

A CONTRIBUTION TO KNOWLEDGE OF THE BLOOD-SUCKING DIPTERA OF PALESTINE, OTHER THAN TABANIDAE.*

By MAJOR E. E. AUSTEN, D.S.O.

(Plate IV.)

As in the case of the TABANIDAE, which have already been described,* the material upon which the following paper is based was collected by the author during the Palestine Campaign of 1917-18.

All the specimens, including types of new species, are in the British Museum (Natural History).

Family CHIRONOMIDAE.

Sub-family CERATOPOGONINAE.

Genus **Leptoconops**, Skuse.

Syn. *Tersesthes*, Townsend.

Leptoconops kertészi, Kieffer.†

In abundance near Wadi Ghuzze, on Cairo road about 5 miles S.-W. of Gaza, on afternoon of 14.v.1917; settling in numbers on the faces of the writer and a companion.

L. kertészi, Kieffer, originally described (Ann. Mus. Nat. Hung., vi, pp. 576-577, 1908) from material taken at Cairo, and subsequently recorded by Kieffer (*op. cit.*, xvi, p. 34, 1918) as occurring in Tunisia, is already represented in the National Collection by a series of specimens from Ouargla, Algeria (*Dr. E. Hartert*), March 1912, bearing the following field-note by the collector:—"Exceedingly numerous in some of the oases south of Biskra, and very troublesome to mules." It may be added that at Bir el-Abd, Northern Sinai (50 miles E. of Kantara), 9.xii.1916, the writer met with two females of what appeared to be this species on the margin of a small salt lake, and was bitten by one of them on the arm at midday.

In life the dorsum of the abdomen of this little midge shows a double, longitudinal series of admedian, dark brown blotches, separated by neutral grey†, triangular interspaces; the venter is whitish; the wings, the surface of which is apparently bare, are uniformly milk-white, except that in each wing the fused ends of the first and third longitudinal veins are expanded to form a kind of *stigma*, which is large and very conspicuous, and of a striking orange colour; the halteres are pale buff.

The suggestion by Kieffer (*op. cit.*, vi, p. 577) that *Tersesthes*, Townsend (founded for a species which attacks horses at fairly high altitudes—5,700-7,000 ft.—in New Mexico) is probably identical with *Leptoconops*, Skuse, is undoubtedly correct.

* For Tabanidae, cf. the author's paper "A Contribution to Knowledge of the Tabanidae of Palestine": Bull. Ent. Res., x, pt. 3, pp. 277-321, figs. 1-18 (April 1920).

† In 1918 this species was selected by Kieffer as the type of a new genus, which he briefly characterised (Ann. Mus. Nat. Hung., xvi, p. 135, 1918) under the name *Holoconops*, relying upon the number of joints in the antenna of the ♀ to justify a generic distinction. As was recently shown, however, by Mr. H. F. Carter in his admirable "Revision of the Genus *Leptoconops*, Skuse" (Bull. Ent. Res., xii, pt. 1, pp. 1-28, June 1921), it is impossible to accord to *Holoconops* anything more than subgeneric rank.

† For names and illustrations of colours used for descriptive purposes in the present paper, see Ridgway, "Color Standards and Color Nomenclature" (Washington, D.C. Published by the Author, 1912).

Genus **Culicoides**, Latr.*Synoptic Table.*

The eight species described or recorded below are mutually distinguishable as follows :—

- 1 (4) Wings entirely devoid of markings.
- 2 (3) Mesonotum and crown of head olivaceous black *vitreipennis*, sp. n.
- 3 (2) Mesonotum and crown of head grey (greyish olive) *puripennis*, sp. n.
- 4 (1) Wings with markings.
- 5 (8) Pale markings on each wing (other than any that there may be at the extreme base) limited to two more or less conspicuous spots or flecks on or close to costal border.
- 6 (7) Pale wing-markings on costal border clearly defined and conspicuous ; mesonotum cinnamon-coloured *tentorius*, sp. n.
- 7 (6) Pale wing-markings on or near costal border inconspicuous, and from certain angles visible with difficulty ; mesonotum dark mummy-brown
odiatius, sp. n.
- 8 (5) Pale markings on each wing (other than those at the extreme base) not limited to two spots or flecks, but much more numerous and extensive.
- 9 (10) Wings each with three dark blotches on costal border, of which at least the two more distal are (as seen against a light background) conspicuously darker than those elsewhere *newsteadi*, sp. n.
- 10 (9) Wings not so marked ; darker blotches on costal border (as seen against a light background) not conspicuously deeper in tint than those elsewhere.
- 11 (12) Mesonotum unicolorous *guttularis*, Kieffer.
- 12 (11) Mesonotum not unicolorous.
- 13 (14) Mesonotum with light grey markings on a dark brown ground ; wings with pale spots at their distal extremities directly in contact with the wing-margin, no dark spot in contact with anterior transverse vein
odibilis, sp. n.
- 14 (13) Mesonotum speckled ; wings in each case with distal pale spot between rami of fourth longitudinal vein not directly in contact with wing-margin, a small but conspicuous dark spot in contact with anterior transverse vein
circumscriptus, Kieffer.

Culicoides vitreipennis, sp. n.

♀.—Length (one dried specimen), from anterior margin of thorax to posterior extremity of abdomen, 1 mm. ; length of wing, 1.25 mm., greatest breadth of wing, 0.6 mm.

Wings hyaline, with a milky appearance but entirely devoid of markings ; crown of head and dorsum of thorax olivaceous black ; legs pale.

Head : vertex sparsely clothed with short, ochreous hairs, space between upper lobes of eyes with longer ochreous hairs ; face and *proboscis* dark brown ; inner margins of upper lobes of *eyes* moderately wide apart ; *palpi* mummy-brown, third segment oval, moderately swollen ; second segment of *antennae* (torus) mummy-brown, relatively large (larger and darker than in the following species), flagellum drab, tinged with brownish towards distal extremity, clothed with yellowish hair, first five or six segments of flagellum more or less spherical in shape, more truncate (more spherical) than in the following species. *Thorax* entirely without markings, mesonotum sparsely clothed with short, ochreous hairs ; *scutellum* agreeing in coloration with remainder of dorsum, and bearing one lateral bristle on each side, also (apparently) one central bristle, as well as several short hairs. *Abdomen* (in dried condition) blackish brown, clothed at distal extremity with yellowish hairs. *Wings*

clothed (somewhat less extensively than in following species) with fine, pale, decumbent hairs (macrotrichia), wing-fringe likewise pale; costa as far as end of third vein, first and third longitudinal veins, base of fourth vein as far as anterior transverse vein and anterior transverse vein itself pale cream-buff, otherwise all veins colourless; distal extremity of third longitudinal vein curved round (not bent at an angle) to meet costa, anterior transverse vein if anything slightly shorter than in following species; both radial cells distinct, but not quite so large as in latter. *Halteres* ivory-yellow, stalks brownish at base. *Legs* cream-buff, femora, except at distal extremities, and tibiae, except at their bases, tinged with sepia, extreme tips of femora and extreme bases of tibiae dark brown, extreme tips of hind tibiae mummy-brown on inner side; hair on legs pale yellowish, longer hairs on outer surface of hind tibiae inconspicuous.

Near Jerisheh, 5 miles N.-E. of Jaffa, 1-8.v.1918, in author's tent at night, on lining, above lighted lamp.

The species just described is distinguishable from the European *C. pumilus*, Winn., which it resembles in size and in the coloration of the body, by the much paler wings and legs, and by the decumbent hairs (macrotrichia) on the wings being pale instead of dusky.

***Culicoides puripennis*, sp. n.**

♀.—Length (one dried specimen), from anterior margin of thorax to posterior extremity of abdomen, 1.25 mm.; length of wing, 1.4 mm., greatest breadth of wing, 0.6 mm.

Wings hyaline, somewhat milky, entirely devoid of markings; *crown of head and dorsum of thorax* deep greyish olive; *legs* pale.

