

INSECTS AND OTHER ARTHROPODA
COLLECTED IN THE CONGO
FREE STATE

MAP of
CONGO FREE
STATE.

showing route of Expedition.
Route shown thus - - - - -

FRENCH
CONGO

PORTUGUESE
POSSESSIONS
ANGOLA

ATLANTIC
OCEAN

REGION
DES
CYTHACLES

LEOPOLDVILLE

COQUILHATVILLE

IBENGE

BIKOPU

LAKE
YUMBA

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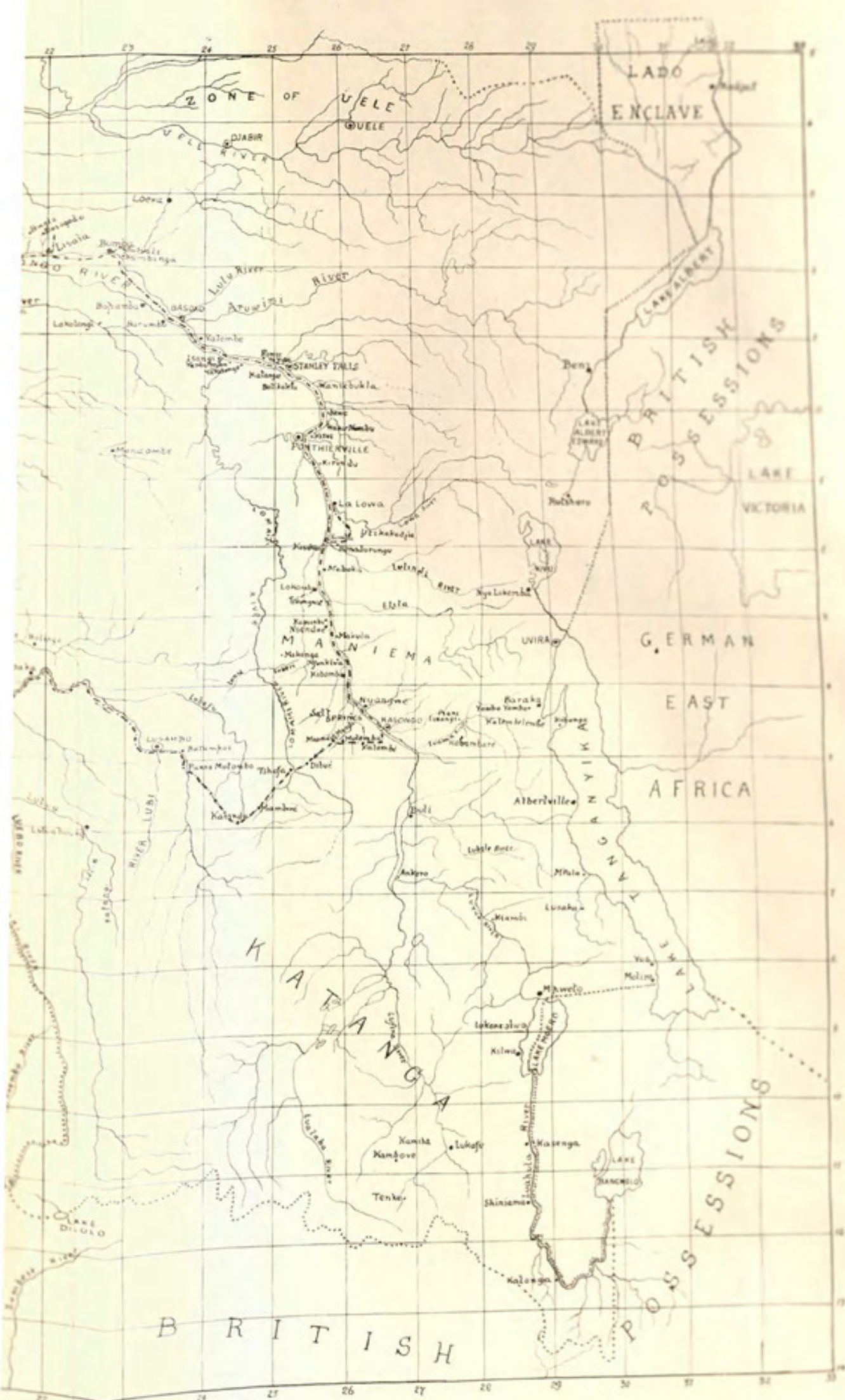
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INSECTS AND OTHER ARTHROPODA COLLECTED IN THE CONGO FREE STATE

