia as far as the Himalayas; North China; Japan. Mosquitos have been more or less carefully collected over practically the whole of this area, the least known portions being perhaps North Russia and North and Central Siberia. Spain also has not yet been thoroughly worked. Iceland should be included in the area, but no mosquitos have yet been recorded or received from that country.

The study of the various collections enumerated above indicates that the mosquito fauna is fairly homogeneous over the greater part of the area, but there are two parts which, so far as this group of animals is concerned, would seem to be better classed in the Oriental region. These are the area immediately round the head of the Persian Gulf, and the southern islands of Japan, at least as far north at Tokio. In the former area there is a very large, perhaps a predominating admixture of Oriental forms, while round Tokio the fauna appears to be of an almost purely Oriental type. If these two areas had been excluded from consideration, the number of species dealt with would have been much less; but it was thought that the usefulness of this paper might be increased by keeping to the wider limits.

The total number of species dealt with is as follows:—

<i>Anopheles</i> , 19.	<i>Orthopodomyia</i> , 1.
<i>Uranotaenia</i> , 2.	<i>Tacniorhynchus</i> , 1.
<i>Rachionotomyia</i> , 1.	<i>Aedes</i> , 38.
<i>Megarhinus</i> , 3.	<i>Armigeres</i> , 1.
<i>Theobaldia</i> , 7.	<i>Lutzia</i> , 1.
	<i>Culex</i> , 20.

The faunistic relationship of these species may be analysed as follows:—

Intrusions from the Oriental Region.		Intrusions from the Ethiopian Region.	
In the West.	In the East.	In Algeria, etc.	In Egypt and Palestine.
<i>A. stephensi</i> , <i>C. tritaeniorhynchus</i> , <i>C. vishnui</i> , <i>C. fatigans</i> .	<i>An. lindesayi</i> , <i>U. bimaculata</i> , <i>R. bambusa</i> , <i>M. towadensis</i> , <i>A. togoi</i> , <i>A. japonicus</i> , <i>A. korcicus</i> , <i>A. niveus</i> , <i>A. albopictus</i> .	<i>Arm. obturbans</i> , <i>L. vorax</i> , <i>C. hayashi</i> , <i>C. bitaeniorhynchus</i> , <i>C. sinensis</i> , <i>C. tritaeniorhynchus</i> , <i>C. vishnui</i> , <i>C. fatigans</i> .	<i>An. costalis</i> , <i>Ae. vittatus</i> , <i>A. mauritanus</i> , <i>A. pharoensis</i> , <i>C. quasigelidus</i> , <i>C. laurenti</i> , <i>C. tritaeniorhynchus</i> .
		In Mesopotamia, <i>A. rhodesiensis</i> .	

The remaining 70 species may be said to comprise the true Palaearctic fauna (though a number of them spread into adjoining regions). As might be expected, there are considerable differences between the North European and the Mediterranean faunas. The former shows very strong affinities with the Nearctic fauna, and a considerable number of the species seem to be common to both Europe and North America, while others have obviously representative forms in the two regions. The species which I consider either identical or only varietally distinct are: *Anopheles maculipennis*, *Theobaldia alaskaensis*, *Aedes dorsalis*, *A. lutescens*, *A. excrucians*, *A. alpinus*, *A. cataphylla*, *A. dianaicus*, *A. sticticus*, *A. punctor*, *A. communis*, *A. intrudens*, *A. pullatus*, *A. vexans*, *A. cinereus*, *Culex apicalis*, *C. pipiens*. Nearly all these species are already known to occur throughout Europe and Siberia, and the two faunas may therefore be assumed to have mixed at a recent date by way of Eastern Siberia and Alaska. In one or two cases (e.g., *Anopheles maculipennis*) there seems to be definite evidence that the European fauna is more closely allied to that of Western than that of Eastern North America.

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The following may be considered representative species:—

Europe.	North America.
<i>Anopheles plumbeus.</i>	<i>A. barberi.</i>
<i>Theobaldia annulata.</i>	<i>T. maccrackena.</i>
<i>T. glaphyoptera.</i>	<i>T. impatiens.</i>
<i>T. morsitans.</i>	<i>T. dyari.</i>
<i>Orthopodomyia pulchripalpis.</i>	<i>O. signifer.</i>
<i>Taeniorhynchus richiardii.</i>	<i>T. perturbans.</i>
<i>Aedes semicantans.</i>	<i>A. stimulans.</i>
<i>A. rusticus.</i>	<i>A. trichurus.</i>
<i>A. geniculatus.</i>	<i>A. triseriatus.</i>

It is of special interest to note that none of the European species in this list are at present known from Asia.

As might be anticipated, few, if any, of the purely southern species have any clearly recognisable North American representatives, but some of them have wide extensions of their range into the Ethiopian and Oriental regions. The most noteworthy of such species are *Theobaldia longiareolata* and *Culex tipuliformis*.

In the more northerly parts of the region the dominant group is the subgenus *Ochlerotatus* of *Aedes*; the species of *Anopheles* which occur are all of the typical subgenus. Further south *Ochlerotatus* rapidly disappears, and begins to be replaced in part by species of *Culex*, and in part by other subgenera of *Aedes*, while the Anophelines of the *Myzomyia* group become numerous.

I have endeavoured in this paper to revise the generic classification of the CULICIDAE on a sounder basis than has been used hitherto, by defining the genera primarily on characters which have no relation to sex. In previous papers I have tried to minimise the use of secondary sexual characters, as well as of the merely superficial characters of the scales, but found myself in some cases compelled to fall back upon these, or else on the male hypopygium. A closer study of the insects now enables me to point out what appear to be constant and important distinctions between most of the genera which are applicable equally to both sexes without being so artificial as the scale characters have been proved to be. Fortunately no changes are involved in our conception of the limits of the genera; these had been already soundly established by the study of the larvae, and the new characters adduced only confirm most of the conclusions already arrived at by a study of the early stages.

Several of the new distinctions employed are to be found in the thoracic chaetotaxy, and to explain these clearly I give explanatory figures of the pleural bristles in *Theobaldia annulata* and *Aedes geniculatus*. The most important bristles for taxonomic purposes I find to be those occurring on the area in front of the prothoracic spiracle. This area is almost entirely occupied by the proepimeron, but there is a small, more or less triangular area immediately adjoining the spiracle which is separated from the proepimeron by a well-marked ridge. The bristles which are found on this small area I speak of here as the *spiracular* bristles. When present they project backwards, covering and protecting the spiracle. When the spiracular bristles are absent, their function is often assumed by the *proepimeral* bristles, which are usually situated in a row near the posterior margin of the proepimeron; it will sometimes be necessary to look closely in order to ascertain whether the bristles present are spiracular or proepimeral, or perhaps both; their position relatively to the above-mentioned ridge is the deciding factor. The two groups are obviously not homologous.

The other groups of bristles on the pleurae are apparently of less importance, and are for the most part more hair-like. They are as follows:—*Pronotal*, on the prothoracic lobes. *Prosternal*, on the prosternal lobes; a group which Christophers considers important in the ANOPHELENI, but which seems to be fairly constant throughout the CULICINI. *Post-spiracular*, a distinct group of some importance situated a little behind the prothoracic spiracle and below the margin of the mesonotum.

Pre-alar, a clump situated on the pre-alar prominence; always present, but variable in number. *Sternopleural*, the row which is nearly always present, extending vertically across the mesepisternum and mesosternum, almost in a line with the row on the

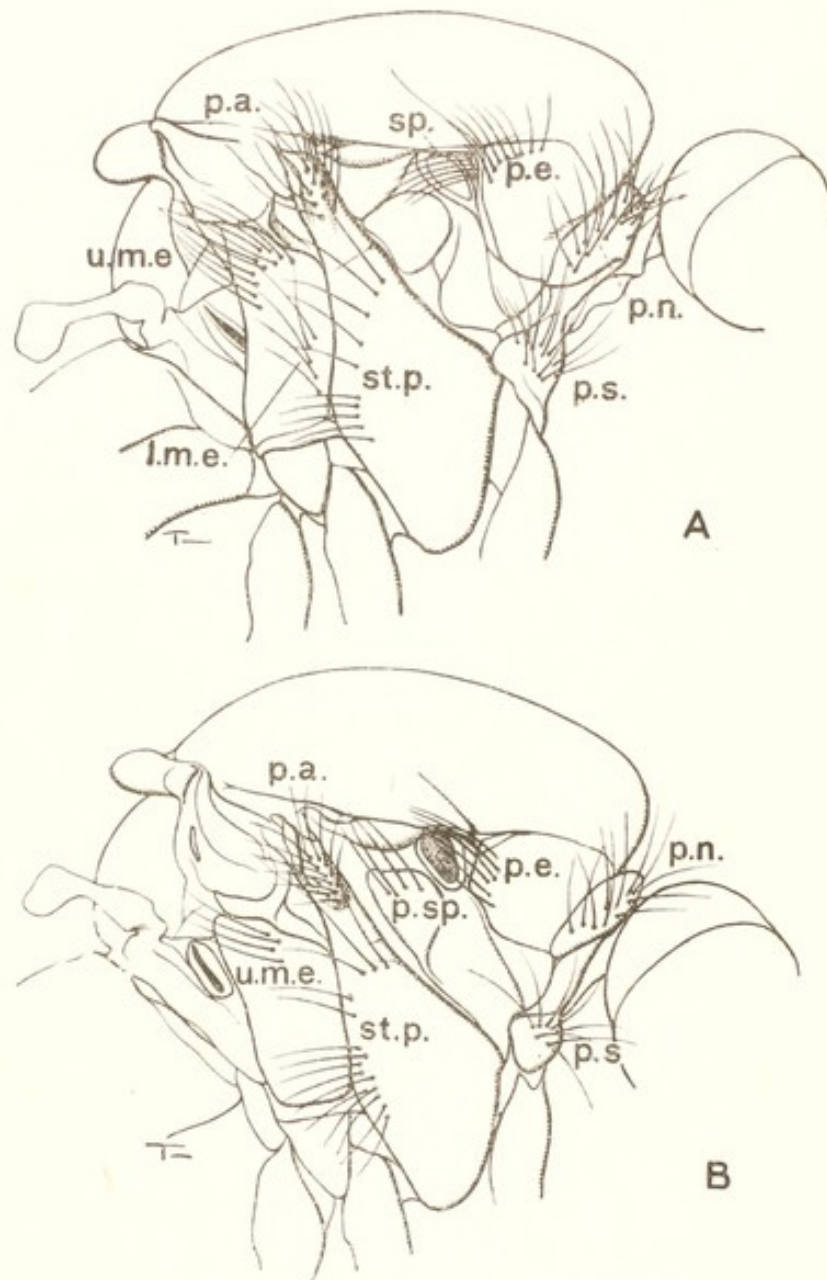


Fig. 1. Side view of thorax of (A) *Theobaldia annulata* and (B) *Aedes geniculatus*, to show arrangement of pleural bristles. (Scales omitted.)
 Bristles: *p.n.*, pronotal; *p.s.*, prosternal; *p.e.*, proepimeral; *sp.*, spiracular; *p.sp.*, post-spiracular; *p.a.*, pre-alar; *u.m.e.*, upper mesepimeral; *l.m.e.*, lower mesepimeral, *st.p.*, sternopleural.

middle coxae. *Mesepimeral*, two groups whose position is indicated by the name; the *upper mesepimeral* bristles form a distinct clump or tuft which is always present; the *lower mesepimeral* are variable in number and have been used to distinguish the genera *Culex* and *Lutzia*.

I have studied also the mesonotal bristles, but although these vary greatly in number and development, I have not succeeded in discovering any differences which are of more than specific value. The same applies to the bristles of the legs, but those of the head sometimes offer useful generic characters. There are two great advantages which bristle characters have over scale characters. Firstly, they are obviously of much greater phylogenetic importance. Secondly, even when they are rubbed off they always leave a recognisable scar. A denuded specimen may even be more easy to examine than a perfect one, as the scales are sometimes liable to obscure the bases of the bristles.

In this paper I believe I have mentioned every name proposed for a mosquito taken within the region dealt with, but I have not as a rule given additional synonyms, nor have I attempted to unravel all the confusion caused by mis-identification, but have tried merely to give clear definitions of the specific concepts. A large number of the old descriptions are unrecognisable, and the types of many (some of Meigen's and all of Robineau-Desvoidy's) have apparently ceased to exist. Since, however, it is highly probable that the old names all apply to species which are known at the present day, I have endeavoured to form an opinion as to which species was most likely intended by the describer, rather than give a separate list of indeterminable species. I have not included Robineau-Desvoidy's *Culex flavovirens* and *C. viridis* in the synonymy, because I consider it obvious that they were CHIRONOMIDAE. Linnaeus' *Culex vulgaris* may very likely have been a species of *Aedes*, but has been considered by Dyar and Knab to be a *Simulium*; it is therefore omitted. *Anopheles sacharovi*, *A. pseudopictus* var. *flerovi*, Portch., and *A. superpictus* var. *vassilievi*, Portch., referred to by Russian writers (see Review of Applied Entomology, B, ii, p. 108, and iii, p. 196), do not appear to have been described; at any rate I have been unable to trace the descriptions. For references to the original publications of *Culex annulatus*, de Fourcroy, *C. niveus*, Eichwald, and *C. pallipes*, Waltl, I am indebted to Mr. C. Davies Sherborn, who has kindly allowed me access to his manuscript.

Tribe ANOPHELINI.

Genus *Anopheles*, Mg.

As the careful and detailed researches of Christophers have shown, there are two main sections of the genus *Anopheles*, differing in small but quite easily definable characters, both in the adult and in the larva, and undoubtedly to be regarded as representing a very early separation of the genus into two distinct stocks. This separation, according to Christophers, probably took place at least as early as the Cretaceous. It is both desirable and convenient to recognise this important conclusion in our nomenclature, and I therefore accept the divisions proposed by Christophers (Ind. Journ. Med. Res. iii, p. 383, 1915) as subgenera. I do not consider that the differences are sufficiently important or sharply defined to warrant the full generic separation of the two old-world groups, nor do I consider it possible to subdivide either of these groups in a satisfactory manner, since the connections between their component species are so intricate and the intergradations so complete. As Christophers has pointed out, the subgenus *Anopheles* shows much more real diversity among its members than the subgenus *Myzomyia*, but when the species of the whole world are taken into consideration it is impossible to recognise clearly-defined divisions.

The eggs of different species of *Anopheles* show remarkable variations in the structure of the air-floats, while these appear to be constant for each species; in some instances, indeed, this is so markedly the case that the egg-structure (when known) affords the readiest means of distinguishing closely allied forms. I have therefore considered it worth while to collect into one block all the published figures of the eggs of Palaeartic *Anopheles*. These, with the two or three new ones which

are added, comprise all the species dealt with in this paper, except *A. mauritanus* and *A. sergenti*. It will be noted that the species in which the air-floats have undergone great reduction are *A. plumbeus*, *A. clutus*, *A. multicolor* and *A. turkhudi*. Dr. G. A. K. Marshall suggests that this reduction may be connected with the habit

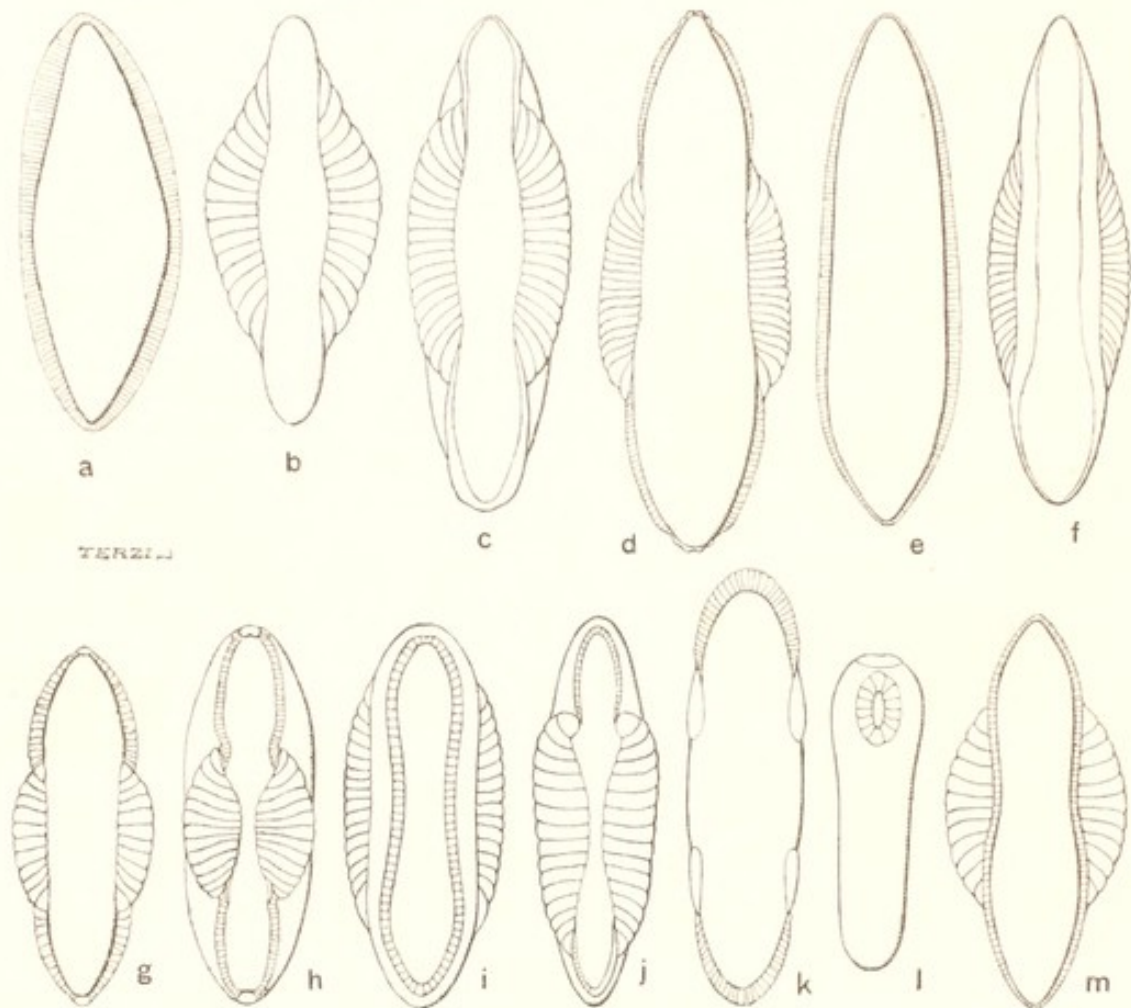


Fig. 1.—Eggs of Palearctic species of *Anopheles*. a, *A. plumbeus*, Steph. (original); b, *A. algeriensis*, Theo. (after Sergent); c, *A. bifurcatus*, L. (after Martini); d, *A. maculipennis*, Mg. (original); e, *A. clutus*, sp. n. (original); f, *A. hyrcanus* (Pall.) (original); g, *A. pulcherrimus* Theo. (after Stephens and Christophers); h, *A. stephensi*, Theo. (after Stephens and Christophers); i, *A. costalis*, Theo. (after Patton); j, *A. rhodesiensis*, Theo. (after Patton); k, *A. multicolor*, Camb. (after Foley); l, *A. turkhudi*, Liston (after Stephens and Christophers); m, *A. hispaniola*, Theo. (after Sergent).

of breeding in water of high specific gravity (tanninised water in the case of *A. plumbeus*, saline water in the case of *A. multicolor*), in which large floats would perhaps not be necessary in order to keep the eggs on the surface during incubation. It is uncertain whether this explanation will apply to *A. clutus* and *A. turkhudi*.

Subgenus *Anopheles*, Christophers.

Ind. Journ. Med. Res. iii, p. 383 (1915).

Adult.—Cross-veins and bases of forks of wing-veins with dark scales. Costa largely dark (in Palearctic species), with at most two pale spots, apart from a pale area in the apical fringe. Male hypopygium with two (rarely one or three) strong spines at the bases of the side-pieces, one or both of which are borne on a strong tubercle. Prosternal hairs usually numerous.

Larva.—Shaft of antenna with a branched hair (except in *A. plumbeus*). Palmate hairs lanceolate, without long terminal filament. Internal clypeal hairs generally close together.

The members of this subgenus exhibit considerable diversity, and some obviously fall together into groups, but when the species of the whole world are considered it does not seem profitable or even possible to recognise distinct subgenera. The nine Palaearctic species at present known may be distinguished by the following tables:—

Adults.

- | | |
|---|---|
| 1. Wing-scales all dark; front femora cylindrical; female palpi slender, the scales appressed (<i>Anopheles</i>) | 2 |
| Wings with many pale scales; front femora thickened at the base; female palpi and proboscis (except in <i>A. lindesayi</i>) shaggily scaled towards the base (<i>Myzorhynchus</i>) | 6 |
| 2. Wing-scales uniform; base of upper fork-cell considerably nearer wing-base than that of the lower | 3 |
| Wings normally with spots of darker, more densely aggregated scales; fork-cells somewhat shorter, their bases practically level | 5 |
| 3. White frontal tuft absent; mesonotum unicolorous, with dark hair | |
| White frontal tuft present; mesonotum darkened at sides, with some pale hair and scales | 4 |
| 4. Smaller, blacker species; a distinct patch of white scales on front of mesonotum | <i>plumbeus</i> , Hal. |
| Larger, browner species; scales on front margin of mesonotum narrower and not pure white | <i>bifurcatus</i> , L. |
| 5. Mesonotum unicolorous; wing-fringe all dark | <i>clutus</i> , sp. n. |
| Mesonotum darker at sides; fringe usually pale at tip of wing | <i>maculipennis</i> , Mg. |
| 6. Costa with only one pale spot (at the tip); hind femora with a conspicuous white pre-apical ring; front femora only slightly enlarged at the base | <i>lindesayi</i> , Giles |
| Costa with two distinct pale spots (normally); hind femora without pre-apical white ring; enlargement at base of front femora conspicuous | 7 |
| 7. A white dot at base of costa, and a second near it | <i>punctibasis</i> , sp. n. |
| These dots absent | 8 |
| 8. Fourth and fifth hind tarsal joints all white | <i>mauritanus</i> , Grp. |
| Fifth hind tarsal joint dark | 9 |
| 9. Fourth hind tarsal joint dark except at the tip | 10 |
| Fourth hind tarsal joint all white or whitish, <i>hyrcanus</i> var. <i>pseudopictus</i> , Grassi | |
| 10. Wing-markings usually more sharply defined; basal half of costa with dark scales only | <i>hyrcanus</i> , Pall. |
| Wing-markings more blurred; basal half of costa with some pale scales on its inner edge | <i>hyrcanus</i> var. <i>mesopotamica</i> , Chr. |

Male Hypopygium.

- | | |
|---|----------------------------|
| 1. Base of side-piece with only one strong spine | <i>algeriensis</i> , Theo. |
| Base of side-piece with more than one strong spine | 2 |
| 2. Base of side-piece with three spines, two of them branched | <i>bifurcatus</i> , L. |
| Base of side-piece with two spines, both simple | 3 |
| 3. Spines of claspette approximated, but not fused | 4 |
| Spines of claspette fused into a spatulate process | 5 |

- | | |
|---|--|
| 4. Aedoeagus short and broad, without leaflets | <i>plumbeus</i> , Hal. |
| Aedoeagus long and narrow, with leaflets at the tip | <i>maculipennis</i> , Mg. ; <i>clutus</i> , sp. n. |
| 5. Spatulate process long and narrow ; ninth tergite without definite processes ; long hair at middle of side-piece moderately developed | <i>lindesayi</i> , Giles |
| Spatulate process shorter and broader ; ninth tergite with distinct processes ; long hair at middle of side-piece stouter, almost spine-like .. | 6 |
| 6. Processes of ninth tergite short and broad | <i>punctibasis</i> , sp. n. |
| Processes of ninth tergite elongate .. | <i>hyrcanus</i> , Pall. ; <i>mauritanus</i> , Grp. |

Larvae.

- | | |
|---|--|
| 1. A row of six large plumose hairs across middle of head | 2 |
| These hairs vestigial, simple | <i>plumbeus</i> , Hal. |
| 2. Outer anterior clypeal hair thickly branched, dendriform | 3 |
| Outer anterior clypeal hair simple or slightly branched .. | <i>bifurcatus</i> , L. |
| 3. Innermost shoulder-hair branched from base or nearly .. | <i>mauritanus</i> , Grp. |
| Innermost shoulder-hair branched only at tip, if at all | 4 |
| 4. Palmate hairs on abdominal segments i-vii (always ?) .. | <i>hyrcanus</i> , Pall. |
| Palmate hairs on abdominal segments iii-vii only | <i>clutus</i> , sp. n. ; <i>maculipennis</i> , Mg. |

The larvae of *A. algeriensis* and *A. lindesayi* are insufficiently described for inclusion in the above table ; that of *A. punctibasis* is not yet described.

1. **Anopheles (Anopheles) algeriensis**, Theo. (fig. 2, b).

Anopheles algeriensis, Theobald, Mon. Cul. iii, p. 21 (1903).

Anopheles lukisi, Christophers, Ind. J. Med. Res. iv, p. 120 (1916).

Easily distinguished by the unspotted wings and the absence of a distinct tuft of long white scales on the front of the head. The mesonotum is uniformly dull light brown, and clothed with dark hair only, the small yellowish hairs or hair-like scales which are found in *A. bifurcatus* being absent in this species. In the female the second segment of the palpi is considerably longer than the first or the third and fourth together.

The male hypopygium, which has not as yet been described, is very distinct. The processes of the ninth tergite (ventral processes of Christophers) are very short, less than half as long as the breadth of the tergite. The side-pieces have a strongly differentiated bristle on the inner side near the tip, as in *A. bifurcatus* ; there is a single very strong basal spine, situated on a large tubercle, with its tip bent ; the outer basal spine is absent or represented only by one or two scarcely differentiated and inconstant bristles. The claspettes are trilobed, the first lobe bearing two or three strong, pointed, closely approximated spines, the second several short hairs, the third (innermost) three nearly equal, moderately strong bristles. The aedoeagus bears two or three pairs of long delicate leaflets at its tip.

The larva is unknown. Sergent, indeed, gives a short, incomplete description and some figures of a larva which he supposes to be *A. algeriensis*, but he was unaware of the real distinctions between *A. algeriensis* and *A. bifurcatus*, and his statements are insufficient to enable us to decide which of these species he had before him, or whether he had both. Sergent's figure of the egg is reproduced in fig. 2, b ; it is not improbable, however, that this really represents the egg of *A. bifurcatus*.

The type of *A. lukisi* shows faint traces of pale banding on the hind tarsi ; in the Mediterranean specimens the tarsi are entirely dark, but there appear to be no other differences. The colour of the mesonotum varies from yellowish to rather dark brown.

The species has a rather close resemblance to the Oriental *A. aitkeni*, and, as suggested by Barraud, it is probable that the specimens of *A. aitkeni* recorded from Palestine were really *A. algeriensis*. *A. aitkeni* is certainly a distinct species, since the upright scales of the head are very much narrower than in *A. algeriensis*, and the side-pieces of the hypopygium have two distinct basal spines.

Distribution.—Algeria (*Sergent*); Italy (*Hargreaves*); Macedonia (*Waterston*); Palestine (*Austen, Barraud*); Egypt (*Austen*); Mesopotamia (*Christophers*).

2. *Anopheles (Anopheles) bifurcatus*, L. (fig. 2, c).

Culex bifurcatus, Linnaeus, Syst. Nat. Ed. x, p. 603 (1758).

Culex claviger, Meigen, Klass. u. Besch. i, p. 4 (1804).

Culex trifurcatus, Fabricius, Ent. Syst. iv, p. 401 (1794).

Anopheles villosus, Robineau-Desvoidy, Mém. Soc. d'Hist. Nat. Paris, iii, p. 411 (1827).

Anopheles grisescens, Stephens, Zool. Journ. xii (1828).

Anopheles antennatus, Becker, Mitt. Zool. Mus. Berlin, ii, p. 68 (1903).

This species varies a good deal in size and colour; small dark specimens might be mistaken for *A. plumbeus* and small light ones for *A. algeriensis*. Apart from the male hypopygial characters, which are absolutely diagnostic, *A. bifurcatus* may readily be separated from *A. plumbeus* and *A. algeriensis* by the other characters mentioned in the key.

The larva, which has been fully described by Lang, occurs generally in clean water with some weed, in rather shady situations; in the Mediterranean region it is frequently found in wells. The winter is passed in the larval stage, the adults dying off in the late autumn and the first brood appearing again in early spring.

A. bifurcatus is less domestic than *A. maculipennis* and does not so readily enter houses, but bites freely in the open.

Distribution:—Throughout Europe, North Africa (except desert regions) and Asia Minor. Turkestan (*Vassiliev*). Not found as yet further east. Apparently rarer in the far north.

South European specimens are commonly smaller than those from Central and North Europe, but are not otherwise distinguishable.

3. *Anopheles (Anopheles) plumbeus*, Stph. (fig. 2, a).

Anopheles plumbeus, Stephens, Zool. Journ. iii, p. 503 (1828).

Anopheles nigripes, Staeger, Kroyer's Nat. Tidschr. ii, p. 552 (1839).

The general black colour, densely and uniformly scaled wings, white scales on front of mesonotum, conspicuously hoary stripe down centre of mesonotum, and conspicuous white frontal tuft, will suffice to distinguish this species from those with which it might be confused.

The larva and egg have been described by Lang, Eysell, and Carter and Blacklock. *A. plumbeus* is the only species in the Palearctic fauna which is known to breed in rot-holes in trees, and the very striking characteristics of the larva all seem to be correlated with this habit. As has already been pointed out by Christophers, tree-hole larvae of different genera of mosquitos commonly show three forms of modification: (1) a reduction of the hairs on the head, and especially of the small bristles on the antennae; (2) an increase and enlargement of the hairs on the thorax and abdomen; and (3) a development of chitinous structures on the last few abdominal segments. All these points are well illustrated by *A. plumbeus*. The tree-holes in which these larvae are found are frequently (perhaps usually) dark, and it may be supposed that the sense of sight would be of little value to the inhabitants of such places, while that of touch would attain a greatly enhanced importance, since the

mosquito larvae have a number of predaceous enemies living with them. Possibly this may help to explain the development of hairs on the soft parts of the body, though their reduction on the head is not so easy to account for. The development of additional chitinous plates may be merely a chemico-physical reaction to the excess of tannin in the water.

Whatever may be the use of these larval modifications, it seems certain that they are due to environmental conditions (since they are shown by species in totally unrelated genera), and therefore the genus *Coelodiazesis*, founded solely on these characters, cannot be satisfactorily maintained.

Distribution.—Throughout Europe, wherever there are many deciduous trees, in which rot-holes can form. Not yet recorded with certainty from North Africa or Asia, except one from Katmia, Cilicia (*Lt.-Col. Lelcan*, recorded by Christophers).

The Himalayan species *A. barianensis*, James, has been referred to by Christophers as identical with *A. plumbeus*, but there are small differences: in *A. barianensis* the white scales on the mesonotum extend further (almost half-way from the front) and the femora and tibiae are conspicuously white at the tips, whereas in *A. plumbeus* they have scarcely a trace of white. As there are also small distinctions between the larvae, it will probably be best to regard the two as distinct species, occupying separate geographical areas in the Palaearctic and Oriental regions. The type has also a North American representative in *A. barberi*, Coq., which is distinct from both the old-world forms, though closely resembling them.

4. *Anopheles (Anopheles) maculipennis*, Mg. (fig. 2, d).

Anopheles maculipennis, Meigen, Syst. Besch. i, p. 11 (1818).

Culex claviger, Fabricius (*nec* Meigen), Syst. Antl. p. 35 (1805).

Anopheles occidentalis, Dyar & Knab, Proc. Biol. Soc. Wash. xix, p. 159 (1906);

Howard, Dyar & Knab, Mosq. N. & C. Amer. iv, p. 1026 (1917).

Anopheles lewisi, Ludlow, Psyche, xxvii, p. 74 (1920).

Anopheles selengensis, Ludlow, Psyche, xxvii, p. 77 (1920).

This could not easily be confused with any other Palaearctic species except *A. elutus*; from this it differs in several small details of coloration, as indicated in the key. The pale area in the fringe at the tip of the wing is diagnostic of *A. maculipennis*, when it is present, but can only be seen in perfect specimens, the fringe at the wing tip being very easily denuded; moreover, the fringe is entirely dark in some individuals, and as the wing-spots also vary somewhat in intensity, the distinction between the adults of these two species is not very clearly marked. Perhaps the best distinction between the two species is in the colour of the scutum, that of *A. maculipennis* having a broad brown or blackish-brown stripe on each side, as in *A. bifurcatus* and *A. plumbeus*.

According to Wesenberg-Lund the Southern European race of *A. maculipennis* is smaller than the Northern. The difference, if it exists, is very slight, and is only to be found in the *average* measurement, since many Mediterranean specimens which I have seen are quite large. Dyar (in correspondence) also maintains that there is a minute difference in the hypopygia between specimens from France and Siberia and those from Hungary. I am unable to confirm this, and consider that the small amount of variation which does occur is individual only. Mounts of male hypopygia of specimens from Britain, Macedonia and Constantinople show no difference whatever.

In my opinion the Western North American *A. occidentalis* is specifically identical with *A. maculipennis*. I can discern no difference in the larvae; the adults are alike in all external features, and the only demonstrable difference in the male hypopygia is that the two outer spines on the claspette are both pointed in *A. occidentalis*, while one or both of them are blunt-ended in *A. maculipennis*. Such a distinction seems to me inadequate even for varietal separation. The egg of *A. occidentalis* is as yet undescribed, and may differ from that of *A. maculipennis*, but

I do not anticipate that such will be found to be the case. In any event *A. occidentalis* is much closer to *A. maculipennis* than is the Eastern North American *A. quadrimaculatus*, which differs in larva, hypopygium, and adult coloration. This is a fact of considerable interest, and is in line with what has been found in the genus *Aedes*.

The early stages have been described in detail by Nuttall and Shipley, Lang and others. The larvae are found most commonly in open, weedy water in low-lying districts, sometimes in brackish water near the coast.

Distribution.—Throughout Europe, from the Arctic to the Mediterranean; North-West Africa (except desert regions); and across Siberia to North-Western America; also recorded by Christophers from Upper Mesopotamia.

5. *Anopheles* (*Anopheles*) *elutus*, sp. n. (fig. 2, c).

Anopheles sp., Christophers, Ind. J. Med. Res. vii, p. 711 (1920).

Anopheles maculipennis var., Barraud, Bull. Ent. Res. xi, p. 389 (1921).

Differs from *A. maculipennis* as follows: No trace of a pale spot in the fringe at the tip of the wing, the fringe being uniformly dark. Dark spots at the bases of the fork-cells and at cross-veins very poorly developed, often hardly perceptible, especially in the male. White frontal tuft small, rather inconspicuous. General coloration of the body rather lighter than in *A. maculipennis*, the sides of the scutum not any darker than the middle. Male hypopygium apparently identical with that of *A. maculipennis* in structure, but the ninth tergite less strongly chitinised relatively to the rest of the organs. Egg without lateral float-cells, evenly fringed all round as in *A. plumbeus*, but resembling *A. maculipennis* in its more elongate shape.

Larva apparently identical with that of *A. maculipennis*.

Type, a male in the British Museum reared from larva taken in marsh at Kishon, Palestine (Capt. P. J. Barraud).

The credit for the recognition of this species belongs to Major Christophers, who was the first to obtain the eggs. These are so different from those of *A. maculipennis* that it is impossible to regard the two forms as varieties of one species, notwithstanding the identity of the larvae and the close similarity between the adults. Major Christophers' observation has been amply confirmed by Capt. Barraud, who reared the species in Palestine, and presented material of all stages to the British Museum.

Distribution.—Mesopotamia (Christophers); Palestine (Barraud); Syria (Barraud); Macedonia (Waterston); Cyprus (Dr. G. A. Williamson); Transcaspia (Amudaria, C. Ahnger, in coll. Helsingfors Mus.); West Caspian (Adzikabul, near Baku, per Col. Wenyon); Steiermark (Admont, Strobl.; in coll. L. Oldenberg); W. Persia (Quritu, H. E. Shortt).

In Palestine, Lower Mesopotamia and Transcaspia this species entirely replaces *A. maculipennis*, but in Macedonia the two occur together. *A. elutus* appears to be absent from Central and Northern Europe.

6. *Anopheles* (*Anopheles*) *lindesayi*, Giles.

Anopheles lindesayi, Giles, Gnats, p. 166 (1900).

A very well-marked species, with no close ally, unless the Japanese and Formosan forms are regarded as distinct. In several respects it is intermediate between the *Anopheles* and *Myzorhynchus* groups; the transition is perhaps made more complete by *A. gigas*.

A. lindesayi is usually found at high altitudes and breeds in mountain streams.

According to Christophers' description and figure the ninth tergite of the male hypopygium is broad and shield-like, but in the Japanese male I have examined it has the usual narrow form, a narrow, curved strip, the ends being pushed out but

not forming definite processes. This may perhaps indicate a specific difference from the Indian form, though I cannot find any other characters in the adult to support such a conclusion.

This is possibly the so-called new species recently recorded (but not named) from Japan (see Tropical Diseases Bulletin, xvi, 1920, p. 106).

Distribution.—Mountains of India; Formosa (*Koidzumi*); Japan (Nagasaki, *Lamborn*).

7. *Anopheles* (*Anopheles*) *punctibasis*, sp. n.