Head: vertex clothed with pale yellowish hairs, face greyish sepia-coloured; *proboscis* mummy-brown; inner margins of upper lobes of *eyes* closely approximate; *palpi* sepia-coloured, third segment but slightly swollen, first three segments clothed mainly with dark brown or blackish hair, last two segments clothed with ochreous hair; second segment of *antennae* (torus) light sepia-coloured, paler and also somewhat smaller than in foregoing species, flagellum drab, clothed with yellowish hair, five segments following torus bluntly ovoid. *Thorax* entirely without markings, mesonotum clothed with pale yellowish hairs; *scutellum* agreeing in coloration with remainder of dorsum, and apparently bearing two central bristles and on each side two lateral bristles, as well as several short hairs. *Abdomen* (in dried condition) clove-brown, sparsely clothed with pale hairs. *Wings*: greater part of surface, except base and costal, basal and radial cells, clothed with fine, pale, decumbent hairs (macrotrichia), which at and towards distal extremity of each wing are shorter and more closely set; wing-fringe pale; costa as far as end of third vein, first and third longitudinal veins, base of fourth vein as far as anterior transverse vein and anterior transverse vein itself cream-buff (distal half of third longitudinal vein and portion of costa immediately above it somewhat darker), otherwise all veins colourless; distal extremity of third longitudinal vein bent up at an obtuse angle to meet costa, anterior transverse vein fairly long; both radial cells well developed, the first about half as long again as the second. *Halteres*: knobs straw-yellow, stalks slightly darker. *Legs* cream-buff or pale cinnamon-buff, distal extremities of hind femora and hind tibiae sepia-coloured, extreme tips of middle femora and tibiae tinged with brown, first joint of hind tarsi somewhat infuscated; hair on legs pale, inconspicuous.

Deirân (Rechoboth), Jaffa district, 7 miles S.-W. of Ludd, 12.iv.1918, in room at night.

From the foregoing species *C. puripennis* is distinguishable, *inter alia*, by the coloration of the dorsum of the thorax ; by the second segment of the antenna being smaller and paler and the following five segments somewhat more elongate ; and by the course (angulate instead of rounded) followed by the distal extremity of the third longitudinal vein.

The species just described is also allied to the European *C. albicans*, Winn., from which it may be distinguished owing to the front and middle femora and tibiae not being conspicuously tipped with blackish brown or black, and also (if Winnertz's figure—*Linnaea Entomologica*, vi, Taf. vi, fig. 35b (1852)—is to be relied upon) by the less abruptly turned up distal extremity of the third longitudinal vein.

***Culicoides tentorius*, sp. n.** (Pl. iv, fig. 1).

♂.—Length (3 dried specimens), from anterior margin of thorax to posterior extremity of abdomen, 1.2 to 1.4 mm. ; length of wing, 1.5 to 1.75 mm. ; greatest breadth of wing, 0.6 mm.

♀.—Length (9 dried specimens), from anterior margin of thorax to posterior extremity of abdomen, 1 to 1.5 mm. ; length of wing, 1.4 to 1.6 mm., greatest breadth of wing, 0.75 mm.

Dorsum of thorax (in dried specimens) cinnamon-drab (♂, and sometimes ♀), or cinnamon-coloured (♀) ; *dorsum of abdomen* (in dried specimens) clove-brown or warm sepia-coloured ; *wings* mouse-grey (♂), or sepia-coloured or dusky-drab (♀), an obliquely elongate area at base pale, otherwise in both sexes the only light markings are situate on costal border in shape of a pair of conspicuous ivory-yellow spots, of which that nearer the base is the larger (Pl. iv, fig. 1) ; *ground-colour of legs* cream-buff or cinnamon-buff, *hind tibiae* in both sexes fringed posteriorly with a row of long hairs.

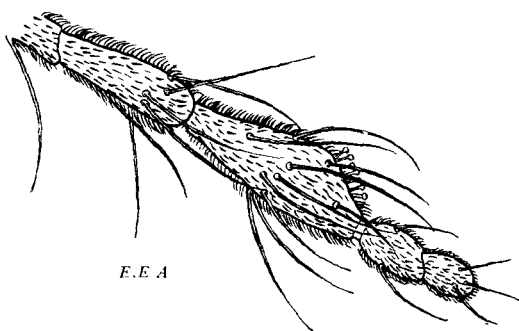
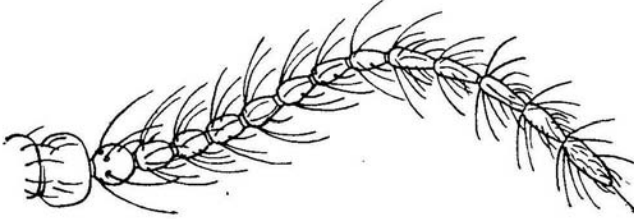


Fig. 1. *Culicoides tentorius*, sp. n. ; palpus of ♀.

Head fawn-coloured (face cinnamon-buff), vertex infuscated (blackish-brown or deep mouse-grey) in ♂ and in both sexes clothed with curved, glistening, yellowish hairs ; inner margins of upper lobes of *eyes* in ♀ very narrowly separated ; *proboscis* and *palpi* cinnamon-buff in ♂, sepia-coloured or dark brown in ♀, palpi in ♀ clothed with brownish hair, third segment moderately swollen towards distal extremity (fig. 1) ; *antennae* in both sexes cream-buff or light cinnamon-buff (distal segments sometimes darker), fourth to tenth segments in ♀ moderately elongate (fig. 2), hair on antennae, including antennal plume in ♂, glistening yellowish (light ochreous or ochraceous-buff). *Thorax* : dorsum without markings in either sex, sparsely clothed with glistening ochraceous-buff hairs ; *scutellum* agreeing in coloration with remainder of dorsum, and bearing in both sexes two central and two lateral bristles, as also several short hairs. *Abdomen* in both sexes clothed with pale yellowish hair. *Hypopygium* of ♂ (fig. 3) : ninth sternite deeply notched in middle line ; posterior

margin of ninth tergite also deeply notched, and with relatively broad finger-like extensions ; lobe-like processes of lower surface of projecting portion of ninth tergite situate some distance in front of posterior margin ; *forceps* of usual form, side-pieces each with two slender, sub-dorsal processes on inner side of proximal extremity ; proximal portion of each *harpe* with a strongly chitinated ventral process, at right angles to distal portion, distal portions of harpes noticeably broad, and each tapering



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Fig. 2. *Culicoides tentorius*, sp. n. ; antenna of ♀.

to a point posteriorly ; *aedoeagus* Y-shaped or lyrate, with broad, well chitinated stem, terminating bluntly behind, and with strongly chitinated limbs. *Wings* (Pl. iv, fig. 1) agreeing in both sexes as regards markings ; proximal ivory-yellow spot on costa surrounding anterior transverse vein, varying somewhat in size and outline in different individuals, but with its lower extremity reaching fold which traverses fork of fourth longitudinal vein ; proximal boundary of distal spot formed

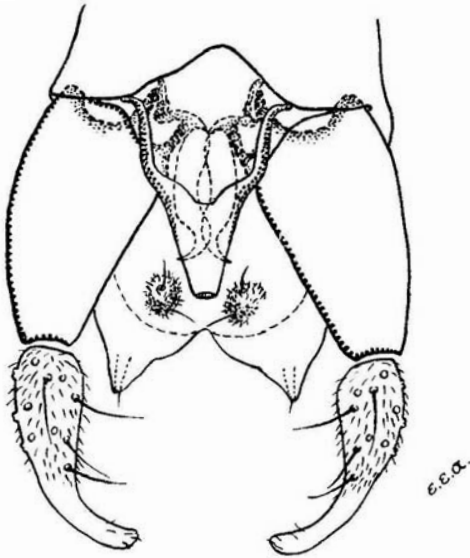


Fig. 3. *Culicoides tentorius*, sp. n. ; male hypopygium, ventral view (greatly enlarged).

by or scarcely extending beyond terminal upturned portion of third longitudinal vein ; in both sexes portions of costa and of first and third longitudinal veins between spots conspicuously darker than anything else in wing ; a larger or smaller area at base of wing pale, portions of veins included in this area, as also anterior transverse vein, upturned terminal portion of third longitudinal vein, and portions of longitudinal veins in proximal costal spot light buff or cream-buff, veins elsewhere, except as already

stated, sepia-coloured; in ♀, decumbent hairs absent from base of wing, including basal cell and costal border as far as end of first longitudinal vein, remainder of wing well clothed with these hairs, which are especially close together on costal border beyond distal costal spot. *Halteres* in both sexes cream-coloured or cream-buff. *Legs*: femora and tibiae, at least of hind legs, usually darker (tinged with mummy-brown or sepia) except at base and tip, so that these joints have a pale band at each extremity, extreme tips of femora and tibiae, at least of hind legs, often mummy-brown.

Near Jerisheh, 5 miles N.-E. of Jaffa, 26.iv.-8.v.1918: type of ♂ and 4 ♂ para-types, type of ♀ and 10 ♀ para-types, in author's tent at night, on lining, above lighted lamp. Not observed biting.

Although in general appearance, including coloration and wing-markings, closely resembling the East and West African *Culicoides* (*Johannseniella*) *fulvithorax*, Austen, the species just described is distinguishable therefrom, *inter alia*, by its generally larger size, by the less elongate shape of the fourth to the tenth segments inclusive of the ♀ antenna, and by the fact that in the wing the distal pale spot on the costa, instead of surrounding the terminal portion of the third longitudinal vein, is only in contact with the upturned part of its extreme tip.