*Being the Seventh Interim Report of the Expedition of the Liverpool
School of Tropical Medicine to the Congo, 1903-05*

BY

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INTRODUCTORY

This expedition was sent to the Congo Free State, on the invitation of His Majesty King Leopold II, by the Liverpool School of Tropical Medicine to report upon the sanitary condition of the more important posts and to study human trypanosomiasis. The collection of various biting insects formed, therefore, a principal part of its work; but once the more important ones, as *Glossina* and *Anophelina*, were obtained in each district the systematic search for insects was discontinued. A large part of this collection represents then, merely the casual wayside gleanings made during a journey through Central Africa.

From the point of view of a dipterologist the collection is therefore regrettably incomplete, especially so, since a large number of specimens have been unavoidably ruined by moulds. Had time been spent in collecting, it is probable that many of those insects reported from only one or two localities would have been found to have a far wider distribution.

Twenty-three months were actually spent in the Congo Free State; during that time a distance of some 2,000 miles was travelled. The course followed by the expedition is indicated on the map; while

the dates when it was at, or passed through, the various posts are briefly mentioned below.

England was left on September 4, 1903. Banana,* the first point of call in the Free State, was reached on September 23. From September 24 to October 27 was spent at Boma, and from October 28 to November 20 at Matadi. Matadi is connected with Leopoldville by railroad. From Tumba, the half way point on the railway line, two of the members of the expedition made a trip of three weeks' duration (November 5 to 28) to Wathen and through the District of the Cataracts. A stay of seven months, from November 22, 1903, to June 23, 1904, was made at Leopoldville.

From Leopoldville the expedition went up the Congo to Stanley Falls in a small steamer placed at their disposal by the Government. When it seemed advisable, stops and short side-journeys were made at posts along the river for the purpose of studying local conditions. Work was done at M'Swata from June 25 to 29. At Tshumbiri (July 2 to 5) one night was spent at a native village some ten miles inland. Mopolengue was visited on July 7 to 9, and Irebu on July 14 to 17. From Coquilhatville (July 18 to August 9) trips were made to Eala and Bamamia. Nouvelle Anvers was visited from August 14 to 21. From Mobeka (August 22) a short journey was made up the Mongala to Bokanga (August 23). Stops were made at Lisala (August 26 to 30) and at Bumba (August 31 to September 4); at both of these places short journeys were made inland. Short stays were made at Basoko (September 7 to 9) and at Yakusu (September 13 to 15). On September 15 Stanley Falls was reached, where the expedition remained until September 28.

From Stanley Falls the journey up the Congo was continued to Kasongo by canoe. Ponhierville was visited from October 5 to October 9. From Lalowa (October 12) two members of the expedition made a side trip of 12 days' duration inland to the east of the Congo. They paralleled the river as far as Kumba, where they once more took canoe. From Lokandu (October 16 to November 1) a journey of some 18 miles was made inland. Stops were made at N'Sendwe (November 4 to 8), and Nyangwe (November 13 to 22). Kasongo was reached on November 23, 1904. A stay of five months

* See Map 1, page 1.

was made at this post, and it is there that Dr. Dutton died and is buried.

Kasongo was left on April 27, 1905. The journey thence to Pania Mutombo lay overland and was done on foot. Kalombe was reached on May 3, Maomedi on May 5. No stop of more than a day was made before reaching Tshofa (May 13 to 25). Four days, June 2 to 6, were passed at Cabinda. At Pania Mutombo (June 12) canoes were once more employed for the two days' journey down stream to Lusambo (June 5), where the expedition remained until July 8, 1905.