Closely related to *A. hyrcanus* (Pall.), but differs in the following particulars:—Average size somewhat larger (σ 4.5 mm., ♀ 5.5 mm. in length of wing); wings more distinctly mottled in naked-eye appearance than in the most brightly-marked *A. hyrcanus*. Antennae slightly but distinctly more slender than those of *A. hyrcanus* except for the first joint, which is distinctly stouter. Scales of antennae light brown and confined to the torus and the first two flagellar joints (in *A. hyrcanus* they are white and extend to the fourth or fifth flagellar joints). Palpi normally entirely black-scaled. All the tibiae, the first three joints of the front and middle tarsi, and the first four joints of the hind tarsi, narrowly but distinctly whitish-ochreous at the base as well as at the tip. A white dot at the extreme base of the costa, and a second immediately beyond the humeral cross-vein. Dark and light areas on veins sharply defined, no intermixture of light and dark scales except to a very slight extent on the third vein. Processes of ninth tergite of male hypopygium very short and broad, almost semicircular in form (hypopygium otherwise much like that of *A. hyrcanus*).

Distribution.—Japan: Nagasaki, 8-19.v.1921, 2 σ (including type), 5 ♀ reared from pupae found in a muddy shaded pool in company with *Culex hayashi* Yokohama, vi.1921, 1 ♀ reared from larva (*Dr. W. A. Lamborn*).

The sum of the characters enumerated above seems to be quite sufficient to distinguish this form specifically from *A. hyrcanus*, though the close relationship is evident. The black-scaled palpi at first sight afford an easy means of distinction, but the Yokohama specimen has narrow white rings at the articulations and a distinct white tip to the last joint.

8. *Anopheles* (*Anopheles*) *hyrcanus*, Pallas (fig. 2, f).

Culex hyrcanus, Pallas, Reise durch versch. Prov. d. Russ. Reichs. i, p. 475 (1771).

Anopheles sinensis, Wiedemann, Aussereurop. zweifl. Ins. i, p. 547 (1828).

Anopheles pictus, Loew, Dipt. Beitr. i, p. 4 (1845).

Anopheles pseudopictus, Grassi, Atti R. Acc. Lincei, Rendic. viii, 1, p. 102 (1899).

Anopheles sinensis var. *mesopotamiae*, Christophers, Ind. J. Med. Res. iii, p. 196 (1916).

Easily distinguished from all other species in the Palaearctic fauna, except *A. punctibasis* and *A. mauritanus*, by the distinctly swollen front femora. This character was pointed out by Loew in his description of *A. pictus*, and together with the shaggily-scaled female palpi forms the best distinguishing mark of the *Myzorhynchus* group, the character of the ventral scale-tuft, on which the group was originally founded, being quite unreliable. The relation with the *Anopheles* group (in the strict sense) is however, obviously close; there is no definable difference in the larvae or hypopygia, and the colour differences are bridged by such species as *A. gigas*. I therefore do not admit *Myzorhynchus* as a distinct subgenus.

A. hyrcanus is a variable species in many respects, and shows a strong tendency to the production of local races. In the Oriental region some of these may be said to have reached specific differentiation (e.g., *A. separatus*, Leic.), but this can hardly be said of the Palaearctic forms, at least with our present knowledge of them.

Christophers seems inclined to distinguish the var. *mesopotamiae* on account of a slight difference in the shape of the processes of the ninth tergite of the male hypopygium, but this distinction is no more constant than the colour characters which he adduces to separate *mesopotamiae* from *hyrcanus*. The form inhabiting Japan and Eastern Siberia has the wing-markings blurred somewhat as in the var. *mesopotamiae*, but the general coloration is much darker. The var. *pseudopictus* is at first sight sharply distinguished by its pale fourth hind tarsal joint (one Macedonian example has the third joint also broadly white at the tip), but the paleness in some specimens is only visible in certain lights, and there appears to be no other distinction between the two forms. The fifth hind tarsal joint in *pseudopictus* remains dark, but in Swellengrebel's *argyropus* from Sumatra both the fourth and the fifth joints are white; this condition seems to have been developed independently in *argyropus* and *mauritanus*, and, if so, *argyropus* should perhaps be regarded as an extreme form of *hyrcanus* rather than as an Oriental form of *mauritanus*.

A. hyrcanus is found chiefly in large marshes, especially near the sea. The larva has been described by Joyeux.

Distribution.—North Mediterranean coast from the Rhone delta to the Levant, and across Central Asia from the Black Sea coasts to Japan; also (in a darker variety) throughout the Oriental region. The var. *mesopotamiae* appears to be confined to the region at the head of the Persian Gulf; the var. *pseudopictus* has been found in Italy (*Grassi*); Macedonia (*Waterston*); Danube delta (*Leon*); Transcaspia (*Tedjen*, *C. Ahnger*).

9. *Anopheles mauritanus*, Grp.

Anopheles mauritanus, Grandpré, Planters' Gazette Press (1900).

Anopheles paludis, Theobald, Royal Soc., Rept. Malaria Com. p. 75 (6th July, 1900).

This is the African representative of *A. hyrcanus*, from which it differs almost solely in the generally blacker colour and the white tip of the hind tarsus. The range of variation of the two forms is, however, quite distinct, and it is no doubt justifiable to regard them as separate species. Christophers distinguishes the hypopygium from that of *A. hyrcanus* by the absence of leaflets on the aedeagus, but either he was mistaken in his observation or the species is variable in this respect, since delicate leaflets are certainly present in those which I have examined.

Like its ally *A. hyrcanus*, this species lives chiefly in large swamps, especially near coasts, and is a poor carrier of malaria.

Distribution.—Tropical Africa, extending into the Palaearctic region only in the south-eastern Mediterranean, where it occurs in the Nile delta and in the marshes on the Palestine coast (*Barraud*).

Subgenus **Myzomyia** (Blanchard), Christophers.

Ind. Journ. Med. Res. iii, p. 383 (1915).

Adult.—Cross-veins and bases of forks of wing-veins with light scales (except in *A. rhodesiensis*). Costa with four or more pale spots. Male hypopygium with a group of several (4-6) stiff bristles at the base of each side-piece, none of which are borne on tubercles or otherwise differentiated. Prosternal hairs nearly always reduced.

Larva.—Shaft of antenna without a branched hair. Leaflets of palmate hairs generally with long terminal filament. Internal clypeal hairs rather wide apart.

The members of this subgenus, though showing a great total range of ornamental characters, are really all much more closely allied than the species of the subgenus *Anopheles*. The male hypopygia are almost identical throughout the subgenus, the minute distinguishing characters given by Christophers being in some

cases of very uncertain value; the species most easily recognisable as regards hypopygial structure are those (*pulcherrimus*, *multicolor*) which have no leaflets on the aedoeagus, but it is impossible to consider a common lack of these structures as indicating relationship. The larvae also are extremely similar and difficult to distinguish.

Adults.

- | | |
|---|---|
| 1. Abdomen densely scaly; the scales forming lateral tufts on each segment; last hind tarsal joint white; female palpi shaggily scaled .. | 2 |
| Abdomen without lateral scale-tufts; last hind tarsal joint dark; female palpi with most of the scales appressed | 3 |
| 2. Fourth hind tarsal joint all white | <i>pulcherrimus</i> , Theo. |
| Fourth hind tarsal joint mostly dark | <i>pharoensis</i> , Theo. |
| 3. Femora and tibiae pale-spotted | 4 |
| Femora and tibiae not pale-spotted; abdomen without scales | 5 |
| 4. Abdomen scaly almost to the base | <i>stephensi</i> , Liston. |
| Abdomen without scales, except on cerci | <i>costalis</i> , Theo. |
| 5. Pale wing-markings confined to costa and first vein | <i>rhodesiensis</i> , Theo. |
| Pale markings on all wing-veins | 6 |
| 6. Tip of last palpal joint white-scaled | 7 |
| Tip of last palpal joint black-scaled | 8 |
| 7. Thorax with hairs only; last two white rings of female palpi quite narrow | <i>sergenti</i> , Theo. |
| Thorax with narrow scales as well as hairs; last two white rings of female palpi rather broad | <i>superpictus</i> , Grassi. |
| 8. Thorax with hairs only; male aedoeagus with leaflets | (<i>turkhudi</i> , Theo.), <i>hispaniola</i> , Theo. |
| Sides of mesonotum with distinct narrow scales | 9 |
| 9. Male aedoeagus with leaflets | <i>turkhudi</i> var. <i>persicus</i> , n. |
| Male aedoeagus without leaflets | <i>multicolor</i> , Camb. |

Larvae.

- | | |
|---|---|
| 1. Outer clypeal hair branched | 2 |
| Outer clypeal hair simple | 3 |
| 2. Palmate tufts on abdominal segments i-vii; outer clypeal hair thickly branched | <i>pharoensis</i> , Theo. |
| Palmate tufts on abdominal segments iii-vii; outer clypeal hair less branched | <i>pulcherrimus</i> , Theo. |
| 3. A rudimentary palmate tuft on first abdominal segment | <i>costalis</i> , Theo.; <i>rhodesiensis</i> , Theo. |
| This tuft absent | 4 |
| 4. Posterior clypeal hair short; innermost shoulder-hair much branched | <i>stephensi</i> , Liston. |
| Posterior clypeal hair long | 5 |
| 5. Innermost shoulder-hair much branched, plumose | <i>superpictus</i> , Grassi. |
| Innermost shoulder-hair slightly branched towards tip | <i>multicolor</i> , Camb.; ? <i>hispaniola</i> , Theo.; ? <i>turkhudi</i> , Theo. |

Good distinctions between some of the above larvae have yet to be discovered; possibly some may be found in the markings of the head. The larvae of *A. rhodesiensis*, *A. hispaniola* and *A. turkhudi* have not been fully described, and the British Museum does not possess sufficient material from which to supplement the descriptions.

10. **Anopheles (Myzomyia) pulcherrimus**, Theo. (fig. 2, g).

Anopheles pulcherrimus, Theobald, Proc. R. Soc. Ixix, p. 369 (1902).

A very well-marked species, easily distinguished from all others in the Palaearctic fauna, except *A. pharoensis*, by having the abdomen densely covered with broad flat scales, rather loosely applied and forming distinct lateral tufts. The front femora are slightly swollen near the base, and in this point, as well as in the shaggily scaled female palpi, *A. pulcherrimus* and *A. pharoensis* seem to show some approach to *A. hyrcanus*; but the type of wing-markings and the structure of the male hypopygium are typical of the subgenus *Myzomyia*.

The early stages have been described by Vassiliev.

Distribution.—Semi-arid regions of south-western Asia, from Turkestan and the Punjab to Lower Mesopotamia.

11. **Anopheles (Myzomyia) pharoensis**, Theo.

Anopheles pharoensis, Theobald, Mon. Cul. i, p. 169 (1901).

Anopheles maculicosta, Becker, Mitt. Zool. Mus. Berlin, ii, p. 69 (1903).

Very similar to *A. pulcherrimus*, but is somewhat larger and has a broad dark ring on the fourth hind tarsal joint; usually also there is a pair of conspicuous black spots about the middle of the mesonotum, which are not seen in *A. pulcherrimus*. In both species the wing-membrane is deeply stained in the areas occupied by the main patches of dark scales. A similar condition is seen in some American species, and to some extent discounts Christophers' theory that all the pale markings of *Anopheles* wings arose by bleaching from a primitive, uniformly dark condition.

Distribution.—Essentially an Ethiopian species, being widely spread, though not common, in tropical Africa, and occurring in Madagascar. Common in Lower Egypt, and occurring rarely in Palestine (*Barraud*).

12. **Anopheles (Myzomyia) stephensi**, Liston (fig. 2, h).

Anopheles stephensi, Liston, Ind. Med. Gaz. xxxvi (1901); Christophers, Ind. J. Med. Res. iii, p. 481 (1916).

The femora and tibiae are conspicuously spotted with white, and the abdomen is almost covered with scales; the scales are narrow, and less dense than those of *A. pharoensis* and *A. pulcherrimus*, and never form lateral tufts. None of the allied Oriental or Ethiopian species (*A. maculatus*, *A. willmori*, *A. maculipalpis*, *A. theobaldi*, etc.) appear to have occurred within the area under discussion, and *A. stephensi* need not therefore be compared with them for our present purpose.

Distribution.—An Indian species occurring in a localised area round Basra, at the head of the Persian Gulf (*Barraud* and *Christophers*).

13. **Anopheles (Myzomyia) costalis**, Theobald (fig. 2, i).

Anopheles costalis, Theobald, Mon. Cul. i, p. 157 (1901).

? *Anopheles costalis*, Loew, Berlin. ent. Zeitschr., x, p. 55 (1886).

Anopheles arabiensis, Patton, J. Bombay Nat. Hist. Soc. xvi, p. 625 (1905).

The spots on the femora and tibiae vary in number and intensity, but are always present, and together with the absence of abdominal scales render the species an easy one to identify when Palaearctic forms alone are considered. The female palpi have three whitish rings, the terminal one broad and including the whole of the last joint.

I am informed by Dr. Enderlein that Loew's type of *A. costalis* is not now in his collection in the Berlin Zoological Museum.

Distribution.—Essentially an Ethiopian species, throughout which region it is abundant. I only include it among the Palaearctic species on the strength of a single female in the Paris Museum captured in Algeria (locality not noted) by M. E. Roubaud. It does not appear to have been recorded from Egypt, though there seems no reason why it should not spread there from the south.

14. **Anopheles (Myzomyia) rhodesiensis**, Theo. (fig. 2, j).

Anopheles rhodesiensis, Theobald, Mon. Cul. i, p. 184 (1901).

Anopheles d'thali, Patton, J. Bombay Nat. Hist. Soc. xvi, p. 627 (1905).

This species could not be confused with any other in the Palaearctic fauna, although the darkest varieties of the African *A. funestus* approach it rather closely. A detailed description has been given by Christophers (1915), who records it from Arabia, Baluchistan and Quetta. Its occurrence in Baluchistan is the only reason for including it in this paper. It occurs also in widely separated parts of tropical Africa.

15. **Anopheles (Myzomyia) superpictus**, Grassi (fig. 3).

Anopheles superpictus, Grassi, Reale Accad. Lincei., p. 78 (1900).

Pyretophorus palestinensis, Theobald, Mon. Cul. iii, p. 71 (1903).

Pyretophorus nursci, Theobald, Mon. Cul. iv, p. 66 (1907).

Pyretophorus cardamitisi, Newstead & Carter, Ann. Trop. Med. iv, p. 379 (1910).

Anopheles superpictus var. *macedoniensis*, Cot & Hovasse, Bull. Soc. Path. Exot. x, p. 890 (1917).

Distinguished from the nearly allied *A. multicolor* by the broad white tips to the female palpi. In both species the scutum bears distinct scales, at least at the sides. The wing markings of *A. superpictus* are very variable, the pale costal spots being sometimes much reduced. According to Ficalbi the tarsi are faintly ringed with

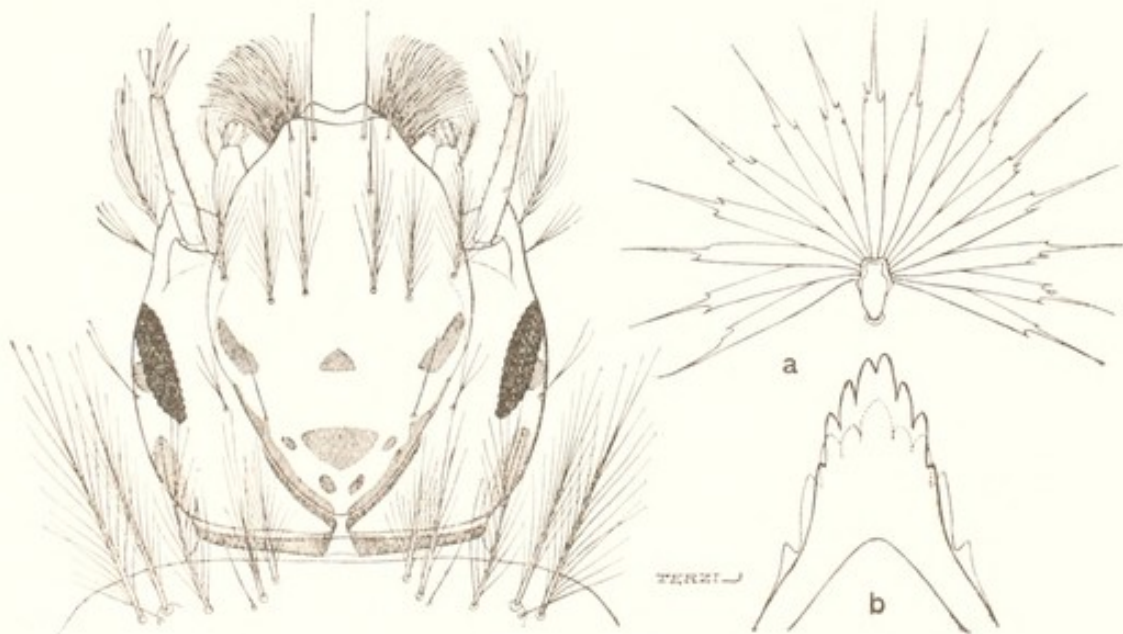


Fig. 3. Larva of *Anopheles superpictus*, Grassi: a, palmate tuft; b, mentum.

pale at the joints, when viewed through a lens. This is certainly true of a few of the specimens I have examined, but the majority have the tarsi entirely dark. I think, however, that there is no doubt that *A. superpictus* and *A. palestinensis* are the same species.

The larva has not been fully described. It may be diagnosed as follows:—Antennae with a minute single hair before the middle. Frontal hairs all simple, and all about equal in length, the inner anterior pair widely separated, the posterior pair almost immediately behind the inner anterior. Head markings fairly constant, arranged as in the figure, the spots small. Innermost shoulder hair plumose from base to tip, the hair next to it also plumose, but longer and with fewer branches. No rudimentary palmate hairs on thorax or on first abdominal segment; a pair of small ones on the second segment, and fully developed pairs on segments 3-7; each fully developed hair has about 16 leaflets, which are lanceolate, with two or three jags beyond the middle, forming a rather indefinite shoulder; terminal portion long, but not nearly as long as the basal. No difference could be detected between Macedonian and Indian specimens.

The species is said to be associated with mountainous districts, though by no means confined to high altitudes, and to be largely a stream-breeder.

Distribution.—Eastern Mediterranean region, from Italy to Macedonia and Palestine; thence through Upper Mesopotamia and Persia to the Punjab. Also recorded from North Africa, though I have seen no specimens from there. Transcaspia (Firudza, *C. Ahnger*).

16. *Anopheles (Myzomyia) sergenti*, Theo.

Pyretophorus sergenti, Theobald, Mon. Cul. iv, p. 68 (1907).

This species very much resembles *A. superpictus*, but is rather smaller, and differs as indicated in the key. I have previously considered it identical with the Indian *A. culicifacies*, but whereas in *A. sergenti* there are four or five pale spots in the wing-fringe, in *A. culicifacies* there is never more than one. *A. sergenti* might equally well be regarded as a variety of the African *A. funestus*, which has several pale fringe-spots, but is much darker in general coloration, and has the third vein much less extensively pale. Detailed comparisons of these three species in all their stages are necessary before final conclusions can be reached as to their exact relationships.

Distribution.—Algeria (*Sergent*); Tunis (Tamerza, *Dr. M. Langeron*); Palestine (*Annandale, Barraud*).

17. *Anopheles (Myzomyia) hispaniola*, Theobald (fig. 2, m).

Myzomyia hispaniola, Theobald, Mon. Cul. iii, p. 49 (1903).

Pyretophorus myzomyfacies, Theobald, Mon. Cul. iv, p. 69 (1907).

Apparently only differs (in the adult) from *A. multicolor* in having leaflets present on the male aedoeagus, and hairs instead of narrow scales on the scutum; according to *Sergent & Foley* the eggs of the two species are remarkably distinct. The wing-markings of both species (especially *A. multicolor*) are so variable that no constant difference can be found between them. *A. hispaniola* is quite indistinguishable, so far as I can see, from the Indian *A. turkhudi* in the adult state. The egg of *A. hispaniola* as figured by *Sergent* is, however, so different from that of *A. turkhudi* as figured by *Christophers* that, unless a mistake has been made by either author, it is impossible to regard the two as conspecific, especially as they are widely discontinuous in their distribution. The larvae also differ, according to the published descriptions, in the number of pairs of palmate hairs present; but this requires confirmation, since the figure given by *James and Liston* is inconsistent with their description.

This species is apparently much less fond of desert conditions and saline water than *A. multicolor*.

Distribution.—S. Spain (*Macdonald*); Algeria (*Sergent*); S. Tunis (Tamerza, *Dr. M. Langeron*). Does not appear to occur in Egypt or Palestine.

References.—*Sergent* (Ed. & Et.), *Ann. Inst. Pasteur*, xix, 1905, p. 144; xx, 1908, p. 393.

18. *Anopheles* (*Myzomyia*) *turkhudi* var. *persicus*, nov.

The type male of *A. turkhudi* has no scales on the scutum, and has distinct leaflets on the aedeagus. The same is true of all specimens I have seen from the Punjab, but a number sent me by Christophers from East Persia show distinct scales on the scutum, and are in fact indistinguishable externally from *A. multicolor*. They can hardly be that species, however, since the male aedeagus bears distinct leaflets, as in *A. turkhudi* and *A. hispaniola*. Provisionally, therefore, I regard them as representing a distinct variety of *A. turkhudi*, which inhabits adjacent areas in the Punjab. The real relationships of all these forms can only be determined by a close study of their habits, early stages and distribution, and the early stages of this Persian form are not yet recorded.

19. *Anopheles* (*Myzomyia*) *multicolor*, Camb. (fig. 2, k).

Anopheles multicolor, Camboulin, C. R. Acad. Sci. cxxxv, p. 704 (1902).

Pyretophorus chaudoyei, Theobald, Mon. Cul. iii, p. 68 (1903).

Pyretophorus cleopatrae, Willcocks (*nom. nud.*).

Anopheles impunctus, Dönitz, Zeitschr. f. Hygiene, xli, p. 67 (1902).

The adult does not differ appreciably from *A. hispaniola* and *A. turkhudi* except in having scales on the mesonotum (these scales, however, varying in number, width, and distinctness), and in the entire lack of leaflets on the male aedeagus. *A. superpictus* has a similar thoracic ornamentation, but can easily be distinguished by its white-tipped palpi. Egyptian specimens commonly have the wings more extensively dark than those from Algeria, but, on the other hand, it is almost certain that Dönitz's *A. impunctus*, described from an abnormally pale specimen, is only a variety of this species.

The larva has been fully described by Foley (1912) and Langeron (1918). According to Langeron's figures the innermost shoulder-hair is only trifid at the tip, but in a number of specimens he has sent me from Tozeur, as well as in some skins sent by Capt. Barraud from Palestine, it is branched almost from the base and somewhat plumose. The head of the larva is extremely dark, the usual markings being all fused in most specimens into a large black patch which occupies the greater part of the head, leaving the front of the clypeus yellowish. The lower surface of the head, as well as the upper, is mainly blackish.

The egg as described and figured by Foley (reproduced in fig. 2, k) is very distinctive, and quite unlike that of *A. hispaniola* or *A. turkhudi*. The species is said to breed in highly saline desert pools, or in brackish water near the sea.

Distribution.—Desert regions of North Africa from Southern Algeria to Egypt; Palestine; Teneriffe. Not certainly known from further east or north.

Tribe CULICINI.

I propose to revert to the old classification of mosquitos, and recognise only two tribes, the ANOPHELINI and CULICINI, including in the latter the MEGARHININI and SABETHINI. I am now convinced that Howard, Dyar and Knab were right in including *Megarhinus* in the CULICINI and placing it somewhere near *Psorophora*; the modifications of the adults, though striking, are not fundamentally important. On the other hand, I am equally convinced that the tribe SABETHINI cannot be maintained. Every character on which it has been attempted to define it breaks

down at some point or other. The character finally adopted by Howard, Dyar and Knab, that of the head bristles, is not indicated in *Érétmopodites*, which is unquestionably a Sabethine genus, while it is shown in some Culicine genera, notably *Megarhinus*. There is, no doubt, a group of genera (or more probably two or three independent groups) which are more closely related to one another than to other Culicines, but in adult structure there is certainly no hard and fast line to be drawn. In regard to the absence of the anal brush of the larva, which is the one common and outstanding feature of all SABETHINI, Colonel Alcock has suggested to me (I consider with great plausibility) that this may be an adaptive character, and therefore not necessarily indicative of relationship. As he points out, larvae living in small confined spaces, as do almost all of the SABETHINI, would not require the anal brush for swimming; and as it is absent in the first stage, there seems no reason whatever why its development should be proceeded with in the later stages. In confirmation of this view, it may be remembered that some of those species of *Aedes* (*Stegomyia*) which live in small collections of water have the brush much less developed than in the free-living forms.

The ancestral form probably had pulvilli and spiracular bristles, narrow scales, and a non-carnivorous larva; partaking thus of some of the characters of *Theobaldia* and *Lutzia*; no such form is known, however.

Table of Genera of Palaearctic Culicine Mosquitos.

Adults.

1. Vein A_n (6th) ending below or a little before the level of the base of R_2 (2nd); no microtrichia on wing-membrane	<i>Uranotaenia.</i>
Vein A_n ending well beyond the level of the base of R_2 ; wing membrane with microtrichia	2
2. Pulvilli absent	3
Pulvilli present	9
3. Spiracular bristles present	4
Spiracular bristles absent	6
4. Proboscis slender, flexible, as long as the whole body; one pro-epimeral bristle (or none); no sternopleural bristles	<i>Rachionotomyia.</i>
Proboscis otherwise; sternopleural bristles present	5
5. Proboscis rigid, hooked; no pro-epimeral bristles; cell R_2 extremely short; a V-shaped thickening of the wing-membrane between veins Cu_1 and Cu_2 (forks of 5th)	<i>Megarhinus.</i>
Proboscis flexible, straight in repose; several pro-epimeral bristles; cell R_2 long; no V-shaped thickening of wing-membrane	<i>Theobaldia.</i>
6. Two pro-epimeral bristles	<i>Orthopodomyia.</i>
Several (about 5) pro-epimeral bristles	7
7. No post-spiracular bristles; female claws simple	<i>Taeniorhynchus</i> (subgenus <i>Coquillettidia</i>).
At least a few small post-spiracular bristles present; female claws nearly always toothed	8
8. Proboscis not very stout, straight or curved upwards in repose	<i>Aedes.</i>
Proboscis stout, apparently (from dry specimens) curved downwards in repose	<i>Armigeres.</i>
9. Lower mesepimeral bristles numerous	<i>Lutzia.</i>
Normally one lower mesepimeral bristle; often none, but very rarely two or three	<i>Culex.</i>

Larvae.

- | | |
|--|------------------------|
| 1. Anal brush and barred area absent; thorax with a strong spine at each posterior corner | <i>Rachionotomyia.</i> |
| Anal brush and barred area present (except in first stage) | 2 |
| 2. Siphon with one pair of ventral tufts | 3 |
| Siphon with several ventral tufts | 9 |
| 3. Siphonal tuft at or near base | 4 |
| Siphonal tuft near middle, or beyond | 5 |
| 4. Mouth-parts modified for predacity; a chitinous plate on each side of eighth segment; body colour dark reddish | <i>Megarhinus.</i> |
| Mouth-parts not modified for predacity; a patch of scales on each side of eighth segment; body colour not reddish | <i>Theobaldia.</i> |
| 5. Pecten teeth rounded and fringed apically; a chitinous plate on each side of eighth segment (in fourth stage only) in addition to the comb | <i>Uranotaenia.</i> |
| Pecten teeth (when present) sharply pointed, with denticles on one side; eighth segment with comb or patch of scales | 6 |
| 6. Valves of siphon and tracheal system highly modified for subaquatic respiration | <i>Taeniorhynchus.</i> |
| Valves of siphon and tracheal system not specially modified | 7 |
| 7. Extremely long single hairs on thorax and abdomen, besides long hair tufts; dorsal chitinous plates on segments 6-8 in the fourth stage; colour reddish | <i>Orthopodomyia.</i> |
| Single hairs not longer than the moderate tufts; no dorsal chitinous plates on segments 6-8; colour not reddish | 8 |
| 8. Pecten present | <i>Aedes.</i> |
| Pecten absent | <i>Armigeres.</i> |
| 9. Mouth-parts modified for predacity; anal segment long and pointed | <i>Lutzia.</i> |
| Mouth-parts not modified; anal segment shorter and less pointed | <i>Culex.</i> |

Genus *Uranotaenia*, Arrib.

Most writers have distinguished this genus mainly by the short upper fork-cell (cell R_2), but while this is a sufficient distinction in the majority of cases, there are a few species (*e.g.*, *U. unguiculata*) in which the shortening of this cell is not very noticeable, and, on the other hand, some species of the *Aedes* group have the cell so short that they have been mistaken for species of *Uranotaenia*. A more absolutely diagnostic character, though requiring a high magnification for its detection, is the absence in all known species of the genus of microtrichia on the wing-membrane. This distinguishes *Uranotaenia* sharply from all other CULICIDAE. The short anal vein, ending below or before the base of the radial sector, is shown also by the tropical genera *Hodgesia* and *Harpagomyia*. In all known species except *U. unguiculata* the front claws of the male are small and equal in length. The pleural bristles are very much reduced in number, there being only one or two in each of the pronotal, pro-epimeral, spiracular and pre-alar series.

The larva is not very sharply distinguished from that of *Aedes*, except in the fourth stage, when the characteristic lateral chitinous plates appear on the eighth abdominal segment. The spine-like frontal hairs found in many species are represented by normal simple hairs in others (*e.g.*, *U. unguiculata*). The form of the pecten-teeth is characteristic. The resting position in the water is almost horizontal.

The genus is tropicopolitan, but two species occur within the limits of the Palaearctic region.

1. *U. unguiculata*, Edw.

Uranotaenia unguiculata, Edwards, J. Proc. Asiatic. (Soc.) Bengal, ix, p. 51 (1913).

A line of pale blue flat scales passes round the margin of the mesonotum from wing-base to neck. The front claws of the male are unequal, the larger one with a small tooth.

The larva has been described by Joyeux.

Distribution.—Eastern Mediterranean region. Originally described from North Palestine, it has since been found in Jerusalem (*Goldberg*), Egypt (*Gough*), Macedonia (*Waterston, Joyeux*), and Italy (*Hargreaves*), but is always rare.

2. *U. bimaculata*, Leicester.

Uranotaenia bimaculata, Leicester, Cul. of Malaya, p. 226 (1908).

There is no line of flat scales on the margin of the mesonotum, but just in front of each wing-base is a large oval velvet-black spot on the integument. The front claws of the male are normal for the genus, small, equal and simple.

The larva is not yet described.

Distribution.—Japan (Tokio, *S. Yamada*); Malay Peninsula (*Leicester*). There is also a representative species (*U. mashonaensis*, Theo., = *U. bimaculata*, Theo.) in tropical Africa, which scarcely differs from the Oriental form. Should the two be united, the species must be known as *U. mashonaensis*, Theo.

Genus *Rachionomyia* (Theo.) Edw.

This genus has never been fully described. I would define it as follows:—

Proboscis slender throughout; longer than the long front femora, and as long as the whole body. Mouth-parts normal; maxillary teeth very small. Palpi short in both sexes, not more than one-sixth as long as the proboscis. Female antennae slender, the verticils about four times as long as the joints; male antennae with shorter joints (except the last two) and longer verticils. Eyes practically touching above the antennae, the supra-antennal portion broad. A pair of strong bristles, placed close together, projecting forwards from immediately above the line of contact of the eyes; far away from these bristles are two other smaller ones on each side of the head. Prothoracic lobes well separated. Mesonotum with or without well-developed dorso-central bristles. One pro-epimeral bristle (even this is absent in some species). Several (3-6) spiracular bristles. No postspiracular bristles; no row of bristles on the upper part of the sternopleura; no lower meso-epimeral bristles. Sub-alar knob small, with few bristles. Postnotum bare, with a pair of slight furrows dividing it into three portions. Last segment of female abdomen blunt, very bristly. Male hypopygium: Lobes of ninth tergite elongate, with long apical bristles; side-pieces rather short, with conical, bristly claspette lobes; clasper long, terminal, with small thick terminal claw; tenth sternites split apically into several short, tergally projecting teeth, in a longitudinal row; aedeagus very small, a simple, incomplete tube, with small parameres and sometimes apparently with some internal spines. Hind tibiae somewhat shorter than the others. Female claws simple; front claws of male unequal. Pulvilli absent. Wing-membrane with distinct microtrichia. R_5 somewhat longer than R_{2+3} ; fork-cells moderately long; anal vein reaching well beyond the level of the base of R_5 .

Larva (description based on a comparison of three Oriental species): Antennae short, smooth, apparently without hair on shaft. Clypeal hairs very small, simple. Posterior corners of metathorax with a long strong spine situated on a chitinous plate, without any accompanying long hairs; a similar but smaller spine towards each side of the mesothorax. First seven abdominal segments with seven pairs of strong stellate tufts (three dorsal, two lateral, two ventral). Thorax and first six

abdominal segments with long, lateral plumose hairs. Comb of eighth segment a row of stout spines, sometimes attached to a plate. Anal plate bears a comb of a few short spines. Siphon moderate, with sparse latero-ventral pecten and numerous hair-tufts or single hairs. Pupal paddles small, somewhat pointed, without fringe or terminal hair. Habitat: pitcher plants, bamboos, etc.

The genus is characteristic of the Oriental and Australasian regions, one species occurring in Japan.

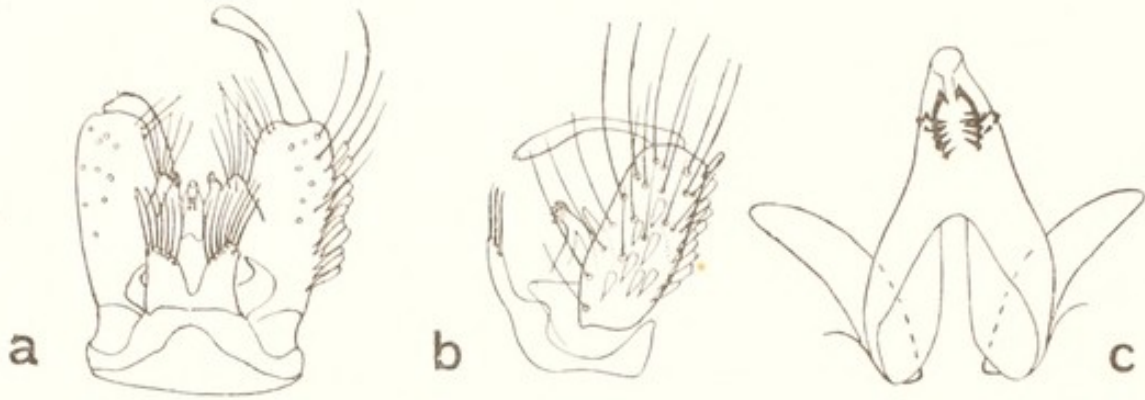


Fig. 4. Male hypopygium of *Rachionotomyia bambusa*, Yam.: a, ventral view, x75; b, lateral view, x75; c, aedeagus, ventral view, x225.

***Rachionotomyia bambusa*, Yamada (fig. 4).**

Rachionotomyia bambusa, Yamada, Dobutz. Z. Tokio, xxix, pp. 61-72 (1917).

This belongs to the rather numerous group of species with metallic silvery markings on the pleura and abdomen, and silvery spots on the femora. The chief diagnostic characters are as follows:—Head with a broad blue band in front. Prothoracic lobes with black scales. Pro-epimera with a few narrow black scales and one bristle. Mesonotum almost entirely dark brown, with long, straight, very narrow greenish-black scales. Scutellar scales broad, greenish black. Integument of pleurae mainly dark brown. Larger claw of front legs of male thick, with a pointed swelling, scarcely a tooth, beyond the middle. Lobes of ninth tergite of male each with about nine long, rather stout bristles.

I have not seen Yamada's description of the larva, and have had no specimens for examination.

Distribution.—Japan (Tokio, S. Yamada; Kofou, L. Drouard de Lezey).

Genus **Megarhinus**, R.D.

I now feel strongly inclined to accept the view of Howard, Dyar and Knab that *Toxorhynchites* should not be separated from *Megarhinus*, except as a rather weakly-marked subgenus. There are no important structural differences whatever, *Toxorhynchites* differing only in the shorter female palpi.

As Banks has pointed out, the labium in this genus is a rigid organ, and the structure of its apical part is apparently such as to prevent the possibility of the mouth-parts being used for sucking blood.

The pleural bristles in this genus are remarkable; there appear to be no true pro-epimeral bristles, but, on the other hand, a row of strong spiracular bristles is developed; there are no post-spiracular bristles, and the only bristles on the prothoracic lobes are a few which point forwards or downwards. There are only two pairs of ocular bristles instead of the usual row. The reduction of the mesonotal bristles has been remarked on by previous writers.

The presence of spiracular bristles, the close similarity in the male hypopygium, and the basally situated siphon-tuft of the larva, are points which seem to indicate some connection, distant no doubt, with *Theobaldia*, a connection which would not be suspected on a superficial examination.

The species of this genus often have very specialised habits, and these have a restricted distribution. Two species have already been recorded from the Palaearctic region; what is probably a third exists in south-east Europe.

1. *Megarhinus christophi*, Portch.

Megarhinus christophi, Portchinsky, Horae Soc. Ent. Ross. xviii, p. 122 (1884).

I do not know this species. According to Portchinsky's description it differs from *M. towadensis* in having silvery transverse bands on each of the first six abdominal segments and yellow lateral hairs on the sixth segment.

Distribution.—Amur (*Portchinsky*).

2. *Megarhinus towadensis*, Mats.

Megarhina towadensis, Matsumura, Thousand Insects of Japan, Add. ii, p. 445 (1916).