From the N. Italian *Culicoides susae*, Kieff., *C. tentorius* may be distinguished by its larger size, by the fourth to the ninth segments inclusive of the ♀ antenna not being globular, by the halteres being cream-buff or cream-coloured instead of white, and by the presence of a row of long hairs on the extensor surface of the hind tibiae.

***Culicoides odiatus*, sp. n.**

♀.—Length (2 dried specimens), from anterior margin of thorax to posterior extremity of abdomen, 1.4 to 1.5 mm.; length of wing, 1.4 to 1.5 mm., greatest breadth of wing, 0.6 to 0.8 mm.

Dusky species, with very hairy wings, which are almost entirely devoid of markings.—Head and thorax dark mummy-brown (vertex darker), without spots or other markings; abdomen (in dried specimens) russet-brown or russet; wings with markings in each case confined to a pair of small, faint, ill-defined and inconspicuous maculae on or near costal border.

Head clothed above with brownish hair; inner margins of upper lobes of *eyes* almost in contact below; *proboscis* cinnamon-brown; *palpi* dark mummy-brown, clothed with dark brown hair, third segment strongly swollen, expansion commencing immediately beyond base; *antennae* light sepia-coloured, agreeing closely with those of *C. tentorius*, Austen (cf. fig 2, p. 111) as regards shape of segments, and clothed with yellowish (ochraceous-buff) hairs. *Thorax*: mesonotum clothed with ochraceous-buff hairs and with dark brown bristles; *scutellum* bearing, in addition to several short hairs, apparently four central bristles, as also on each side two lateral bristles. *Abdomen* sparsely clothed with pale hairs, except on sides and at distal extremity, where a portion at least of the hairs are dark brownish. *Wings*: with exception of basal and costal cells, practically entire surface clothed with long, closely set, decumbent hairs, which, especially in region beyond level of end of third longitudinal vein, where they are thickest, largely overlap one another; of the two faint pale maculae in each wing, that nearer the base surrounds the anterior transverse vein and extends only indistinctly to the costa, the other is situate on and adjacent to the costa at the end of the third longitudinal vein, the extreme tip of which it includes; second radial cell much broader than the other, which is practically obliterated and indistinguishable. *Halteres* cream-buff, distal extremities of stalks greyish. *Legs*: femora light sepia-coloured (hind pair darker), in each case with a faintly marked pale band (less conspicuous in that of hind pair) before extreme tip,

which is infuscated; tibiae drab-coloured or brownish drab, their extreme tips infuscated; tarsi light ochraceous-buff; tibiae clothed with brownish or yellowish hair, a series of long hairs on extensor surface of hind pair; upper surface of hind tarsi clothed with fairly long, pale hair.

Near Jerisheh, 5 miles N.-E. of Jaffa, 29.iv.-8.v.1918: type and one para-type, in author's tent at night, on lining, above lighted lamp.

The species described above is allied to the foregoing (*C. tentorius*, Austen), but, in the ♀ sex at any rate, is distinguishable *inter alia* by the more swollen third joint of the palpi, by the much darker colour of the dorsum of the thorax, by the wings being much more hairy, and by the two pale spots on the costal border being only faintly indicated and much less developed.

***Culicoides newsteadi*, sp. n. (Pl. iv, fig. 3).**

♀.—Length (3 dried specimens), from anterior margin of thorax to posterior extremity of abdomen, 1.2 mm.; length of wing, 1.3 mm., greatest breadth of wing, 0.6 mm.

Allied to the European C. pulicaris, L., and agreeing therewith in wing-markings in case of specimens in which pattern shown in Pl. iv, fig. 3 is somewhat reduced, but, in ♀ sex at any rate, distinguishable inter alia by much smaller size, and by presence of a pale band, sharply defined in case of fully-coloured specimens when viewed against a dark background, at distal extremity as well as at base of hind tibiae.

Head: vertex sparsely clothed with curved, yellowish hairs; inner margins of upper lobes of eyes in contact or separated by an exceedingly narrow interval; *proboscis* dark brown; *palpi* sepia-coloured, clothed partly with brownish, partly with yellowish hair, third segment strongly swollen; *antennae* light sepia-coloured or light mummy-brown, third to tenth segments inclusive generally paler (cream-coloured), hair on antennae yellowish. *Thorax*: dorsum clothed with shining ochraceous-buff hairs, ground-colour (in dried specimens) olive-grey, with a mummy-brown area on each side anteriorly, or light greyish olive, with anteriorly a narrow, sepia-coloured, longitudinal streak in middle line, becoming obsolete towards hind margin, and on each side, between it and lateral border, a broader and longer, curved, longitudinal stripe of same colour; *scutellum* agreeing in ground-colour with remainder of dorsum, and bearing two central and two lateral bristles, as also three short hairs between each central and corresponding lateral bristle. *Abdomen* sparsely clothed with pale (cream- or cream-buff-coloured) hairs. *Wings*: in specimens with fully-developed wing-markings, latter are as shown in Pl. iv, fig. 3, the three dark blotches on costal border dark mouse-grey and very conspicuous, remaining dark markings mouse-grey; in many specimens, however, mouse-grey markings between costal border and hind margin are much reduced in extent, taking form of partly discontinuous and isolated spots and flecks; greater part of distal half of wing-surface, as well as of hind border, fairly thickly clothed with decumbent hairs. *Halteres*: stalks cream-coloured, knobs ivory-yellow. *Legs* sepia-coloured or light sepia-coloured, tarsi, middle and hind knees, and a band at each extremity of hind tibiae paler (pinkish-buff or pale pinkish-buff—in well-coloured specimens pale bands on hind tibiae are cinnamon-buff); hair on legs pale, hind tibiae on outer surface with a row of long hairs.

Near Jerisheh, 5 miles N.-E. of Jaffa, 26.iv.-8.v.1918: type and 5 para-types, in author's tent at night, on lining, above lighted lamp: dedicated, as a trifling token of sincere regard, to Robert Newstead, F.R.S., Dutton Memorial Professor of Entomology, Liverpool School of Tropical Medicine. Although not actually taken *in flagrante delicto*, there can be no doubt that this species is a blood-sucker, since in the case of the type fresh blood was observed in the abdomen at the time of capture.

A ♂ *Culicoides* taken, with specimens of four other species of the same genus, at Sheikh Zowaid, N. Sinai, 14.iii.1917, in the author's tent at night, and almost certainly belonging to the species just described, measures (in the dried condition) 1.6 mm. in length from the anterior margin of the thorax to the posterior extremity of the abdomen. In the *genitalia*, the side-pieces (basal portions of forceps) are considerably less swollen than in the case of *C. pulicaris*, L., ♂, so that the disparity in size between these and the claspers is not so great. As regards *wing-markings*, with the exception of the distal costal blotch, which is undiminished, all the dark markings are much reduced, those other than on the costal border appearing as some eight or nine faint and almost completely isolated flecks.

***Culicoides guttularis*, Kieff.**

Culicoides guttularis, Kieffer, Ann. Mus. Nat. Hung., xvii, p. 45 (1919).

Three ♀♀, near Jerisheh, 5 miles N.-E. of Jaffa, 29.iv.-8.v.1918, in author's tent at night, on lining, above lighted lamp. Not observed biting, but one of the three specimens brought back has its abdomen distended, apparently with blood.

C. guttularis, the type of which was taken in Hungary (Budapest), also occurs in Great Britain, and has been taken in Middlesex, Herts, Huntingdonshire and the Isle of Arran. The specimens obtained in Palestine differ from the typical form, as described by Kieffer, and agree with British examples, in having a dark transverse mark across the centre of the axillary cell, the distal extremity of which, in contact with the posterior branch of the fifth longitudinal vein, is also infuscated.

***Culicoides odibilis*, sp. n. (Pl. iv, fig. 2).**

♂.—Length (1 dried specimen), from anterior margin of thorax to posterior extremity of abdomen, 1.25 mm.; length of wing, 1.5 mm., greatest breadth of wing, 0.6 mm.

Antennal plume cream-buff (looking brownish in certain aspects, or when the hairs are matted together); *dorsum of thorax* dark brown, with conspicuous light grey markings; *wings* infuscated and iridescent, with sharply defined milk-white or cream-coloured spots, as shown in Pl. iv, fig. 2.