The journey from Lusambo to Leopoldville was done as quickly as possible by steamer, and no stops were made for work. At Leopoldville (July 21 to 30) arrangements were made for leaving Africa. The railroad between Leopoldville and Matadi was once more traversed, and on August 8, 1905, the expedition left the Congo Free State. On the way home Freetown, Sierra Leone, was visited for a week (August 16 to 22). Liverpool was reached on September 5, 1905; the expedition had been absent from England for just two years.

Other side-trips were made besides those mentioned; and it must be understood that when a stay of any duration was made in a post short journeys were always made in its neighbourhood.

As is shown by the map, the route followed by the expedition twice crossed the equator and traversed a territory lying between 2° North and 6° South of that line. The climates of the posts visited therefore varied somewhat. The succession of the seasons at the most important places is briefly as follows:—

At Boma the seasons are irregular. There is usually said to be a long and a short wet, and a long and a short dry, season. Practically, we may say that from May to September there is but very little—or no—rain; and that from October to the end of April there is a good deal; from January to April are the hottest months of the year. It is then, from October to May that conditions are the most favourable for the breeding of mosquitoes. At Leopoldville rain is more likely to fall in every month of the year than at Boma. From the 15th of June to the 1st of September is usually considered to be the dry season, and during this period there may be practically no rain.

Coquilhatville is almost on the equator, and consequently has no marked variation in its seasons. Rain falls in every month of the year, perhaps the most in November and December. The

temperature is constantly high, and during the first four months of the year it may be very hot. The climate is then admirably suited for the development of mosquitoes.

Bumba is one of the furthest north among the posts visited by the expedition. The seasons there are not well marked, rain falls in every month of the year; perhaps the least in January and February.

At Kasongo and Cabinda the seasons are much the same as at Boma, save that the "dry season" is shorter and rain often falls in August and May.*

When the expedition arrived at Boma the rainy season had already set in. For the first half of the month spent there, rain fell almost daily, the thermometer meanwhile varying between 85° and 70° F. During the latter two weeks there was an occasional shower or two and the temperature was slightly higher.

While at Matadi there was but little rain, so that but few of those places were seen where rain-water collects during the wet season to form breeding-places for mosquitoes.

When Leopoldville was reached the rainy season was well-established. The ground was sodden with water and the streams were filled to overflowing. From November to April rain fell almost daily, and there were frequent thunderstorms. The daily temperature varied from 70° to 89° F. In May less rain fell, and in June the "dry season," with its accompanying over-cast sky, evidently commenced, although there were still occasional thunderstorms.

On leaving Leopoldville practically no rain was met until the neighbourhood of Coquilhatville was reached. While the expedition was there rain fell almost every second day. One or two really hot days, maximum temperature 93° to 94° F, were encountered on the way up river. At Coquilhatville the temperature was much lower and exceedingly equable; this type of weather persisted during the journey up river, past Bumba and Basoko, to Stanley Falls. There

*For general information concerning the climate of the Congo Free State we are indebted to a "Rapport sur le Climat, la constitution du sol et l'Hygiène de l'Etat Indépendant du Congo" presented to the "Congrès national d'Hygiène et de Climatologie" at Brussels, Aug. 14, 1897, by Drs. Bourguignon, J. Cornet, G. Dryepont, Ch. Firket, A. Lancaster and E. Meuleman. Thanks are also due to Dr. Etienne for copies of his meteorological observations at Banana, and to Commandant Verdick for a copy of the observations made during 1904-05 at Kasongo.

were, however, one or two hot days (maximum 96°F), and while at the Falls there were a couple of severe thunderstorms.