This is very much like the common Oriental *M. regius* (Tennent), but there are differences, evidently of specific value. The only specimen I have seen is one sent for determination from the Paris Museum by M. Séguy. This agrees with Matsumura's description, except that the narrow white ring on the first joint of the middle tarsus is close to but not at the base (the front legs are missing). The thorax is much rubbed, but the remaining mesonotal scales are metallic emerald green, quite unlike the dull scales of *M. regius*. The abdominal tuft is large and conspicuous, the long hair on the sixth and seventh segments black, on the eighth segment orange. The venter is mainly shining blue, but there are lateral yellow patches on sternites two, three and six, and sublateral, elongate yellow triangles on sternites four and five.

Distribution.—Japan (Towada, *Matsumura*; Kofou, *L. Drouart de Lezey*, 1906).

3. *Megarhinus* sp.

It is necessary to mention here a *Megarhinus* larva which was obtained near Karasouli, Macedonia, by Capt. Waterston.

The specimen was taken with a number of other larvae of different insects which were thought to be preying on mosquito larvae. It was not identified until after the collector's return to England, and no attempt was made at the time to rear it or to obtain others. It differs only in minute characters from the larvae of the African *M. brevipalpis*, the Oriental *M. regius*, and the North American *M. rutilus*, and it is therefore impossible to say whether it belongs to one of these species, or to some other, perhaps undescribed, form.

Genus *Theobaldia*, Neveu-Lemaire.

The two characters on which most writers have based their conception of this genus—the spotted wings and the position of the cross-veins in a straight line or nearly so—are both worthless for purposes of definition. In *T. longiarcolata* and in the subgenus *Culicella* the cross-veins are well separated; while, on the other hand, in *Lutzia vorax* and occasionally in some other species (*e.g.*, *Culex tipuliformis*, *Aedes rusticus*) they are practically in a straight line. The female palpal character on which Neveu-Lemaire founded the genus is of even less value. In one point, however, the adults do seem to be sharply distinguished from most other genera of the tribe CULICINI. This is in the possession, immediately in front of the prothoracic

spiracle, of a row of yellow bristles.* These bristles are quite apart from the usual pro-epimeral bristles, which are present in *Theobaldia* but somewhat reduced in length, their place being largely taken by the spiracular bristles, which are placed in a close-set row on the posterior side of the posterior ridge of the pro-epimeron. As in *Orthopodomyia*, there are no post-spiracular bristles.

The African species, *Leptosomatomyia fraseri*, shows the same pleural and hypopygial characters as *Theobaldia*, and should probably be included here. Apart from this, the genus is practically confined to the temperate regions of the northern hemisphere, three species occurring in the Punjab.

The larvae are sharply distinguished from others in the Palaearctic fauna (except *Megarhinus*) by the basally situated hair-tuft on the siphon.

Three subgenera (*Theobaldia*, *Culicella* and *Allotheobaldia*) are sharply defined by larval structure, but the distinction in the adults is not so clear, and it will therefore be best to tabulate all the species together, while admitting the subgenera as valid. I agree with Brolemann that *Culicella* is not generically separable from *Theobaldia*.

Adults.

- | | | |
|--|------------------------------|---|
| 1. Thorax with rather sharply defined white lines; femora and tibiae striped and spotted; costa largely pale-scaled; male palpi shorter than the proboscis (subgenus <i>Allotheobaldia</i>) | <i>longiareolata</i> , Macq. | |
| Thorax without sharply defined white lines; femora and tibiae not striped; costa all dark; male palpi longer than the proboscis | | 2 |
| 2. Cross-veins in a straight line, or nearly (subgenus <i>Theobaldia</i>) | | 3 |
| Cross-veins well separated; tarsi with narrow pale rings embracing both ends of joints; wings not distinctly spotted (subgenus <i>Culicella</i>) | | 6 |
| 3. Tarsi entirely dark; wings not distinctly spotted | <i>glaphyoptera</i> , Schin. | |
| Tarsi broadly ringed with white at the bases of the joints; wings more distinctly spotted (at least in the female) by accumulation of scales at the bases of the fork-cells and on the cross-veins | | 4 |
| 4. Femora without pale pre-apical ring; hind metatarsi without white ring in the middle | <i>alaskaensis</i> , Ludlow. | |
| Femora with pale pre-apical ring; hind metatarsi with white ring in middle | | 5 |
| 5. Wing-spots distinct; abdomen conspicuously banded with black and white | <i>annulata</i> , Schrank. | |
| Wing-spots indistinct, especially in the male; abdominal scales nearly all ochreous | <i>subochrea</i> , Edw. | |
| 6. First joint of front tarsi of male longer than the remaining joints together; proboscis of female almost entirely black | <i>morsitans</i> , Theo. | |
| First joint of front tarsi of male not longer than the remaining joints together; proboscis of female with many pale scales at the sides and beneath | <i>fumipennis</i> , Steph. | |

Male Hypopygia.

- | | | |
|---|------------------------------|---|
| 1. Ninth tergite with a pair of long processes; aedoeagus remarkably large and complicated | <i>longiareolata</i> , Macq. | |
| Ninth tergite without distinct processes; aedoeagus normal | | 2 |
| 2. Clasper somewhat swollen at the tip; side-piece with a subapical projection bearing a number of long, flattened appendages | <i>glaphyoptera</i> , Schin. | |
| Clasper not swollen at the tip; side-piece otherwise | | 3 |
| 3. Side-piece with a more or less distinct, hairy subapical knob | | 4 |
| Side-piece without subapical knob or agglomeration of hairs | | 5 |

* This character is also possessed by *Megarhinus*, *Psorophora* and some Sabethine genera (e.g., *Rachionotomyia*), but none of these could well be confused with *Theobaldia*.

4. Tip of eighth sternite with a close-set row of short spines *alaskaensis*, Ludlow.
 These spines absent *annulata*, Schrank; *subochrea*, Edw.
5. Side-pieces barely three times as long as their basal width; tip of eighth
 sternite without row of spines *morsitans*, Theo.
 Side-pieces four times as long as their basal width; tip of eighth sternite
 with row of short spines *fumipennis*, Steph.

Larvae.

1. Antennae short, with small hair-tuft or a single hair; siphon short, at
 most three times as long as broad 2
 Antennae long, with large, many-branched tuft; siphon long, at least five
 times as long as broad (subgenus *Culicella*) 3
2. Siphon with 6-10 stout, widely-spaced spines (subgenus *Allotheobaldia*)
longiareolata, Macq.
 Siphon with a well-marked pecten, most of the teeth of which have their
 tips drawn out into long hairs (subgenus *Theobaldia*)
annulata, Schrank; *subochrea*, Edw.
3. Pecten straighter; siphon without accessory spines . . . *morsitans*, Theo.
 Pecten oblique; siphon also with accessory spines . . . *fumipennis*, Steph.

The larvae of *T. glaphyoptera* and *T. alaskaensis* are unknown.

Subgenus **Allotheobaldia**, Brolemann.

1. **Theobaldia (Allotheobaldia) longiareolata** (Macquart).

Culex longiareolatus, Macquart, Dipt. Exot. i, 1, p. 34 (1838).

Culex spathipalpis, Rondani, Bull. Soc. Ent. Ital. iv, p. 31 (1872).

Culex serratipes, Becker, Mitt. Zool. Mus. Berlin, iv, p. 78 (1908).

Culex annulatus var. *maroccanus*, d'Anfreville, Bull. Soc. Path. Exot. ix, p. 140 (1916).

A very distinct species, which could not be confused with any other, either in the adult or larval state. The larva has been fully described by Langeron.

Distribution.—Throughout the Mediterranean region and in most of the Atlantic islands; spreading southwards by East Africa as far as the Cape Province, and eastwards through Transcaspia, Mesopotamia and Persia to the Punjab. In France it has been taken as far north as Rambouillet (*Villeneuve*), but it appears to be otherwise unknown in central and northern Europe. Some new records are: Transcaspia (Askhabad, Firudza, Vrefskaja, *Ahnger*); Scistan (*Annandale*).

Subgenus **Theobaldia**, Neveu-Lemaire.

2. **Theobaldia (Theobaldia) glaphyoptera** (Schiner).

Culex glaphyopterus, Schiner, Fauna Austriaca, ii, p. 628 (1864).

Theobaldia bergrothi, Edwards, Entom. Tidskr. p. 50 (1921).

This was described by Schiner and Ficalbi as having spotted wings, and assuming that these authors' statements indicated a definite spotting such as that of *T. annulata*, I was led to regard the specimens sent me by Drs. Bergroth and Frey as a distinct new species. Later, however, I received a series of specimens from the Vienna Museum, including some of Schiner's original series, and these showed that the spotting of the wings is really hardly distinguishable, except for a darkened area of the membrane towards the costa in the middle. The Finnish and Swedish female specimens for which I proposed the name *bergrothi* are almost certainly only *T. glaphyoptera*. On the other hand, Theobald's *Pseudotheobaldia nivicaeniata*, which I supposed in 1913 to be synonymous with *T. glaphyoptera*, is a perfectly distinct species.

T. glaphyoptera is distinct in coloration from all other European species, but is very similar to the North American *T. impatiens*, Walk., from which it differs by the very distinctive male hypopygium. The male palpi are much more slender than those of any other European species, and seem to indicate an approach to *Culex*, although the terminal joints are not upturned. The ornamentation of the thorax is variable, some specimens having a distinct pattern of ochreous or whitish lines (one straight median, and a pair of curved lateral) on a dark ground.

The larva is unknown.

Distribution.—Recorded by Schiner from Austria, and by Eckstein from the Strasburg district. The specimens I have seen are from Austria (Rekawinkel, *Pokorny*; Hammern, *Mik*; also several from Schiner's original series, collected by Egger); Moravia (Frain, *Handlirsch*); Hungary (Bartfa, *Kertész*); Sweden (Stockholm; Dalecarlia, Norrbotten, *Boheman*; Östergötland, *Haglund*); Germany(?) (Coll. Loew, Berlin Museum); Finland (Kivikoski, Saima-Canal, *Adelung*; Kuustö, *Lundström*; Kittilä, *Krogerus*; Petrosaw, *Günther*; Säräsniemi, *Wuorentaus*).

3. *Theobaldia (Theobaldia) alaskaensis*, Ludlow.

Theobaldia alaskaensis, Ludlow, Can. Ent. xxxviii, p. 326 (1906).

Culiseta siberiensis, Ludlow, Insec. Inscit. vii, p. 151 (7th Jan. 1920).

Theobaldia arctica, Edwards, Bull. Ent. Res. x, p. 136 (end Jan. 1920).

In describing *T. arctica* I compared it with *T. alaskaensis*, and suggested that the two might be the same, though according to the published figure of *T. alaskaensis* there appeared to be certain differences in the male hypopygium. Recently Dr. H. G. Dyar sent me a male from Alaska which shows that the supposed differences do not exist. The species is easily distinguished by leg markings from the other European forms, but is represented by allied species, differing in hypopygial structure, in Mexico and the Punjab.

Distribution.—I have examined specimens from Archangel; Scotland; N. England; Sweden (Norrbotten, *Boheman*; Jemtland, *Schönherr*; Stockholm, *Boheman*); Lower Austria; Upper Silesia (Astron, *Brauer*); Siberia (Irkutsk, *Ahnge*; Inserovo, 62° 5', *Trybom*). Ludlow and Dyar record it from Eastern Siberia, Alaska and Alberta.

4. *Theobaldia (Theobaldia) annulata* (Schrank) (fig. 1A).

Culex annulatus, Schrank, Beitr. Z. Naturg. p. 97 (1776).

? *Culex variegatus*, Schrank, Enum. Ins. Austr. p. 482 (1781).

? *Culex annulatus*, de Fourcroy, Ent. Paris, p. 516 (1785).

Culex annulatus, Fabricius, Mantissa Ins. ii, p. 363 (1787).

? *Culex nicaensis*, Leach, Zool. Journ. ii, p. 292 (1825).

Culex affinis, Stephens, Zool. Journ. iv, (1825).

A common and easily recognised domestic species, normally exhibiting very little variation except in size. North European specimens are on the average larger than those from the south.

The name *Culex annulatus* was apparently proposed independently by Schrank, de Fourcroy and Fabricius, but the same species was designated in each case. De Fourcroy's diagnosis is totally inadequate, but he gives the habitat as Parisian gardens, so that he more probably had this species than an *Aedes*.

C. variegatus, Schrank, is generally quoted as a synonym of *T. annulata*, but the inadequate diagnosis would perhaps serve better for *Aedes lutescens*. Walker mentions specimens of *T. annulata* in the British Museum "from Dr. Leach's collection," and it is possible that these specimens (which are no longer in existence) may have been the originals of *C. nicaensis*.

The larva has been described by Langeron.

Distribution.—Throughout Europe, but probably commoner in the north than in the south, where it seems to be largely replaced by *T. longiarcolata*; extending into Palestine (Jerusalem, *Dr. Goldberg*) and North Africa (Biskra, Algeria, *Eversmann*; etc.). Has not yet been found further east, but is represented in the United States by an allied species. A female in the Berlin Museum is labelled "Ural, *Eversmann*."

5. *Theobaldia* (*Theobaldia*) *subochrea*, Edw.

Theobaldia annulata var. *subochrea*, Edwards in Wesenberg-Lund, Danske Vid. Selsk. Skr., Nat. Math. Afd. (8) vii, p. 198 (1921).

Theobaldia subochrea, Edwards, Ent. Tidsk. p. 50 (1921).

? *Culex penetrans*, Robineau-Desvoidy, Mem. Soc. Hist. Nat. Paris, iii, p. 407 (1828).

Though structurally identical with *T. annulata*, this differs so conspicuously and sharply in coloration that it must be regarded as a distinct species, especially as it is not confined (as was at first thought) to desert areas, and its coloration therefore cannot be purely adaptive. The differences from *T. annulata* are as follows:—

Mesonotum with the integument lighter, the scales almost uniformly reddish brown. Abdomen almost uniformly ochreous, the dark brown scales of *T. annulata* being replaced by light ochreous brown, and the white ones by almost the same colour. Whitish lateral patches, however, remain at the base of each segment, and the basal segmental bands, as well as the median line of the second segment, can be faintly made out on account of their slightly lighter colour. Leg-markings as in *T. annulata*, but somewhat less conspicuous owing to the dark parts being somewhat lighter. Wing-spots very faint, the scales being less densely aggregated than in *T. annulata*; in the male the spotting of the wing is scarcely perceptible at all.

The larva, so far as I can see, is absolutely identical with that of *T. annulata*.

Robineau-Desvoidy's description of *C. penetrans* applies in many respects to this species, but he states that the third joint of the middle tarsi of the male is bristly, which if true, is very remarkable. The type being lost, *C. penetrans* may be left as a possible synonym of *T. subochrea*.

Distribution.—I have examined specimens from the following places:—Mesopotamia (Basra, *Capt. P. J. Barraud*; a series including the type male); Persia (Ghilan, 950 m., Calhors, *J. de Morgan*); Palestine (Jerusalem, *Dr. Goldberg*); Macedonia (Hadji Geul, *Capt. J. Waterston*); Denmark (brackish-water swamp near Copenhagen, *Dr. C. Wesenberg-Lund*); England (Earl's Court, London, *W. J. Pendlebury*). In Mesopotamia this was the only form found; in the other countries *T. annulata* was found in the same localities.

Subgenus *Culicella*, Felt.

6. *Theobaldia* (*Culicella*) *morsitans* (Theobald).

Culex morsitans, Theobald, Mon. Cul. ii, p. 8 (1901).

? *Culex flavirostris*, Meigen, Syst. Besch. vi, p. 242 (1830).

Apart from the characters mentioned in the key, this species can generally be distinguished from *T. fumipennis* by its slightly smaller size, by the more slender and rather less hairy male palpi, and by the absence of distinct A-shaped black marks on the abdominal sternites in both sexes. I at one time considered that the North American *T. dyari* (Coq.) might be synonymous, but Dr. H. G. Dyar informs me that the two are distinct by hypopygial characters.

Meigen's statements concerning the proboscis and palpi of his *C. flavirostris* (male) might possibly be taken as indicating this species, but he says "Füsse ganz braun," which presumably excludes it. Like the great majority of Meigen's names, *C. flavirostris* is unrecognisable.

The larva varies in colour, but is usually dark brown or blackish.

Distribution.—Throughout Europe, from Britain and France to Finland (Sam-matti, *Sahlberg*; Kuustö, *Lundström*), Petrograd (♂ in coll. *B. Lichtwardt*) and Macedonia. Not yet known from North Africa or Asia.

7. **Theobaldia (Culicella) fumipennis** (Steph.) (fig. 5c).

Culex fumipennis, Stephens, Zool. Journ. i, p. 453 (1825).

Culex ficalbii, Noé, Bull. Soc. Ent. Ital. xxxi, p. 238 (1899).

Culicada theobaldi, de Meijere, Tijds. v. Ent. liv, p. 142 (1911).

Distinguished by the characters mentioned in the keys and under *T. morsitans*.

The larva, apart from the conspicuous structural differences in the siphon, may generally (perhaps always) be distinguished in life from that of *T. morsitans* by its pale yellowish green colour. Both species are mainly bottom feeders and are generally found in shallow, weedy, stagnant water.

Distribution.—Throughout Europe, except perhaps in the far north. The material I have examined shows a range from Scotland and France to Sweden and Macedonia.

Genus **Orthopodomyia**, Theo.

This genus is well characterised in the larval state by the absence of a pecten on the siphon and the development, in the fourth-stage larva, of dorsal chitinous plates on the sixth, seventh and eighth segments of the abdomen. These two characters together will distinguish the genus from all other mosquitos. In addition there are some small peculiarities, such as the development of reddish pigment in the body of the larva, and the very long single lateral hairs on the thorax and abdomen. The adult characters are not very well marked, the most obvious being: (1) the presence of only two pro-epimeral bristles; (2) the small number of bristles on the pre-alar prominence of the pleurae; there are five or six in *O. pulchripalpis*, but the number is reduced to one or none in the tropical species, while in *Culex*, *Aedes*, *Theobaldia* and *Taeniorhynchus* there are 12 or more; (3) the length of the first front tarsal joint, which in both sexes is distinctly longer than the remaining four together, while in most other mosquitos it is only about as long; (4) the rather long and stout antennae of the male, all the joints being longer than usual; (5) the short fourth joint of the front and middle tarsi of the female, which is much shorter than the fifth, and like that of the male, scarcely any longer than broad. The very long fork-cells and the long first hind tarsal joint are also noticeable. The hypopygial structure is practically the same as in *Theobaldia* (subgenus *Culicella*).

1. **Orthopodomyia pulchripalpis** (Rondani).

Culex pulchripalpis, Rondani, Bull. Soc. Ent. Ital. iv, p. 31 (1872).

Orthopodomyia albionensis, MacGregor, Journ. R.A.M.C. p. 451 (1919).

The beautiful pattern of narrow, pure white lines on the deep black thorax is not to be seen in any other species known from the Palaearctic region, though confusion might be possible with some Himalayan species of *Aedes*, such as *A. pseudotaenialus*. The entirely white terminal joint of the male palpi, and the rather long female palpi (nearly half as long as the proboscis), will distinguish it from all such species, without reference to the generic characters. The North American *O. signifer* (Coq.) is very closely allied, being structurally identical, but differing in having scattered white scales on the wings, especially a patch of white scales in the middle of the wing over the cross-veins. The Oriental species are very differently coloured.

In Ficalbi's redescription of Rondani's types he does not definitely describe the thorax, but refers to the mesonotal scales as "giallo-ottono?" I therefore at first considered that the British and Italian forms could not be the same. However,

Prof. M. Bezzi has kindly re-examined for me Rondani's types in the Florence Museum, and reports that though the thorax in both specimens is much damaged by the pin, it is black, "even deep black," and there are traces of white lines, and two white spots in the middle of the scutellum. There can therefore be little or no doubt of the identity of *C. pulchripalpis* and *O. albionensis*.

The larva lives in tree-holes, and shows the modifications commonly found in such a habitat. It has been described by MacGregor and Lang.

Distribution.—Italy; England (Epping Forest); France (near Paris, *Séguy*). The species may not be so rare as is supposed, since all the specimens so far known (with the probable exception of Rondani's types) have been obtained by rearing.

Genus *Taeniorhynchus*, Arrib.

This genus may be distinguished in the adult from *Culex* by the absence of empodia; from *Theobaldia* by the absence of spiracular bristles; and from *Aedes* by the absence of a definite "tibial scraper" (a close-set row of bristles at the tip), by the non-retractile eighth segment of the female abdomen and the structure of the male hypopygium. The wing-scales vary greatly in width in the different species, but are nearly always broader than in *Aedes* or *Culex*. Although no more satisfactory distinctions can be discovered in the adults, the larval siphon is so wonderfully modified that on this character the genus is extremely well marked. At the same time the larval structure of *Mansoniodes* is so nearly identical with that of *Taeniorhynchus* and *Coquillettidia* that the three are much best regarded as subgenera under the main genus *Taeniorhynchus*, in spite of some rather conspicuous differences in the adults.

The only known Palaearctic species* belongs to the subgenus *Coquillettidia*, to which belong also the North American species and the rather numerous African and Oriental species placed by Theobald in *Chrysoconops*. *Coquillettidia* differs from the other subgenera in having no post-spiracular bristles, and this affords a further distinction from *Aedes*, in which a few of the bristles are apparently always present.

Taeniorhynchus (*Coquillettidia*) *richiardii* (Fic.).

Culex richiardii, Ficalbi, Bull. Soc. Ent. Ital. xxi, p. 50 (1889), and xxxi, p. 199 (1899).

The rather broad wing-scales and the pale ring in the middle of the first joint of the hind tarsus will distinguish this species from other mosquitos in the European fauna.

The bionomics and morphology of the early stages have been described in detail by Wesenberg-Lund.

Distribution.—Apparently occurs somewhat locally throughout Europe, except probably in the far north, and extends into Palestine. Some apparently new records are: Sweden (Småland, Stockholm, *Boheman*); Hungary (Keszthely, *Kertész*); Austria (Freistadt, *Frauenfeld*).

Genus *Aedes*, Mg.

This genus, as a whole, is characterised as follows:—Proboscis of uniform thickness throughout. Palpi of the female less than one-quarter as long as the proboscis. Antennae distinctly plumose in the male, with the last two joints elongate; with moderately long verticils in the female, all the flagellar joints being about equal in length. Eyes distinctly separated. A continuous row of orbital bristles. Pronotal lobes widely separated. Pro-epimeral bristles about

* The South American *T. titillans* has been recorded from Rumania by Leon, but no doubt incorrectly.

4-6, in a posterior row overlapping the spiracle. Spiracular bristles absent. Post-spiracular, pre-alar, sternopleural and upper mesepimeral bristles all present and generally numerous. Postnotum without setae. Eighth segment of female abdomen retractile, a wide membrane between it and the seventh. Side-pieces of male hypopygium with a lacuna of chitinisation extending the whole length of the inner side; claspers articulating in an horizontal plane. Tenth segment with tergites feebly developed; sternites simple, without teeth or spines. Hind tibiae with the usual row of fine microscopic hairs just before the tip on the inner side, and also with a row of 7-10 longer hairs parallel with the first row and slightly more distally placed. First hind tarsal joint shorter than the tibia. Pulvilli absent. Front and middle claws of female nearly always toothed. Cell R_2 (upper fork-cell) seldom much longer than its stem. Vein A_1 (sixth longitudinal) terminating distinctly beyond the level of the base of R_2 (second vein). Distinct microtrichia on wing-membrane.

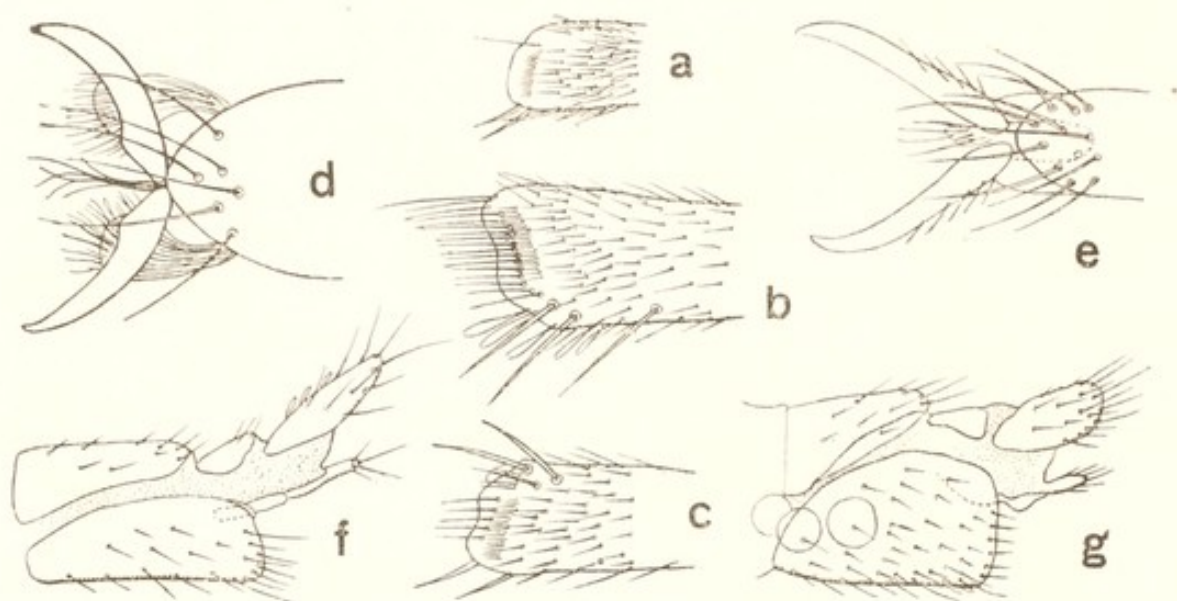


Fig. 5. Structural details of Culicidae: a, tip of hind tibia, seen from the inner side, of *Culex hortensis* (scales omitted), $\times 65$; b, the same structure in *Aedes lepidonotus*; c, the same in *Theobaldia fumipennis*; d, tip of last tarsal joint of *Lutzia vorax*, showing claws, empodium and pulvilli, $\times 340$; e, tip of last tarsal joint of *Theobaldia annulata*, showing claws, small empodium, and absence of pulvilli, $\times 340$; f, tip of abdomen of *Aedes lepidonotus* ♀, showing slender eighth segment with narrow sternite, $\times 40$; g, the same, *Aedes geniculatus* ♀, showing stouter eighth segment with broader sternite.

Larva.—Mouth-parts not specially modified for predaceous habits, but the inner hairs of the mouth-brushes are generally more or less serrate. Antennal tuft generally at or before the middle. Abdomen without chitinous plates except for the anal saddle, and sometimes small plates at the bases of the thoracic hairs. Eighth segment with a lateral comb or patch of scales. Siphon unmodified, short and stout, at most four times as long as its breadth at the base, provided with a well-developed pecten and a single pair of ventral hair-tufts, situated about or beyond the middle; only very exceptionally with accessory dorsal hairs or hair-tufts.

As pointed out by Dyar (*Insector Inscitiae*, vi, p. 71, 1918) the genus can be divided into two main groups, on the presence or absence of distinct claspettes in the male hypopygium (the term claspette in this connection signifying a definite structure separated from the base of the upper flap of the side-piece, and terminating in a flattened appendage or a more or less modified bristle). Dyar's two groups may

also be defined on the structure of the mesosome of the aedocagus. In the group which possesses claspettes the mesosome is a simple tube, rather lightly chitinised below and at the sides, membranous above. In the other group the mesosome is a paired structure, the halves of which are more or less crenulate, spiny or brush-like. Both these distinctions are so well marked that one would expect to find corresponding distinctions in the body characters or in the larvae, but all efforts in this direction have so far been fruitless.

The first group includes the subgenera *Ochlerotatus* and *Finlaya*, and is spoken of by Dyar as the New World type—inappropriately, since it includes the majority of the European mosquitos, and has many representatives in Australia, while *Finlaya* attains its strongest development in the Oriental region. The second or Old World group (subgenera *Ecculex*, *Aedes* and *Stegomyia*) is almost confined to the tropical and subtropical regions of the Old World.

The subgenera occurring in the Palaearctic region may be separated (as adults) by the following keys, which will not necessarily hold good for the species of other regions.

Male Hypopygium.

- | | |
|---|-----------------------|
| 1. Claspettes present ; mesosome an unpaired simple structure | 2 |
| Claspettes absent ; mesosome a paired, more complicated structure | 3 |
| 2. Side-piece with more or less distinct apical and basal lobes | <i>Ochlerotatus</i> . |
| Side-piece without apical or basal lobes | <i>Finlaya</i> |
| 3. Clasper deeply divided, placed before tip of side-piece ; without articu-
lated spine | <i>Aedes</i> . |
| Clasper not divided, placed at tip of side-piece, with distinct articu-
lated spine | 4 |
| 4. Spine of clasper well before the tip | <i>Ecculex</i> . |
| Spine of clasper at the tip (except in <i>A. vittatus</i>) | <i>Stegomyia</i> . |

Other Adult Structures.

- | | |
|---|-----------------------|
| 1. Proboscis distinctly longer than front femora ; last two joints of male
palpi distinctly swollen, hairy, and turned downwards | 2 |
| Proboscis not longer than front femora ; male palpi otherwise ; female
cerci short | 4 |
| 2. Female cerci short, the eighth sternite large and prominent in repose ;
male palpi somewhat shorter than the proboscis | <i>Finlaya</i> . |
| Female cerci long, the eighth sternite much smaller and not prominent
in repose | 3 |
| 3. Male palpi longer than the proboscis | <i>Ochlerotatus</i> . |
| Male palpi not longer than the proboscis | <i>Ecculex</i> . |
| 4. Palpi alike in the two sexes, very short ; tarsi dark | <i>Aedes</i> . |
| Male palpi long, slender, the last two joints upturned and nearly bare ;
tarsi with white rings at the bases of the joints | <i>Stegomyia</i> . |

The adults of these subgenera are treated separately, but it will be more convenient to tabulate all the known larvae together, as follows:—

*Key to the known Larvae of Palaearctic Species of Aedes (sens. lat.).**

- | | |
|---|---|
| 1. Antennal tuft represented by a single minute hair ; shaft devoid of
small spines ; eighth abdominal segment with a well-marked comb of
teeth set in a single row | 2 |
|---|---|

* This key will not necessarily apply to any but fourth-stage larvae. For the characters of *A. dorsalis* and *A. intrudens* I have relied on American descriptions, and for those of *A. alpinus* on Wesenberg-Lund's description of specimens from Greenland.

- Antennal tuft at least two-haired; shaft nearly always spinose; eighth abdominal segment with a patch of scales or teeth which may tend to form a single row when few in number 5
- 2. Antennae rather long; dorsal surface of abdomen with numerous stellate tufts (*Finlaya*) 3
- Antennae short; dorsal surface of abdomen without conspicuous stellate tufts (*Stegomyia*) 4
- 3. Abdominal tufts composed of long, stout bristles *echinus*, Edw.
- Abdominal tufts composed of shorter and much more slender bristles *geniculatus*, Oliv.
- 4. Comb-teeth simple *albopictus*, Skuse.
- Comb-teeth with lateral basal denticles *argenteus*, Poiret.
- 5. Shaft of antenna quite bare, tuft 2-3-haired (*Stegomyia*) *vittatus*, Bigot.
- Shaft of antenna spinose (very slightly so in *mariae*), tuft generally multiple 6

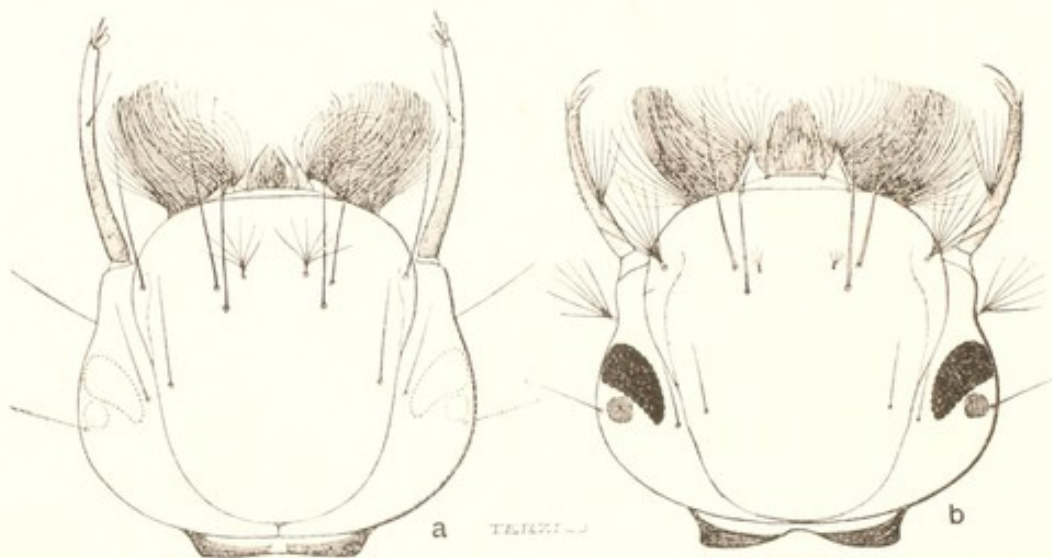


Fig. 6. Heads of larvae: a, *Aedes echinus*, Edw.; b, *Aedes mariae* (Serg.).

- 6. Pecten with detached, simple teeth outwardly; hair-tuft very small and well beyond middle of siphon; no long hairs near middle of front margin of thorax 7
- Either the pecten has no detached simple teeth outwardly, or the hair-tuft is larger and situated practically at the middle of the siphon; long hair-tufts present near middle of front margin of thorax (*Ochlerotatus*) 8
- 7. The three post-antennal hairs (Lang) nearly in a straight line (*Aedes*) *cinereus*, Mg.
- Middle post-antennal hairs almost directly in front of the inner *vexans*, Mg.
- 8. Siphon with three or four pairs of hairs on dorsal (anterior) surface *rusticus*, Rossi.
- Siphon without hairs on dorsal surface 9
- 9. Antennae longer than the head *diantaeus*, H. D. & K.
- Antennae shorter than the head 10
- 10. Siphonal index about 1.5 11
- Siphonal index 2 or more; antennal spinules well-developed 12

- | | | |
|---|----------------------------|--------------------------|
| 11. Antennae almost devoid of spinules ; pecten-teeth very long | <i>mariae</i> , Serg. | |
| Antennal spinules well-developed ; pecten-teeth shorter | <i>zammittii</i> , Theo. | |
| 12. Five or six small hair-tufts in anal brush before the barred area | .. .. | 13 |
| At most three such tufts ; siphonal index 3 or less | .. .. | 17 |
| 13. Siphonal index distinctly over 3 ; terminal teeth of pecten more or | | |
| less detached | .. .. | 14 |
| Siphonal index at most 3 ; all pecten-teeth close-set | .. .. | 16 |
| 14. Comb of eighth segment with 6-9 teeth in one irregular row | <i>semicantans</i> , Mart. | |
| Comb with 23-35 teeth in a triangular patch | .. .. | 15 |
| 15. Siphonal index about 3.2 ; anal gills half as long as the saddle | <i>lutescens</i> , F. | |
| Siphonal index quite 3.5 ; anal gills as long as the saddle | <i>excrucians</i> , Walk. | |
| 16. Siphonal index 2.3-2.7 | .. .. | <i>annulipes</i> , Mg. |
| Siphonal index 2.6-3 | .. .. | <i>maculatus</i> , Mg. |
| 17. One or two simple detached pecten-teeth beyond the siphonal tuft | <i>cataphylla</i> , Dyar. | |
| No pecten-teeth beyond the tuft | .. .. | 18 |
| 18. Anal gills much shorter than the saddle | .. .. | 19 |
| Anal gills at least as long as the saddle | .. .. | 22 |
| 19. Hair-tuft distinctly beyond middle of siphon ; anal gills, one-third to | | |
| two-thirds as long as saddle | .. .. | <i>caspius</i> , Pall. |
| Hair-tuft practically at middle of siphon | .. .. | 20 |
| 20. Siphonal index 2 ; anal gills globular | .. .. | <i>detritus</i> , Hal. |
| Siphonal index 2.6-3 | .. .. | 21 |
| 21. Anal gills globular, not a quarter as long as the saddle | .. .. | <i>dorsalis</i> , Mg. |
| Anal gills half as long as the saddle | .. .. | <i>salinellus</i> , Edw. |
| 22. Comb with 50 or more scales in the patch | .. .. | 23 |
| Comb with 10-20 pointed scales in the patch | .. .. | 24 |
| 23. Comb-scales sharp-pointed ; anal gills twice as long as the saddle | <i>pullatus</i> , Coq. | |
| Comb-scales blunt-ended, fringed ; anal gills about as long as the saddle | <i>communis</i> , De G. | |
| 24. Last few pecten-teeth detached | .. .. | 25 |
| All pecten-teeth close-set | .. .. | 26 |
| 25. Anal segment with a complete chitinous ring, only half as long as the | | |
| gills ; frontal hairs single | .. .. | <i>alpinus</i> , L. |
| Anal segment with saddle only, as long as the gills ; frontal hairs | | |
| branched | .. .. | <i>intrudens</i> , Dyar. |
| 26. Anal segment with a complete chitinous ring, about as long as the gills | <i>punctor</i> , Kirby. | |
| Anal segment with an incomplete ring, only half as long as the gills | <i>sticticus</i> , Mg. | |

Subgenus *Ochlerotatus*, Arrib.