Head: *proboscis* and *palpi* mummy-brown, clothed with dusky hairs; *torus of antenna* blackish brown, third to twelfth segments inclusive ivory-yellow or almost colourless, last three segments sepia-coloured in certain lights, clothed with dusky hairs mixed with some pale hairs. *Thorax* dark mummy-brown, mesonotum sparsely clothed with glistening yellowish hairs, and with ground-colour varied by conspicuous and sharply defined light neutral grey markings, chief among which are a sinuous mark, shaped something like a note of interrogation (?), embracing each anterior slit-like depression, a small spot behind each of these marks, a transverse row of four transversely elongate spots across the middle, and a broad, somewhat trident-shaped mark on hind border; base and sides of *scutellum* light neutral grey. *Abdomen* dark neutral grey (claspers paler—light brownish olive), clothed with dusky hair, paler (yellowish) towards the tips. *Hypopygium*: ninth sternite deeply emarginate; posterior margin of ninth tergite not noticeably notched in middle line, finger-like extensions narrower than in *C. guttularis*, Kieff.; lobe-like processes of lower surface of projecting portion of ninth tergite situate some distance in front of posterior margin; *forceps* of usual form, but claspers less elongate than in *C. guttularis*, and their distal extremities not swollen as in the latter species; *harpes* broad, with distal extremity of each attenuate and elongate; limbs of *aedoeagus* strongly chitinised and forming a Y-shaped or lyrate rather than a U-shaped figure, as in *C. guttularis*, stem of *aedoeagus* moderately broad, apparently rather short, fairly well chitinised and ending bluntly behind. *Wings* (Pl. iv, fig. 2) deep mouse-grey, with a strongly

developed purplish iridescent sheen, and with sharply defined, spot-like, milk-white or cream-coloured markings, chiefly along distal and posterior borders, as shown in figure; hind border of axillary cell to level of axillary angle, and greater part of distal half of each wing fairly thickly clothed with decumbent hairs, which as usual are especially close together on distal third, particularly in area beyond distal costal spot. *Halteres*: knobs straw-yellow, stalks cream-coloured. *Legs*: femora and tibiae light sepia-coloured (hind femora somewhat darker), knees (tips of femora and extreme bases of tibiae) and tips of hind tibiae mummy-brown; tarsi, extreme bases of all femora, a ring immediately before tips of front and middle femora, and a similar ring immediately beyond bases of all tibiae and before tips of hind tibiae cream-coloured; hind femora with a faint indication of a narrow pale ring before tips; hind tibiae with a row of long, dusky hairs on extensor surface, hair on tarsi and on flexor surface of hind tibiae pale.

Near Jerisheh, 5 miles N.-E. of Jaffa, 26.iv.1918; in author's tent at night, on lining, above lighted lamp.

Culicoides odibilis is allied to the foregoing species (*C. guttularis*, Kieff.), from which however it is readily distinguishable by the neutral grey markings on the dorsum of the thorax, by the differences in the ♂ hypopygium detailed above, and by the much more sharply defined wing-markings, in which the pale spots are considerably less extensive.

***Culicoides circumscriptus*, Kieff.**

Culicoides circumscriptus, Kieffer, Ann. Mus. Nat. Hung., xvi, p. 49, fig. 15 (1918).

One ♀, near Jerisheh, 5 miles N.-E. of Jaffa, 29.iv.1918, in author's tent at night, on lining, above lighted lamp.

The specimen referred to agrees on the whole very well with Kieffer's description of the species, the type of which was obtained in Tunis. The inner margins of the upper lobes of the *eyes*, though separated above by a space, the width of which is approximately equal to that of the flagellum of the antenna, are closely approximate below. In the much bespotted *wings*, practically the entire surface of which is thickly clothed with decumbent hairs, the dark fleck (alluded to by Kieffer) enclosed in the proximal pale costal blotch is situate immediately beyond, and in contact with, the anterior transverse vein, occupying the angle formed by the latter and the praefurcal portion of the fourth longitudinal vein; a small pale fleck inside the fork of the fourth vein, close to its base, is not mentioned by Kieffer.

Note.—In an addendum to a short paper by E. Brunetti on "Some Noxious Diptera from Galilee" (Journ. Asiatic Soc. Bengal, New Ser., ix, pp. 43–35, 1913), Dr. N. Annandale writes (*loc. cit.*, p. 45):—"Another irritating blood-sucker common at Tiberias in October, though much less so than *Ph. papatasi*, is a minute Chironomid of the sub-family Ceratopogoninae. Like *Phlebotomus* it is nocturnal in its habits." On p. 370 of Vol. x of the same journal (1914), in a note to Kieffer's description of *Trichotanypus tiberiadis*, Kieff., Dr. Annandale remarks:—"This is the species I referred to in a note on a former paper (J. A. S. B. (n.s.), ix, p. 45, 1913) as being a troublesome bloodsucker at Tiberias." There would appear to be some confusion here, since the genus *Trichotanypus* does not belong to the CERATOPOGONINAE, and the species included in it are structurally incapable of sucking blood.

Genus ***Forcipomyia*, (Mg.) Kieffer.***

***Forcipomyia* (?) *bipunctata*, L. var.**

One ♂, Mount of Olives, 1.vii.1918, in Kaiserin Auguste-Viktoria Stiftung, on window.

* No species of this genus is actually known to suck blood.

The only obvious differences from British examples of *F. bipunctata*, L., exhibited by the above specimen are that the hair on the scutellum is paler and perhaps longer, that clothing the distal extremity of the abdomen paler, and that covering the wings apparently shorter, while the knobs of the halteres are dead white without a tinge of yellow.

Family CULICIDAE.

Of the mosquitos collected and bred by the author during 1917-18, a considerable number were subsequently destroyed by Psocids. The material actually brought home includes representatives of 20 species, all but two of which, however, have already been recorded from various localities in Palestine by Captain P. J. Barraud, in a paper published by him in this Bulletin a few months ago.* It will therefore suffice to mention the additions† to Captain Barraud's list, which both belong to the genus *Culex*, and are as follows.

***Culex tritaeniorhynchus*, Giles.**

One ♀, bred, 9.viii.1918, from larva in floating débris : R. Auja, Khirbet Hadrah, 6 miles N.-E. of Jaffa.

***Culex modestus*, Fic.**

Two ♀♀, bred, 14.20.v.1918, from larvae in marsh at Tel Abu Zeitun, near Jerisheh, 5 miles N.-E. of Jaffa.

It may be added that bionomical notes on various species of *Anopheles* will be found in the author's paper entitled "Anti-Mosquito Measures in Palestine during the Campaigns of 1917-1918,"‡ although it now appears that in certain cases the nomenclature there used is in need of revision. Thus—

A. maculipennis, Mg., should be *A. maculipennis*, Mg. var.

A. sinensis, Wied., should be *A. hyrcanus*, Pall.

A. palestiniensis, Theob., should be *A. superpictus*, Grassi.

A. turkhudi, Liston, should be *A. multicolor*, Camb.

Family SIMULIIDAE.

Genus ***Simulium***, Latr.

***Simulium flavipes*, sp. n.**

♂.—Length (4 specimens), 2 mm.

Black; anterior border of dorsum of thorax with a pale neutral grey patch on each side, a similar patch on hind border in front of scutellum; antennae vinaceous cinnamon or light pinkish cinnamon; genitalia indistinguishable from those of S. angustitarsis, Lundstr.; legs Naples yellow or pale buff yellow, tarsi, tips of tibiae and of hind femora mummy-brown or sepia-coloured, front tarsi slender, not at all expanded, first joint of hind tarsi strongly incrassate.

Head: palpi mummy-brown. Thorax: front border of dorsum clothed with minute, appressed, glistening yellowish hairs; meso- and sternopleurae neutral grey or light neutral grey. Abdomen: hair on abdominal scale pale yellowish. Halteres cream-coloured. Legs: front and middle coxae (at least in some specimens)

* "Mosquitos Collected in Palestine and Adjacent Territories," by Captain P. J. Barraud, F.Z.S., F.E.S.: Bull. Ent. Res., xi, pt. 4, pp. 387-395 (March 1921).

† For the identifications of these the author has to thank Mr. F. W. Edwards.

‡ Trans. Soc. Trop. Med. and Hygiene, xiii, no. 4, pp. 47-60 (November 1919).

§ Figured by Edwards, Bull. Ent. Res., vi, pt. 1, p. 24, fig. 1, i (June 1915), as those of "*S. aureum*."

with a dark brown or blackish spot or streak on posterior surface; middle femora with extreme tips light mummy-brown on upper surface; hind legs clothed with fine yellowish hair (tips of tarsi with brownish hair); hind tibiae strongly expanded towards distal extremities; last four joints of front tarsi together approximately equal in length to, or slightly longer than first joint; first joint of hind tarsi somewhat lighter towards base, second joint short but *without any noticeable dorsal excision*, combined length of last four joints of hind tarsi equal to slightly more than half length of first joint.