From Stanley Falls the route lay south through the equatorial zone towards Kasongo where the rainy season had already set in. Frequent showers and thunderstorms were encountered on the way up river. The weather was pleasantly cool, the temperature varying usually between 82° and 71°F.

From November to April there was much rain at Kasongo (December, 216.3 mm.). The temperature meanwhile varied between 68° and 85°F. The march overland from Kasongo to Lusambo in May and June was made during the commencement of the dry season. Rain fell but rarely, the temperature became higher and its daily variation greater. Streams and swamps dried up rapidly, and by the end of the first week in May the prairie grass was often dry enough to burn.

Rain fell only twice during the stay of the expedition at Lusambo.

By referring to this synopsis of the weather encountered by the expedition the climatic conditions under which the insects, described in this report, were collected may be easily ascertained.

In the case of a post at which a long stay was made the month in which the specimen was obtained has been specified. To facilitate the finding of places in the map, the names of localities at which specimens were collected are always mentioned in the order in which they were visited.

A certain number of insects were sent to the expedition from places it left unvisited. In referring to these specimens the name of the collector and, when possible, the date of capture are given.

A considerable number of flies, collected in the British Colony of the Gambia* and in French Senegal, were taken, together with certain drawings and observations referring to them, to the British Museum on the return of the expedition of the Liverpool School of Tropical Medicine to Senegambia in July, 1903.

At the end of 1905 these insects had not been described by the British Museum authorities. It was therefore requested that they should be returned to the Liverpool School. While at the Museum, a considerable part of the collection had unfortunately been mislaid;

*For a map showing the localities mentioned in the Gambia, see Memoir XI of the Liverpool School of Tropical Medicine.

but a description of the remaining insects, which were returned to Liverpool, has been incorporated in this publication, with one or two exceptions, and these will be subsequently referred to as occasion may arise.

We desire to express our indebtedness and thanks to Mr. F. V. Theobald and Mr. E. E. Austen, for kind assistance rendered in the identification of the more obscure insects; and to Professor G. Neumann for the identification of the Ixodidae, and also for his valuable contribution to this group of the Arthropoda.

FAMILY CULICIDÆ

SUB-FAMILY ANOPHELINÆ

Pyretophorus costalis, Loew

Localities:—Zambia; Boma (Oct. 8 to 21); Prince's Island; Matadi (Oct. 29 to Nov. 25); Tumba; Wathen; Leopoldville (Dec. 10, 1903, to June 16, 1904); Telegraph post No. 4; Kitoto; Yumbie; above Lukolela in bush; Irebu; Coquilhatville; Bamamia; Lulongo; Nouvelle Anvers; Bokanga; Lisala; Bumba; Yambinga; below Basoko in bush; Stanley Falls; Benaburungu; Lokandu; Sendwe; Makula; Kasongo (Nov. 26, 1904, to Feb. 13, 1905); Tshofa; Lusambo; Lado enclave (Nov. Lemaire).

Circumstances of capture:—Imagines were taken in the day time and at night in the dwelling-places of Europeans and natives, in the mosquito nets of servants sleeping in the bush and, during the day time, far in the forest itself at a long distance from any village. Several were also caught in the evening about the table lamp on board our steamer.

Breeding places:—Pupae and larvae were found amongst the aquatic grasses growing along river edges, in swamps, in small clear puddles of rain-water lying on clayey soil, and in the foul-smelling pools used by the natives of the lower Congo for steeping manioc.

Field notes:—This is by far the most common Anopheline in the Congo. It seems to feed most fiercely just after sunset and again before dawn.

On two occasions during the stay of the expedition at Leopoldville it was necessary to work all night. On each occasion *P. costalis* was noticed to feed from dusk to about 11 p.m. From 11 p.m. to 3 a.m. none were seen. From 3 a.m. to

5 a.m. they fed fiercely, 15 or 20 insects attacked one at the same moment, and were able to feed successfully through clothing.

At Coquilhatville, early in the evening, these mosquitoes were seen flying into the houses of Europeans where ordinarily none could be found during the day time. The parasites of malaria were seen to develop in this mosquito at Boma.