Adults. Proboscis slender, distinctly longer than the front femora. Palpi short in the female ; longer than the proboscis in the male (very rarely of equal length or slightly shorter), the last two joints and the tip of the long joint swollen and hairy, the last two joints turned very slightly downwards, the terminal joint generally a little more slender than the penultimate. Hair-whorls of male antennae rather irregular, the majority of the hairs projecting either dorsally or ventrally. Vertex with narrow scales only, the flat ones being confined to the sides of the head. Lower mesepimeral hairs usually (not always) present. Male hypopygium with long,

simple claspers which are provided with a terminal spine; side-pieces with well-developed basal lobes and more or less distinct apical lobes; distinct claspettes always present, terminating in a more or less flattened appendage; aedeagus simple, the mesosome never divided into two halves. Female cerci always well-developed and long, the eighth segment small, rarely visible at all externally. All the claws of the female toothed (normally).

Larva. Antennae with a well marked hair-tuft and minute spicules on the surface. Frontal hairs generally simple or only slightly branched, the anterior pair immediately in front of the lower. Abdomen without well-marked stellate tufts; the scales of the comb of the eighth segment in a triangular patch.

This subgenus includes the great majority of the Palaearctic and Nearctic species of *Aedes*, and attains its maximum development in the north temperate parts of these regions; it is almost or quite unrepresented in the Ethiopian and Oriental regions, but appears again with numerous representatives in southern Australia, and one or two in New Zealand. Many species also occur in the Neotropical region, and it is possible therefore that Australia was colonised by way of South America, especially as some of the South American, New Zealand and Australian species show rather marked affinities. We may perhaps assume from this that the subgenus is an old-established one.

The Palaearctic species are divisible (as adults) into three groups according to the markings of the tarsi. The first two of these groups appear to be natural assemblages of species, but the third, with dark tarsi, is less natural and shows more structural diversity. These groups may be known as the *dorsalis*-group, the *annulipes*-group and the *communis*-group; as mentioned below, *A. punctator*, though placed on account of coloration in the *communis*-group, shows signs of affinity with the *dorsalis*-group, while other members of the *communis*-group (such as *A. communis* itself) are probably more nearly related to the *annulipes*-group. The structure of the male hypopygium shows the isolated position of *A. rusticus* and *A. lepidonotus*, but suggests an affinity between *A. pullatus* and the peculiar *A. diantacus*.

Adults.

- | | |
|--|------------------------------------|
| 1. Tarsi with pale rings embracing both ends of the joints, the last hind tarsal joint entirely pale (<i>dorsalis</i> -group) [compare also <i>Finlaya togoi</i>].. | 2 |
| Tarsi with pale rings at the bases of the joints only (<i>annulipes</i> -group) [compare also subgenera <i>Ecculex</i> and <i>Stegomyia</i> , and <i>Finlaya japonica</i>] | 7 |
| Tarsi without pale rings (<i>communis</i> -group) [compare also subgenera <i>Aedes</i> and <i>Finlaya</i>] | 12 |
| 2. Abdomen with a pale median dorsal stripe in addition to transverse bands; sometimes entirely pale | 3 |
| Abdomen with whitish bands at the bases of the segments only | 4 |
| 3. Mesonotal scales generally fawn-coloured, with two narrow white bands running the whole length; dark and light wing-scales evenly mixed | <i>caspius</i> , Pall. |
| Mesonotal scales generally duller brown, with two broad, creamy bands in front; dark scales aggregated on certain veins | <i>dorsalis</i> , Mg. |
| 4. Wings and legs densely speckled with pale scales; tarsi brown with creamy rings | 5 |
| Wings and legs only very slightly speckled; tarsi black with white rings.. | 6 |
| 5. Mesonotal scales uniformly brown or fawn-coloured.. .. . | <i>mariae</i> , Serg. |
| Mesonotum with two longitudinal bands of white scales | <i>zammittii</i> , Theo. |
| 6. Mesonotal scales bronzy ochreous, not forming distinct markings | <i>pulchritarsis</i> , Rond. |
| Mesonotum with whitish median stripe | <i>pulchritarsis</i> , Rond., var. |

7. Outer side of hind femora with numerous scattered dark scales ; white rings of middle joints of hind tarsi less than half as long as the joints ; thorax dark with some obscure paler markings *maculatus*, Mg.
Outer side of hind femora pale except towards the tip ; white rings of middle joints of hind tarsi at least half as long as the joints 8
8. Costa at most with scattered pale scales ; abdomen largely dark 9
Costa pale-scaled on anterior edge, at least on basal half ; abdominal scales mainly or all yellow 11
9. Abdomen dark, tergites with well-defined basal white bands narrowed in the middle *semicantans*, Martini.
Abdomen with ill-defined yellowish bands and scattered yellowish scales .. 10
10. Mesonotum with a distinct broad median band of dark scales, sides yellowish ; pale bands of abdomen mainly basal *annulipes*, Mg.
Mesonotum with obscure markings ; pale bands of abdomen largely at apices of tergites *excrucians*, Wlk.
11. Costa yellow-scaled only on the basal half *freyi*, sp. n.
Costa mainly yellow-scaled in its entire length *lutescens*, F.
12. Pro-epimeral scales all flat and straight, the upper ones black *rusticus*, Rossi.
Pro-epimeral scales all ochreous, the upper ones narrow and curved .. 13
13. Postnotum with a tuft of scales *lepidonotus*, Edw.
Postnotum without scales 14
14. Wing-membrane whitish ; costal scales all pale *albescens*, sp. n.
Wing-membrane not whitish ; costal scales mostly or all dark 15
15. Front and middle femora conspicuously mottled in front with dark and light scales 16
Front and middle femora with only a few pale scales in front 19
16. Head and thorax with very dense bristles ; integument deep black .. *alpinus*, L.
Head and thorax only moderately bristly ; integument of legs paler .. 17
17. The dark parts of the abdominal tergites with scattered pale scales ; male palpi usually all dark *detritus*, Hal.
The dark parts of the abdominal tergites without scattered pale scales ; male palpi with a whitish ring or numerous pale scales on the long basal joint 18
18. Proboscis all dark *cataphylla*, Dyar.
Proboscis with numerous pale scales in the middle *salinellus*, Edw.
19. Hind femora pale, with a sharply defined black-scaled area at the tip .. *diantaeus*, H. D. & K.
Dark area at tip of hind femora much less sharply defined 20
20. Hind tibia (at least in the female) with a distinct whitish stripe on the outer side running nearly the whole length ; mesonotum with white scales at the sides, blackish in the middle *sticticus*, Mg.
Hind tibia without whitish stripe on outer side in either sex 21
21. Scales of head and mesonotum ochreous brown, the mesonotum usually with one broad dark brown median stripe ; sometimes with two ill-defined stripes, or none *punctor*, Kirby.
Scales of head and mesonotum darker brown, often mixed with white at the sides ; the mesonotum usually without distinct stripes, or with two ill-defined ones 22
22. Flat scales of the head approaching the middle line *parvulus*, Edw.
Flat scales confined to the sides of the head *communis*, De G. ;
intrudens, Dyar ; *pullatus*, Coq.

Male Hypopygia.

1. Basal lobe of side-piece bearing a row of flattened bristles or scales ; terminal spine of clasper wavy *rusticus* (Rossi).
Basal lobe of side-piece quite otherwise ; terminal spine of clasper straight 2
2. Side-piece with three spines or differentiated bristles ; two on the basal lobe, backwardly directed, one more distally placed and inwardly directed 3
Side-piece with at most two differentiated bristles on the basal lobe 5
3. Side-piece swollen in the middle, where it has a large inwardly-directed hair-tuft *diantacus*, H. D. & K.
Side-piece more regularly shaped, without hair-tuft in the middle 4
4. A distinct hair-tuft adjoining the apical lobe ; stem of claspette with a distinct projection near the middle.. .. . *intrudens*, Dyar.
No definite hair-tuft adjoining the apical lobe ; stem of claspette somewhat angulated but without definite projection.. .. . *pullatus* (Coq.).

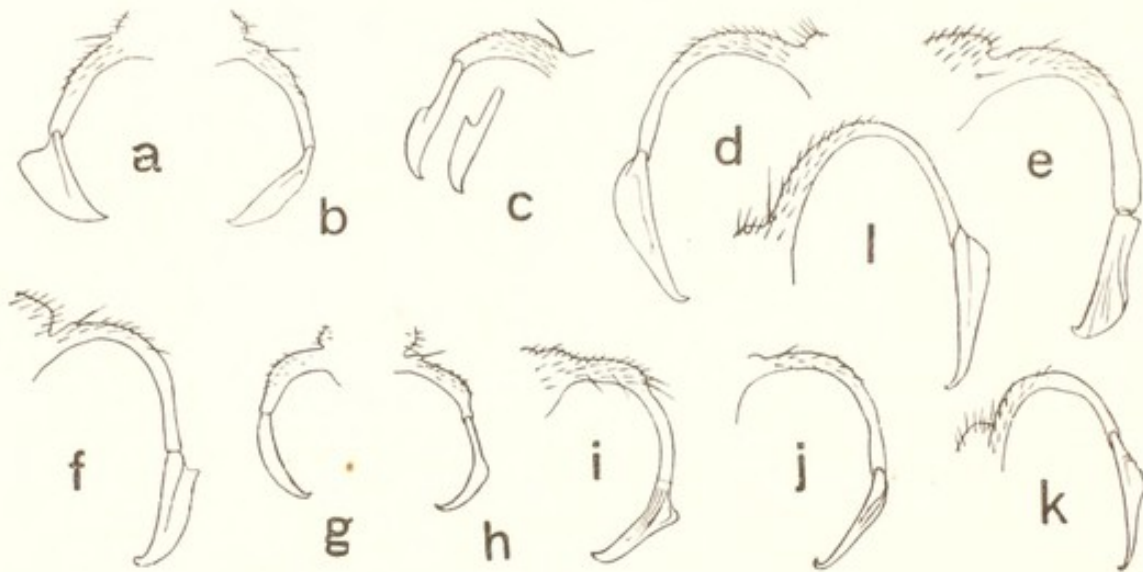


Fig. 7. Claspettes of Palearctic species of *Aedes*, dissected from hypopygia and drawn in side view, all $\times 75$: a, *A. maculatus* (Mg.); b, *A. semicantans*, Mart.; c, *A. lutescens* (F.); d, *A. freyi*, sp. n.; e, *A. annulipes* (Mg.); f, *A. excrucians* (Walk.); g, *A. punctor* (Kirby); h, *A. detritus* (Hal.); i, *A. pullatus* (Coq.); j, *A. communis* (De G.); k, *A. salinellus*, Edw.; l, *A. cataphylla*, Dyar.

5. Basal and apical lobes of side-piece both very small, the latter hardly distinguishable 6
Either basal or apical lobes, or both, quite large and conspicuous 8
6. Appendage of claspette short and twisted, rounded at tip *lepidonotus*, Edw.
Appendage of claspette long, curved and pointed 7
7. Basal lobe without a spine *mariae* (Serg.); *zammittii* (Theo.).
Basal lobe with a distinct spine *pulchritarsis* (Rond.).
8. Basal lobe with two spines ; apical lobe ill-defined 9
Basal lobe with at most one spine ; apical lobe nearly always well-marked.. .. . 10
9. Basal lobe very prominent (fig. 8 b) *dorsalis* (Mg.).
Basal lobe much less prominent (fig. 8 a) *caspius* (Pall.).
10. Apical lobe reaching back to near middle of side-piece, and clothed with very short, curved bristles ; stem of claspette short and straight 11
Apical lobe not reaching so far back, and bearing longer bristles 12

11. Appendage of claspette three times as long as broad; basal lobe not separated from the side-piece *punctator* (Kirby).
 Appendage of claspette not much longer than broad; basal lobe separated from the side-piece in its apical portion *sticticus* (Mg.).
12. Basal lobe with a strong black spine and short pubescence *lutescens* (F.).
 Spine of basal lobe when present weaker and paler, and generally accompanied by long bristles 13
13. Basal lobe small, without spine, but a rugose area extends more than half the length of the side-piece 14
 Basal lobe larger, spine generally well-marked, rugose area not nearly reaching middle of side-piece (except in *freyi*) 15
14. Stem of claspette uniformly stout *annulipes* (Mg.).
 Stem of claspette slender apically *excrucians* (Walk.).
15. Stem of claspette shorter and nearly straight 16
 Stem of claspette longer and strongly curved 18
16. Appendage of claspette winged in the middle only, cylindrical on the basal third; basal lobe rather small, not pointed *detritus* (Hal.).
 Appendage of claspette winged for its whole length or nearly; basal lobe produced and rather sharply pointed 17
17. Basal lobe much longer than broad; appendage of claspette extremely broad *maculatus* (Mg.).
 Basal lobe scarcely longer than broad; appendage of claspette less broad *semicantans*, Mart.
18. Side-piece with short hair only 19
 Side-piece with long hair arching over the upper surface 20
19. Basal lobe large, spine present though weak *freyi*, sp. n.
 Basal lobe smaller, spine absent *parvulus*, sp. n.
20. Appendage of claspette with two slight ridges near the base *communis* (De G.).
 Appendage of claspette with one ridge or wing, which is broadest in the middle 21
21. Aedoeagus and anal segment heavily chitinised *alpinus* (L.).
 Aedoeagus and anal segment not unusually strongly chitinised 22
22. Lobes of ninth tergite with about six short straight bristles *cataphylla*, Dyar.
 Lobes of ninth tergite with about twelve longer bristles which curve outwards *salinellus*, Edw.

1. **Aedes (Ochlerotatus) caspius** (Pallas) (= *dorsalis*, Theo.) (fig. 8 a).

Culex caspius, Pallas, Reise versch. Prov. Russ. Reichs. i, p. 475 (1771).

Culex punctatus, Meigen, Klass, i, p. 6 (1804).

? *Culex siculus*, Robineau-Desvoidy, Mém. Soc. d'Hist. Nat. iii, p. 406 (1827).

Culex penicillaris, Rondani, Bull. Soc. Ent. Ital. iv, p. 31 (1872).

? *Culex leucogrammus*, Loew, Zeitschr. Ges. Naturw. xliii, p. 413 (1874).

Grabhamia subtilis, Ed. & Et. Sergent, Bull. Mus. Paris, xi, p. 240 (1905).

Grabhamia willcocksii, Theobald, Mon. Cul. iv, p. 294 (1907).

Grabhamia longisquamosa, Theobald, Ann. Mus. Nat. Hung. iii, p. 102 (1905).

Mansonia arabica, Giles, J. Trop. Med. p. 130 (1906).

Culex arabicus, Becker, Denkschr. k. Ak. Wiss. Wein. lxxi, p. 140 (1910).

As has often been pointed out, this is a very variable species, particularly as regards the abdominal markings. The palest specimens have the abdominal scales uniformly ochreous, while in the darkest the median pale stripe tends to be reduced, one Hungarian specimen which I have examined showing it on the second segment only. *A. caspius* may generally be known by the bright fawn-coloured scales of the mesonotum, with two narrow longitudinal stripes of white running the whole length, and by the even scattering of the dark scales over the wing-veins, as well as by the

shape of the basal lobes of the side-pieces of the male hypopygium. The variation in the thorax is in the direction of the reduction of the white scales, which are occasionally absent, especially in the male sex, where the reduction of the white lines is often accompanied by a more or less pronounced bleaching of all the mesonotal scales. There seems to be a slight difference between the north and south European forms in coloration, the Mediterranean type being lighter than the north European, and also somewhat smaller. The difference, however, is quite indefinite, and I see no necessity for the maintenance of a varietal name. Theobald's *G. longisquamosa* was evidently described from an extremely pale specimen. The variety *hargreavesi*, Edwards (Bull. Ent. Res. x, p. 130, 1920), seems to be well distinguished by having all the scales of the female mesonotum white; it is, however, known from only a very few rather imperfect specimens.

There are two main generations in the year (in June and September), and the species is often abundant enough to cause serious annoyance. It will often migrate some miles from its breeding-places (a habit common to most salt-marsh species), and is the only *Aedes* in the European fauna which commonly enters houses. The adults are not known to hibernate, but Dr. Langeron captured a female at Gabes in January 1919.

The larvae show the reduction in the size of the anal gills which is commonly seen in salt and brackish-water species, but they are by no means confined to saline waters, the species often spreading far up the courses of the larger rivers, breeding in open meadows. It may be that specimens from fresher water have longer gills, as these organs certainly vary in length in this species. English specimens which I have examined agree with Martini's description in having the gills about two-thirds as long as the saddle, while Capt. Barraud's Mesopotamian specimens agree with Wesenberg-Lund's description in having gills only about one-third as long as the saddle.

Distribution.—European and Mediterranean coasts; Central European plain, and eastwards to the Gobi desert; desert regions of North Africa; Palestine; Persian Gulf; Punjab, as far inland as Rawalpindi. Apparently does not extend into North America. Since the species has been so much confused with *A. dorsalis*, it may be worth while to record some of the specimens I have examined from different museums: Denmark (near Copenhagen, *Wesenberg-Lund*); Finland (Kuustö, *Lundström*); France (Bourg la Reine, *Langeron*); Germany (Usedom, *Sulldorf*, *Litchwardt coll.*); Austria (Vienna, *Handlirsch*; Carniola, *Loitsch*); Hungary (Neusiedler See, *Handlirsch*; Hortobagy, *Kertész*; Csepel, *Bartko*; Fehertelep, *Ujhelyi*; Iszak, *Uhl*; Torda, *Biró*); Italy (Mehadia, Livorno, Spalato, *Mann*); Roumania (Tultscha, *Mann*); Constantinople (*Paris Mus.*); Asia Minor (Fregli, Tskehir, Kara, *Lendl*); Palestine (Jerusalem, *Goldberg*); West Caspian ("Lenkoran bis Elizabetpol, 1-2 Aug. Nachts. Schrecktl. Mücken-plage," *Berlin Mus.*); Transcaspia (Aschabad, Firudza, Tedjin and Kopet Dagh, *C. Ahnger*); Gobi Desert (Cha Tcheou, Marais de Pa-hou-lian, *Dr. L. Vaillant*).

2. *Aedes (Ochlerotatus) dorsalis* (Meigen) (*nec* Theobald et al.) (fig. 8 b).

Culex dorsalis, Meigen, Syst. Besch. vi, p. 242 (1830).

Culex maculiventris, Macquart, Dipt. Exot. Supp. i, p. 7 (1846).

Culex curriei, Coquillett, Can. Ent. xxxiii, p. 259 (1901).

Culex onondagensis, Felt, N.Y. State Mus. Bull. 79, p. 278 (1904).

Grabhamia broquettii, Theobald, Entomologist, xlv, p. 179 (1913).

Aedes grahami, Ludlow, Insector Inscitiae, vii, p. 154 (1920).

Doubt has been expressed by Wesenberg-Lund whether this is really distinct from *A. caspius*, but I still believe that the characters I have adduced are sufficient for the separation of the two, though it must be admitted that they are both variable species with entirely similar habits, and that they are frequently found together.

The thoracic scaling (brown to dark brown central stripe on front part of mesonotum only, with a broad creamy stripe on each side of it, dark brown again on the shoulders), wing scaling (preponderance of dark scales on the first, third and fifth veins, and of pale scales elsewhere), and the prominent basal lobes of the side-pieces of the male hypopygium will render the identification of nearly every good specimen certain.

I have decided to adopt the name *dorsalis* for this species for two reasons. First, I am indebted to M. Séguy for sending me a female from Meigen's collection labelled "*Culex dorsalis*. Berlin," probably in Meigen's own handwriting. As *C. dorsalis* was originally described from Berlin, it seems reasonable to accept this specimen as the actual type of the species. It is in good condition, and obviously *A. currici*, not *A. caspius*. Secondly, from the descriptions of Staeger and Zetterstedt, as well as from some examples named by Staeger which were sent me by Dr. Wesenberg-Lund, it would seem that these writers based their conception of *C. dorsalis* mainly on *A. currici*.

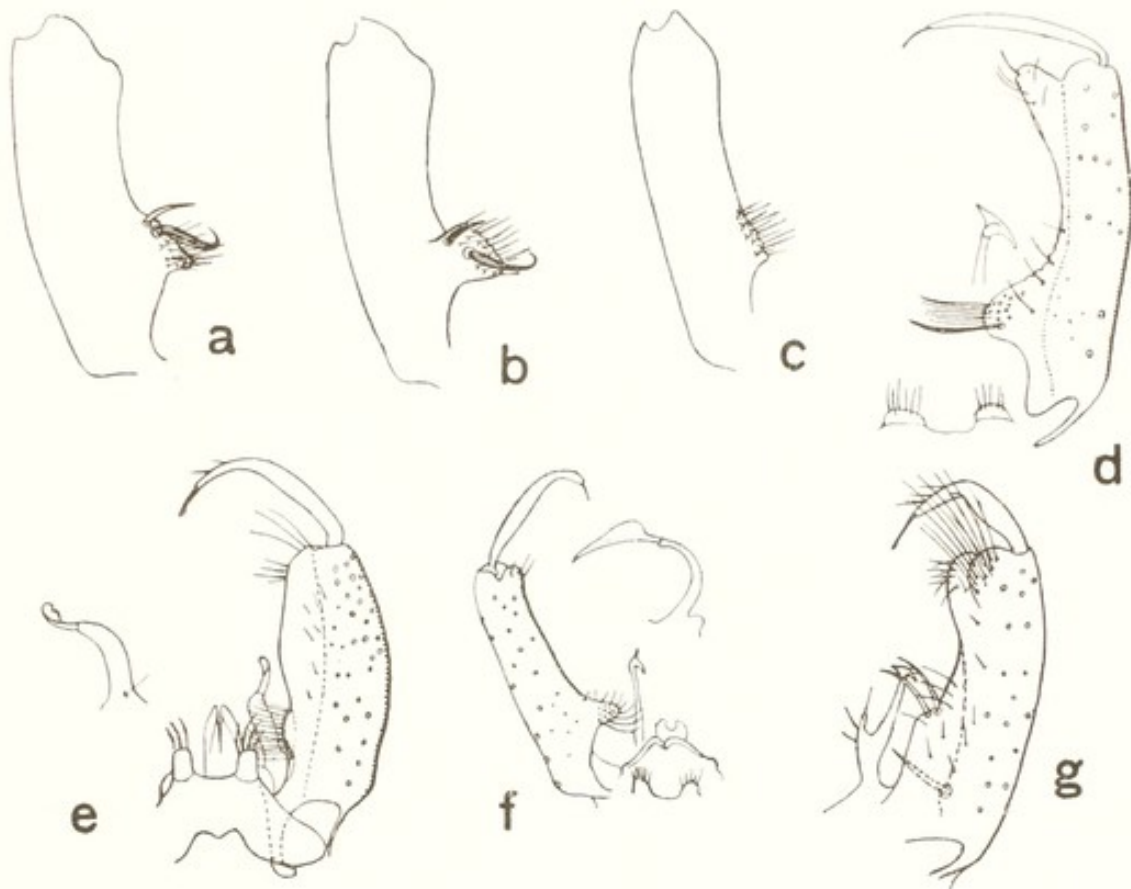


Fig. 8. Hypopygia of Palearctic species of *Aedes*: a, outline of side-piece, to show structure of basal lobe, of *A. caspius* (Pall.); b, the same, *A. dorsalis* (Mg.); c, the same, *A. maria* (Serg.); d, hypopygium of *A. freyi*, sp. n.; e, hypopygium of *A. lepidonotus*, Edw., ventral view, claspette shown also in side view; f, the same, *A. parvulus*, sp. n.; g, *A. intrudens*, Dyar.

Rather contrary to expectation, Macquart's *C. maculiventris* proves to be this species and not *A. caspius*, according to the type female, which was sent me by M. Séguy.

The larva is at present only known from the description of Howard, Dyar and Knab; it has not yet been isolated in European collections. Specimens sent me by Dr. Dyar agree with the description in the monograph, and differ from *A. caspius* in at least three points: the siphon is distinctly more slender (index about 2.75 instead of about 2.3); the hair-tuft is scarcely beyond the middle of the siphon;

and the anal gills are very small and globular, not a quarter as long as the saddle. Whether these characters distinguish *A. dorsalis* as a species or merely the American race remains to be proved.

Distribution.—Coasts of northern Europe from France and southern England to Norway and the Baltic; Central European plain, and thence westward across Central Asia, China and North America as far as the Atlantic coast; North Africa (according to Macquart).

Some localities from which I have examined specimens are:—Denmark (*Wesenberg-Lund*); Sweden (*Östergötland, Haglund*); Finland (*Kexholm, Eriksberg, Uskela, E. J. Bonsd.; Kuustö, Lundström; Soroka, J. Sahlberg*); Germany (*Berlin, Meigen, Enderlein; Usedom, Sülldorf, Lichtwardt; Halle, Loew*); Austria (*Hainfeld, Mik*); Hungary (*Budapest, Kertész; Budafok, Bartko; Fehertelep, Ujhelyi; Torda, Biró; Keczel, Hild, Thalhammer; Neusiedler-See, Handlirsch*); North Russia (*Waloniki, Velitchkovsky*); Mongolia ("Vallée près de la Kouré de Bandie, 1500 m." and "Bords du Tarim," *Mission de Lacoste, Dr. du Chazaud, 1909*); Siberia (*Irkutsk, Schulz*); North China (*Tinghai, C. Ford*).

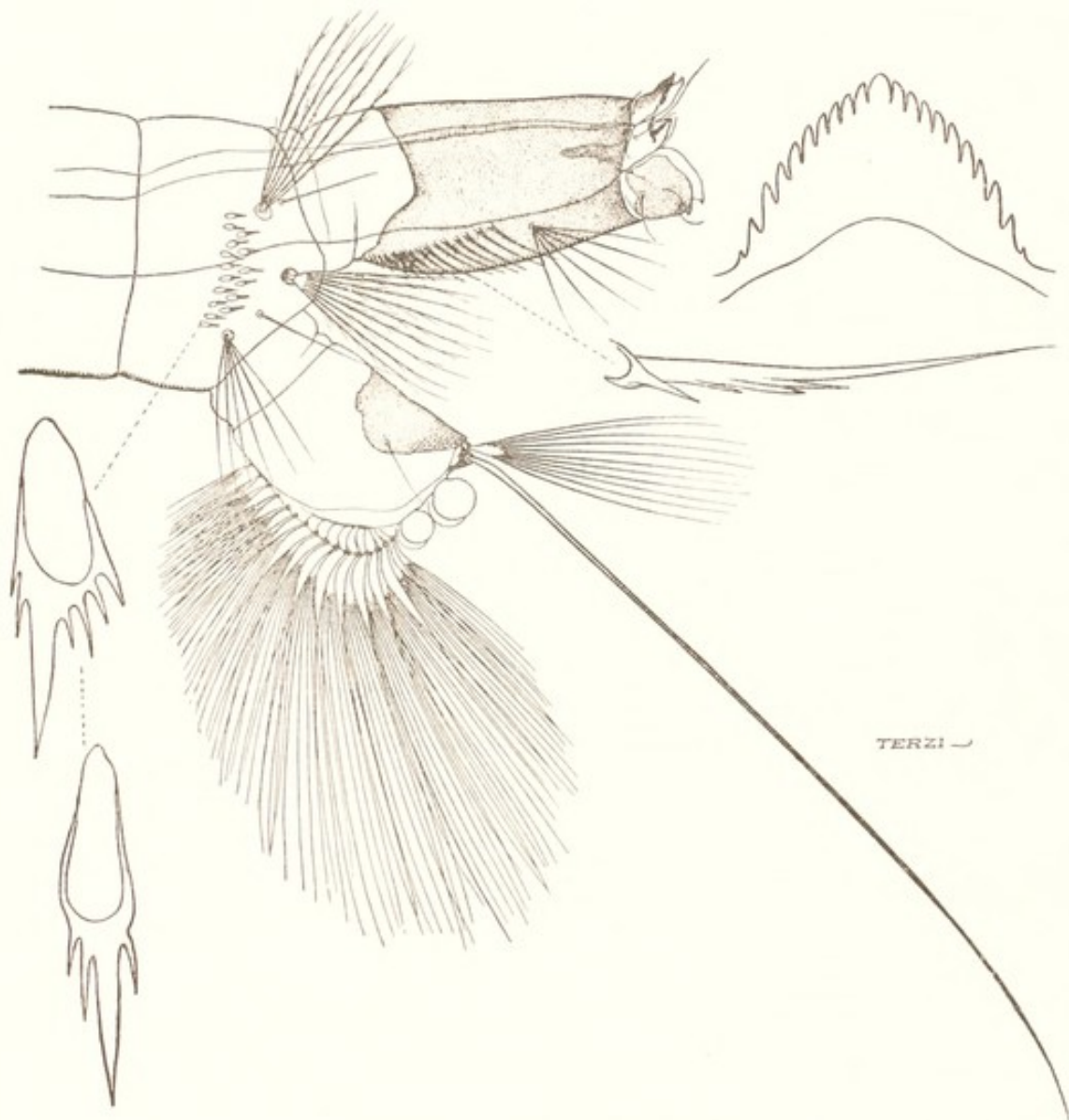


Fig. 9. *Aedes mariaae* (Serg.), end of abdomen of larva; comb and pecten teeth and mentum more highly magnified.

3. **Aedes (Ochlerotatus) mariae** (Sergent) (figs. 6 b, 8 c, 9).

Culex mariae, Ed. & Et. Sergent, Ann. Inst. Pasteur, xvii, p. 62 (early in 1903).

Before having examined specimens of the true *A. pulchritarsis*, I took *A. mariae* to be synonymous with Rondani's species, but the two are in fact distinct. *O. mariae* has the wings, femora and tibiae, and even the tarsi in part, densely speckled with pale scales; the tarsal rings are creamy white and not very sharply marked; the mesonotal scales are almost uniformly ochreous without any bronzy tint. The male hypopygium resembles that of *O. caspius*, but the basal lobes of the side-pieces are smaller and carry no spines.

The Sergents' description of the larva being somewhat inadequate, fresh figures are given here, prepared from specimens collected by Capt. Barraud. These figures will explain themselves, but it may be specially noted that the antennae are almost devoid of small spicules, a very unusual character for this genus; the siphon is also remarkable in being almost as broad at the tip as at the base, the base being feebly or not at all chitinised (even in full-grown larvae); siphonal index 1.4-1.6. (It may be remarked here that Wesenberg-Lund's figure of the siphon of *A. caspius* is inaccurate; the tip in that species is really much narrower than the base.) The anal gills in *A. mariae* are minute and globular, as usual in salt-water breeders; the saddle is extremely small; formula of anal brush 10 + 4.

The species seems to be exclusively a salt-water breeder.

Distribution.—Algerian coast (*Sergent*); Southern France (*Séguy*); Palestine coast (Athlit, *Barraud*); Syria (Beirut, *Barraud*). Probably occurs also along the intervening Mediterranean coasts.

4. **Aedes (Ochlerotatus) zammittii** (Theobald).

Acartomyia zammittii, Theobald, Mon. Cul. iii, p. 252 (25th July 1903).

This rather closely resembles *A. mariae*, the only difference I can detect in the adult being the presence of two more or less definite longitudinal stripes of white scales on the mesonotum, resembling those seen in *O. caspius*. The male hypopygia appear to be identical. The main reason for keeping the two distinct is the occurrence of certain larval differences. The two larvae of *A. zammittii* in the British Museum are both very much damaged, and one is immature, but the antenna has distinct spicules, and the pecten teeth are shorter, rather more numerous, closer together, and with more serrations than in *A. mariae*; it is possible they may have been wrongly associated with the adults, and in any case it is very desirable that more and better material should be obtained. If *A. zammittii* should prove identical with *A. mariae*, the latter name will stand for the species; it must have been published earlier, since Theobald quotes it (Mon. Cul. iii, p. 354).

Distribution.—Originally described by Theobald from Malta. I have also seen specimens with a more or less distinctly white-striped thorax from Palma, Majorca (*Grünberg*), and Southern France (*Dollfus*, per *Dr. Langeron*).

5. **Aedes (Ochlerotatus) pulchritarsis** (Rondani).

Culex pulchritarsis, Rondani, Bull. Soc. Ent. Ital. iv, p. 31 (1872).

Culex leucacanthus, Loew, Besch. Eur. Dipt. iii, p. 1 (1873).

In the specimens which I have examined there are no pale scales on the wings, the femora and tibiae are moderately speckled; the tarsi are black, with sharply marked white rings; the mesonotal scales rather variable, usually dull bronzy-ochreous with some patches of darker ones, sometimes, as in the specimens from Paris and Chitral, a more or less distinct central white stripe. It is just possible that the species may not be correctly identified, since Ficalbi in his detailed description says of the

wings, "con qualche brizzolatura chiaro." Ficalbi's description, however, fits this species much better than it does *O. maria*. The two Italian specimens were both determined by Prof. M. Bezzi, who has seen Rondani's collection. Judging from the description, it seems highly probable that Loew's *C. leucacanthus* is the same species.

The larva is unknown. The male hypopygium differs from that of *A. maria* and *A. zammittii* in having a single distinct spine on the basal lobe of the side-piece, the structure being otherwise similar.

Distribution.—Italy (Toscana, near sea, *Ficalbi*; Faenza, *E. Hargreaves*; Macerata, *Bezzi*); Macedonia (Bajirli, near Snevce, *Waterston*); Persia (Kasan, *Loew*); Paris (*Berland, Séguy*); Croatia (Novi, *Horváth*); Chitral (Drosh, *Walker*, 1915; *per Capt. P. J. Barraud*).

6. *Aedes (Ochlerotatus) maculatus* (Meigen) (fig. 7 a).

Culex maculatus, Meigen, *Klass. und Beschr.* i, p. 4 (1804).

Culex cantans, Meigen, *Syst. Beschr.* i, p. 6 (1818).

Culicada waterhousei, Theobald, *Ann. Mag. Nat. Hist.* (7), xvi, p. 674 (1905).

This species may generally be distinguished from others of the group by its darker colour; the femora (especially the hind pair) have more numerous dark scales, the white rings on the tarsi are narrower, and the mesonotum is much darker, the pale scales occurring mainly on the posterior third and often forming a pair of spots just behind the middle and indistinct pale lines in front of the scutellum. There appear to be two more or less definite forms: a smaller, with entirely dark-scaled wings and distinct pale bands at the bases of the abdominal tergites, and a larger, with scattered pale scales on the wings and the abdominal bands more or less obsolete, the pale scales which are present occurring as much towards the apices as the bases of the segments. The peculiar male hypopygium, with its divided basal lobes and very broad appendage to the claspets, is the same in both forms.

I am still unable to distinguish satisfactorily the larvae of *A. maculatus* and *A. annulipes*,* but the two species are certainly quite distinct. *A. maculatus* is essentially a woodland species, while *A. annulipes* (and most others of the group) prefer more open breeding-places.

This species has generally been known as *A. cantans*, though Meigen's description will apply as well or better to one of the other species of the group. For this reason Lang adopted the later name *waterhousei*. M. Séguy, however, informs me that males of this species are labelled *C. cantans* in Meigen's collection in Paris, and the identification of Theobald, de Meijere and others must therefore be regarded as correct. Meigen himself states that his *C. maculatus* was the male of *C. cantans*, and this statement must be accepted, since the type of *C. maculatus* no longer exists to prove or disprove it. Many of the earlier records of *C. cantans* apply no doubt to other species of the group.

Distribution.—Apparently confined to Europe, occurring chiefly north of the Alps. I have seen males from Britain; France (*Séguy, Langeron*); Belgium (*Goetghebuer*); Denmark (*Wesenberg-Lund*); Sweden (Stockholm, *Boheman*; Småland, *Haglund*); Finland (Kymmene, *Sallm.*); Germany (Urdingen and Frankfort-an-der-Oder, *Riedel*; Berlin, *Oldenberg, Lichtwardt*); Austria (Polzleinsdorf, *Schiner*; Moritzburg, *Kuntze*); Hungary (Munkács, *Ujhelyi*); also females, probably of this species, from Lapland (Qvikkjökk), and Italy (Turin, *Sangone, coll. Bezzi*).

* Séguy's figure of "*A. cantans*" in *Bull. Mus. Paris*, 1920, p. 327, really represents *A. communis*; his later figure of "*O. cantans*" in *Bull. Soc. Ent. France*, 1920, p. 310, probably represents *A. lutescens* (see Séguy, *Bull. Soc. Ent. France*, 1921, p. 165).

7. **Aedes (Ochlerotatus) semicantans**, Martini (fig. 7 b).

Aedes semicantans, Martini, Arch. f. Schiffs- und Tropenhyg. xxiv, Beiheft 1, p. 247 (1920) (diagnosis only), and Sitzb. u. Abh. natf. Ges. Rostock, vii, p. 205 (1920).

Resembles *A. maculatus* in coloration, being darker than the other four species of the group; the mesonotum has a more definite dark median stripe than in *A. maculatus*, and the abdominal segments have distinct basal white bands, which are narrowed in the middle, but the two are not easily separated, except by characters of the male hypopygium and larva, which are perfectly distinct. The hind femora are largely pale on the outer side, and the tarsal rings are broader than in *A. maculatus*. One or two North American species resemble this rather closely, but I have not at present been able to identify *A. semicantans* definitely with any North American form. The larva is very distinct on account of the small number of scales in the comb of the eighth segment.

Distribution.—Northern Europe; apparently widely distributed, but local. I have seen males from Sweden (Småland, *Boheman*); Germany (Hamburg, *Martini*; Berlin, *Stobbe*; Posen?, *Loew*); Austria? (*coll. Winthem*).

8. **Aedes (Ochlerotatus) annulipes** (Meigen) (fig. 7 c).

Culex annulipes, Meigen, Syst. Besch. vi, p. 241 (1830).

Aedes quartus, Martini, Über Stechmücken, p. 128 (1920).

Meigen mentions the dark stripe in the middle of the mesonotum, the banded abdomen and pale femora, and I therefore have no doubt that the species is correctly identified. Zetterstedt, Ficalbi and others who have described the entirely yellow abdomen of the female probably had *A. lutescens* before them. In this species the abdomen almost always has distinct yellowish-white bands, which are situated mainly or entirely at the bases of the segments.