Wadi el Kelt, Jordan Valley, near Jericho: type and three para-types, 1.vi.1918, forming part of a number of ♂♂ of same species, dancing in small swarms in dry portion of Wadi bed, 5.30–6.30 p.m. At the same time ♀♀ of *Simulium equinum*, L. (see below), were abundant in the ears of horses picketed close by, on top of the Wadi bank.

The species just described is allied to the Algerian *Simulium beckeri*, Roubaud (Bull. Mus. d'Hist. Nat., xii, p. 520, 1906), but is apparently distinguishable, *inter alia*, by its somewhat larger size, and by the leg markings, *e.g.*, by the presence of dark brown or brownish tips to the front and middle tibiae, and by the proximal extremity of the hind tibiae being entirely yellowish (*i.e.*, without a blackish ring at the base). *Simulium flavipes* is also closely allied to an undetermined Ethiopian species (represented in the National Collection by five specimens from Zomba, Nyasaland Protectorate), in which, however, the dark markings of the femora and tibiae are more strongly developed.

Simulium equinum*, L.

Seven ♂♂, Tel Abu Zeitun, near Jerisheh, 5 miles N.-E. of Jaffa, 2.v.1918—part of small swarm dancing at foot of the Tel, near the marsh, 6.15 p.m.; 3 ♀♀, Jericho Plain, 15.iv.1918, "biting horses' ears in morning and evening, all over the Plain" (Captain Kendle, *Australian Veterinary Corps*); 12 ♀♀, Jericho Plain, 19.iv.1918, "in large numbers, attacking insides of horses' ears"; 1 ♀, Hadrah Dam, R. Auja, 29.iv.1918, "flying low over the water, apparently ovipositing on green slime close to the water's edge, 6.15 p.m."; 1 ♀ (pale-legged variety), Jericho Plain, near Wadi el Kelt, 31.v.1918, "in horse's ear in evening."

In the Wadi Hamis, near Ain Kanieh (about 11 miles N.N.-W. of Jerusalem), on 8.iii.1918, at a spot where the shallow water was flowing very swiftly, a greenish *Simulium* larva was present in myriads on the stones in the bed of the stream. No adults were seen, and under the circumstances it was impossible to attempt to breed out any of the larvae. Close to the spot referred to, a number of *Simulium* larvae, apparently belonging to three different species, were also found on the leaves of a submerged piece of reed. Some of these latter larvae were collected and taken back to quarters, and although the majority of those brought back died within two days, two were observed on 10.iii.1918 to have pupated. One of the pupae (examined and sketched as well as possible with the aid of an ordinary platyscopic lens) was found to have on each side six slender respiratory filaments, apparently arising separately from what looked like a long, narrow, whitish pad, the whole arrangement, except as regards the thinness and length of the filaments, being similar to that of the pupal respiratory organs of *S. equinum*, L., as recently figured by Edwards.†

On 19.iv.1918 in the Wadi el Aujah (6½ miles N. of Jericho), a rushing stream of about five yards in width, *Simulium* larvae were abundant on the stones. In fact, just as in the Wadi Hamis six weeks earlier, so numerous were the larvae on some of the stones that the latter looked as though they were hairy.

* For the definite determination of this species, the writer is indebted to Mr. F. W. Edwards.

† F. W. Edwards, Bull. Ent. Res., xi, pt. 3, p. 236, fig. 6 (December 1920).

At Hadrah Dam, R. Auja, on 29.iv.1918, when, as already recorded, a ♀ of *S. equinum* was taken apparently ovipositing, the stones in the bed of one of the sluices were seen to have numerous small *Simulium* larvae on them.

No adults of *Simulium* were observed in Palestine in 1917, but on 9th June in that year larvae were found on stones in running water in the Wadi Shanag (the upper part of the Wadi Ghuzze), at Bir Esani, by Lt.-Col. Richardson, D.S.O., R.A.M.C. Similarly, in the Wadi Ghuzze itself near Tel el Fara, in a rapidly flowing channel issuing from a pool, the writer noticed a few *Simulium* larvae on stones, on 31st July 1917. There can be little doubt that several species of *Simulium*, in addition to the two recorded above, occur in Palestine, and that the genus will be found to exist wherever the presence of running water affords the conditions necessary for breeding.

Family PSYCHODIDAE.

Genus *Phlebotomus*, Rond.

Phlebotomus papatasi, Scop.

Probably abundant during the hotter months in every town and village in Palestine, besides being widely distributed in the open country.

The small amount of material of this species which the author succeeded in bringing home in safety consists of:—2 ♂♂, 4 ♀♀, Deir el Belah, 8 miles S.-W. of Gaza, 13.viii.1917, in corners of an "E.P." tent, 10.30 a.m.; 1 ♀ (abdomen distended by eggs), Deir el Belah, 22.viii.1917, in circular tent (alongside earth bank surmounted by cactus hedge) in which a case of "sand-fly (*Phlebotomus*) fever" had occurred; 1 ♀, Deir el Belah, 8.ix.1917—both sexes numerous in upper corners of E.P. tent, used as office by 14th Coy. (A.T.) R.E., in palm grove at No. 14 Well; 2 ♂♂, 2 ♀♀, Bir ez Zeit (13 miles N. of Jerusalem), 22.vii.1918, in house—at least 5 ♀♀ seen in dark, cellar-like basement of one house, and a number more specimens of both sexes (one ♀ full of partly digested blood) in a dark, open cupboard in a room on first floor of another dwelling; 1 ♀, Et Tireh (about 5 miles N.N.-E. of Ludd), in corner of dark granary; 1 ♀, Mulebbis, 2.viii.1918—with another specimen, in corner of packing shed at orange grove.

More than one of the females enumerated above, which has the wing fringes, especially those on the costal margins, decidedly dark, apparently belongs to Newstead's "*Dark form.*"*

In July and August 1917, the occurrence of a number of cases of sand-fly fever in the E.E.F. at Deir el-Belah caused attention to be directed to *Ph. papatasi*, which was at that time common in many places in dug-outs and tents, in the case of the latter, especially such as were pitched in the palm groves near the wells or close to banks of earth crowned with cactus hedges. Efforts to find breeding places failed, though possibly lizard holes, more particularly the burrows of *Agama stellio*, L. ("*Hardun*" of the Arabs), the large repulsive-looking lizard so common about cactus hedges in Palestine, may be among the sheltered retreats serving the insects as nurseries. At Deir el Belah, 13.viii.1917, at 10.30 a.m., the writer found *Ph. papatasi* abundant in an E.P. tent, situated in a garden close to a well and occupied as sleeping quarters by enginemen working the pump at the latter. The insects were in numbers in the upper corners of the tent, sheltering behind the valances and at the back of framed photographs hung across the corners; there were also several inside helmets and coats hanging on the tent-pole. Both sexes were present, ♀♀, the majority of which were gorged with blood, perhaps slightly predominating; over 20 specimens were caught in tubes with little difficulty. At

* Newstead, Bull. Ent. Res., ii, p. 73 (1911).

Jericho, in May-June 1918, *Ph. papatasi* was fairly common, and in the compound of the Pilgrim's Hospice at 4.45 a.m. on 7.vi.1918, the author was bitten on the back of the hand by a ♀ of this species, in broad daylight. On 2.x.1918, when occupying a tent on a spur of Mt. Carmel, above Haifa, the writer observed a ♂ *Ph. papatasi* inside his mosquito net.

***Phlebotomus minutus*, Rond., var. *africanus*, Newst.**

The following are the data with regard to the few specimens of this insect brought back by the author:—1 ♂, near Jerisheh, 5 miles N.-E. of Jaffa, 7.v.1918, in author's tent, 8.0 a.m.; 1 ♀, same locality and place, 15.v.1918, 7.15 p.m.; 2 ♂♂, 2 ♀♀, near Yahudiye, about 8 miles E. of Jaffa, 24.viii.1918, in E.P. tent in olive grove; 1 ♂, 6 ♀♀, and 3 ♂♂, 7 ♀♀, near Jerisheh, 26.viii. and 3.ix.1918, behind hanging valance of E.P. tent, in open country.