In some of the mosquito breeding pools at Leopoldville the larvae of *P. costalis* were completely destroyed by larger, cannibalistic *Culex* larvae.

At Leopoldville in December, 1903, and in July, 1905, as well as at Ponthierville in October, 1904, it was observed that *Culicidae* were not breeding in the water of puddles and small streams containing an amorphous, brownish, apparently vegetable deposit,* although similar neighbouring collections of water contained many larvae.

Pyretophorus marshallii, Theobald

Six specimens, all females, were captured in the localities mentioned below. They were in all cases associated with *P. costalis*, but may readily be distinguished from the latter by the characteristic banding of the palpi. It is important to note, however, that among the long series of *P. costalis* there are many intervening forms between typical examples of the two species.

Localities:—Boma; Leopoldville (May); Coquilhatville; Yambinga.

Circumstances of capture:—The specimens were taken in the huts and mosquito nets of natives.

Myzomyia funesta, Giles

Localities:—Zambia; Prince's Island; Matadi; Wathen; Kalombe; Lusambo.

Circumstances of capture:—Examples of this mosquito were taken in the houses of both Europeans and Africans as well as in the mosquito nets of native servants. It is curious to note that not a single specimen of this mosquito was seen at Leopoldville where a careful mosquito survey was made.

Breeding places:—Examples of this species were obtained from larvae developed in the laboratory. It is probable that in the Lower Congo it breeds amongst aquatic grasses along the banks of rivers and in pools used for steeping manioc.

* Possibly a species of *Crenothrix* on whose gelatinous sheath iron becomes deposited as ferric oxide.

Field notes:—Malaria parasites were seen to develop in these mosquitoes at Lusambo.

Myzorrhynchus paludis, Theobald

Localities:—Leopoldville (Dec. 1903 to Feb. 1904); Bamu Island; Bamamia; Eala; Barumbu; Kumba; Kasongo (Dec.); Lusambo.

Circumstances of capture:—Imagines were caught in forests and marshes and in natives' huts. They also came on board the steamer in the evening after the lamps were lighted, and at Lusambo were caught about the lamps on three occasions.

Breeding places:—Adults were bred from larvae taken in marshes and in the stagnant and overgrown but fairly clean water left in pits from which clay had been taken for brick-making.

Myzorrhynchus mauritanus, Grandpré

Localities:—Zambia; Boma; Leopoldville (Dec.); Bamu Island; Kasongo (Dec.).

Circumstances of capture:—Imagines were caught only in the forest at Bamu Island.

Breeding places:—Larvae and pupae were taken from among the grass along the edges of rivers, from swamps, from rain-water collected in puddles on clayey ground, and from stagnant, overgrown, but fairly clean, water left in pits from which clay had been taken for brick-making, and imagines were bred from them.

Cellia pharoensis, Theobald

Localities:—This mosquito was collected only at Boma. Specimens were caught in dwelling-places and some were also reared from larvae.

Breeding places:—Larvae were found amongst water-grasses growing along the river's edge, in swamps and in a dirty, muddy puddle.

Field notes:—Malaria parasites were seen to develop in this mosquito at Boma.