The larva is of the short-siphoned type, apparently identical with that of *A. maculatus* (except that the siphon is slightly shorter on the average), but very distinct from that of *A. excrucians*. It occurs typically in open swamps.

Distribution.—I have examined male specimens from England (various localities); Holland (Ghent, *Theobald*); Belgium (Wesembeek, *Tonnoir*); Germany (Urdingen, *Riedel*; Berlin, *Oldenberg*); Lower Austria (Speising, *Mik*); Hungary (Pressburg, *Mik*; Tultscha, *Mann*). A female from Sweden (Östergötland, *Haglund*) may be this species, but is perhaps more probably *A. excrucians*. Martini records it from the neighbourhood of Hamburg and Dantzig. It may be regarded as the western European representative of *A. excrucians*, though the ranges of the two species must overlap to some extent.

9. **Aedes (Ochlerotatus) excrucians** (Walker) (fig. 7 f).

Culex excrucians, Walker, Ins. Saund. Dipt. p. 429 (1856).

Culex abfitchii, Felt, Bull. N.Y. State Mus. 79, p. 381 (1904); et auct.

(?) *Culicada surcoufi*, Theobald, Bull. Mus. Paris, xviii, p. 59 (1912).

Aedes excrucians, Dyar, Insecutor Inscitiae, vii, p. 25 (1919), and viii, p. 109 (1920).

This species is most nearly allied to *A. annulipes*, but the abdomen is less distinctly banded, the dark bands being reduced to a more or less diamond-shaped spot on each segment; the dark colour is often more extensive in the female. The mesonotum usually has some obscure markings; rarely a distinct, broad, dark median stripe as in *A. annulipes*. The difference of structure in the male claspettes is slight but well defined. I can see no difference between American and European specimens, except that in the former the pale markings are cream-coloured rather than yellowish.

A. excrucians is evidently one of the commonest species of the group on the European continent (it has been described by Martini as *A. abfitchii*), and it is therefore

not surprising that it has frequently been determined either as *C. cantans* or as *C. annulipes*. I consider, however, that the evidence of the original descriptions and of the types in Meigen's collection in Paris is sufficient to allot these names to other species.

I learn from M. Séguy that the type male of *Culicada surcoufi* has been lost, so that there is now very little prospect of determining Theobald's species with certainty. A female which M. Séguy sent me for examination might have been either this species or *A. annulipes*. A female in Meigen's series of *C. cantans* in the Paris Museum is almost certainly *A. excrucians*.

Distribution.—I have examined male specimens from the following countries:—Finland (Hattula, *L. v. Essen*; Tvarminno, Messuby and Walkj, *R. Frey*; Eriksberg, *E. J. Bonsd.*; Karislojo, *J. Sahlberg*); Sweden (Södermanland, *Aurivillius*; Östergötland, *P. Wahlberg*); Denmark (*Wesenberg-Lund*); Germany (Berlin, *Lichtwardt, Oldenberg, Stobbe, Enderlein*); Austria (many in Winthem's old collection without definite data; one male labelled "rufibarbis, Gtl."); Hungary (Buda, *Biró*; Munkács, *Ujhelyi*; Berecsasz, *Kertész*); Saghalin Island (*Paul Labbe*, 1902). In addition I have seen many females which are probably this species, but cannot be determined with absolute certainty, including some from Siberia (*Antsiferovo*, 59° 10', and *Turuchansk*, 65° 55', *Trybom*). The species may therefore be assumed to have a continuous distribution over North Europe and North Asia; it is also known to be widely spread in North America. It appears to be absent from North-western Europe.

10. ***Aedes (Ochlerotatus) freyi***, sp. n. (figs. 7 d, 8 d).

Scales of head and mesonotum all small and yellow. Abdomen yellow, the tergites with black apical lateral patches, no median dark line. Male palpi longer than the proboscis by nearly the length of the last joint. Long joint with a yellow ring at the base and another beyond the middle; last two joints pale-scaled at the base; hairs long, brown. Proboscis all black. Tarsi with white rings at the bases of the joints; those on the middle joints of the hind tarsi slightly more than half of the length of the joints. Front and middle femora speckled in front, yellow behind; hind femora mostly yellow, with some black scales towards the tip. Wing-scales mostly dark, the costa yellow on about the basal third.

Hypopygium: side-pieces rather slender, fully three times as long as their greatest breadth. Basal lobe prominent, rounded apically, with a small patch of long hair, and a single long, weak, pale spine. Apical lobes rather large, somewhat pointed, with a few longish hairs. No arching-hairs on sternal side of side-piece. Claspette with long curved stem and broadly flattened appendage, the expansion commencing at the base. Lobes of ninth tergite each with about six short hairs.

This species, though resembling *A. lutescens* in coloration and *A. semicantans* in the structure of its hypopygium, is certainly distinct from both. The few examples I have seen are all more or less damaged and do not allow a very precise definition of the species on colour characters. Possibly the costa being yellow towards the base only instead of for the greater part of its length might distinguish the female of *A. freyi* from that of *A. lutescens*. The only undoubted female of *A. freyi* I have seen was considerably denuded; it had scattered light scales on the wings, and the proboscis largely pale except towards the base and tip.

Distribution.—Finland (Eriksberg, *E. J. Bonsd.*, type male in Helsingfors Museum); Germany (Berlin-Finkenkrug, 27.v.00, *L. Oldenberg*, 3♂, 1♀).

11. ***Aedes (Ochlerotatus) lutescens*** (Fabricius) (fig. 7 c).

(?) *Culex flavescens*, Müller, Fauna Insectorum Friedrichsdalina, p. 87 (1764).

Culex lutescens, Fabricius, Syst. Ent. p. 800 (1775).

(?) *Culex variegatus*, Schrank, Enum. Ins. Austr. p. 482 (1781).

Culex flavescens, Fabricius, Syst. Antl. p. 35 (1805).

(?) *Culex bifunctatus*, Robineau-Desvoidy, Mém. Soc. d'Hist. Nat. Paris, iii p. 405 (1827).

Culex flavus, Motchulsky, Bull. Soc. Imp. Nat. Moscow, xxxii, pt. 2, p. 503 (1859).

Culex flavescens, Theobald, Mon. Cul. i, p. 410 (1901).

Culex arcanus, Blanchard, Les Moustiques, p. 303 (1904).

Culex fletcheri, Coquillett, U.S. Bur. Ent. Tech. Ser. 11, p. 20 (1906).

Aedes cyprius, Ludlow, Insecutor Inscitiae, vii, p. 158 (1920).

Although this species seems to be subject to a good deal of variation, it may probably always be recognised by the predominantly yellow-scaled costa and the mainly or entirely yellow-scaled abdomen. In the lightest specimens the proboscis is yellow-scaled except at the tip, where the scales are black; the palpi and wings are almost entirely yellow-scaled; the mesonotal scales are rather light yellow; the thoracic integument is reddish, with a black patch in front from which three black lines extend backwards; the abdominal scales are all yellow in the female, usually with a median line of dark ones in the male; the tarsi, though with the usual white rings at the bases of the joints, have the dark portions largely replaced by yellow, except at the tips of the joints. In the darkest specimens the proboscis and palpi are almost entirely black-scaled, the wings are much darker, even the costa having a considerable sprinkling of dark scales; the mesonotal scales are rather deep brown, contrasting strongly with the white scales of the pleurae; the thoracic integument is nearly all black; the female abdomen has rather numerous dark scales at the sides; and the tarsi are darker. In some males the thoracic scales are almost white, and there are traces of a darker median band.

It is possible that the two forms above described may represent distinct varieties, or even species, but they appear to intergrade, and males associated with both dark and light females have practically identical hypopygia, the only difference observed being that some (though not all) of the light specimens had a more or less definite hook to the membrane of the claspette appendage (see fig. 7 c). Apart from this the hypopygium is well distinguished by the shape of the side-pieces, the very large basal lobes bearing a strong black spine, and the appendages of the claspettes, which have no membranous expansion on the basal third.

I at first considered that *A. lutescens* was identical with the American *A. fletcheri*, but there are some slight differences: in *A. fletcheri* the apical lobe of the side-piece of the male hypopygium is smaller, and the mesonotum has a distinct broad dark central stripe.

This, being a common European species, is much more likely to be Fabricius' *C. lutescens* than the rare one which Theobald has redescribed as such. Fabricius emphasises the yellow costa and the yellow proboscis with a black tip; he does not mention the tarsi, the statement that they are dark being due to Meigen, who may have had another species before him. Martini was of the same opinion regarding Fabricius' species, but did not adopt the name; I consider the identification sufficiently probable for the name to be used. Zetterstedt, Ficalbi and Martini use the name *annulipes*, Mg., for it, but this is certainly wrong, since the abdomen is never banded, as Meigen states is the case in *annulipes*. Although Motchulsky's diagnosis is very brief, I consider it highly probable that his *C. flavus* is our *A. lutescens*.

Distribution.—Europe, except the west; Siberia; extending in a slightly modified form into North America. I have seen specimens from Denmark (*Wesenberg-Lund*); Sweden (*Östergötland*, *Scania*, *Boheman*, light females); Finland (*Kuustö*, *Lundström*; *Eriksberg*, *E. J. Bonsd.*); Germany (Berlin, *Wanen*, *Lichtwardt*, *Oldenberg*, *Tetens*, females of light and dark forms; *Radoj*, *Loew*, dark female); Austria (*Mödling*, *Pokorny*; *Michelstettin*, *Bischoff*; *Sterize*, Styria, *Mann*, *Weyshi*, *Steiermark*, *Mann*; males, and females of dark form); Hungary (*Pressburg*,

Mik; Jaszenova, *Ujhelyi*; Kovákspatak, *Kertész*; Budapest, *Csiki*, males; Neusiedler See, *Mik*, and Munkacs, *Ujhelyi*, dark females); Ural (Winthem, light female); Siberia (Nasimovo, 59° 35', males and dark females; Nikulina, 60° 25', lighter male, *Trybom*; Omsk, *Granö*, light females); Kamtchatka (Bolsherjetsk, 20.vii.17, *Y. Wuorentaus*, light female); Asia Minor (Seraj-Koj, *Naday*, dark females).

12. ***Aedes (Ochlerotatus) rusticus*** (Rossi).

Culex rusticus, Rossi, Fauna Etrusca, ii, p. 333 (1790).

? *Culex musicus*, Leach, Zool. Journ. ii, p. 293 (1825).

Culex pungens, Robineau-Desvoidy, Mem. Soc. Hist. Nat. Paris, iii, p. 407 (1827).

Culex quadratimaculatus, Macquart, Suites à Buffon, i, p. 34 (1834).

Culex diversus, Theobald, Mon. Cul. ii, p. 73 (1901).

Culex nemorosus var. *luteovittatus*, Theobald, Mon. Cul. ii, p. 85 (1901).

This is the largest species of the dark-footed group of the subgenus, and is very distinct from all the rest in the structure of the hypopygium and larva. The male has the palpi stouter than in most species; it can generally be distinguished even by the naked eye on account of the dense golden-yellow hairs which arch over the hypopygium, hiding the claspettes. The most strongly-marked form of the female, on which I have presumed Rossi's and Robineau-Desvoidy's original descriptions were based, shows a yellowish longitudinal stripe running the whole length of the abdomen, and dividing the black scales into two squarish areas on each segment; but it is commoner to find this longitudinal stripe distinguishable only on the last two or three segments, and such specimens will sometimes have to be examined carefully to avoid confusion with other species, such as *O. punctor* and *O. communis*. The pro-epimeral scales will separate it immediately from all other Palaearctic species.

An interesting variation is shown in a female from Szeged (*Kertész*), which has the abdomen almost entirely covered with yellowish scales, the black ones occurring only towards the middle of some of the segments without forming definite markings; the mesonotal scales are also much paler than usual, especially towards the sides. The pro-epimeral scales are normal for the species. A similar specimen from Budapest has been described by Theobald (Mon. Cul. iv, p. 344) as *Culex lutescens*, but, as stated above, I prefer to use Fabricius' name in another sense.

Walker (List Dipt. Brit. Mus. i, p. 8) queries *C. musicus* as the same as *C. quadratimaculatus*. The synonymy indicated may be correct, but the specimens are no longer in existence.

The larva is one of the few in this genus which lives through the winter, though perhaps many of the eggs do not hatch until the early spring. There is some individual variation in the number of hairs on the antero-dorsal side of the siphon.

Distribution.—West, central and south Europe. Locally common in England, France, Belgium, Germany and Denmark. Also Italy (*Rossi*; Taranto, *Hargreaves*; Livorno, *Mann*); Macedonia (*Waterston*). Not yet recorded from Sweden, Finland, Russia or Asia.

13. ***Aedes (Ochlerotatus) lepidonotus***, Edw. (figs. 5 b, 5 f, 8 e.)

Ochlerotatus lepidonotus, Edwards, Bull. Ent. Res. x, p. 132 (1920).

Distinguished by the characters given in the keys and by the uniformly pale-scaled abdomen of the female. The larva is unknown.

Distribution.—Macedonia (*Waterston*).

14. ***Aedes (Ochlerotatus) albescens***, sp. n.

Apparently related to *A. lepidonotus*, Edw., but the postnotum bears no scales. Almost all the scales of the body whitish, except on the proboscis and palpi, where they are mostly brown. Pro-epimeral scales whitish, rather narrow, some of them

curved. Palpi rather long, nearly one-third as long as the proboscis. Wings rather scantily scaled (not rubbed); veins all pale, membrane whitish; costal scales all whitish-yellow; first longitudinal vein with some dark scales. Integument of legs pale yellow, scales almost all whitish-yellow, those on the terminal tarsal segments browner; no sign of pale tarsal rings. Claws all toothed. Integument of thorax and abdomen blackish.

W. SIBERIA: Omsk (*Granö*); 1 ♀. Type in Helsingfors Museum.

15. *Aedes* (*Ochlerotatus*) *alpinus* (Linn.).

Culex alpinus, Linnaeus, Flora Lapp. Ed. 2, p. 381 (1792).

Culex nigripes, Zetterstedt, Ins. Lapp. p. 807 (1838); Henriksen and Lundbeck, Med. Groenland, xxii, p. 595 (1917).

Aedes innuitus, Dyar and Knab, Insecutor Inscitiae, v, p. 166 (1917).

Aedes (*Ochlerotatus*) *nearcticus*, Dyar, Rept. Canad. Arctic Exp. iii, Pt. C, p. 32 (1919).

Aedes alpinus, Dyar, Insecutor Inscitiae, viii, p. 52 (1920).

This species is fairly readily distinguishable by the unusually dense bristles on the thorax, looking, as Dyar has remarked, "as though it had a long woolly coat to keep out the cold." The very dark colour of the mesonotal scales, the black integument of the whole body, and the straight, shining greyish-white abdominal bands are also characteristic. However, since the density of the bristles is somewhat variable (smaller specimens being less bristly), and they are also rather liable to denudation (though less so than the scales), it is not always easy to distinguish the species from *A. cataphylla* and *A. parvulus*. In fact *A. alpinus* might almost be regarded as a race of *A. cataphylla* which has become adapted to arctic conditions by the multiplication of its bristles and the thickening of the chitin of the whole body.

I have failed to obtain a European male for examination from any correspondent, and it is very unfortunate that the good series of the species brought from north Russia by Capt. Carment and Dr. E. A. Cockayne consisted of females only. I am, however, indebted to Prof. Sjöstedt and Dr. Lundbeck for several males from south-west Greenland. These differ from the females (from the same place) in showing hardly any scales on the thorax; consequently they appear a good deal blacker; they are also even more hairy, especially on the abdomen. The hypopygium very much resembles that of *A. cataphylla*, except in being far more heavily chitinised, especially in the anal and genital parts. The apical lobe of the side-piece is very small, hardly distinguishable; the basal lobe has a moderately stout spine.

It seemed highly probable that these Greenland specimens were *A. innuitus*, D. & K., but that species was described as having a "double angular membrane" on the appendage of the claspette, as in *A. lazarensis*, while the males I have examined showed the normal single membrane. Dr. Dyar therefore re-examined the types of *A. innuitus*, and reports that the original description was in error; the membrane is really single, and the structure of the hypopygium of *A. innuitus* and *A. nearcticus* is really identical. That being so, there can be little doubt that *A. alpinus* is also the same, especially since we now know that a number of northern species of *Aedes* are common to the Old and New Worlds.

Distribution.—Probably a circumpolar species, occurring in all the lands to the north of the Arctic Circle. I have seen males and females from south-west Greenland, and females from Finmark, Lappland, Murmansk, and north-west Siberia; also a female from the Paris Museum labelled "Fontainebleau, Dufour et Laboulbène." In regard to this last there must surely have been some mistake in labelling.

16. **Aedes (Ochlerotatus) detritus** (Hal.) (fig. 7h).

Culex detritus, Haliday, Entom. Mag. i, p. 151 (1833).

Culex salinus, Ficalbi, Bull. Soc. Ent. Ital. xxviii, p. 29 (1896).

Culex terrii, Theobald, Mon. Cul. iii, p. 193 (1903).

This species is subject to a good deal of variation. Normally the dark parts of the abdomen are speckled over with light scales, but these are sometimes absent. Normally also the male palpi are entirely dark-scaled, but specimens are not infrequently met with in which the long joint bears a good many pale scales on its apical half. When both these variations occur together the specimens are not easy at first sight to distinguish from *A. salinellus*. Apart from the structure of the male hypopygium, which is of course diagnostic, the best distinctions are to be found in the almost uniform brown colour of the mesonotal scales of *A. detritus*, and the row of black spots down the middle of the venter, which are usually conspicuous in living specimens, though they are not so easily seen in the dry.

So far as known, the larva is confined to salt or brackish water, and, as in many other such forms, the gills are greatly reduced in size.

Distribution.—European coasts, from Ireland and France to Denmark and Macedonia; also coasts of North Africa, Suez Canal and Palestine. Apparently does not occur inland in eastern Europe, as do its frequent associates *A. caspius* and *A. dorsalis*. I have, however, seen a single male specimen, with a hypopygium identical with that of European *A. detritus*, from Kashgar, Chinese Turkestan (*Racquette*, in Stockholm Museum).

17. **Aedes (Ochlerotatus) cataphylla**, Dyar, var. **rostochiensis**, Martini (fig. 7i).

Aedes cataphylla, Dyar, Insecutor Inscitiae, iv, p. 86 (1916).

Aedes prodotes, Dyar, Insecutor Inscitiae, v, p. 118 (1917).

Aedes rostochiensis, Martini, Über Stechmücken, p. 246, diagnosis only (1920), and Sitzb. u. Abh. natf. Ges. Rostock vii, p. 204 (1920).

This species and *A. salinellus* are together distinguished by the pale-speckled femora and the more or less conspicuous pale ring towards the end of the long joint of the male palpi; they differ from *A. detritus* in never having scattered pale scales on the dark parts of the abdomen, though the eighth segment is generally almost entirely pale. The two species *A. cataphylla* and *A. salinellus* are extremely alike; the most obvious difference in the adult is in the colour of the scales of the proboscis, which in *A. cataphylla* are almost all black, in *A. salinellus* extensively pale about the middle, but I am not sure how far this difference is constant. There is a slight but fairly well defined difference in the hypopygia (indicated in the key), but the most striking character of *A. cataphylla* is the presence of a couple of disconnected spines at the end of the pecten of the larval siphon.

None of the old European names seem to be applicable to this species, but I am satisfied that it is specifically identical with the western North American *A. prodotes*, Dyar (which Dyar now recognises to be the same as his previously described *A. cataphylla*). The male palpi have the same pale ring; the larva has the same two detached spines on the pecten, and the hypopygia are identical, except for a slight difference in the size of the apical lobes of the side-pieces. The American specimens, however, are on the average smaller, and the mesonotal scaling is rather different from the usual European type, being rather darker in the middle and with more numerous white scales at the sides. Nevertheless the Norwegian specimens in the British Museum have the sides of the mesonotum even whiter than the American specimens I have examined.

Distribution.—I have seen male specimens from Denmark (*Wesenberg-Lund*); Sweden (Småland, Stockholm and Dalecarlia, *Boheman*); Norway (*Smaalenene*,

Prof. O. Collet; Finland (*Jämsä, Bergroth*; *Helsingfors, Hattula, L. v. Essen*; *Finnström, Frey*; *Sund, Forsius*; *Karislojo, J. Sahlberg*; *Kuusamo, Frey*); Germany (*Frankfurt-Oder, Riedel*; *Berlin, Oldenberg*); Austria (*Prater, Mann*; this specimen was insufficiently examined and may have been *A. salinellus*); Siberia (*Yeniseisk, 58° 20', Trybom*).

18. ***Aedes (Ochlerotatus) salinellus***, Edw. (fig. 7 k).

Aedes salinellus, Edwards (?) in Wesenberg-Lund, K. Danske Vid. Selsk. Skr. Nat. Math. Afd. vii, p. 197 (1921).

Ochlerotatus salinellus, Edwards, Ent. Tidskr. p. 52 (1921).

Aedes terrici, Martini (*nec Theo.*), Über Stechmücken, p. 112 (1920).

The distinguishing points of this species have been mentioned under *A. cataphylla*. In spite of their close similarity, there can be little doubt that the two species are distinct. I am not satisfied that any older name can be applied to this species. The type of *C. terrici* is certainly nothing but a normal, if rather small, female of *A. detritus*, which is common in the locality where *C. terrici* was taken. It is quite possible that *A. salinellus* may eventually be found to be the same as some known American species, but at present I have not been able to identify it with any such; it may be the European representative of *A. impiger* (= *decticus*, H.D.K.), which has the male palpi all black and fewer bristles on the ninth tergite.

The name *salinellus* was suggested partly because of the strong resemblance to *A. detritus (salinus)*, and partly because the first specimens sent me by Dr. Wesenberg-Lund were reared from brackish water.

Distribution.—Northern and central Europe. I have seen males from England (Nottinghamshire, *Carr*); Denmark (*Wesenberg-Lund*); Germany (Berlin, *Oldenberg, Lichtwardt*; Kiel, *Wiedemann*); Austria (Vienna, *Pokorny*); Hungary (Budapest, *Kertész*; Bethlen, *Ujhelyi*; Pöstyén, *Lichtwardt*). Also some small females, probably of this species, from south Russia (Waloniki, *Velitschkovsky*). Martini records it from various places in north Germany, generally near the sea, sometimes in company with *A. detritus*.

19. ***Aedes (Ochlerotatus) diantaeus***, H.D.K.

Aedes diantaeus, Howard, Dyar and Knab, Mosq. N. & C. Amer. iv, p. 758 (1917).

Aedes serus, Martini, Über Stechmücken, p. 96 (1920).

An extremely distinct species in larva and male hypopygium; less well defined in the female, but recognisable by the deep bluish-black colour of the tibiae and tarsi, and the broad black stripe down the middle of the mesonotum. Owing to the colour of the legs, and the usually interrupted pale bands of the abdomen, the female might easily be mistaken for *A. geniculatus*, which of course differs in the structure of the tip of the abdomen, as well as in thoracic markings. I have compared adults and larvae of European and North American specimens, and can find no difference, except in the length of the anal gills of the larva, which is known to be a variable character. Neither of the published figures of the hypopygium is very accurate; in particular it should be noted that Martini's omits altogether the conspicuous hair-tuft of the side-piece.

Distribution.—I have examined the following European material:—Finland (*Kuustö, Kuusamo and Küminki, R. Frey*); Denmark (*Wesenberg-Lund*). Martini's material presumably came from the Hamburg district.

20. ***Aedes (Ochlerotatus) sticticus*** (Meigen).

(?) *Culex lateralis*, Meigen, Syst. Besch. i, p. 5 (1818).

Culex sticticus, Meigen, Syst. Besch. vii, p. 1 (1838).

- Culex concinnus*, Stephens, Illustr. Brit. Ent. Suppl. p. 19 (1846).
Culex nigripes var. *sylvae*, Theobald, Mon. Cul. ii, p. 96 (1901).
Culicada sylvae, Theobald, Mon. Cul. iii, p. 194 (1903).
 (?) *Aedes aldrichi*, Dyar & Knab, Proc. U.S. Nat. Mus. xxxv, p. 57 (1908).
Culicada nigrina, Eckstein, Centralbl. f. Bakt. Abt. Orig. lxxxii, p. 67 (1918).
Culex nemorosus var. *dorsovittatus*, Villeneuve, Bull. Soc. Ent. France, p. 57 (1919).
Ochlerotatus dorsovittatus, Séguy, Bull. Mus. Paris xxvi, p. 408 (1920).
 (?) *Ochlerotatus lesnei*, Séguy, Bull. Mus. Paris xxvi, p. 328 (1920).
Culicada nemorosa salina, Brolemann (*nec* Ficalbi), Ann. Soc. Ent. France, lxxxviii, p. 81 (1919).

This species is fairly easily recognisable by the general blackish colour, the white scales on the sides of the mesonotum, contrasting strongly with the dark brown stripe which occupies the middle third, and the whitish stripe on the outer side of the hind tibia of the female (often, though not always, present also in the male). The hypopygium (figured by Séguy and Brolemann) is characterised by the extremely short appendage to the claspette, which is very little longer than broad, and not much broader than the width of the stem, and by the large basal lobes, which are to a great extent separated from the side-pieces.

The species varies a good deal in size, though it is on the average smaller than *O. punctor*, to which it is most nearly allied. It also varies in regard to the abdominal bands of the female, which are in some specimens reduced to lateral spots (as in the type of *C. sticticus*, and as described by Eckstein for *C. nigrina*), while in others they are complete and scarcely even contracted in the middle (as in the types of *C. concinnus* and *C. sylvae*). I do not believe that these differences represent anything more than individual variation. Eckstein describes and gives rough figures of a difference between the hypopygia of his *C. nigrina* and what he regards as *C. lateralis*, stating that the appendage of the claspette is shorter and less broad in the latter than in the former. This may be true, and if so must indicate that we are dealing with two distinct species, but I have seen no specimens corresponding to Eckstein's figure of *C. lateralis*, and am inclined to think he has merely shown the same structure from two different points of view.

Since there may be two allied species here, and since there has been difference of opinion as to the interpretation of Meigen's *C. lateralis*, Theobald using the name for *A. geniculatus*, it does not seem advisable to adopt this earlier name for the species; the type of *C. lateralis* being no longer in existence, it seems best to follow Theobald in adopting Ficalbi's suggestion that it is the same as *C. albopunctatus*, Rond. (*A. geniculatus*). Of *C. sticticus* there is a female in good condition in Meigen's collection at Paris, and Séguy reports that the hind tibiae have a distinct pale stripe on the outer side. The name *sticticus* may therefore be used without further question.

I have examined the types of *C. concinnus* and *C. sylvae* and cotypes of *C. dorsovittatus*, and have no doubt as to their identity. Séguy's figure of the hypopygium of *O. lesnei* represents a structure apparently identical with that of *A. sticticus*, his other figure of *O. dorsovittatus* being rather inaccurate, besides showing the same structure in a different position. Specimens of *A. sticticus* were collected by M. Lesne in the same locality and at the same time as the type of *O. lesnei*, and I cannot help thinking that Séguy has confused two different species in his description: the tarsi of *O. lesnei* are said to have pale rings.

The North American species *A. hirsuteron* (Theo.), *A. aestivalis*, Dyar, and *A. aldrichi*, D. & K., are all very similar to *A. sticticus* in coloration, as well as in the male hypopygium, all having the same peculiar structure of the basal lobes. It is not at all unlikely that *A. sticticus* occurs in North America under one or other of these names. I can see no difference between European *A. sticticus* and American *A. aldrichi*, and consider that they are most probably identical, though distinctions

may be discovered on closer study, especially when the European form is better known.

According to Eckstein the larva of *A. nigrius* lives in flooded meadows together with *A. vexans* and *A. dorsalis*, and several generations are passed through during the year. This does not accord with what is known of the habits of the allied North American species.

Distribution.—Widely spread in Europe, but seems to be nearly always rare. I have seen specimens (mostly females) from Scotland (Stephens' type; also Aberfoyle, Carter); England (New Forest, Theobald's types); France (Melun, Debreuil; Bois de Lutterbach, Bois de Borne, Chalampe, P. Lesue); Germany (Lüben, Rados, Halle, Loew; Bonn, Schneider; Berlin, Lichtwardt); Denmark (Jutland, Wesenberg-Lund); Austria (Linz, Kahlenberg, Aigen, Mik; Dornbach, Handlirsch; Prater, Pokorny; Styria, Mann); Hungary (Szóváta, Csiki); Siberia (Asinovo, 61° 25' Trybom).

A long series collected by Dr. K. Kertész at Fuzine and Jasenak (Croatia) shows very little variation; in all these the abdomen of both sexes has complete white basal segmental bands, and the dark-scaled area in the middle of the mesonotum is more extensive than usual, the specimens agreeing in this respect with many American examples of *A. aldrichi*, though not showing a pale median line dividing the dark area.

21. ***Aedes (Ochlerotatus) punctor*** (Kirby) var. ***meigenanus***, Dyar (fig. 7 g).

Culex punctor, Kirby, Fauna Boreali-Americana, Zool. Ins. p. 308 (1829).

Culicada (or *Ochlerotatus*) *nemorosus*, Theobald, de Meijere, Edwards, Lang (nec Meigen).

(?) *Culicada nemorosa* f. *haplolineata* and f. *alineata*, Schneider, Verh. Nat. Ver. Bonn, lxx, p. 37 (1913).

Aedes punctor, Dyar, Insecutor Inscitiae, viii, p. 3 (1920), and ix, p. 71 (1921).

Aedes meigenanus, Dyar, Insecutor Inscitiae, ix, p. 72 (1921).

Aedes sylvae, Martini (nec Theobald), Über Stechmücken, p. 108 (1920).

This species is a variable one, and hence difficult to distinguish with certainty from its allies. The absence of a definite speckling of pale scales on the femora and tibiae, and the creamy tint of the abdominal bands—those on the last few segments being rather conspicuously narrowed in the middle—are, taken together, the best means of distinguishing the female. The male hypopygium is very distinct; the large, prominent basal lobes and the short stem and strongly chitinised appendage of the claspette suggest that the species is really more nearly related to the *A. caspius* group than to the other members of the dark-legged group; this supposition is to some extent borne out by the larval structure.

In the commonest type the mesonotum has brown or ochreous scales at the sides, with a broad longitudinal dark brown band in the middle; this form is fairly distinct from other European species, though it might perhaps be confused with *A. sticticus* or *A. dianiaecus* (cf. the distinctions of those species). Frequently, however, the dark central band of the mesonotum is either absent altogether or represented by two narrow bands, and such specimens are difficult to distinguish from *A. communis* or *A. pullatus*.

I have rejected the name *nemorosus* for this species, because there appear to be no examples of it so named in Meigen's collection in Paris, while there is a male of *A. communis*; the name *nemorosus* has been used to cover so many species that there would be little advantage in retaining it. The present species is possibly Meigen's *C. sylvaticus*, but this is doubtful. While admitting that there are minute differences in larva and adult, as well as some distinction in breeding habits, between *A. punctor* and the European form, I cannot believe these are sufficient to justify

the maintenance of the two as distinct species. The European form should perhaps be known as *A. punctor* var. *meigenanus*. The hypopygium is identical in the two forms, and also in two or three other American forms which are regarded by Dyar as distinct species. The relationship of all these forms appears to require closer investigation.

It is quite possible that there may be more than one form in Europe, but the only evidence I have seen of this is provided by a male from Kuusamo, Finland, which has the hypopygium (and indeed the whole body) much more strongly chitinised than usual, and the hairs on the apical lobe rather longer. This may perhaps represent a distinct variety or species.

Distribution.—Apparently widely spread throughout northern Europe, and probably spreading across Siberia into Alaska and Canada. I have seen males from Britain; France; Belgium; Sweden (Stockholm, Småland, *Boheman*; Östergötland, *Wahlberg*); northern Lapland (*Boheman*); Finland (Kuusamo, Finnström, *Frey*; Kuustö, *Lundström*; Hattula, *L. v. Essen*; Karislojo, *J. Sahlberg*; Wiborg, *Pipping*; Jämsä, *Bergroth*; Tvarminno, *Levander*); Germany (Berlin, *Oldenberg*, *Stobbe*; Brocken, *Lichtwardt*); Hungary (Munkacs, *Ujhelyi*); also females, probably this species, from Austria (Hammern, *Mik*); Tyrol (Landro, *Mann*); Siberia (R. Ob, *Finsch*; Turuchansk, Yeniseisk, Inserovo, Antsiferovo and Nasimovo, all on R. Yenisei, *Trybom*).

22. *Aedes (Ochlerotatus) parvulus*, sp. n. (fig. 8 f).

♂ Palpi all dark, long-haired, slightly shorter than the proboscis, proportions of joints, 55 : 26 : 19. Head-scales mixed in the middle, then grey, then a patch of blackish scales on each side; the broad lateral scales extend further up towards the middle of the head than usual; bristles black. Thorax dark brown; some white scales at the sides of the mesonotum; bristles rather dense. Abdomen black, the tergites with narrow straight basal bands of pure white scales. Legs almost all dark, the femora with only a few scattered pale scales and pale beneath. (Hind legs missing.) Length 4.5 mm.

Hypopygium: Lobes of ninth tergite each with about six short hairs. Basal lobe of side-piece prominent, rather pointed, with many long curved hairs but without a spine. Apical lobe very small, with a few short straight hairs. Claspette with the stem strongly curved; appendage with a broad membranous expansion commencing near the base.

♀ Similar to the male. Palpi about one-sixth as long as the proboscis. The hind tibiae have no pale lateral stripe. Length 3.5 mm.

A. parvulus has the appearance of a small, less hirsute race of *A. alpinus*, and perhaps it really is so, but the less strongly chitinised hypopygium, the absence of a spine on the basal lobes of the side-pieces, the slightly shorter male palpi, and the less speckled femora seem to be sufficient to distinguish it specifically.

Distribution.—Finland: Kittilä (♂ *F. Silén*, ♀ *U. Sahlberg*); type male and female in Helsingfors Museum; also several females, doubtfully conspecific, in Helsingfors and British Museums, from Karislojo (*J. Sahlberg*), Kusomen (*Hellén*) and Suomussalmi (*Hellén*); these last have mostly a fairly distinct pale hind tibial stripe, and the broad head-scales do not extend so far up as in the type.

23. *Aedes (Ochlerotatus) communis* (De Geer) (fig. 7 j).

Culex communis, De Geer, Mémoires, vi, p. 316 (1776).

Culex nemorosus, Meigen, Syst. Besch. i, p. 4 (1818).

(?) *Culex fasciatus*, Meigen, Klass. i, p. 4 (1804).

(?) *Culex leucomelas*, Meigen, Klass. i, p. 3 (1804).

- (?) *Culex sylvaticus*, Meigen, Syst. Besch. i, p. 6 (1818).
Aedes obscurus, Meigen, Abbild. Zweifl. Ins. pl. ii, fig. 2 (1830).
Culex lazarensis, Felt & Young, Science, xx, p. 312 (1904).
Culicata nemorosa forma *diplolincata*, Schneider Verh. Nat. Ver. Bonn, lxx, p. 37 (1913).
 (?) *Aedes tahoenis*, Dyar, Insecutor Inscitiae, iv, p. 82 (1916).
 (?) *Aedes pionips*, Dyar, Insecutor Inscitiae, vii, p. 19 (1919).
Ochlerotatus palmeri, Edwards, Ent. Tidskr. p. 52 (1921).

This is one of a group of species which can only be satisfactorily distinguished by the structure of the male hypopygium. When this organ is mounted and examined under the high power of a binocular microscope, *A. communis* may be readily distinguished from other species by the two ridges at the base of the appendage of the claspette. These are best seen when the whole hypopygium is viewed from above; the small additional ridge is on the outer side of the appendage and at the base only. The long, strongly arched stem of the claspette and the form of the basal lobes seem to show that *A. communis* is more closely related to *A. cataphylla* and *A. salinellus* than to *A. pullatus* or *A. punctor*, though in coloration the first two species are more easily distinguished from *A. communis* on account of their speckled femora and tibiae. The indications of relationship afforded by the male hypopygium are also supported by the larval characters.

A. communis is evidently one of the most abundant woodland mosquitos of Europe, and is no doubt the species which has most frequently been identified as Meigen's *C. nemorosus*. This, together with the fact that a male of the species is included in Meigen's series of *C. nemorosus* in the Paris Museum, will definitely settle this name; although Meigen's description (brownish-yellow thorax, etc.) does not agree. De Geer's description of the adult and larva of *C. communis*, however, is quite sufficiently detailed for identification, and I have therefore adopted his name for the species. The disappearance of the name *nemorosus* from dipterological literature will be an advantage rather than otherwise, since it is now known that a number of species have been confused under this name.

I have examined the type of Meigen's *Aedes obscurus*, which I received on loan through the kindness of M. Séguy. The hypopygium is apparently identical with that of *A. communis*, and the short palpi (if they were not merely broken) were therefore probably an individual abnormality similar to those which I have recorded as occurring in *A. punctor*.

In describing *C. nemorosus*, Meigen refers to his earlier description of *C. reptans* (Klass. i, p. 3, a doubtful identification of Linnaeus' *C. reptans*) as synonymous. In this earlier description, however, the tarsi are said to be white-ringed, so that the same species cannot have been referred to in both descriptions. The explanation probably is that Meigen intended to give a reference to his *C. leucomelas*, very briefly diagnosed immediately after *C. reptans*, with the remark, "Diese Art, die vielleicht nur eine Abänderung der vorigen ist, unterscheidet sich von derselben bloss durch die ganz schwarzen Füße." This name *C. leucomelas* has been overlooked, and will unfortunately necessitate the renaming of a South American species.