In the Jaffa district, at any rate during the period July-September 1918, *Ph. minutus* var. *africanus* was generally to be found sheltering in numbers behind the hanging flaps or valances in E.P. tents, while, if the settlement of Wilhelma may be taken as a criterion, it was also common in villages. On 30.vii.1918, the writer was informed by Captain (afterwards Major) W. F. Corfield, D.A.D.M.S., 54th Division, that the fly was abundant in all the houses in Wilhelma, and that in the room used as the informant's mess, 40 or 50 specimens were sometimes seen, or were caught on the lamp, in one evening. On making a search in the office of the A.D.M.S., 54th Division, in Wilhelma, the writer found two examples of what appeared to be *Ph. minutus* var. *africanus*, while in the cellar-like basement of the same house several more specimens of this *Phlebotomus*, including a female gorged with blood, were seen and caught. Since every house in Wilhelma is provided with a basement, the walls of which, being built of rough stone, are full of cracks and crannies forming ideal breeding and sheltering places, the local abundance of these "sand-flies" was scarcely surprising, while, at any rate under active service conditions, effective prophylactic measures were of course impossible.

When collecting specimens of *Ph. minutus* var. *africanus* in their favourite retreats in E.P. tents, it was noticed that on first being uncovered they are often, or usually, so completely motionless that they appear to be dead. On being disturbed, however, they become very active, either jumping from side to side after the manner of *Ph. papatasi*, or just as frequently taking wing at once. Placed in tubes loosely plugged with cotton wool, these little flies frequently burrow into the wool like minute mice, and then remain perfectly motionless. In the Jerisheh-Wilhelma region, in the summer of 1918, occasional specimens of *Ph. papatasi* were seen or caught in company with *Ph. minutus* var. *africanus*, though the latter appeared to be far more numerous. Like *Ph. papatasi*, *Ph. minutus* var. *africanus* sometimes shelters among clothing hanging on tent-poles; thus, near Jerisheh on 7.ix.1918, the author took 1 ♂ and 3 ♀♀ of this variety among the folds of a Burberry suspended from the pole in his tent. None of these females had blood in them, and no specimens of *Ph. minutus* var. *africanus* were ever observed to bite; in fact the finding in the basement of a house at Wilhelma, as mentioned above, of a single female gorged with blood was the only evidence obtained that the present variety is actually a blood-sucking fly. It only remains to add that whenever a series of specimens was collected, females were found to be much more numerous than males, and that a single male taken by the writer, 26.ix.1918, in his tent at Tul Keram, appeared to belong to the variety under discussion.

Writing from observations made during a five weeks' visit to southern Galilee and Syria in October and November 1912, Dr. N. Annandale says*:—"By far the

* Journ. Asiatic Soc. Bengal, ix, pp. 44-45 (1913).

most troublesome blood-sucking flies at Tiberias and Nazareth in October are the so-called sand-flies of the genus *Phlebotomus* (fam. Psychodidae). They occur in large numbers in every house, concealing themselves during the day in ceilings or dark corners to which they retire shortly after sunrise, and commencing their onslaught, which is continued until they retire, at sunset. Although I was unable to find the larvae, I obtained indirect evidence that they breed in half-dried algae just above the water level on the sides of open cisterns. Miss S. L. M. Summers, of the London School of Tropical Medicine, who has been kind enough to examine the adult specimens I collected, finds only two species (*Ph. papatasi* [sic], Scop., and *Ph. minutus*, Rond.), among them, thus confirming the preliminary diagnosis made in the field. Col. Alcock tells me that he found the same two species, and them only, in a large collection from Aleppo. *Phlebotomus* apparently occurs at Tiberias practically throughout the year, but at Damascus, in which it is troublesome in summer, it had entirely disappeared before the end of October. I did not obtain *Ph. minutus* at Nazareth, and at Tiberias it was much less common than *Ph. papatasi*."

Genus et sp. incert.

At Bir Esani, 24.x.1917, in the Wadi Immalaga near its mouth, on a ladleful of water just taken from among bulrushes, the author found a small Psychodid with a distinct proboscis and slightly spotted wings. Most unfortunately the specimen, which was quite unlike anything seen before or since, was blown away before it could be secured.

Family MUSCIDAE.

Genus **Philaematomyia**, Austen.

Philaematomyia crassirostris, Stein.

Musca crassirostris, Stein, Mitt. Zool. Mus. Berlin, ii, p. 99 (1903)

Philaematomyia insignis, Austen, Ann. & Mag. Nat. Hist. (8) iii, p. 298, figs. i-iii (1909).

Eleven ♂♂, 11 ♀♀, Latron, close to Jaffa-Jerusalem road, 5.ix.1918; 1 ♀, Tul Keram, 26.ix.1918 (*Lt.-Col. (temp. Col.) E. P. Sewell, C.M.G., D.S.O., R.A.M.C.*).

Although from the moment of entering Palestine the writer kept a sharp lookout for this widely-distributed species, it was not met with at all during 1917, and even in 1918 it was not observed until 5th September, when the author took it in abundance on his own person, at Latron. Had cattle been examined, the fly would very possibly have been encountered earlier.* Patton and Cragg,† writing of *Philaematomyia insignis*, Austen (= *Ph. (Musca) crassirostris*, Stein), as observed by them in Madras, state that flies of this species "feed almost exclusively upon cattle and . . . only occasionally bite human beings." The present writer's experience tends to support this statement. At Latron on the date mentioned he took both sexes of *Philaematomyia crassirostris* in numbers on his puttees (24 specimens—11 ♂♂, 13 ♀♀—were caught without difficulty in a killing tube), all the insects being actively engaged in probing the material with their proboscises, evidently in search of nutriment; while, although the writer's arms were bare and perspiring, only a few specimens settled upon them, and only one of these latter flies (a ♀)

* In Galilee, in October 1912, according to Dr. N. Annandale, the present species was "by far the commonest blood-sucking fly on horses and cattle":—cf. E. Brunetti, "Some Noxious Diptera from Galilee" (Journ. Proc. Asiatic Soc. Bengal, ix, p. 43, 1913).

† Annals of Tropical Medicine and Parasitology, v, p. 518 (1912).

attempted to bite. It was felt at the time that so unmistakable a predilection for settling upon and feeding from a hairy surface could scarcely be without significance. The ♀ taken in the act of biting the author's arm caused a sharp, pricking sensation, which lasted for several minutes, although there was no visible blood at the bitten spot. The ♀ caught at Tul Keram by Colonel Sewell bit its captor on his bare leg at 7.30 a.m., while he was dressing in his tent; though disturbed before it had time to draw blood, the fly left a mark upon the skin.

The greyness of the ♀♀ of this species in life is very noticeable; male specimens do not appear nearly so grey. Another remarkable characteristic of this fly is the softness of its body; when pinning the specimens taken at Latron, which did not appear to be newly-emerged, the author found it difficult to impale them on No. 20 pins, without crushing in the dorsum of the thorax, and the contrast in this respect between *Ph. crassirostris* and *Musca domestica* or *M. autumnalis* was most striking.

Genus *Stomoxys*, Geoff.

Stomoxys calcitrans, Linn.

One ♂, 2 ♀♀, Deir el-Belah, 8 miles S.-W. of Gaza, 7.20.iv.1917; 1 ♀, Jaffa, 26.ii.1918, in house; 1 ♀, Wadi Hanein, near Richon le Sion, 9.iv.1918; 1 ♂, 1 ♀, Deiran, 11.iv.1918, *in coitū*.

Generally distributed. Brunetti (*loc. cit.*) states that in October 1912 this species was met with in houses at Nazareth and Tiberias by Dr. N. Annandale, who writes (*ibid.*) that it was "also seen commonly on cattle."

Genus *Lyperosia*, Rond.

Lyperosia irritans, Linn.

Fairly common in Wadi Ghuzze, near El Shellal, 11.xi.1917, when a number of specimens settled on author's sleeve, but did not attempt to bite; 1 ♂, 3 ♀♀, Ain es-Sultan, near Jericho, 22.iv.1918, on horses.

[*Lyperosia minuta*, Bezzi.—Brunetti (Journ. Proc. Asiatic Soc. Bengal, ix, p. 43, 1913) records a single ♀ of this species as having been taken at Tiberias, in October 1912, by Dr. N. Annandale, who writes (*loc. cit.*):—"The specimen was caught biting my hand at night. What I take to be this species is very troublesome, especially in the early morning and at sunset, on the shores of the Lake of Tiberias, easily piercing ordinary flannel with its proboscis. The wound is not very painful and does not as a rule become inflamed."]

Family HIPPOBOSCIDAE.

Genus *Hippobosca*, Linn.

Hippobosca equina, Linn.

One ♀, near Jericho, 6.iii.1918 (*Captain (acting Lt.-Col.) W. J. Dale, O.B.E., R.A.V.C.*); 1 ♀, Deir el-Belah, 8 miles S.-W. of Gaza, v.1917; 1 ♀, near Jerisheh, 5 miles N.-E. of Jaffa, between 1.v. and 8.v.1918; 1 ♂, 1 ♀, Mulebbis, 21.v.1918, on cow (*Captain C. Searle, M.C., R.A.M.C.*); 1 ♂, Jericho Plain, 26.v.1918, on horse; 3 ♀♀, Mount of Olives, 26.v.1918, on horse (*Captain (acting Lt.-Col.) Dale*); 1 ♂, 1 ♀, Mount of Olives, 20.vi.1918, inside Kaiserin Auguste-Viktoria Stiftung; 1 ♂, Tul Keram, 27.ix.1918.