Meigen's *C. sylvaticus* (*fasciatus*, 1804) is impossible to determine from the description, and I see no particular justification for Martini's suggestion that it is *Culex apicalis*; since the type does not exist it will be as well to accept Meigen's statement (Syst. Besch. vi, p. 241) that it is only his *C. nemorosus*.

The American forms *A. lazarensis* and *A. tahoenis*, and probably also *A. pionips*, differ in such minute details that they can hardly be ranked as more than varieties of *A. communis*, but it is interesting to note that the hypopygium of the Alaskan *tahoenis* is the more nearly identical with European *communis* in regard to the exact position of the spine on the basal lobe of the side-piece, the only point in which Dyar has indicated distinctions between the American forms. I had intended to describe

a new species, *A. palmeni*, on account of some differences which I thought I perceived in the male hypopygium in two specimens from Finland. On a re-examination I failed to verify these differences, but meanwhile, unfortunately, I had published the name *palmeni* in my key to the Swedish species.

Distribution.—Europe, except west and south, and probably across Siberia to Alaska and Canada. I have examined male specimens from Denmark (*Wesenberg-Lund*); Sweden (Dalecarlia, Vesterbotten, Norrbotten, *Boheman*); Finland (Helsingfors, *J. Sahlberg*; Seitjaur, *Palmen*); France, Forêt de Marles, *Alluaud*; Germany (Berlin, *Lichtwardt*); Austria (Admont, Steiermark, *Strobl*; Richenau and Linz, *Mik*; Dornbach, *Handlirsch*).

I have also seen females, probably of this species, from Lappland and Siberia (Yeniseisk).

24. ***Aedes (Ochlerotatus) pullatus*** (Coq.) var. ***jugorum*** (Villen.) (fig. 7 i).

Culex pullatus, Coquillett, Proc. Ent. Soc. Wash. vi, p. 168 (1904).

Culex jugorum, Villeneuve, Bull. Soc. Ent. France, p. 58 (1919); Séguy, Bull. Soc. Ent. France, p. 39, figs. (1921).

Aedes metalepticus, Dyar, Insecutor Inscitiae, viii, p. 51 (1920).

Aedes gallii, Martini, Über Stechmücken, p. 110 (1920).

This closely resembles *A. communis*, and it is almost impossible to distinguish the two satisfactorily, apart from the male hypopygium and the larva, which are very distinct. *A. pullatus* is somewhat smaller than *A. communis*, the integument is perhaps darker, and there are more numerous white scales on the mesonotum.

I have not seen the types, but an Italian male of *A. metalepticus* sent by Prof. Bezzi is practically identical in structure with an American male of *A. pullatus* in the British Museum; the distinctions given by Dyar must be due either to individual variation or to differences of mounting. The only differences observable in the Italian specimen were that the stem of the claspette was slightly stouter, slightly more angulated, and with a more distinct bristle arising from the angle; the main spine of the basal lobe was somewhat stouter, and the pale scales of the thorax whiter. These differences taken together may possibly indicate a varietal distinction.

Dyar suggested that *C. jugorum* might be the same as *A. metalepticus*, and this is almost certainly the case, but Séguy's figure of the hypopygium of a specimen (not the type) of *C. jugorum* shows a distinct apical hair-tuft on the side-piece, as in *A. intrudens*. The Verestorony examples that I have examined have an aggregation of hairs in this position, almost suggesting a tuft, and Séguy may have exaggerated the appearance of a tuft in his specimen, or the species may be somewhat variable. Both Séguy's and Kertész's specimens agree with Bezzi's except in this one point. As remarked by Villeneuve, there are long dense hairs arching over the upper (sternal) surface of the hypopygium, as in *A. rusticus*, *A. cataphylla*, and some others.

Distribution.—As yet imperfectly known; occurs in mountainous regions of Europe and North America, and therefore probably also of Central Asia. Recorded by Martini from Switzerland (*Galli-Valerio*), by Dyar from north Italy (*Bezzi*), and by Villeneuve from the Pyrenees (*Brolemann*). I have seen males from north Italy (Scais, *Bezzi*); Transylvania (Verestorony, *Kertész*); and the Balkans (Vermosa, 1200m., Greuze, *Penther*); also females, possibly of this species, from north Sweden (Kiruna, *Lichtwardt*).

25. ***Aedes (Ochlerotatus) intrudens***, Dyar (fig. 8 f).

Aedes impiger, Howard, Dyar and Knab (*nec Walker*), Monogr. iv, p. 755 (1917).

Aedes intrudens, Dyar, Insecutor Inscitiae, vii, p. 23 (1919).

I know of no satisfactory means of distinguishing the adults of this species from those of *A. pullatus* or *A. communis*, but the hypopygium is quite distinct, owing

4. Lobes of ninth tergite with 6-8 fine hairs .. *japonicus* (Theo.); *koreicus*, Edw.
 Lobes of ninth tergite with 2-4 stouter hairs .. *geniculatus* (Oliv.).
 Since most of the larvae are unknown, a table cannot be given.

26. ***Aedes* (Finlaya) *togoi*** (Theobald).

Culicella togoi, Theobald, Mon. Cul. iv, p. 379 (1907).

This is very distinct from the other Palaearctic species of the subgenus, both in the tarsal markings and in the male hypopygium, which shows the following characters:—Side-pieces a little over twice as long as their depth at the base; upper flap much expanded basally, its inner margin with a dense row of long, slightly flattened bristles or bristle-like scales, extending the whole length except on the expanded basal portion; the lower flap has an aggregation of hairs at the base, but no definite basal lobe. Claspers moderately long, nearly cylindrical, tapering; terminal spine not very long. Claspettes with the stem extraordinarily short, reduced to a mere knob; appendage sickle-shaped, slender, not expanded in the middle. Lobes of ninth tergite small, with about 6-8 moderately long hairs.

The male palpi are about three-quarters as long as the proboscis, nearly straight and slightly hairy.

The larva is undescribed (unless recently by Yamada); Dr. Lamborn found them in granite basins in cemeteries.

Distribution.—Japan (Osaka, Theobald; Tokio, S. Yamada, Harmand; Yokohama and Kobe, Lamborn); eastern Siberia (Vladivostok, per Dr. C. S. Ludlow).

27. ***Aedes* (Finlaya) *japonicus*** (Theobald).

Culex japonicus, Theobald, Mon. Cul. i, p. 385 (1901).

Apart from the tarsal characters, which are diagnostic, this species is noteworthy for the fine yellowish lines on the mesonotum; similar lines are found in *A. koreicus* and *A. eatoni*. The male palpi are slightly shorter than the proboscis, slender, the last two joints somewhat upturned, and with rather scanty hairs, thus approaching very nearly to the type of palpi found in *Stegomyia*. The male hypopygium is extremely similar to that of *A. geniculatus*. Theobald suggested that this might possibly be the same as *A. aureostriatus* (Dol.), but this is unlikely.

The larva is undescribed, unless recently by Yamada; Dr. Lamborn found a few in similar situations to those in which he took *A. togoi*.

Distribution.—Japan (Tokio, Theobald, Yamada; Kofou, L. Drouard de Lezey; Chuzenji, E. Gallois; Nagasaki, Lamborn).

28. ***Aedes* (Finlaya) *koreicus***, Edw.

Ochlerotatus (Finlaya) *koreicus*, Edwards, Bull. Ent. Res. vii, p. 212 (1917).

This should probably be ranked as a variety of *A. japonicus*, from which it differs in little else than in having narrow white rings at the bases of the last two hind tarsal joints. The palpi of the type male are perhaps slightly less hairy than in *A. japonicus*.

The larva is unknown.

Distribution.—Korea (Dr. R. G. Mills).

29. ***Aedes* (Finlaya) *niveus*** (Ludlow).

Stegomyia nivea, Ludlow in Theobald, Mon. Cul. iii, p. 139 (1903).

Stegomyia pseudonivea, Theobald, Ann. Mus. Nat. Hung. iii, p. 75 (1905).

Stegomyia albolateralis, Theobald, Rec. Ind. Mus. ii, p. 289 (1908).

In typical examples of *A. niveus* the silvery area on the scutum forms a solid patch, but in some specimens (generally females) it is divided more or less completely by a dark median stripe, which may even reach the front margin. The

specimens with this dark stripe (such as the Japanese examples recorded below) may represent a distinct species or variety (*albolateralis*, Theo.), but in view of Leicester's remarks on the variability of the species I doubt if this is so. Unfortunately, I did not examine the hypopygium of the Japanese male. A male from the Andaman Islands shows the following characters:—Side-pieces about twice as long as their depth (or three times as long as their width) at the base, tapering, densely scaly on their outer and under sides, finely hairy on the inner side, some long hairs at the base beneath; a dense row or tuft of very long and broad scales on the upper (sternal) side, not reaching the base. Claspers short, with a very long terminal spine which is quite two-thirds as long as the clasper itself. Lobes of ninth tergite with about four very long bristles. Claspettes with the appendage moderately expanded in the middle, about equalling the stem in length. The male palpi are of practically the same length as the proboscis, the last two joints turned downwards and bearing long hairs.

If Eichwald's *Culex niveus* is an *Aedes*, the name is ineligible for this species, and *pseudoniveus* should be used instead, but in view of the uncertainty there is perhaps no necessity to make the change.

The larvae are not yet described, though Leicester records finding them in cut bamboos.

Distribution.—A widely-spread Oriental species extending into Japan (Tokio, S. Yamada; 1 ♂ 1 ♀ in coll. M. Koidzumi).

30. *Aedes (Finlaya) eatoni* (Edw.).

Ochlerotatus eatoni, Edwards, Bull. Ent. Res. vi, p. 358 (1916).

Apart from the very different thoracic markings, this species differs from *A. geniculatus* in the coloration of the hind femora, which are black above for their whole length, instead of entirely white on the basal half. The female and larva remain unknown, the description being based on a single male, the palpi of which are only about two-thirds as long as the proboscis.

Distribution.—Madeira Island (*Eaton*).

31. *Aedes (Finlaya) geniculatus* (Oliv.) (figs. 1 b, 5 g, 10 a).

Culex geniculatus, Olivier, Encycl. Méth. Hist. Nat. Ins. vi, p. 134 (1791)

(?) *Culex lateralis*, Meigen, Syst. Besch. i, p. 5 (1818) et auct.

Culex ornatus, Meigen, Syst. Besch. 1, p. 5 (1818).

Culex guttatus, Curtis, Brit. Ent. p. 537 (1834).

Culex fuscus, Zetterstedt, Dipt. Scand. ix, p. 3459 (1850).

Culex albopunctatus, Rondani, Bull. Soc. Ent. Ital. iv, p. 31 (1872).

The shining white, almost silvery knee-spots, and the coloration of the hind femora will distinguish even somewhat rubbed adults of this species from any member of the subgenus *Ochlerotatus*. Fresh specimens are obviously distinct by their thoracic markings. From the allied *A. echinus* this species differs mainly in the narrower scutellar scales; but even this is not absolutely diagnostic, as I have seen a male from the south of France which is certainly only *A. geniculatus*, but which has some small flat scales on the scutellum. The larva, however, is very different from that of *A. echinus*, and as it is the only other species of the genus which is found in tree-holes in Europe, no confusion with any other species is likely.

As I have previously stated (Ent. Mo. Mag. 1912, p. 277), I do not think there can be any doubt that Olivier's name should apply to this species, and that Theobald was in error in using it for *Culex hortensis*. I now believe that the female which Meigen originally described as *C. ornatus* must have been this species, although the male which he described at a later date must have been something else, as he refers to the white marks on the palpi. Van der Wulp, Verrall, Galli-Valerio

and others who identified *C. ornatus* as this species were therefore probably right. Meigen's *C. lateralis* may also be the same, as supposed by Theobald, but the type being lost it is impossible now to say whether it was this species or *A. sticticus*. Mr. J. E. Collin has kindly examined for me the two males of *C. fuscus* in Zetterstedt's collection at Lund, and from his notes and accompanying sketch of the claspette there can be no doubt that *C. fuscus* is *A. geniculatus*. Zetterstedt must also have included with these males rubbed females of other species, as one which was sent me by Dr. Bengtsson in 1912 was an *Ochlerotatus* near *O. cataphylla*.

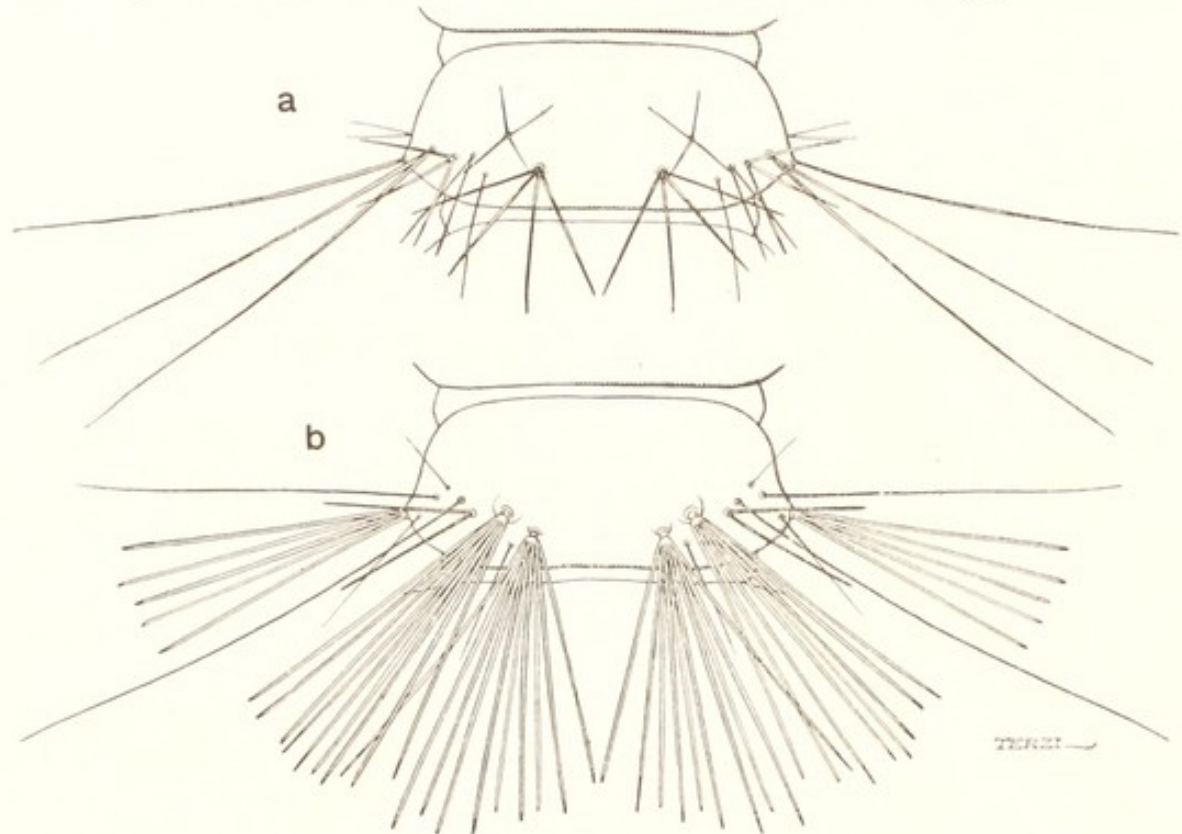


Fig. 10. First abdominal segment of larva of (a) *Aedes geniculatus* and (b) *Aedes echinus*, showing the remarkable difference in the development of the hairs.

Distribution.—Throughout Europe from France to Galicia and from south Sweden to Macedonia, wherever there are deciduous trees, such as beech, sycamore, plane, horse-chestnut, sweet chestnut, etc., in sufficient numbers. It occurs also in Corsica (*Yerbury, Séguy*) and in Asia Minor (*Brussa, Mann*). It is not yet known from Siberia or North Africa, though its known range will no doubt be extended by future observations. The most northerly record I have is Scania, Sweden (*Boheman*). Its absence from the far north may be accounted for by the fact that coniferous trees, also birches and willows, do not readily form rot-holes that will contain water. Its apparent absence from Scotland and Ireland is not so easy to explain. The North American representative (*A. triseriatus*, Say) is specifically distinct.

32. ***Aedes (Finlaya) echinus*** (Edw.) (figs. 6 a, 10 b, 11).

Ochlerotatus (Finlaya) echinus, Edwards, Bull. Ent. Res. x, p 133 (1920).

The adult is very similar to *A. geniculatus*, apart from the two points mentioned in the key, but the larva is strikingly different, chiefly on account of the remarkable development of the hair-tufts on the thorax and abdomen. These appear to correspond rather closely in number and position with those of *A. geniculatus*, but the component hairs are more numerous, distinctly plumose, somewhat longer, and much stouter, giving the insect a very urchin-like appearance (whence the specific

name). Fig. 10 illustrates well the difference in vestiture of the first abdominal segment in the two species; the following segments in both have the hairs longer. (In the case of *A. echinus* both the skins preserved by Capt. Waterston are much distorted, and careful reconstruction was necessary.) The larva of *A. echinus* also differs from that of *A. geniculatus* in the distinctly longer antennae, which are much more extensively pale towards the tip, in the much more numerous pecten teeth, which are in a straighter row, in the somewhat smaller siphon and somewhat larger comb teeth, as well as in some other details, perhaps not constant.

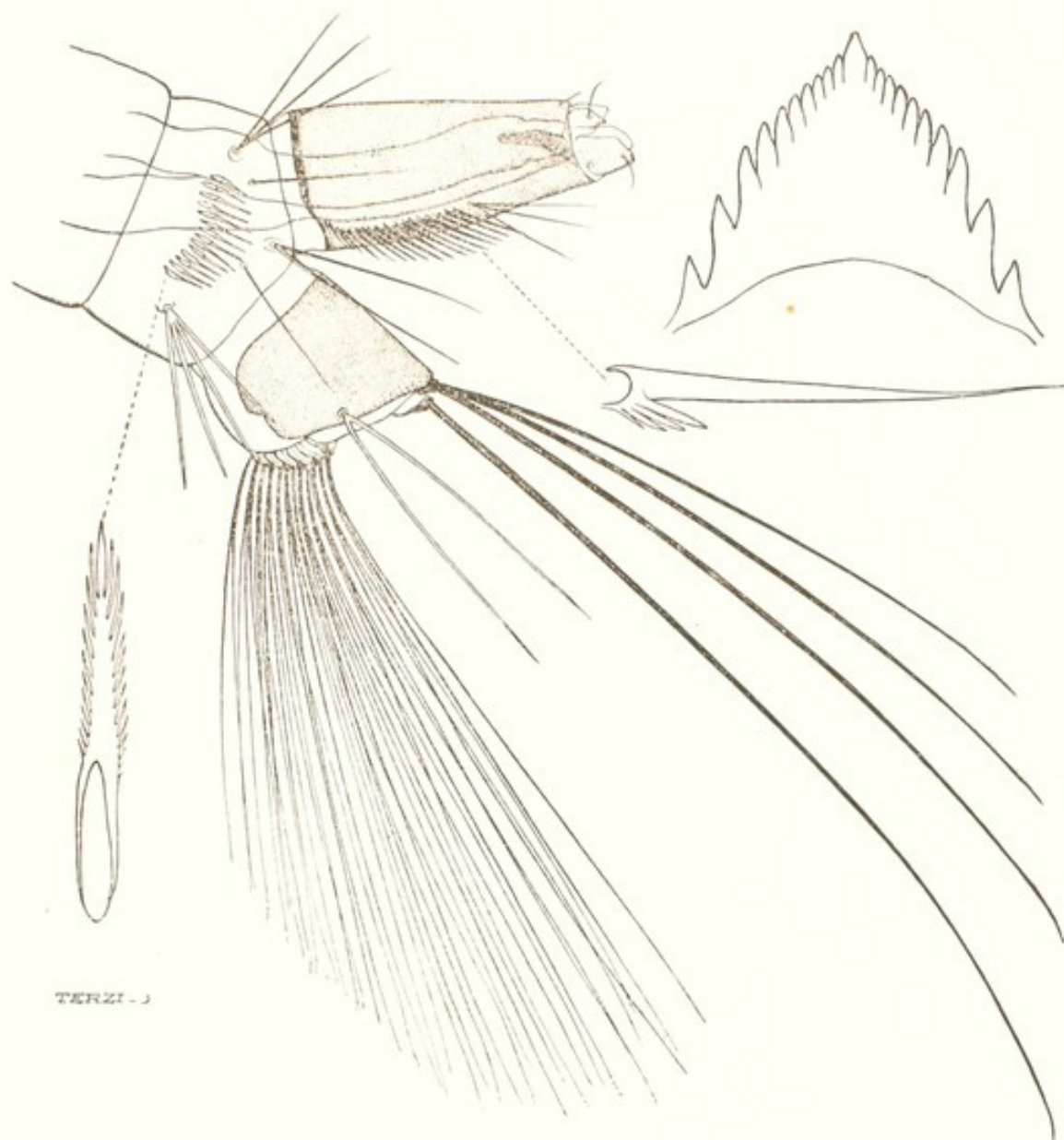


Fig. 11. *Aedes echinus*, Edw., end of abdomen of larva; comb and pecten teeth and mentum more highly magnified.

The pupa differs from that of *A. geniculatus* in having the paddles more strongly emarginate and the terminal hair placed at some distance outside the tip of the midrib.

Distribution.—Macedonia (Stavros, *Waterston*; reared from larvae in hole in plane tree; many adults of *A. geniculatus* also found in the same locality); Morocco (Fez, *Fowler*); Algeria (*Sergent*).

Subgenus **Ecculex**, Felt.

Adult.—As in *Ochlerotatus*, but the male palpi are usually no longer than the proboscis; the vertex and the scutellum in many species are covered with flat scales; lower mesepimeral hairs are usually absent; the male hypopygium has no distinct claspettes, these being represented by hairy basal lobes; while, on the other hand, the claspers are highly modified in most species, and even in the simple forms are distinguished by having the spine inserted before the tip. The aedoeagus is quite different from that of *Ochlerotatus*, but almost identical with that of *Aedes*. The hind claws are usually simple.

Larva.—Practically as in *Ochlerotatus*, but the pecten usually has detached teeth outwardly, which in *Ochlerotatus* is rarely the case, and the siphonal tuft is usually distinctly beyond the middle.

In *E. vexans* the frontal hairs are situated one in front of the other, as in *Ochlerotatus*, but in the rather numerous Ethiopian species of which the larvae are known the anterior pair is placed outside the posterior, as in *Culex* and *Aedes* (*s. str.*).

It is only with reluctance, in deference to the opinion of Dyar, that I recognise this as a distinct subgenus, as it is almost impossible to define apart from the characters of the male hypopygium. However, there is no doubt that it is a natural group, representing a distinct line of evolution in which the clasper has undergone specialisation instead of the claspette. The separation is confirmed by present-day distribution, the species being numerous in the Oriental and Ethiopian regions, only a single one extending into the Palaearctic and Nearctic, while none are found in the Neotropical, and only one or two in north Australia.

33. **Aedes (Ecculex) vexans** (Mg.).

Culex vexans, Meigen, Syst. Besch. vi, p. 241 (1830).

(?) *Culex parvus*, Macquart, Suites à Buffon, i, p. 36 (1834).

Culex articulatus, Rondani, Bull. Soc. Ent. Ital. iv, p. 30 (1872).

Culex malariae, Grassi, Atti Acc. Lincei, vii, p. 168 (1898); Noé, Bull. Soc. Ent. Ital. xxxi, p. 244 (1899).

(?) *Culex arabiensis*, Patton (adult, not larva), J. Bombay Nat. Hist. Soc. xvi, p. 633 (1905).

Apart from the characters of the male hypopygium and the somewhat shorter male palpi, this species is not easy to distinguish from the *annulipes* group of the subgenus *Ochlerotatus*, especially small specimens of *A. maculatus*. The structural and scale characters are the same, except that the hind claws are often (not always) simple; in both the lower mesepimeral bristles are absent. We have therefore, in the case of the female, to rely mainly on coloration for the determination of this species, the most constant feature being the median emargination of the pale abdominal bands. The white tarsal rings are always narrow, but rather variable; in large specimens they are sometimes not much narrower than those of the narrowest-banded specimens of *A. maculatus*; while in the other examples (generally small ones) they are often so narrow as to be visible only under a lens. The head markings (the uppermost of the flat scales at the sides of the head being black, the rest pale) are of a type very rarely met with in *Ochlerotatus*, but common in *Ecculex*, *Stegomyia* and *Finlaya*. *E. vexans* differs from the great majority of species of the subgenus in having no flat scales either on the vertex or on the scutellum, its resemblance to the subgenus *Ochlerotatus* being thus increased.

Two varieties occur within the Palaearctic region: the typical form, in which the abdomen has only the emarginate white bands on a dark ground; and the variety *nipponii*, Theobald, in which the abdominal segments have, in addition to the bands, a median whitish patch.

The species is so abundant in many parts of Europe as to constitute a serious plague; so much so that, according to Eckstein and others, agricultural work in some districts has to be carried on by night and cattle stalled during the day, owing to the attacks which *A. vexans* makes by day on the men and cattle.

The larva occurs characteristically in flooded meadows, and several generations are passed through in the year. There is very little difference between the larva and those of some species of *Ochlerotatus* which have detached teeth at the end of the pecten, even the distinctions given in the key being somewhat doubtful. According to the figure and description in Howard, Dyar and Knab's monograph (where the species is named *A. sylvestris*, Theo.), the siphonal tuft is situated in the middle, though according to Schneider and Martini it is placed well beyond the middle. The only larvae I have seen are from Ceylon, and these agree entirely with Martini's description; I suspect therefore that the American description may be in error, as there is certainly no difference in the adults.

Distribution.—Apart from the domestic species (*Culex pipiens*, *C. fatigans* and *Aedes argenteus*), this is the most widely spread of all mosquitos, occurring practically throughout the Palaearctic, Oriental and Neartic regions. Possibly it may have had its origin in tropical Africa, where there are a number of related forms, but if so its apparent absence from that region at the present time is remarkable. It is common throughout central Europe, perhaps less so in the south, and certainly rare in the north. Some fresh records are: Sweden (Oeland I., *Boheman*); Finland (Helsingfors, *Frey*; Tvarminno, *Levander*); Italy (Susa, Sondrio, Torino, Macerata, Chivasso, *Bezzi*); Asia Minor (Konia, *Naday*); Transcaspia (Tashkent, Aschabad, *C. Ahnger*); Ussuri (Spasskaja, *Wuorentaus*); Persia (Enzeli, *Buxton*); Korea (*Yamada*); Aden (*Kazan Chand*, per *Capt. P. J. Barraud*).

The variety *nipponii* occurs in China and Japan, also the Amur region (Ussuri, Spasskaja, *Wuorentaus*).

Subgenus **Aedes**, Mg.

Adult. Proboscis (in the Palaearctic species) about equal in length to the front femora, or slightly shorter. Palpi very short in both sexes. Antennae of the male with the hair-whorls evenly spread all round the joints. Vertex with broad flat scales, leaving only a small patch of narrow ones on the nape. Lower mesepimeral bristles absent. Male hypopygium with the claspers deeply bifid, without terminal claw, inserted before the tip of the side-piece; the latter with small hairy basal lobes. Aedoeagus with the parameres indistinct, almost membranous, the mesosome chitinised in two lateral halves, which are split into rather numerous small spines; one very much larger spine is apically directed. Female cerci moderately elongate; eighth segment rather large. Front and middle claws of female toothed.

Larva. Antennae rather long, with numerous spinules and well-developed tuft. Frontal hairs not one in front of the other, as in *Ochlerotatus*, but almost side by side (in Lang's terminology, the three post-antennal hairs are almost in one line, the middle one not displaced). The median anterior thoracic tufts are absent.

34. **Aedes (Aedes) cinereus**, Mg.

Aedes cinereus, Meigen, Syst. Besch. i, p. 13 (1818).

Aedes rufus, Gimmerthal, Bull. Soc. Imp. Nat. Moscou, xviii, p. 295 (1845).

Aedes leucopygus, Eysell, Abh. Ver. Naturk. Kassel, xlvi, p. 285 (1903).

Culex nigrifulus, Zetterstedt, Dipt. Scand. ix, p. 3459 (1850).

Aedes fuscus, Osten-Sacken, Bull. U.S. Geol. Surv. iii, p. 191 (1877).

? *Culex ciliaris*, Linnaeus, Syst. Nat. Ed. xii, i, p. 1002 (1767).

This species need not be confused with any other in the Palaearctic fauna. The mostly flat-scaled head, extremely short palpi of the male, reddish, unmarked thorax,

and dark-scaled dorsum of the abdomen of the female, should make it quite unmistakable. So far as European specimens are concerned there is little variation, though it should be noted that the thorax of the male is always much darker than that of the female, usually quite black.

The larva does not differ in any very striking manner from those of the subgenera *Ochlerotatus* and *Ecculex*; the main points have already been noted. The early stages are spent usually in flooded meadows and large marshes, but the species is also found in woods. It is commonly associated with *A. vexans*.

Distribution.—Throughout Europe, and extending across Siberia to North America, where it has a wide distribution. The following are some new records:—Italy (Sondrio, *Bezzi*); Finland (various localities and collectors); Siberia (Yeniseisk, 58° 20', and Turuchansk, 65° 55', *Trybom*; Omsk, *Granö*).

Subgenus *Stegomyia*, Theo.

Adult. Proboscis moderately slender, but stouter than in *Ochlerotatus*, scarcely as long as the rather short front femora. Palpi short in the female, normally longer than the proboscis in the male, the last two joints slender, upturned, with very few hairs. Vertex with broad flat scales, few or no narrow ones on the nape. Thorax usually with conspicuous and well-defined ornamentation. Lower mesepimeral bristles absent. Male hypopygium usually without claspettes, unless these are represented by hairy basal lobes; no apical lobes; clasper with distinct terminal spine. Aedoeagus divided into two more or less brush-like halves. Eighth segment of female abdomen rather large, but distinctly retractile, the sternite not very prominent in repose; cerci rather short. Front and middle claws of the female either toothed or not.

Larva. Antennae short, with single hair and without spicules on shaft. Frontal hairs single. Abdomen with or without numerous stellate tufts on dorsal surface; the eighth segment with a definite comb of teeth set in a single row. Siphon not much more than twice as long as broad; hair-tuft well developed and situated about the middle.

The larvae of many African species live in tree-holes, leaf-axils, etc., and these species show a much greater development of the abdominal hair-tufts than is seen in the Palaearctic species.

Adults.

- | | | | | | |
|--|----|----|----|----|----------------------------|
| 1. Mesonotum with a median silvery-white line | .. | .. | .. | .. | 2 |
| Mesonotum without such line | .. | .. | .. | .. | 3 |
| 2. Female claws simple (Japan) | .. | .. | .. | .. | <i>albopictus</i> (Skuse). |
| Female claws toothed (Crete) | .. | .. | .. | .. | <i>cretinus</i> , sp. n. |
| 3. Mesonotum with a lyre-shaped silvery-white mark; tibiae dark except at tip | .. | .. | .. | .. | <i>argenteus</i> (Poiret). |
| Mesonotum with four distinct white dots; tibiae ringed with white a little beyond the middle | .. | .. | .. | .. | <i>vittatus</i> (Bigot). |

Male Hypopygia.

- | | | | | | |
|--|----|----|----|----|----------------------------|
| 1. Clasper modified, swollen and hairy apically, the spine long and curved and placed far before the tip | .. | .. | .. | .. | <i>vittatus</i> (Bigot). |
| Clasper normal; spine shorter, straight, and terminal | .. | .. | .. | .. | 2 |
| 2. Clasper shorter, narrowed at the tip, side-piece with a large, densely bristly area | .. | .. | .. | .. | <i>argenteus</i> (Poiret). |
| Clasper longer, slightly swollen at the tip, side-piece with a large, hairy basal lobe | .. | .. | .. | .. | <i>albopictus</i> (Skuse). |

35. *Aedes (Stegomyia) albopictus* (Skuse).

Culex albopictus, Skuse, Ind. Mus. Notes iii, p. 20 (1895).

Stegomyia scutellaris, Theobald (*nec* Walker), Mon. Cul. i, p. 298 (1901).

This is the only species of *Aedes* in the Palaearctic region in which the front and middle claws of the female are not toothed; it cannot however be removed from the genus, or even from the subgenus *Stegomyia*, with which it agrees in all other respects. The silvery line down the middle of the mesonotum will at once differentiate it from all other mosquitos in the region except *A. cretinus*, its Mediterranean representative.

The larva has been described and figured by Banks (Phil. J. Sci. A, iii, 1908, p. 246) but he omits to notice the structural difference from *A. argenteus* in the shape of the comb-teeth.

Distribution.—A common semi-domestic species throughout the Oriental region, occurring in Japan in the neighbourhood of Tokio (*Yamada*); Mt. Takao, near Hachioji and Kofou (Paris Museum); Yokohama and Kobe, also Shanghai (*Lamborn*). It occurs also in Madagascar and Réunion.

36. *Aedes (Stegomyia) cretinus*, sp. n.

Closely allied to *A. albopictus*, Skuse, but differs as follows:—A pair of small round spots of white scales in the middle of the mesonotum, a little in front of the wing-roots level with the posterior end of the central white stripe. Abdomen with very distinct white basal bands on segments 2-7, somewhat narrowed in the middle. Fourth hind tarsal joint darkened only at the extreme tip. Front and middle claws toothed. As in *A. albopictus*, the front and middle femora have a narrow line of white scales towards the base anteriorly, but no median white spot.

A single female in Herr Lichtwardt's collection, labelled "Creta. v. O. *Culex calopus*, Mg." Since, apart from the toothed claws, there are slight differences from both *A. albopictus*, Skuse, of the Oriental region, and *A. unilineatus*, Theo., of Africa and the Punjab, it is more likely that we are dealing with a distinct Mediterranean representative of *A. albopictus* than that there has been any error in labelling.

A second female is in the Buda-Pest Museum from Amari, Crete, 4. vi. 1906 (Biró); the abdomen and claws agree with the type, but the mesonotum is rubbed and the hind tarsi missing.

37. *Aedes (Stegomyia) argenteus* (Poiret) (*Stegomyia fasciata*).

Culex argenteus, Poiret, Journ. de Phys. xxx, p. 245 (1787).

Culex fasciatus, Fabricius, Syst. Antl. p. 36 (1805).

Culex calopus, Meigen, Syst. Besch. i, p. 3 (1818).

Culex konoupi, Brullé, Exp. Sci. de Morée, Zool. iii, p. 289 (1836).

(?) *Culex niveus*, Eichwald, Reise Casp. Kauk. ii, p. 183 (1837).

Culex elegans, Ficalbi, Bull. Soc. Ent. Ital. xxi, p. 95 (1889).

Culex albopalposus, Becker, Mitt. Zool. Mus. Berlin, iv, p. 80 (1908).

Culex angustalatus, Becker, Mitt. Zool. Mus. Berlin, iv, p. 79 (1908).

? *Culex aegypti*, Linnaeus, Hasselquist's Reise nach Palestina, p. 470 (1762).

The yellow fever mosquito is widely spread, though apparently nowhere very abundant, in the warmer parts of the Palaearctic region. It occurs on the Atlantic islands, in Portugal, and all round the Mediterranean coasts. In the eastern Mediterranean it is by no means confined to the coasts, since Barraud has found it to be common at Aleppo. Further east it is known from Mesopotamia, Persia, and Japan.

Eichwald says of *Culex niveus*, which he records from Tiflis and Baku, "in unzähliger Menge abends in den Zimmern bemerkt werden." This, together with his "thorax nigro alboque varius, alba pube obsitus" and "pedibus nigro canoque variis," seems to suggest *Aedes argenteus*, but other parts of the description ("alis

niveo-albis, corpore ex dimidio fere brevioribus," and "pedibus anticis in apice utrinque fasciculo pilorum ornatis") will not apply to this or any other known mosquito.

It is quite possible that Dyar may be right in identifying *C. aegypti* with this species. Certainly it seems to be some *Stegomyia*, and *A. argenteus* is the only member of the genus now known to occur in Egypt, but there are one or two points in the description which quite definitely do not agree; I have therefore not adopted the name.

38. *Aedes* (*Stegomyia*) *vittatus* (Bigot).

Culex vittatus, Bigot, Ann. Soc. Ent. France, (4) i, p. 327 (1861).

Stegomyia sugens, Theobald, Mon. Cul. i, p. 300 (1901).

Culex sugens, Wiedemann, Aussereurop. zweifl. Ins. i, p. 545 (1828).

The white dots on the mesonotum, together with the white-ringed tibiae and tarsi, make this species an extremely easy one to recognise. The pre-apical spine of the male clasper, and the position of the siphonal tuft of the larva well beyond the middle, suggest that the species may have more in common with the subgenus *Ecculex* than with other species of *Stegomyia*, in spite of the spineless larval antennae and the slender, bare, upturned male palpi. The species affords a good illustration of the difficulty of drawing any hard and fast line between the subgenera of *Aedes*, and confirms the inclusion of all of them in one comprehensive genus.

The larva has been recorded as occurring in rock pools.

Distribution.—Corsica (Bigot). Also widely distributed in the Ethiopian and Oriental regions, occurring as far south as Ceylon. It is remarkable that so conspicuous a species has not been found in the Mediterranean region since Bigot's time.

Genus *Armigeres*, Theobald.

This genus is evidently closely allied to *Aedes* (especially the subgenera *Aedes* and *Stegomyia*), so much so that scarcely any tangible differences can be discovered in the adults. The proboscis is rather short (not longer than the front femora) and is slightly but distinctly stouter throughout than in *Aedes*; also the tip is slightly but distinctly curved downwards (at least in dry specimens), which is very seldom the case in *Aedes*. In the allied Oriental genus or subgenus *Leicesteria* the mesonotum is somewhat produced over the head, and this tendency is slightly indicated also in the typical subgenus *Armigeres*. The structure of the eggs and manner of oviposition in *Armigeres* is similar to that of *Aedes*; but *Leicesteria flava*, according to Strickland, has peculiar egg-laying habits. The male clasper has numerous spines, generally placed in a row (4-10 in *Leicesteria*, 15-20 in *Armigeres*). Another small point of distinction from *Aedes* is that the middle claws of the male are apparently always equal and simple.

The main reason for keeping *Armigeres* distinct from *Aedes* is the structure of the larval siphon, which has only a minute and often scarcely distinguishable hair-tuft, and no trace of a pecten. This latter point constitutes such a sharp difference from *Aedes* that the separation from that genus may be justified, in spite of the feeble characterization of the adults. The anal gills are of large size and rounded apically.

The genus is endemic in the Oriental region, a single species extending into Japan and thus claiming our attention in this paper.

Armigeres obturbans (Walker).

Culex obturbans, Walker, Proc. Linn. Soc. London, iv, p. 91 (1860).

Culex subalbatus, Coquillett, Proc. U.S. Nat. Mus. xxi, p. 302 (1898).

Like the other species of the genus, this is a dark-coloured insect, with entirely dark tarsi and mainly white venter, and with flat scales, mostly dark, covering the head and scutellum. It differs from all its congeners in having a distinct if narrow band of black scales at the apex of each abdominal sternite. The male palpi resemble those of *Stegomyia*, but are entirely dark. I am indebted to Dr. H. G. Dyar for information as to the identity of Coquillett's type.

The larvae live in bamboo stems, and have been described by Banks (Phil. J. Sci., A. iii, p. 240, 1908). They have remarkably large, sausage-shaped anal gills, which enable them to remain long periods at the bottom.

Distribution.—Japan (Kofou, *L. Drouard de Lezey*; Kouy-Tchéou, *Fortunal*; Hakone, *E. Gallois*; Tokio, *Yamada*); also throughout the Oriental region, and extending into Celebes, New Guinea and North Australia.

Genus *Lutzia*, Theobald.

Owing to the highly modified larval mouth-parts and antennae, and the peculiar structure of the siphon and anal segment, it was long ago proposed by Christophers to separate the Old World species of this genus from *Culex* as a distinct genus (*Jamesia*); the same characters were used by Dyar and Knab in separating the New World *Lutzia* from *Culex*. In revising the African CULICIDAE in 1912 I did not accept this separation, owing to the apparent structural identity of the adults. I now find, however, that an excellent diagnostic character exists in the numerous lower mesepimeral bristles of *Lutzia*, and I therefore propose to revive this name. There is no real difference between the Old World and New World forms, and I consider Dyar's separation of *Jamesia* and *Lutzia* on a small detail of aedeagal structure to be quite unjustifiable. The Old World species are all very similar, their separation resting on small differences of colour and venation.

Lutzia vorax, sp. n. (fig. 5 d).

Penultimate joint of male palpi with the integument and the hairs dark except at the extreme tip. Abdominal tergites in both sexes all with rather narrow but distinct apical pale ochreous bands. Lobes of mesosome of male aedeagus enlarged beneath a little beyond the middle, the enlargement with some minute teeth; lobe of side-piece with three strong spines only. The whole of the outer side of the hind femora has the light and dark scales about evenly mixed. Cross-veins either in a straight line, or else m-cu (posterior) placed beyond r-m (mid).

L. concolor (R.-D.), Theo., the commonest form in the Oriental region, differs in having the last few abdominal segments entirely yellow-scaled, the yellow bands on the anterior segments narrower; the lobes of the mesosome are not enlarged beneath; the lobe of the side-piece usually has a fourth spine more or less developed, separate from the other three; the outer side of the hind femora is entirely pale at the base, from which a more or less definite pale line runs almost to the apex; and the cross-vein m-cu is placed at least slightly before r-m.

L. halifaxi (Theo.), known from the Malayan region and Queensland, has the hypopygium almost identical with that of *L. vorax*, the enlargement of the mesosomal lobes perhaps more prominent and practically in the middle; it differs in having the integument and hairs on the apical half or more of the penultimate joint of the male palpi paler than the basal part, and in having few or no pale scales on the apices of the abdominal tergites; the hind femora are as in *L. vorax*, but darker; the cross-veins, on the other hand, are placed as in *L. concolor*.

Dr. Lamborn found the larvae in old cess-pits preying upon *Culex fatigans*.

Distribution.—Japan (Tokio, *Yamada*; a series presented to the British Museum in 1916, determined at the time as *Culex concolor*; the type of the new species is one of the three males in this series; also Karuizawa, *Cornford*, and Nagasaki,

Lamborn). North India (Punjab, *Barrow*; female only). Probably widely distributed in the Oriental region, but confused with the two species above mentioned and with the Ethiopian *L. tigripes*.

Genus *Culex*, L.

This genus, I find, is sharply distinguished from almost all other mosquitos by the possession of distinct pulvilli. It is remarkable that the presence of these structures has been overlooked for so long; Howard, Dyar and Knab even state positively that they are absent throughout the family; these and other writers must either have omitted to study *Culex* closely, or else have used an insufficient magnification. I have examined a large number of species of this genus, and find pulvilli present in all; they do not vary much in size, but are naturally more easily detected in the larger species. Figs. 5 d and 5 e (made with the aid of a camera lucida) show clearly the different appearance under a sufficiently high power between a hairy empodium and a pair of true pulvilli. In the front and middle tarsi of the male the pulvilli, like the claws, are elongated, and therefore less noticeable; they may be seen, however, on the hind tarsi as well as on all the feet of the female. The only other mosquitos which possess pulvilli are the genera which on other grounds have already been regarded as close allies of *Culex*: *Culiciomyia*, *Lophoceratomyia*, *Micraëdes*, *Carrollia*, *Lutzia*, and *Deinocerites* (including *Dinomimetes*). The first three or four of these should not be regarded as more than subgenera of *Culex*, though the last two may be treated as distinct genera.

The following characters are also common to most if not all species of *Culex*; some of these will further help to distinguish the members of this genus from *Aedes*: Eyes very narrowly separated or even touching for a considerable length above the antennae. Proboscis not or scarcely longer than the front femora. Male palpi when long always slender, with the last two joints upturned. Male antennae always plumose, with the hairs spreading out evenly all round. Spiracular and post-spiracular bristles absent. Usually only one lower mesepimeral bristle or none; very rarely two or three. Female abdomen blunt-ended, the cerci short and broad, eighth segment not at all retractile. Male hypopygium without claspettes or basal lobes to the side-pieces, but with subapical lobes bearing modified bristles. Tenth sternites ending in a tuft or comb of spines. Mesosome a paired structure with pointed processes. Claspers articulating in a more or less vertical plane. First joint of hind tarsus as long as the tibia or slightly longer. Female claws always simple. Wings with distinct microtrichia on the membrane; cell R_2 markedly longer than its stalk in the female; vein A_n ending much beyond the level of the base of R_4 .

Larva.—Antennae with a distinct hair-tuft, which is generally well beyond the middle, the part of the antenna beyond the tuft usually rather suddenly narrowed, and with few or no spinules; two long preapical spines. Hairs of mouth-brush simple. Frontal hairs rarely if ever single, and never placed one in front of the other. Anal segment with a complete chitinous ring (in the fourth stage only). Siphon with numerous ventral tufts, or else greatly elongate.

The genus is essentially tropical and sub-tropical, only a very few species extending into the temperate regions. Only *C. apicalis* and the domestic *C. pipiens* and *C. fatigans* are common to Europe and North America.

Three fairly well-marked subgenera occur within the Palaearctic region, as indicated in the following keys.

Adults.

- | | |
|--|---|
| 1. First joint of hind tarsi distinctly shorter than the tibiae; small | |
| obscurely coloured species (<i>Barraudius</i>) | 2 |
| First joint of hind tarsi scarcely, if at all, shorter than the tibiae | 3 |

- | | | |
|--|-----------------------------------|----|
| 2. Abdominal tergites with continuous lateral pale stripes .. | <i>modestus</i> , Fic. | |
| Abdominal tergites, with basal lateral pale patches.. .. | <i>pusillus</i> , Mcq. | |
| 3. A row of small flat white scales round the margin of the eyes (<i>Culicomylia</i>) | <i>impudicus</i> , Fic. | |
| Scales on the top of the head all narrow (<i>Culex</i>) | | 4 |
| 4. Prothoracic lobes and pro-epimera with numerous broad flat scales ; pale bands of abdominal tergites apical (occasionally reduced to lateral spots) | | 5 |
| Prothoracic lobes and pro-epimera with few or no flat scales | | 6 |
| 5. Hind tibia with a distinct white spot on the outer side at the tip, <i>hortensis</i> , Fic. | | |
| No such spot | <i>apicalis</i> , Adams. | |
| 6. Dorsum of abdomen uniformly dark brown ; species without ornamentation | <i>hayashi</i> , Yam. | |
| Abdominal tergites at least with basal lateral patches of pale scales .. | | 7 |
| 7. Proboscis and tarsi pale-ringed.. .. . | | 8 |
| Proboscis and tarsi without pale rings | | 14 |
| 8. Anterior two-thirds, or at least the middle third, of the mesonotum with whitish scales, which contrast sharply with the dark scales of the posterior third | | 9 |
| Thorax not so marked | | 11 |
| 9. Femora and tibiae with numerous small but conspicuous pale dots ; abdominal tergites with basal pale bands or spots only <i>quasigelidus</i> , Theo. | | |
| Femora and tibiae with the scales mottled, but without conspicuous pale dots ; abdominal tergites with apical pale bands | | 10 |
| 10. Wings with numerous pale scales | <i>bitaeniorhynchus</i> , Giles. | |
| Wing-scales all dark | <i>sinensis</i> , Theo. | |
| 11. Wings with conspicuous pale markings | | 12 |
| Wings unmarked | | 13 |
| 12. Tip of vein Cu ₂ (lower branch of fifth) dark-scaled | <i>mimeticus</i> , Noé. | |
| Tip of vein Cu ₂ pale-scaled | <i>orientalis</i> , sp. n. | |
| 13. Mesonotal scales all dark reddish-brown, except perhaps round the margin ; middle tibiae without any trace of a pale stripe .. | <i>tritaeniorhynchus</i> , Giles. | |
| Mesonotal scales mixed light and dark brown ; middle tibiae with a pale anterior longitudinal stripe more or less indicated .. | <i>vishnui</i> , Theo. | |
| 14. Femora and tibiae with distinct pale longitudinal stripes anteriorly (most marked on front and middle legs).. .. . | | 15 |
| Femora and tibia not striped | | 16 |
| 15. Mesonotal scales dark brown, more or less mixed with lighter ; pale abdominal bands generally triangularly produced in the middle | <i>tipuliformis</i> , Theo. | |
| Mesonotal scales reddish-brown ; pale abdominal bands gently rounded | <i>virgatipes</i> , Edw. | |
| 16. Abdominal tergites with complete basal pale bands | | 17 |
| Abdominal tergites with basal pale lateral spots only | | 20 |
| 17. Abdominal bands white | | 18 |
| Abdominal bands pale ochreous | | 19 |
| 18. Pale abdominal bands very broad ; hind tibiae dark except at tip | <i>laticinctus</i> , Edw. | |
| Pale abdominal bands narrow ; hind tibiae with a more or less distinct pale lateral stripe | <i>perexiguus</i> , Theo | |

19. Mesonotal scales ochreous-tinged *fatigans*, Wied.
 Mesonotal scales generally reddish-brown *pipiens*, L.
20. Upper fork-cell in female with a very short stalk; last two joints of
 male palpi with a white line beneath *pipiens*, L., var.
 Upper fork-cell in female with a longer stalk; last two joints of male
 palpi dark beneath *laurenti*, Newst.

Male Hypopygia.

1. Side-piece with scales, the lobe scarcely if at all beyond the middle,
 without flattened plate (*Barraudius*) 2
 Side-piece without scales, the lobe well beyond the middle 3
2. Clasper long and slender *modestus*, Fic.
 Clasper shorter and stouter *pusillus*, Macq.
3. Clasper with a conspicuous spiny crest (?); side-piece with a large and con-
 spicuous tuft of hairs projecting outwards (*Culiciomyia*), *impudicus*, Fic.
 Clasper without conspicuous subapical spiny crest; side-piece without
 conspicuous hair-tuft (*Culex*) 4
4. Lobe of side-piece without an apically situated flattened plate 5
 This plate present, or represented by several 6
5. Side-piece with an apical finger-like process; appendages of lobe short
hortensis, Fic.
 Side-piece without finger-like process; appendages of lobe long, *apicalis*, Adams.
6. Lobe of side-piece with several flattened plates *hayashi*, Yam.
 Lobe of side-piece with only one flattened plate 7
7. Plate on lobe of side-piece narrow and pointed 8
 The plate broad, rounded, and leaf-like 10
8. Tenth sternites without basal arm *quasigelidus*, Theo.
 Tenth sternites with well-developed basal arm 9
9. Mesosome formed of two pairs of upwardly-directed, sickle-shaped
 structures; basal arm of tenth sternites short *bitaeniorhynchus*, Giles.
 Mesosome formed of one pair of pointed, almost straight structures; basal
 arm of tenth sternites long *sinensis*, Theo.
10. Side-piece with dense hairs round the tip and near the lobe 11
 Tip and region near lobe of side-piece not densely hairy 12
11. Clasper greatly widened in the middle, ending in a long, sharp point
orientalis, sp. n.
 Clasper not much widened in the middle *laticinctus*, Edw.
12. Basal arm of tenth sternites well developed 13
 Basal arm of tenth sternites very short or absent 19
13. Clasper sickle-shaped, gradually tapering to the tip 14
 Clasper somewhat broadened beyond the middle 18
14. Mesosome elaborately divided, the two main divisions each further split up 15
 Mesosome much more simple 17
15. Lower division of mesosome with only two or three teeth, which are
 turned outwards *mimeticus*, Noé.
 Lower division of mesosome with 4-6 teeth, which are spread out finger-
 like or curved tailwards 16
16. Innermost tooth on mesosome considerably longer than the rest
tritaeniorhynchus, Giles.
 All the teeth approximately equal in size *vishnui*, Theo.

17. Mesosome with two divisions, one of which carries two or three short teeth
tipuliformis, Theo.
 Mesosome (as seen from above) with three simple divisions .. *virgatipes*, Edw.
18. Second division of mesosome simple *perexiguus*, Theo.
 Second division of mesosome divided into several teeth .. *laurenti*, Newst.
19. Second division of mesosome very broad and plate-like .. *fatigans*, Wied.
 Second division of mesosome narrow and hook-like *pipiens*, L.

Larvae.

1. Siphon rather less than three times as long as broad 2
 Siphon at least four times as long as broad, generally much more .. 3
2. Siphon pale, all the tufts arranged in a slightly zigzag mid-ventral line; tip of antennae black and much narrowed .. *pusillus*, Mcq.
 Siphon blackish; ventral tufts in three or four pairs, the members of which are widely separated; two lateral tufts also present; antennae all pale, tip scarcely narrowed .. [*nebulosus*, Theo.], *impudicus*, Fic.
3. Comb of eighth segment with 4-8 large sharp teeth 4
 Comb of eighth segment with numerous small scales in a triangular patch .. 5
4. Siphon with a dark ring at one-third of its length; head very dark; pecten-teeth 6-9 *quasigelidus*, Theo.
 Siphon and head pale; pecten teeth only 2-3 .. *bitaeniorhynchus*, Giles.
5. Siphonal tufts 8-10, in a zigzag ventral row, the first two or three tufts between the pectens *laticinctus*, Edw.
 Siphonal tufts more or less paired, none between the pectens 6
6. Siphon 6-7 times as long as its breadth at the base; or, if a little shorter (*C. tipuliformis*), the pecten teeth have short basal denticles only .. 7
 Siphon 4-5 times as long as its breadth at the base; pecten teeth with rather long denticles extending more than half their length 12
7. Pecten spines strong, curved, rather wide apart, with small basal denticles *tipuliformis*, Theo.
 Pecten spines smaller, straight and closer together, generally with more numerous denticles 8
8. Siphon distinctly enlarged at the tip, tufts few and small .. *apicalis*, Adams.
 Siphon not enlarged at the tip 9
9. Siphonal tufts rather numerous, some much longer than the diameter of the siphon 10
 Siphonal tufts fewer, none longer than the diameter of the siphon 11
10. Antennae pale except on the portion beyond the subapical bristles, which is nearly as long as the part between these bristles and the tuft *mimeticus*, Noé.
 Antennae entirely, or at least more than half, dark, subapical bristles quite near tip *hortensis*, Fic.
11. Antennal tuft at two-thirds; siphonal tufts all subventral (paired) *tritaeniorhynchus*, Giles.
 Antennal tuft beyond two-thirds; two pairs of siphonal tufts lateral *perexiguus*, Theo.
12. Siphon about 5×1, pecten teeth averaging 12-15 *pipiens*, L.
 Siphon scarcely 4×1, pecten teeth averaging 9 *fatigans*, Wied.

Subgenus **Barraudius**, nov.

First joint of hind tarsus distinctly shorter than the tibia. No flat scales on top of head adjoining eyes. Side-pieces of male hypopygium with numerous small scales on the outer side; lobe situated scarcely beyond the middle, without flattened plate, and with only two or three stout spines. Clasper without subapical spiny crest. Larval mouth-parts normal, not modified for predacity. Siphonal hair tufts arranged mid-ventrally in a single very slightly zigzag line which runs the whole length. Anal segment short, as in typical *Culex*. Type species: *Culex pusillus* (Macq.), Storey.

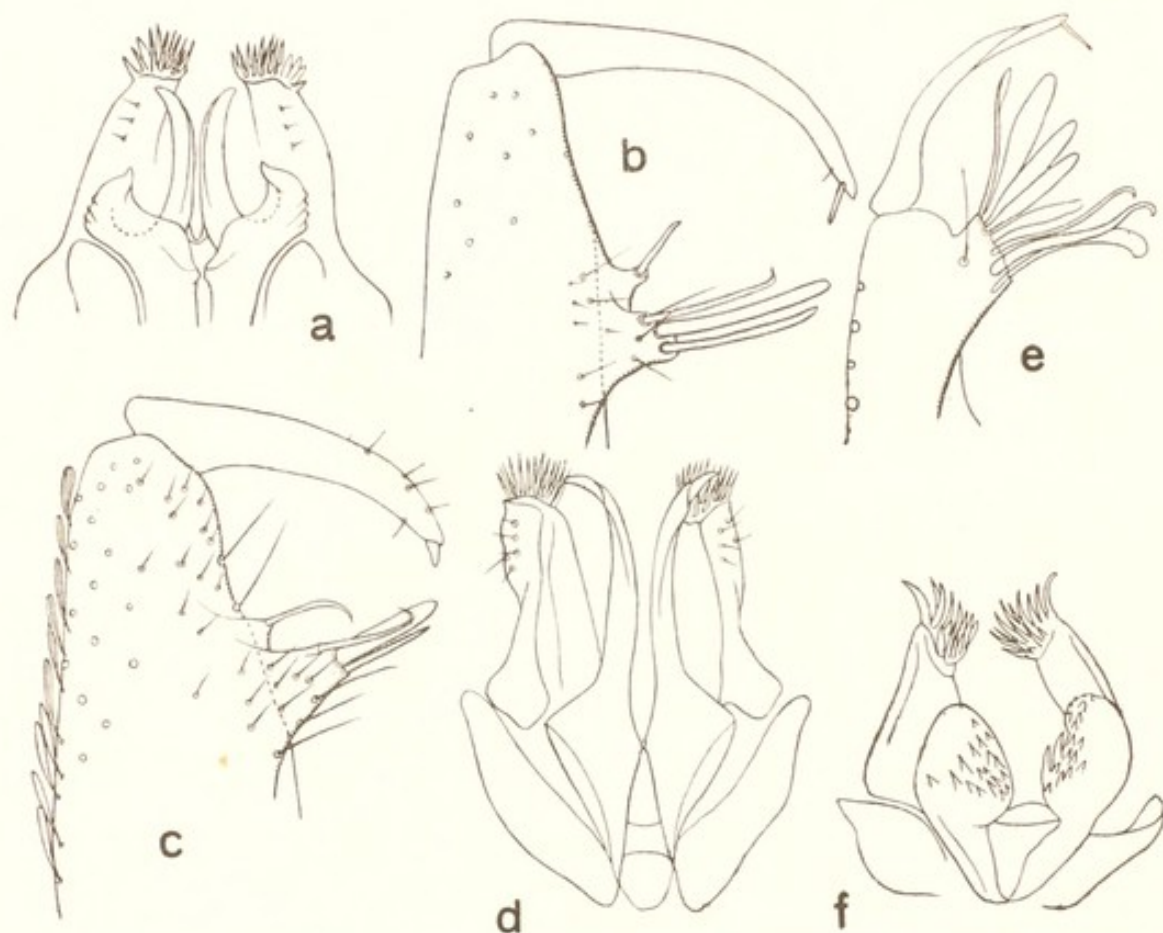


Fig. 12. Hypopygia of Palaearctic species of *Culex*: a, d, f, basal parts, dorsal view; b, c, e, tips of side-pieces, lateral view, all $\times 200$. a, b, *C. modestus*, Fic.; c, d, *C. pusillus* (Macq.), Storey; e, f, *C. hayashi*, Yamada.

The erection of this subgenus is necessary for the reception of two small obscure species from the eastern Mediterranean region. By several of the characters enumerated above they appear to be more distinct from typical *Culex* than any other groups occurring in the Old World.

1. ***Culex (Barraudius) modestus*** (Fic.) (fig. 12 a, b).

Culex modestus, Ficalbi, Bull. Soc. Ent. Ital. xxi, p. 293 (1890), and xxxi, p. 211 (1899).

Apart from the tarsal character mentioned in the key, the female of this species is not easy to distinguish from the unbanded variety of *C. pipiens*. There is, however, no connection between the two species, which are as widely separated in the structure of the male hypopygium as any two species of the genus. The average size is smaller

than the smallest *C. pipiens*, the integument of the thorax is generally paler and the scales browner. The long, bare male palpi will at once distinguish that sex from *C. pipiens* as well as from all other Palaearctic species except *C. pusillus* and *C. hortensis*. The pale markings of the abdomen have an ochreous tint; the colours of the tergites are either separated in a straight line, or the pale lateral stripes are slightly enlarged apically.

Distribution.—Italy (*Ficalbi*); Hungary (*Kertész*; also Neusiedler See, *Mik*); Macedonia (*Waterston*); Asia Minor (Salyr, Konia and Bashara, *Naday*); Palestine (marsh at Tel Abu Zeitun, *Austen*); perhaps the species recorded from Rumania by Leon as *C. fuscus*.

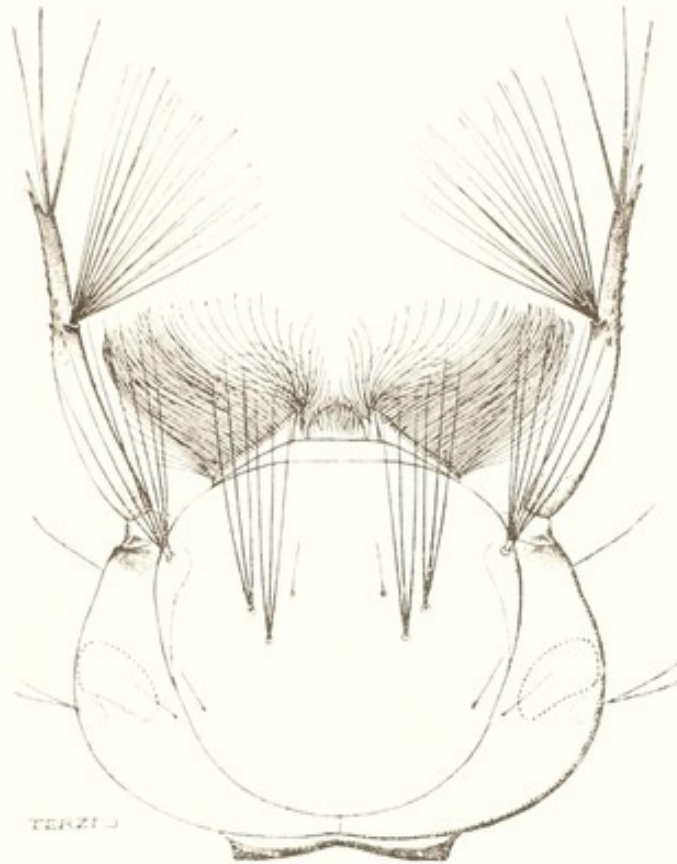


Fig. 13. *Culex pusillus* (Macq.) Storey, head of larva.

2. ***Culex (Barraudius) pusillus*** (Macq.) Storey (figs. 12 c, d, 13, 14).

Culex pusillus, Macquart, Dipt. Exot. Supp. iv, p. 9 (1850).

Culex pusillus, Storey, Bull. Soc. Ent. Egypte 1918, (1919).

I did not at first distinguish this species from *C. modestus*, and it was recorded by Barraud under this name. It closely resembles *C. modestus*, but differs quite markedly in the male hypopygium. The claspers are shorter and stouter, there are differences in the lobe of the side-piece, and the anal and genital parts are much more elongate and rather differently constructed. The pale markings of the abdomen are pure white, and thus differ in colour as well as in form and position from those of *C. modestus*.

I have examined the original specimens of Macquart's *C. pusillus*, one of which is in the Vienna Museum and the rest in the Bigot collection in Mr. Collin's possession.

(4183A—F)

F

All are in such bad condition that they are totally unrecognisable, but from their size there is no reason to suppose that Storey's identification is incorrect.

The larva was found by Barraud in small numbers near Basra. The accompanying figures have been prepared from a comparison of two mounted skins presented by him to the British Museum. The extremely short siphon, with all the hair-tufts placed in a slightly zigzag row in the mid-ventral line, is very remarkable, and very suggestive of the siphon of *Lutzia*, to which genus *C. pusillus* and *C. modestus* also

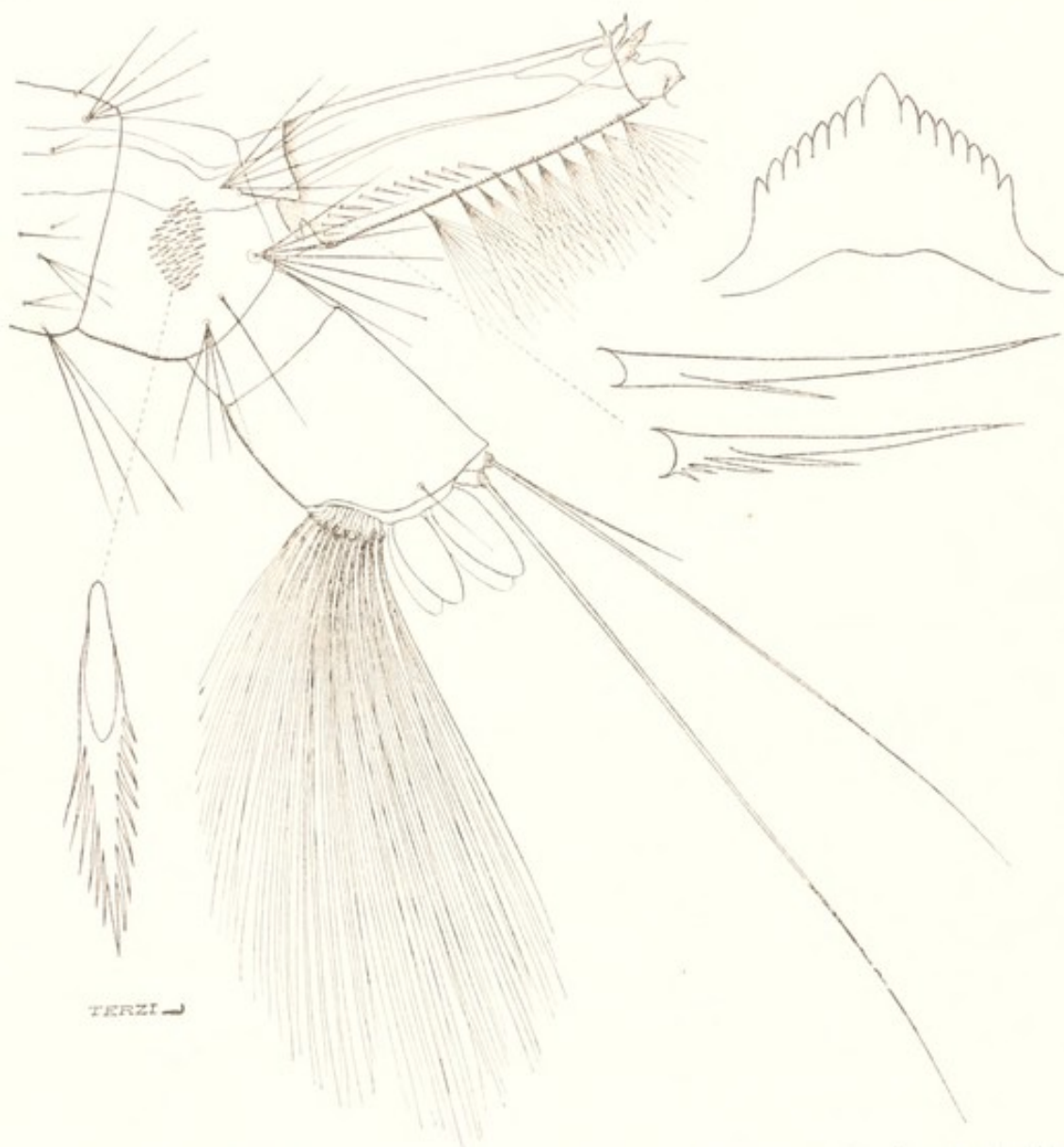


Fig. 14. *Culex pusillus* (Macq.) Storey, end of abdomen of larva; comb and pecten teeth and mentum more highly magnified.

show a marked resemblance in the structure of the male hypopygium. There is no sign, however, of any modification of the larval mouth-parts for predaceous habits, and the anal segment is differently shaped.

Distribution.—Egypt (Storey). Mesopotamia (Barraud).

Subgenus **Culiciomyia**, Theo.

Head in both sexes with a narrow rim of small flat scales along the upper orbital margin. Male palpi with a row of long scales projecting inwards from the apical

half or more of the long joint; the scales are of peculiar shape, sharply pointed at the tip and more or less widened about the middle. Lobe of side-piece of male hypopygium with two flat plates. Clasper with a conspicuous spiny crest at some distance before the tip, which is rather suddenly narrowed. Tips of tenth tergites with the inner spines slender and sharp-pointed, the outer ones much stouter and blunter. Otherwise as in *Culex*, s. str.

None of the distinctions mentioned above are fundamental, and it may be doubted if the subgenus is worth maintaining. The rather well-marked larval characters of *C. nebulosus* are not shared by the Oriental members of the subgenus.

One species apparently occurs in the Mediterranean region; another (*C. pallidothorax*, Theo.) is common in south China, and should be looked for in Japan. There are other Oriental and Ethiopian species, but none in Australia or America. In the New World the type is represented by *Chocroporpa*, Dyar.

3. *Culex* (*Culiciomyia*) *impudicus*, Ficalbi.

Culex impudicus, Ficalbi, Bull. Soc. Ent. Ital. xxii, p. 81 (1890), and xxxi, p. 214 (1899).

(?) *Culiciomyia nebulosa* (Theobald) Edwards, Bull. Ent. Res. ii, p. 254 (1911).

I do not know *Culex impudicus* except from Ficalbi's works, but his figures of the male hypopygium are so much like the structure to be found in some specimens of *C. nebulosus*, Theo., from the Gold Coast* that I feel certain *C. impudicus* must be a *Culiciomyia* closely related to the African species, and it even seems possible that the apparent differences may be due to inaccuracies in Ficalbi's figures. This conclusion is rendered more probable by the fact that I have examined two females of a *Culiciomyia* indistinguishable from *C. nebulosus* in the Paris Museum collection from Beirut (*Dr. Landriet*). The species should therefore be determinable easily by the characters mentioned under the subgenus. It is an almost uniformly dark species, with small pale spots at the apical corners of the abdominal tergites.

According to Ficalbi the larvae of *C. impudicus* were found in water-holes with much vegetation used for irrigating gardens in Sardinia, and in large marshes in Sicily. In West Africa *C. nebulosus* breeds in any small collection of water, especially about houses; it is sometimes found in tree-holes and bamboos.

Subgenus *Culex*, s. str. (including *Neoculex*, Dyar).

Head without any small flat scales in the middle in front. Male palpi without a row of outstanding scales on the long joint. Usually 5-7 pro-epimeral bristles, some smaller than others. First joint of hind tarsus as long as the tibia, or very slightly longer or shorter. Side-pieces of male hypopygium without scales, the lobe well beyond the middle, normally with a flat plate as well as four or five modified bristles. Clasper without definite spiny crest. Larva with the siphonal tufts more or less paired, not all in the mid-ventral line, no tufts on basal fourth or more of siphon.

The members of this subgenus exhibit a fair amount of diversity, but it does not seem to me that any groups are sufficiently circumscribed to be treated as subgenera. Dyar's *Neoculex* (to which belong *C. hortensis* and *C. apicalis*) cannot be defined on any larval character, while even the hypopygial characters on which it is based are closely approached by *C. sinensis*, from which species by slight gradations (through *C. quasigelidus* and other allied forms) the typical *Culex* structure is soon reached.

* There are, I find, two definite varieties or species of *Culiciomyia* in Africa, distinguishable by hypopygial differences. I have not yet estimated the precise relationship of these two nor their distribution. If either is synonymous with *C. impudicus* it will of course have to take Ficalbi's name, but it is perhaps more likely that the Mediterranean form is distinct.

4. *Culex hortensis*, Ficalbi.

Culex hortensis, Ficalbi, Bull. Soc. Ent. Ital. xxi, p. 27 (1889), and xxxi, p. 217 (1899).

Maillotia pilifera, Theobald, Mon. Cul. iv, p. 274 (1907).

Culex geniculatus, Theobald (*nec* Olivier), Mon. Cul. iii, p. 216 (1903).

Easily distinguished from the other Palaearctic species with dark tarsi by the apically situated bands on the abdominal tergites and from its ally *C. apicalis* by the white spot at the tip of the hind tibia, and the bare male palpi. The abdominal bands are variable in width, being reduced occasionally to lateral spots only.

The larvae are said to prefer weedy ponds, particularly those covered with duckweed.

Distribution.—Throughout the Mediterranean region and central Europe, extending as far north as Paris and Berlin. Some new records are: Corsica (*Mann*); Asia Minor (*Ereckli*, *Sabanja*, *v. Bodemeyer*); Germany (*Berlin*, *Schildhorn*, *Oldenberg*, 1 ♀); Transcaspia (*Firudza*, *C. Ahnger*); Syria (*Beirut*, *Landrieu*).

5. *Culex apicalis*, Adams.

Culex apicalis, Adams, Kansas Univ. Sci. Bull. ii, p. 26 (? June 1903).

Culex sergenti, Theobald, Mon. Cul. iii, p. 218 (July 1903).

Culex pyrenaicus, Brolemann, Ann. Soc. Ent. France, lxxxvii, p. 427 (1919).

Culex territans, Howard, Dyar & Knab, Monogr. iv, p. 293 (1912) (*nec* Walker).

In spite of the great differences in the male hypopygium, there can be no doubt that this is closely related to *C. hortensis*. The most obvious distinctions of *C. apicalis* are the hairy terminal joints of the male palpi and the dark tip of the hind tibia. The wing-scales seem to be a little narrower, and the pale abdominal bands are also perhaps on the average narrower. It may not always be possible to distinguish the females with certainty; Eckstein states that they differ from those of *C. hortensis* in having the bases of the abdominal sternites dark-scaled, but I cannot confirm this.

The larva differs from that of *C. hortensis* in the bicoloured antennae, in the shape of the siphon, and in the smaller and less numerous siphonal tufts. The two species are said by Séguy to breed under similar conditions, though according to Eckstein *C. apicalis* is found in clear water.

Distribution.—Occurs over a wide area in Europe and North America, apparently also in North Africa, though I have seen only females from there (including Theobald's type of *C. sergenti*) and am not absolutely certain of their identity. Some new records are: Tunis (*Tamerza*, *Langeron*, ♀); Italy (*Gorizia*, *Mik*, ♂ ♀); Carniola (*Wippach*, *Handlirsch*); Transcaspia (*Amudaria*, *C. Ahnger*).

6. *Culex hayashi*, Yamada (fig. 12 e, f).

Culex hayashi, Yamada, Dobuts. Z. Tokio, xxix, pp. 61-72 (1917).

This differs from all other species known from the Palaearctic region in having the male palpi straight and considerably shorter than the proboscis (about three-quarters as long), but there are several other Oriental species with which it might be confused, such as *C. brevipalpis* (Giles) and *C. jenseni* (Meij.). The male hypopygium is also very distinct, on account of the structure of the mesosome and the numerous plates on the lobe of the side-piece; in the former point *C. hayashi* much resembles the subgenus *Lophoceratomyia*, but it does not show any modification of the male antennae, nor any flat scales on the top of the head; it should perhaps be placed in Dyar's subgenus *Neoculex*, if that is adopted. The species is unicolorous brown, only the lower side of the abdomen somewhat lighter. The scaling is that of a normal *Culex*, but there seem to be some flat scales on the prothoracic lobes.

Dr. Lamborn found the larvae in muddy pools in company with those of *Anopheles punctibasis*.

Distribution.—Japan (Tokio, *Yamada*, a series presented by the collector to the British Museum in 1915; Nagasaki, *Lamborn*).