Brunetti (*loc. cit.*, p. 44) mentions that in October 1912 specimens of this species were taken by Dr. N. Annandale at Tiberias, Nazareth, and Kefr Kenna, "sucking blood of horses." The collector states (*loc. cit.*) that in Galilee *H. equina* is "very common on horses and cattle."

Hippobosca capensis, v. Olf.

One ♂, 1 ♀, Deir el-Belah, 8 miles S.-W. of Gaza, v.1917; 1 ♂, near Kefr Insha, about 20 miles E. of Jaffa, 21.v.1918, settled in ear of author while he was travelling in motor car; 1 ♂, Mount of Olives, 6.vii.1918, inside Kaiserin Auguste-Viktoria Stiftung, on author's neck; one specimen (sex uncertain, abdomen missing), near Abud, 19 miles E. of Jaffa, 25.viii.1918, on author's arm.

Hippobosca camelina, Leach.

One ♂, near Jericho, 6.iii.1918 (*Captain (acting Lt.-Col.) W. J. Dale, O.B.E., R.A.V.C.*); 1 ♀, Tel es-Sultan, near Jericho, 21.iii.1918, caught in horse lines, with many specimens of *Hippobosca equina*, Linn. (*Captain W. W. Averill, Auckland Mtd. Rifles*); 1 ♂, 4 ♀♀, Deir el-Belah, 8 miles S.-W. of Gaza, 2.ix.1917, on camels.

It may be mentioned that a somewhat misshapen pupa (puparium), deposited prematurely by one of the specimens last referred to, measures 7 mm. in length, while the dimensions of a fully mature, empty puparium of *H. camelina*, obtained at Biskra, Algeria, 3.iii.1894 (*Rev. A. E. Eaton*) are—length, 6 mm., greatest breadth, 5.4 mm.

Owing to the very large number of camels (some 30,000), chiefly from Egypt, serving with the Egyptian Expeditionary Force in 1917–18, this species could have been taken practically anywhere within the British lines in Palestine, at any rate wherever there was a detachment of the Imperial Camel Corps or section of the Camel Transport Corps.

Genus **Lynchia**, Weyenb.**Lynchia maura**, Big.

Three ♂♂, 3 ♀♀, Deir el-Belah, 8 miles S.-W. of Gaza, 23.viii.1917, on carrier-pigeons belonging to Army Signal Service, R.E.

In the warmer parts of the earth, including southern Europe, this well-known parasite of the domestic pigeon and disseminator of the haematozoon, *Haemoproteus columbae*, Celli & Sanf., is nowadays to be found on its host practically wherever the latter occurs. The *Lynchia maura* series already in the British Museum (Natural History) includes specimens from the Canary Islands (Orotava, Teneriffe); N. Nigeria (Hadeija); Nyasaland Protectorate (Kanyenda, Dwangwa R., W. Nyasa); Union of South Africa (Cape Town, and Mowbray, Cape Province; Pretoria and Onderstepoort, Transvaal); Mauritius; Mesopotamia (Qurnah, R. Tigris); India (Deesa, Ambala, Bangalore); Selangor (Kuala Lumpur); Jamaica (Spanish Town); and Brazil (Pará). Knab (*Insec. Inscit. Mens.*, iv, 1916, p. 3), who gives records ranging from Iowa to Southern Brazil (S. Paulo), states that the species "is widely distributed in America," and that recently it "has made its appearance in the Hawaiian Islands."

Apart from the dissemination of haematozoa, pathogenic or otherwise, by *Lynchia maura*, these flies, several of which may occur on the same bird, are prejudicial to carrier-pigeons by disturbing their rest. It was found in Palestine that an infested pigeon on returning from a flight, instead of at once seeking its resting place, as these birds usually do, would alight on the floor of the loft and proceed to stamp and peck itself.

Genus **Lipoptena**, Nitzsch.**Lipoptena caprina**, sp. n.

♂♀.—Length, ♂ (7 specimens), 3.2 to 3.8 mm. (from anterior margin of clypeus to posterior margin of scutellum, 2 to 2.2 mm.), ♀ (3 specimens), 3.8 to 5 mm. (from anterior margin of clypeus to posterior margin of scutellum, 2.4 mm.); width of head, ♂, 1 to just over 1 mm., ♀, 1.25 mm.

Dorsum of thorax (in dried specimens) *shining mummy-brown*; *chitin plates on dorsum of abdomen small* (first three plates in ♀ *minute*); *entire dorsum of abdomen of ♂ from posterior margin of basal segment backwards inclusive, except greater part of the four plates of chitin and area immediately in front of last plate, thickly clothed with relatively long, recumbent, cinnamon-rufous hair*; *corresponding area of dorsum of abdomen of ♀ clothed for most part with very short hair*.

Head: dorsal surface, including *antennae*, ochraceous-tawny, *vertical triangle* (ocelligerous plate) dark brown or dark mummy-brown, nearly semi-circular and extending much further forward than in *L. cervi*, L., *frontal stripe* cinnamon-brown, sepia-coloured or light mummy-brown, about half as broad again as long; each *inner orbit* at its widest equal to or slightly exceeding extreme breadth of corresponding eye; *clypeus* generally with a more or less distinct, isolated, pit-like depression in middle line, midway between pit at posterior end of median longitudinal groove and its hind margin, a dark brown horseshoe-shaped mark (more or less complete or widely interrupted in middle line), usually fairly well defined, and with forwardly directed concavity, encircling pit at end of median longitudinal groove, each arm of the horseshoe running along inner edge of corresponding antennary pit, but not reaching front margin of clypeus, a second, narrower, dark brown, curved mark, interrupted in middle line by posterior pit-like depression, behind horseshoe and midway between it and posterior margin of clypeus, arms of posterior curved mark not extending so far forward as those of horseshoe, area adjacent to pit at posterior end of median longitudinal groove brownish; *palpi* dark brown, short; hair on ventral surface of anterior border of head brownish at base, glistening ochraceous-tawny towards distal extremity. *Cephalic chaetotaxy*: one bristle close to inner upper angle of each orbit, on a level with posterior ocelli; two bristles side by side on each inner orbit, in a row extending obliquely forwards and inwards on a level with upper margin of eye; one bristle (occasionally two bristles) on inner margin of each orbit close to upper boundary of clypeus. *Thorax*: dorsum clothed with hair and bristles of moderate length, dark brown at base, glistening cinnamon-rufous towards their distal extremities; middle line of mesonotum bordered on each side with a curved row of bristles, commencing anteriorly a little in advance of hind margin of humeral callus; humeral calli each with six or seven bristles, postalar calli each with three bristles; lateral area of mesonotum on each side clothed fairly thickly with bristles, of which those forming a transverse row on upper surface of protuberance in front of base of each wing-stump are stouter and recurved; *scutellum* sometimes showing a pit-like depression (perhaps due to *post mortem* shrinkage) near each lateral angle, sometimes also with a similar depression in middle line; hind margin of scutellum with six bristles. Each half of mesosternum roughly quadrate in outline when seen from below, considerably larger than corresponding half of metasternum, and closely beset with very short dark brown bristles, those on hind margin, apart from usual long, hair-like bristle in front of socket of middle leg, larger and stouter than elsewhere; short bristles on metasternum smaller and fewer than those on mesosternum, though in this case also bristles on hind margin are stouter than remainder. *Abdomen*: dorsum of ♂ with basal segment of usual type, followed in middle line by four small, transversely elongate plates of shining dark brown chitin, widely separated by pinkish buff or cinnamon-buff integument; transverse diameter of last two plates about the same (0.6 mm.), but last plate considerably deeper (*i.e.*, longer when measured from front to rear) than penultimate, the two anterior plates very small, one-third or considerably less than half the size of the penultimate, basal segment, except hind margin, clothed with short, appressed, dark brown hair; venter cinnamon-buff, with a large horseshoe-shaped, dark neutral grey mark not extending to distal extremity, and entire surface thickly clothed with short hair, similar in colour and character to that on dorsum; dorsum of abdomen of ♀ with basal segment similar to that of ♂, followed in middle line by four plates of chitin widely separated by light ochraceous-buff integument, the terminal plate,

consisting of dark brown chitin, situate at bottom of notch or depression in hind margin of abdomen, and about equal in size to corresponding plate in ♂, remaining plates very small, light mummy-brown in colour and transversely elliptical or elliptical oval in shape, the penultimate plate and the plate immediately following the basal segment between one-third and one-fourth of the terminal plate in size, the antepenultimate plate considerably smaller than either of the two plates between which it is situate; dorsum in ♀ sparsely clothed with appressed, dark brown, chestnut-brown or cinnamon-rufous hair, very short except on hind margin of basal segment and on lateral margins of posterior half of abdomen, and, with exceptions stated, much shorter than corresponding hair in ♂, each of the four median chitinous plates with a more or less complete row of short hairs, varying in number, on or close to its hind margin; venter cinnamon-buff, fairly densely clothed with minute, appressed, dark brown, chestnut-brown, or cinnamon-rufous hair. *Legs*, except tarsi, buff-yellow or ochraceous-buff, front and middle femora brownish above towards distal extremities, anterior surfaces of front and middle tibiae also more or less brownish; tarsi cinnamon-brown or chestnut-brown; bristles and hairs on legs dark brown to cinnamon-rufous, stouter bristles dark brown at base, then paler.