7. ***Culex quasigelidus***, Theobald.

Culex quasigelidus, Theobald, Mon. Cul. iii, p. 181 (1903); Edwards, Bull. Ent. Res. ii, p. 258 (1911).

This is one of the most distinct members of a rather large group of tropical species, which Theobald included in his genus *Leucomyia*. The leg markings are distinctive, but are not at all unlike those of the Old World species of *Lutzia*, especially *L. tigripes*, of which *C. quasigelidus* has been taken to be a variety, though in reality it is very different. The larvae, like many others with long siphons, live in weedy pools; they are very similar in structure to those of the other members of this group.

Distribution.—Widely spread in the Ethiopian region, occurring in Madagascar, and spreading northward by the Nile valley as far as Alexandria.

8. ***Culex bitaeniorhynchus***, Giles.

Culex bitaeniorhynchus, Giles, J. Bombay Nat. Hist. Soc. xiii, p. 607 (1901); Edwards, Bull. Ent. Res. iv, p. 231 (1913).

The wing-scales of this species are unusually broad for a *Culex*, and on this account Theobald placed it in the genus *Taeniorhynchus*, with which it has really no connection. Usually the pale scales on the wings are almost as numerous as the dark ones, at least in the female, but a variety occurs in which they are comparatively few and scattered. The femora and tibiae are also very much mottled. The pale bands of the abdomen are very variable in width; they may be very narrow, or the abdomen may be almost all pale. The species is semi-domestic, the larva often living in polluted water.

Distribution.—Throughout the Oriental region; occurring also in Japan and North Australia. A variety, differing slightly in the male hypopygium, is widely spread in Africa.

9. ***Culex sinensis***, Theobald.

Culex gelidus var. *sinensis*, Theobald, Mon. Cul. iii, p. 180 (1903).

Leucomyia sinensis, Theobald, Mon. Cul. v, p. 313 (1910).

Culex sinensis, Edwards, Bull. Ent. Res. iv, p. 231 (1913).

This is at first sight very much like *C. bitaeniorhynchus*, but differs in the much narrower and entirely dark wing-scales, and very considerably in the male hypopygium. Apart from this, the femora and tibiae are less mottled, the pale scales which are present tending to be aggregated into small dots, though these are not nearly so conspicuous as in *C. bitaeniorhynchus*.

Distribution.—Widely spread in the Oriental region, and, like the last species, occurs also in Japan (Tokio, *Yamada*), but is not known from Australia or Africa, where it seems to be represented by allied but distinct species.

10. ***Culex mimeticus***, Noé.

Culex mimeticus, Noé, Bull. Soc. Ent. Ital. xxxi, p. 240 (1899).

A very interesting species on account of the spotted wings, the markings comprising three pale ochreous areas on the costa, which extend on to the first vein,

also other pale areas, the most noticeable of which are in the middle of the third vein and towards the base of the sixth. The fifth vein is entirely dark, except for a part of its upper branch. The wing-scales are narrow but rather short. The proboscis has a well-defined pale ring about the middle in both sexes. The male palpi have pale rings at the bases of the last two joints and a very narrow one at the tip of the last joint. The side-pieces of the hypopygium are only moderately hairy; the lobe with the usual five modified bristles (the apical one unusually flattened and outwardly directed) and leaf-like plate; clasper sickle-shaped, gently tapering, with well-marked terminal claw; tenth sternites with the basal arm quite long, though shorter than the sternites; second division of mesosome split into two or three teeth.

The larva has been partly described and figured by Martini, but he has omitted to notice an important point, the position of the pair of subapical antennal bristles only a little more than mid-way between the tuft and the apex of the shaft. It is also noteworthy that the pale colour of the antenna extends some way beyond the tuft, almost to the subapical bristles. The 4 or 5 pairs of larger siphonal tufts are at least twice as long as the diameter of the tube. The larva is remarkably like that of *C. hortensis*, differing in antennal characters and in the rather greater number of siphonal tufts; the latter point is probably not of much importance, as the number and also the position of the tufts is certainly variable in many species of the genus.

The most interesting fact about this species is its occurrence in association with *Anopheles superpictus*, to which it bears a considerable resemblance in wing-markings. Whether we have a genuine case of mimicry, and if so what advantage the species could gain by it, I will not attempt to judge, but it is perhaps an even more remarkable fact that the allied *C. mimulus*, which differs in having a dark third vein, occurs with *Anopheles culicifacies* or *A. minimus*, which differ in the same way from *A. superpictus*.

Distribution.—Mountainous regions in the eastern Mediterranean region. Italy (Noé), Macedonia (Martini, Waterston); Palestine (Cropper); Cyprus (Miss Bate).

The species was till recently supposed to have a much more extended distribution, but I have recently shown that the form inhabiting Ceylon and Malaya differs slightly both in wing markings and hypopygial details, and have therefore treated it as a distinct species, *C. mimulus*. There are good larval differences between *C. mimeticus* and *C. mimulus*, the latter having few and short siphonal tufts, and the subapical antennal bristles close to the tip. A second form, which is probably equally distinct, is found in Hong Kong, Formosa, and South India (Ootacamund, recorded by me recently as *C. mimeticus*). This differs from the true *mimeticus* in the much broader pale tip to the longer male palpi, the absence (apparently not quite constantly) of the basal arm of the tenth sternites, and perhaps in other details. I have seen only females from North India, and cannot say whether they belong to this second Oriental form or to the true *mimeticus*. The Japanese form must obviously be treated as another quite distinct species.

11. *Culex orientalis*, sp. n.

Differs from *C. mimeticus* as follows:—Wing-scales somewhat broader and distinctly longer, the wings therefore appearing more densely scaled. Cu_2 (lower branch of fifth vein) with a pale area at its tip, most noticeable in the female; another pale area (more or less developed) before the fork. Male proboscis with numerous pale scales on the apical portion beyond the ring, sometimes the whole apical portion is pale. Hypopygium: side-pieces large and stout, densely hairy, especially round the somewhat produced tip and near the lobe; lobe with eight somewhat flattened appendages, all much alike, with rounded, not hooked tips, and placed almost in a continuous row; besides these there are numerous accompanying long hairs; leaf-like plate and its accompanying bristle present as usual. Clasper

very large, flat, very much broadened a little beyond the middle, ending in a rather long sharp point; terminal claw very minute; subapical spiny crest slightly indicated. Tenth sternites with moderate basal arm. Second division of mesosome with three rather large teeth and about five small ones.

The hypopygium is more like that of *C. laticinctus* than that of *C. mimeticus*. It would be of interest to know whether there is any similar resemblance in the larvae.

Distribution.—Japan (Tokio, *Yamada*). A series presented by the collector to the British Museum in 1915 was determined by me then as *C. mimeticus*, but a closer study reveals the striking differences enumerated above. Also Yokohama and Kobe (*Lamborn*); the larvae in rice-fields in company with *Anopheles hyrcanus*.

12. *Culex tritaeniorhynchus*, Giles.

Culex tritaeniorhynchus, Giles, J. Bombay Nat. Hist. Soc. xiii, p. 606 (1901); Edwards, Bull. Ent. Res. iv, p. 233 (1913), and vii, p. 224 (1917).

This species is sufficiently distinguished by the characters mentioned in the key, but I have given a number of others in the papers quoted above. The average size is very small (3 mm.), but in this respect the species varies a good deal in different parts of its range, Japanese examples being much larger than those from Palestine.

Larvae have been received from Capt. Barraud from Mesopotamia; they are remarkably similar to those of *C. perexiguus*, described below; I can discover very few differences beyond those mentioned in the key, which seem most likely to be constant. Other larvae from Ceylon differ slightly from these, but not to such an extent that they need be separated specifically. They are found usually in salt marshes, often in company with other small species with a banded proboscis (*C. vishnui* or *C. sitiens*).

Distribution.—Palestine and Mesopotamia (*Barraud*); Palestine (Khirbet Hardrah, *Austen*; Jerusalem, *Goldberg*); Japan (Tokio, *Yamada*; Chuzenji, *Gallois*; Nagasaki, *Lamborn*); China (Shanghai, *Lamborn*, etc.). Also throughout the Oriental region and on both the east and west coasts of Africa.

13. *Culex vishnui*, Theobald.

Culex vishnui, Theobald, Mon. Cul. i, p. 355 (1901); Edwards, Bull. Ent. Res. iv, p. 233 (1913), and vii, p. 225 (1917).

In spite of the very slight difference in the hypopygia (there are perhaps some other slight distinctions besides the one mentioned in the key) I feel sure this species is distinct from *C. tritaeniorhynchus*, its closest ally and frequent associate. *C. vishnui* breeds in rice-fields, salt-marshes, and elsewhere. No isolated larvae have been received at the British Museum, nor has a description of the early stages been published. The hypopygium is very similar to that of *C. mimulus*.

Distribution.—Mesopotamia (*Barraud*); Japan (Osaka, *Theobald*). Also throughout the Oriental region, but as yet unknown from Africa.

14. *Culex tipuliformis*, Theo. (figs. 15, 16).

Culex tipuliformis, Theobald, Mon. Cul. ii, p. 325 (1901); Edwards, Bull. Ent. Res. ii, p. 262 (1911), and iii, p. 31 (1912).

Culex creticus, Theobald, Mon. Cul. iii, p. 189 (1903).

Apart from the striped femora and tibiae, and the more or less produced abdominal bands, this might easily be mistaken for *C. pipiens*, especially in rubbed specimens. It is, however, generally darker in colour, the upper fork-cell is not so long, and the

cross-veins, though variable in position, tend to be more approximated than in *C. pipiens*, being occasionally almost in one line. As in *C. pipiens*, the last two joints of the male palpi have whitish markings beneath, but in this species the pale scales tend to be arranged more in patches, one of which is at the tip of the last joint.

The larva has been described by Bedford from the Transvaal (U.S. Afr. Dept. Agr., 5th & 6th Repts. Director Vet. Res., 1919, p. 741), his description and figure agreeing in the main with specimens I have examined, though he shows shorter and more numerous tufts on the siphon. The accompanying figures are based on Capt. Barraud's material. The siphon is distinctly longer than that of *C. pipiens*, index about 5.5-6.* The pecten teeth are 6-9 in number, but rather widely spaced, and reaching beyond a third of the length of the siphon. The first few teeth are quite small, but the last four or five are long, curved, and almost simple, only one or two small basal denticles being present. The antennae are dark at the tip and at the extreme base, pale in the middle, the tuft being placed at about three-fifths. The head is more or less extensively dark basally. The siphon

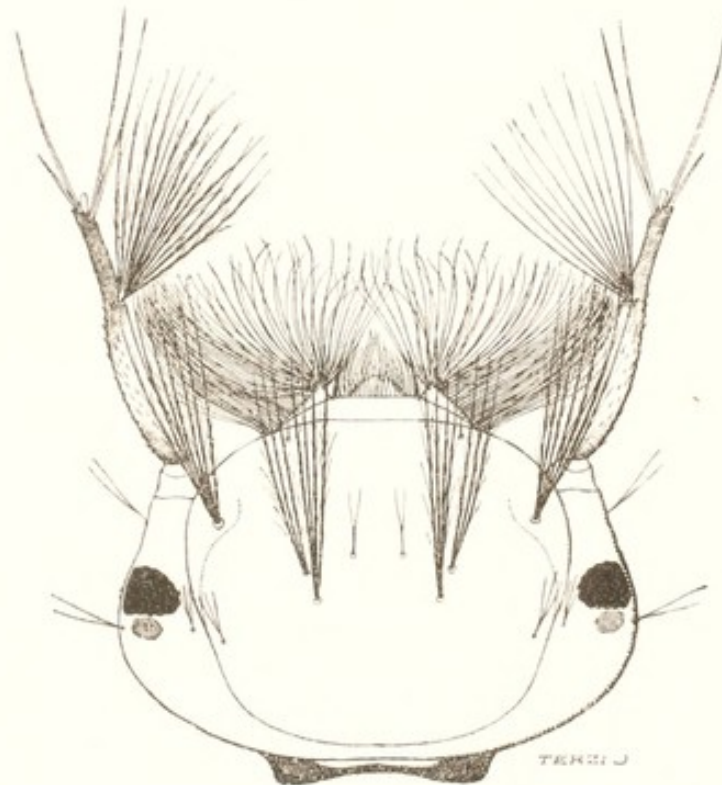


Fig. 15. *Culex tipuliformis*, Theo., head of larva.

is generally all pale, but among the specimens sent by Capt. Barraud from Mesopotamia there are several which have the basal half of the siphon dark or even black; these specimens also appear to have the siphon a little shorter than usual, but the adults issuing from them do not differ appreciably from normal *C. tipuliformis*.

Distribution.—Atlantic islands; Mediterranean region generally; extending through East Africa to the Cape and by way of Persia into north India and Assam;

* By the siphonal index I mean the ratio of the diameter of the *base* of the siphon to the length, the valves not being reckoned into the length. Séguy apparently takes the ratio of the *average* width to the length.

a rather remarkable distribution, which is exactly paralleled by that of *Theobaldia longiarcolata*. I believe the following are new records:—Asia Minor (Konia and Bashara, *Naday*) ; Persia (Enzeli, *Buxton*) ; West Caspian (Lenkoran, *Karsch*) ; Libyan Desert (Bulag, *W. J. H. King*).

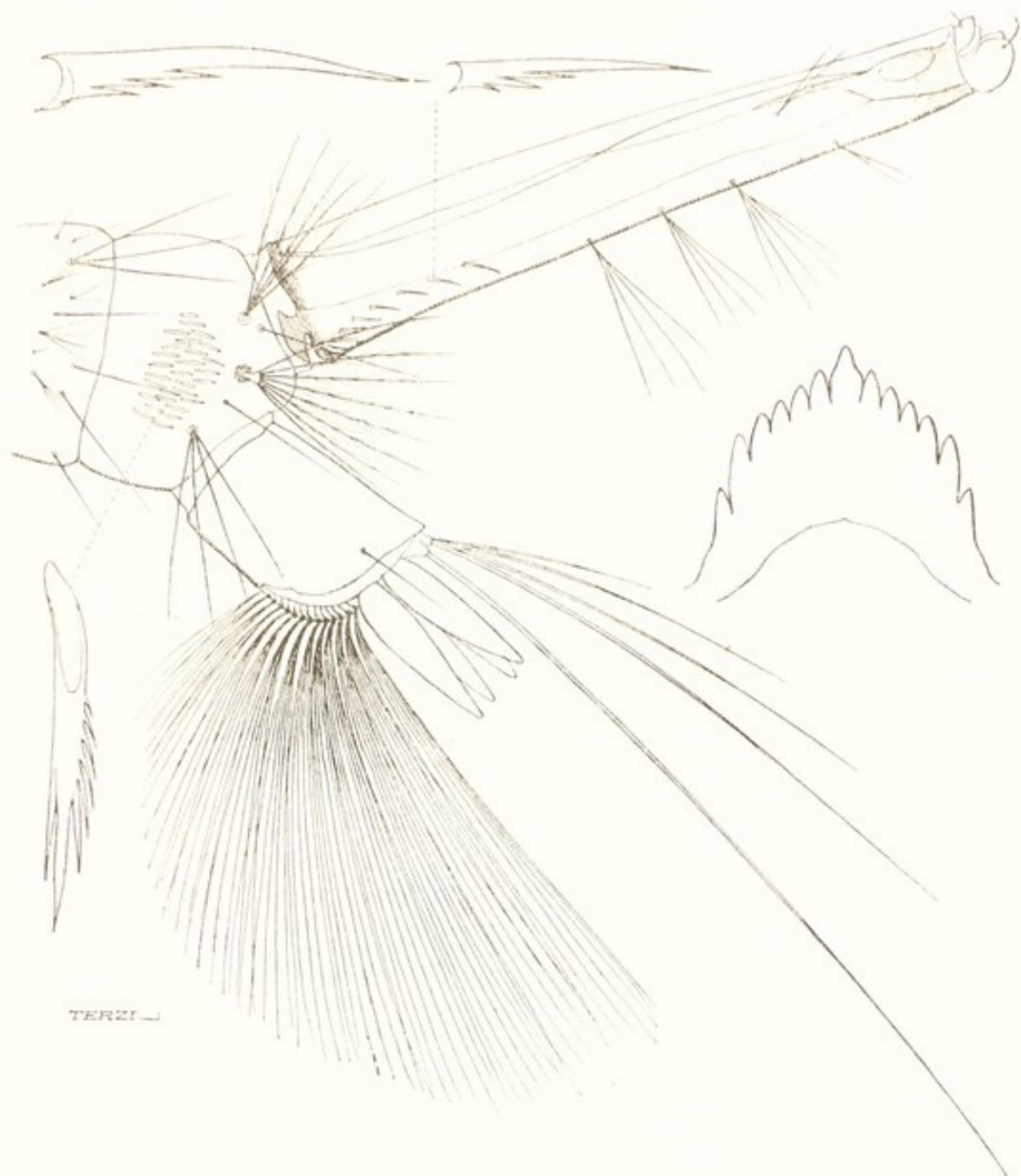


Fig. 16. *Culex tipuliformis*, Theo., end of abdomen of larva; comb and pecten teeth and mentum more highly magnified.

15. *Culex virgatipes*, Edw.

Culex virgatipes, Edwards, Bull. Ent. Res. v, p. 126 (1914).

Differs from *C. tipuliformis* in the male hypopygium, which is extremely similar to that of the African *C. triflatus*, Edw., in the uniformly reddish-brown mesonotal scales and in the abdominal markings. The cross-veins are on the average more

widely separated than in *C. tipuliformis*, and the femoral and tibial stripes, though quite distinct, are rather narrower in this species. The resemblance to *C. pipiens* is much more close than in the case of *C. tipuliformis*, the leg-markings affording the main external distinction. The larva is undescribed; it was found by Dr. Lamborn in company with that of *C. fatigans*.

Distribution.—So far as our present knowledge goes, this species is confined to the eastern part of the Palaearctic and Oriental regions, into which *C. tipuliformis* apparently does not extend. Hong Kong (*Macfarlane*); Sikkim (*Wyville-Thompson*); Vladivostok and River Amur (*Wuorentaus*: Helsingfors Museum); Shanghai (*Lamborn*).

16. *Culex laticinctus*, Edw.

Culex laticinctus, Edwards, J. Proc. Asiatic Soc. Bengal, ix, p. 49 (1913).

This species differs markedly from *C. pipiens*, the one to which it approaches most nearly in size and appearance, in the pure white abdominal bands, which are as broad as or broader than the dark bands which alternate with them. The male palpi are no longer than the proboscis, and are less hairy than those of *C. pipiens*. The prothoracic lobes often show a number of flat scales on the lower part. The hypopygium is not unlike that of *C. orientalis*, especially in the form and hairiness of the side-piece, but the appendages of the lobe and the structure of the mesosome are different.

The rather remarkable larva has been described and figured by Storey as "*Culex* sp. no. 2258."

Distribution.—Throughout the Mediterranean region; Canary Islands (*Orotava, Graham-Smith*); southern Spain (*Aguilas, G. Boag*); southern France, and as far north as Paris (*Séguy*); Tunis (*Tamerza, Langeron*; *Djerba, in coll. Bezzi*); Anatolia (*Budrum, Mus. Civ. Genova*); Cilicia, Syria and Palestine (*Barraud*; *Mt. Carmel, Austen*; *Jerusalem, Goldberg*); Egypt (*Storey*); Arabia (*Muscat, Gill*).

17. *Culex perexiguus*, Theobald (figs. 17, 18).

Culex perexiguus, Theobald, Mon. Cul. iii, p. 199 (1903).

The very small size of this species, together with the narrow white (not ochreous-white) abdominal bands, and the pale stripe on the outer side of the hind tibia (not always very clearly marked, and in the male sometimes indistinguishable), will serve to separate it from other members of the group with dark tarsi and basally banded abdominal tergites. Apart from this, and the aedoeagal structure, *C. perexiguus* may be known by the colour of the mesonotal scales, dark brown mixed with brassy ochreous.

I cannot detect any difference whatever between the adults of *C. perexiguus* and the West African form of *C. univittatus*, either in external characters or male hypopygial structure. The larvae, however, seem to be utterly different. Some confusion has existed regarding the larvae of *C. univittatus*, but Dr. Ingram assures me that the larva described and figured by him and Dr. Macfie (*Bull. Ent. Res.* x, p. 68) was identified by the isolation method, and he is sure that no error occurred. The figure indicates a larva similar in many respects to that of *C. quasi-gelidus*, but with several remarkable features, such as the possession of only a single pair of minute siphonal tufts and an incomplete ring on the anal segment.

Larvae of *C. perexiguus* sent from Palestine by Capt. Barraud differ in practically every detail from the larva described by Ingram and Macfie, almost the only point

of resemblance being in the length of the siphon. The accompanying figures have been prepared from isolated skins sent by Capt. Barraud, the adults issuing from which I have examined. The following is Capt. Barraud's description:—

"Antenna light in colour except towards base and tip. Shaft clothed with spicules. Antennal tuft of about 24 subplumose hairs arising at about three-quarters from the base. Mid frontal hair tufts of subplumose hairs; ante-antennal tuft of 8 hairs; outer median tuft of 2, inner median of 3. Small lateral tuft above eye of about 4 very small hairs. Mental plate with 7 teeth on either side of the central one, the outermost tooth some distance below the others.

"Siphon about seven times as long as the width at base. Pecten of from 11–14 teeth; teeth slightly curved, with three secondary spines on one side; last few teeth *slightly*

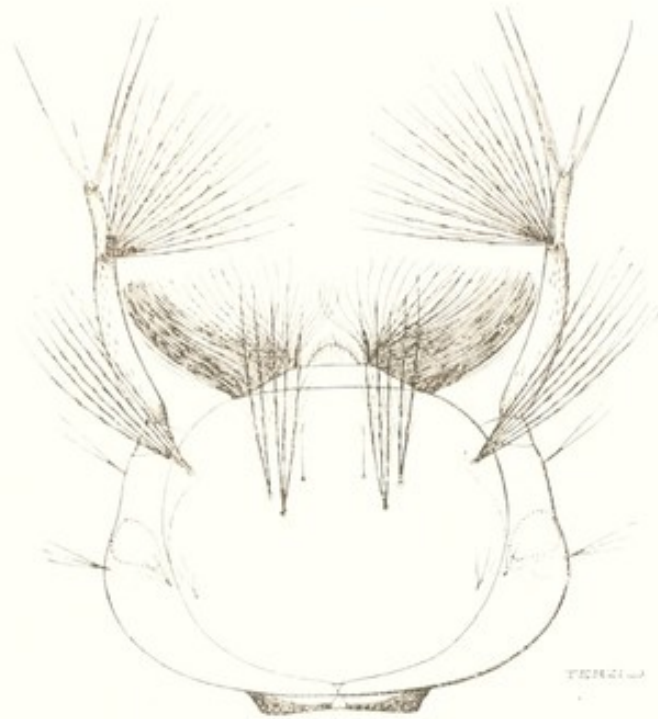


Fig. 17. *Culex perexiguus*, Theo., head of larva.

more detached than the remainder. Hair tufts on siphon represented by about four pairs of very short and fine hairs (towards tip usually single). Tufts on eighth segment of from 4 to 6 subplumose hairs. Comb of small teeth in triangular patch. Anal gills about the length of the anal segment, the dorsal pair rather longer than the ventral. Two or three hairs in the tuft on the dorsal edge of the anal segment. Brush well developed, about 12 tufts each with about 6 hairs."

Since it is impossible to consider two such different larvae as belonging to the same species, there is no alternative but to revive Theobald's name *perexiguus* for the Mediterranean form.

Distribution.—Palestine (*Cropper, Barraud*). Since it is impossible to separate the adults, the further distribution of *C. perexiguus* as distinguished from *C. univittatus* cannot be given, but it seems reasonable to assume that the form is the same throughout the Mediterranean region. From an examination of adults and from Storey's remarks on the larva it is obvious that this is the species he has recorded

from Egypt as *C. decens*; the larva of the African *C. decens* is indeed very similar, though the hypopygium differs. It is perhaps also the species recorded from Algeria by the Sergents as *C. fatigans*, since they state that the siphon is longer than that of *C. pipiens*. Adults, probably of *C. perexiguus*, have been received from southern Spain (Fowler), Muscat (Gill) and Amritsar, Punjab (Barraud).

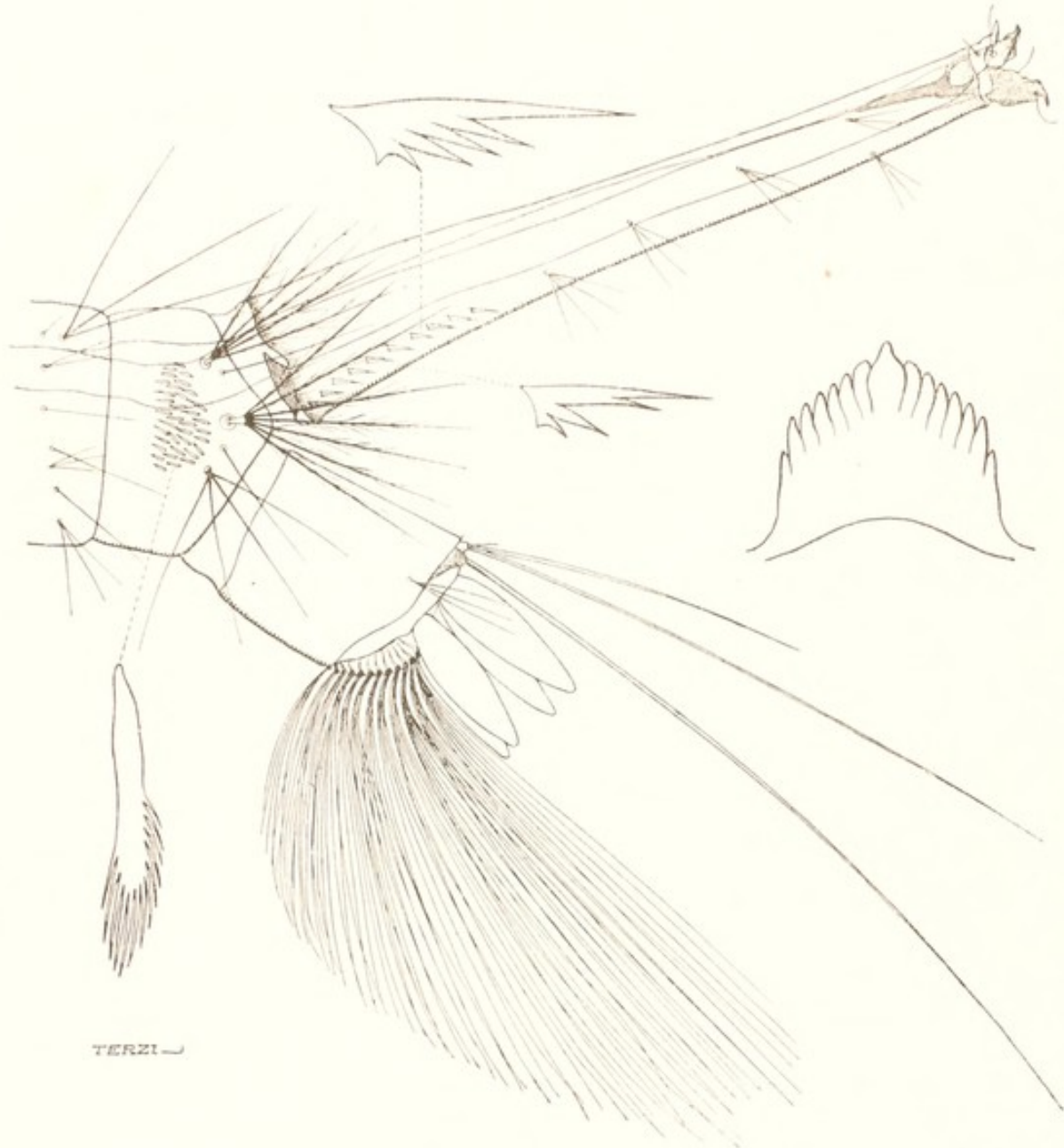


Fig. 18. *Culex perexiguus*, Theo., end of abdomen of larva; comb and pecten teeth and mentum more highly magnified.

18. ***Culex laurenti***, Newst.

Culex laurenti, Newstead, Ann. Trop. Med. i, p. 24 (1907); Edwards, Bull. Ent. Res. v, p. 70 (1914).

The female of this species is almost impossible to distinguish from the unbanded variety of *C. pipiens*. The male differs from both *C. pipiens* and *C. perexiguus* in having no pale line beneath the last two joints of the palpi. I have figured the

hypopygium in the paper quoted. According to Storey the larvae are indistinguishable from those of *C. perexiguus*.

Distribution.—An Ethiopian species, known from Madagascar, Zanzibar, and the Congo, which has also been recorded from Egypt by Storey as *C. invidiosus*. Also found in Egypt by Austen (Kantara, Suez Canal). Perhaps occurs in Palestine (Acre and Jerisheh, *Austen*; females only).

19. *Culex fatigans*, Wied.

Culex fatigans, Wiedemann, Aussereurop. zweifl. Ins. p. 10 (1828).

Culex quinquefasciatus (? Say), Howard, Dyar and Knab, Monogr. iii, p. 345 (1915).

This species may be distinguished from *C. pipiens* by the combination of some or all of the following characters:—Mesonotal scales somewhat coarser, with a dull brownish-ochreous instead of a dark brown or reddish-brown tinge (but Japanese and American specimens are often as red-tinged as *C. pipiens*). Upper fork-cell shorter in both sexes, that of the female being less instead of more than three times as long as its stem. Male palpi somewhat shorter and less hairy. Pale abdominal bands of the female rather more rounded. The only absolutely reliable distinction between the adults is, however, in the structure of the aedoeagus (see figures in Bull. Ent. Res. iv, pp. 54, 55). The larvae are rather more easily separated than the adults by the characters mentioned in the key.

Distribution.—This species, almost universal in the tropics, has a very limited area of occurrence within the Palaearctic region. I have only seen it from Lower Mesopotamia (*Barraud*), Seistan, eastern Persia (*Annandale*), and Japan (Kobe and Nagasaki, *Lamborn*). It has been recorded by various observers from southern Europe and North Africa, but I consider it highly probable that all such records refer to other species.

20. *Culex pipiens*, L.

Culex pipiens, Linnaeus, Syst. Nat. Ed. x, p. 602 (1758).

(?) *Culex fasciatus*, Müller, Fauna Insectorum Fridrichsdalina, p. 87 (1764).

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Culex pallens, Coquillett, Proc. U.S. Nat. Mus. xxi, p. 303 (1898).

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Culex longifurcatus, Becker, Mitt. Zool. Mus. Berlin, ii, p. 68 (1904).

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Culex varioannulatus, Theobald, Mon. Cul. iii, p. 198 (1903).
Culex azoriensis, Theobald, Mon. Cul. iii, p. 210 (1903).
Culex quasimodestus, Theobald, Ann. Mus. Nat. Hung. iii, p. 88 (1905).
Culex osakensis, Theobald, Mon. Cul. iv, p. 439 (1907).
Culex pipiens var. *doliorum*, Edwards, Entom. xlv, p. 263 (1912).
 (??) *Culex nigrutilus*, Wesenberg-Lund, Danske Vid. Selsk. Skr. Nat. Math. Afd. (8) vii, p. 131 (1921).

The distinctions in external characters between the adults of *C. pipiens* and *C. fatigans* have been enumerated above. I have found them reliable in sorting out Mesopotamian specimens, where the two species occur together and *C. pipiens* is fairly constant; but in the southern and eastern Mediterranean region *C. pipiens* is subject to so much variation that the hypopygial differences would have to be relied on; the structure of this organ in *C. pipiens* is fairly constant, the slight variation that does occur showing usually little or no approach to *C. fatigans*.

The examination of a number of mounts of hypopygia of Japanese specimens, however, seems to show that the Japanese race of *C. pipiens* differs constantly from the European, having the second division of the mesosome much broader than usual and the third division not quite so stout, thus being to some extent intermediate between *C. pipiens* and *C. fatigans*. Theobald's type male of *Culex osakensis*, which in 1912 I took to be *C. fatigans*, belongs to this form, but Coquillett's name *pallens* is no doubt also applicable, and should be used to designate the variety. It would seem from their figures that Dyar and Knab's *Culex comitatus*, described from California, belongs to this var. *pallens* rather than to typical *C. pipiens*, and it is quite likely to have been introduced into California from Japan. In both *C. pipiens* and *C. fatigans* a minute basal arm to the tenth sternites may be present or absent.

A variety of frequent occurrence in the Mediterranean region has the pale bands of the abdomen reduced to lateral spots, either in the female only, or in both sexes. There are also two other varieties worthy of special mention. In North Africa many specimens occur with the mesonotal scales more or less ochreous, and in some the dark parts of the abdomen also tend to this colour, so that it is tempting to assume that we have here an incipient modification in colour to suit desert conditions. I have examined the hypopygium of one specimen so coloured, and have no doubt as to its identity. Theobald has described this variety as *C. quasimodesta*, but it is doubtful if it is at present more than a sporadic variation. The second variation is in the length of the upper fork-cell of the female. Over the greater part of the range of the species this is fairly constant, but in the Levant and Asia Minor many specimens are found in which the cell is shorter than usual, and little, if any, longer than that of *C. fatigans*. It seems rather significant that this very region is on the borders of the range of *C. fatigans*; the possibility of interbreeding may be indicated, but, against this, it should be noted that such intermediate specimens have not been found in Mesopotamia, where the two species are known to occur together.

I am indebted to Capt. Barraud for calling my attention to the existence of what seems to be a definite larval variety of *C. pipiens* in Palestine and Syria. In this form the average number of pecten-teeth is 12, and there seems to be little variation from this; of 39 specimens critically examined by Capt. Barraud, no fewer than 24 had either 12 or 13 pecten teeth, the number in the remaining specimens varying from 9 to 17. Further distinctions of this Levantine race are the smaller average size, the lighter-coloured antennae, and the shorter average length of the siphon (index about 4.5).

Capt. Barraud found that in Mesopotamian specimens the average number of pecten teeth was greater and the range of variation more. Out of 27 specimens examined the average number of teeth was 15.7; only 10 specimens had either 15

or 16 teeth, the number in the others ranging from 12 to 20. These specimens also had dark antennae, and the average size was larger and the average length of the siphon rather greater (index about 5). I find that specimens from Britain and Macedonia, though rather variable, agree in the main with this Mesopotamian type, which may therefore be taken as the common European form.

I have not been able to detect any constant difference between Palestine adults and those of other countries. Both the banded and unbanded forms occur there, and, as mentioned above, some (but by no means all) of the females have the upper fork-cell shorter than usual. It may be noted that in its several peculiarities the Palestine larva of *C. pipiens* approximates to that of *C. fatigans*.

It is possible, as long ago suggested by Ficalbi, that there are two races of this species, differing little, if at all, externally, but one being more addicted to sucking human blood than the other. In England *C. pipiens* will certainly attack man at times, but can seldom be regarded as troublesome; I have never myself experienced its bite, nor found a blood-gorged female in a bedroom. In south Europe, however, the reports of various observers lead one to suppose that it is more regularly addicted to feeding on human blood. Further experience may possibly show that the Palestinian type of larva described above is widely distributed in the Mediterranean region and represents the more troublesome race. If this should be proved to be the case the varietal name *molestus*, Forskål, might be applied to this form.

Wesenberg-Lund describes as *C. nigritulus*, Theo., a *Culex* larva which seems to differ in many respects from *C. pipiens*: e.g., in the shape of the mentum and of the pecten-teeth and comb-scales and in the longer siphon. As I have not seen the adults reared from these larvae, I will only remark that the larvae of my *C. pipiens* var. *doliorum* (which I considered identical with Theobald's *C. nigritulus*, and which I do not now consider even varietally distinct from *C. pipiens*) conform fairly well to Wesenberg-Lund's description of *C. pipiens*.

Synonymy.—It is impossible to say what species were actually intended by most of the old descriptions, but I think it probable that the names *C. bicolor*, Mg., *C. pallipes*, Mg., *C. thoracicus*, R.-D., *C. calcitrans*, R.-D., and perhaps also *C. luteus*, Mg., were based on more or less rubbed specimens of this species. From the habits indicated by Forskål and Germar for *C. molestus* and *C. domesticus* it seems probable that this species was intended, *C. fatigans* being excluded owing to its now apparently established absence from Europe and Egypt. The description of *C. pallipes*, Waltl, was evidently supplied by Meigen, and amplified by him in 1838. The British Museum possesses a copy of Meigen's *Abbildung eur. zweifl. Ins.*, hand-coloured by the author, in which the figure of *C. rufus* evidently represents *C. pipiens*, though the venation is shown in a conventional manner.* In his diagnosis of *C. meridionalis*, Leach says "abdomine segmentis omnibus postice griseo marginatis," but as he makes a similar statement regarding his *C. nicaensis* and *C. musicus*, it seems probable that by "postice" he meant "basally." Ficalbi's description of *C. phytophagus*, especially as regards the male palpi and abdominal bands, shows that he had *C. pipiens*, not *C. laticinctus* or *C. univittatus*, before him. I have examined the types of *C. marginalis*, *C. agilis*, *C. varioannulatus*, and *C. azoriensis*, and find them to be *C. pipiens*. Dr. Dyar informs me that he has examined Coquillett's type of *C. pallens*, and that it is *C. pipiens*. The species has frequently been referred to as *C. ciliaris*, L., but I think probably incorrectly.

Distribution.—Throughout the Palaearctic region; also in parts of North and South America, East and South Africa, and Madagascar; no doubt spread by commerce.

* It may also be remarked here that the figures in this work of *C. vexans* and *C. annulipes* agree with the interpretation of these names adopted in this paper. Some of the other figures are less decisive.

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