Jerusalem and Ain Arik (10 miles N.N.-W. of Jerusalem): type of ♂, and 5 ♂ and 2 ♀ para-types, taken at Jerusalem, 29.vi.1918, on goats and kids; type of ♀, and 1 ♂ para-type, caught at Ain Arik, 15.vii.1918, on a kid. In all cases the insects were on the inside of the thighs; at Jerusalem "on 29.vi.1918 several specimens were found on one small kid. It may be noted that, in addition to harbouring the parasite just described, the goats examined, which appeared to be perfectly healthy, were also infested with ticks, specimens of which, apparently belonging to two or three species, were numerous on the inside of the animals' ears.

Among the microscopic preparations forming part of the National Collection of Diptera is a ♀ *Lipoptena*, which is evidently conspecific with the specimens enumerated above, and was taken on man at Snevce, Macedonia, in May 1918 (Col. C. M. Wenyon, C.M.G., C.B.E., late A.M.S.).

In general appearance *Lipoptena caprina* presents a close resemblance to *L. ibicis*, Theob. (Second Report Wellcome Research Labs., Khartoum, 1906, p. 88, figs. 45-47), which was described from specimens found on an ibex at Port Sudan, Anglo-Egyptian Sudan. The new species agrees with *L. ibicis* with respect to size, etc., of the abdominal plates of chitin and as regards the hairiness of the body, but is distinguishable by the row of bristles running obliquely across each inner orbit consisting of only two instead of three or four, or sometimes even five bristles, and by the antero-posterior diameter of the vertical triangle (ocelligerous plate) being if anything slightly longer.

Owing to similarity of provenance, it might be reasonable to assume the identity of *Lipoptena ibicis*, Theob., with *L. chalcomelaena*, Speiser (Zeitschr. f. syst. Hym. u. Dipt., iv, p. 178, 1906), the typical series of which was obtained at Tor (Peninsula of Sinai) on "*Capra caucasica*" (*Capra aegagrus*, Gmel.?). While, however, the number of bristles in the row running obliquely across the inner orbits as given by Speiser for *L. chalcomelaena* agrees with what is found in *L. ibicis*, Speiser in describing the abdomen of the male of his species gives no indication of special hairiness; on the other hand he describes the vertical triangle on the head as "broad and short," whereas in *L. ibicis*, Theob., the antero-posterior diameter of the corresponding plate is considerably longer than in *L. cervi*, Linn. On the other hand, in a subsequent paper (*op. cit.*, v, p. 354, 1905), Speiser, when giving additional localities for his species, mentions that the majority of the specimens afterwards examined by him were collected in Egypt (two on the shores of the Red Sea), and that all of these bore a label with the MS. name of "*L. hirta*, Löw." This would suggest that if Speiser has correctly identified these latter specimens as belonging to his own species, *Lipoptena ibicis*, Theob., may still be a synonym of *L. chalcomelaena*, Speiser.

EXPLANATION OF PLATE IV.

Fig. 1.—Wing of *Culicoides tentorius*, Austen, ♀. × 75.

Fig. 2.—Wing of *Culicoides odibilis*, Austen, ♂. × 75.

Fig. 3.—Wing of *Culicoides newsteadi*, Austen, ♀. × 75.

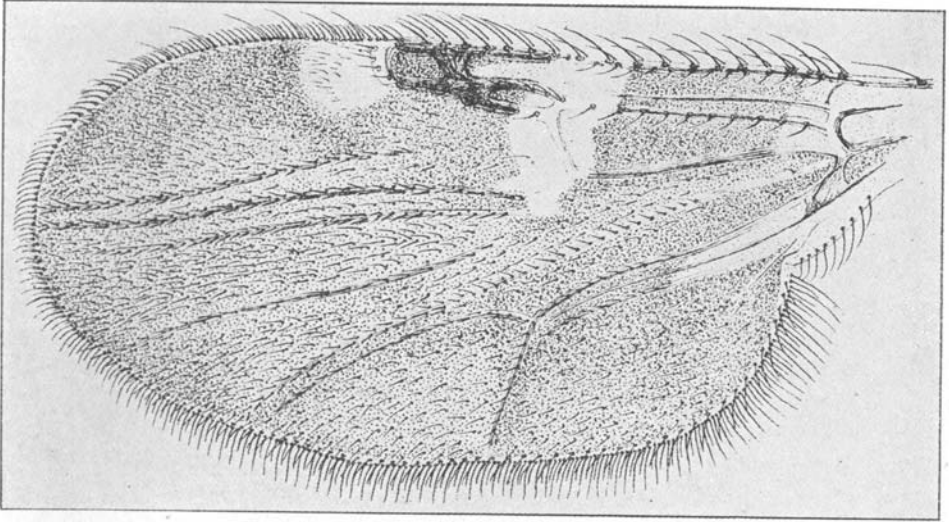


Fig. 1. *Culicoides tentorius*. sp. n., ♀ ($\times 75$).

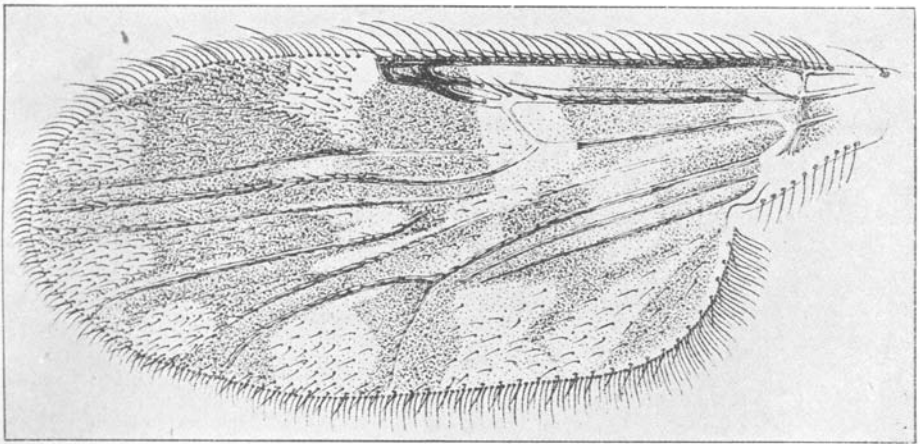
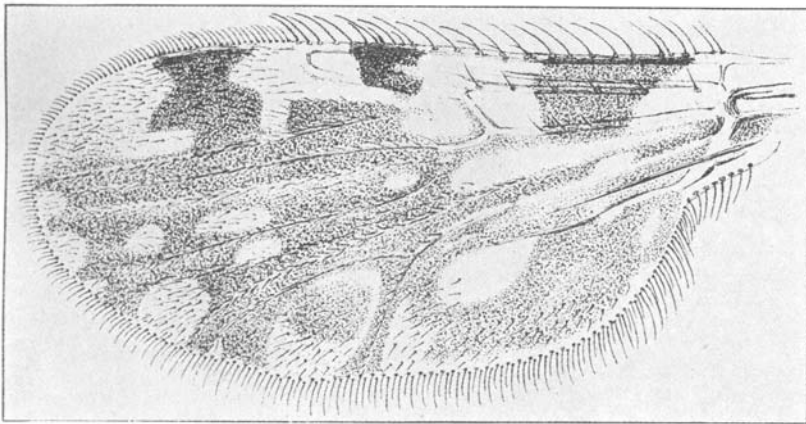


Fig. 2. *Culicoides odibilis*. sp. n., ♂ (> 75).



E. E. Austen ad nat. del.

Fig. 3. *Culicoides newsteadii*. sp. n., ♀ ($\times 75$).