SUB-FAMILY TOXORHYNCHITINÆ, Theobald

Toxorhynchites marshallii, Theobald

FEMALE.—*Head* scales bronzy-blue at the sides and between the eyes, bronzy-green on occiput, black along the nape. *Palpi* of four segments; sub-apical and apical segments minute; clothed with brilliant azure blue scales. *Antennae* black; first segment black at the base dorsally, grey at the apex with a patch of dull white scales; pubescence grey; hairs black. *Proboscis* azure blue. *Thorax*: Prothoracic lobes dull azure blue, with bronzy-green reflections; mesothorax black with brilliant bronzy-green scales; scutellar scales rich bronzy-yellow; and there are patches of the same coloured scales near the base of the wings; pleurae almost covered with dull white scales. *Abdomen* azure blue with rich violet reflections; penultimate segment with brilliant ruby reflections; anterior half of anal tuft black, the rest rich orange; there are white lateral spots to the first, second, third and fifth segments; venter blue with white scales on the fifth segment. *Legs* dark violet; coxæ with some white scales; mid and hind femora dull bronzy-yellow beneath with white reflections, in some lights, and in the hind tibiae this colour extends to the upper surface on the inside; first segment of mid and hind tarsi with a dusky white band; second segment almost entirely white forming a distinct broad band; second tarsal segment to fore legs with an inconspicuous basal band of dusky white scales; fore, mid and hind ungues equal and simple.

Length 9 to 10 mm., exclusive of the proboscis.

A description of the ♀ has been given as it has not, apparently, been hitherto described.* Of the 22 specimens collected, only one is a male, the rest are all females.

Localities:—Tshumbiri and Coquilhatville.

Circumstances of capture:—Our thanks are due to the Rev. and Mrs. Billington, members of the American Baptist Missionary Union stationed at Tshumbiri, for a series of these mosquitoes collected in March, April, June and November. They have also supplied the following notes on the bionomics of these mosquitoes. "The adults fly with a characteristic loud humming; they were frequently caught in a European's house. The larvae were found in a metal water-tank."

* *Mono. Culicid.*, vol. 3, p. 121, 1903.

SUB-FAMILY CULICINÆ

Eretmapodites inornatus, n. sp. (Newstead)

(Pl. i, fig. 10)

Head clothed with brilliant silvery metallic scales with a patch of black ones in the centre. Thorax rich brown with two median, two short lateral, and a continuous marginal stripe of golden-yellow scales. Abdomen black; penultimate segment of the male with two lateral silvery spots; apical segment, in female only, almost entirely covered by silvery metallic scales; venter with five white metallic bands. Legs long, black with coppery or bronzy-brown reflections; no paddles to hind tarsi of ♂.

FEMALE.—Large basal median area of *head* clothed with flat black scales and a few isolated metallic silvery ones; upright forked scales black, rigid, occupying the dark area only; nape with a few narrow-curved, golden-yellow scales; lower third at the sides with flat black ones. *Palpi* densely clothed with black scales. *Proboscis* black with beautiful peacock-blue reflections. *Thorax*: Prothoracic lobes clothed with flat silvery scales except at base where they are black, there are also a few outstanding yellow scales and three long black bristles; mesothorax covered with dark brown and golden-yellow curved scales; the latter forming two median, two lateral and a continuous marginal stripe; the median stripes are short and curved downwards almost touching the marginal stripe; mid-lobe of scutellum with a long median patch of silvery metallic scales, bordered by narrow-curved, black ones; lateral lobes with a tuft or rosette of narrow-curved golden-yellow and a few black scales; metanotum with three black chaetae and three minute narrow-curved, golden-yellow scales (in type ♀); pleurae brownish-yellow or ochreous with a well-defined silvery line. *Abdomen* black, basal half bronzy-brown and black in some lights; penultimate segment with two lateral silvery spots; terminal segment silvery, tipped with black; venter black with five brilliant silvery bands and two lateral terminal silvery spots; the terminal band is interrupted in the centre by a narrow line of golden scales, which are continued into the succeeding segment where they form a rectangular basal patch. *Legs* black, bronzy-brown or peacock-green in some lights; tarsi paler; coxae ochreous; knee spots to posterior pair more conspicuous than in the anterior and mid pairs.

Wings clothed with dark brown scales, but in strong lights are of a beautifully bronzy peacock-blue and green.

Length 4.50 to 6.50 mm.

MALE.—*Head* as in the ♀ but the narrow-curved golden scales are more numerous and extend over the whole of the black median patch. *Thorax*: Prothoracic lobes and mesothorax as in the ♀; scutellum rubbed in both specimens, but there are traces of a similar decoration to that which is seen in the ♀; metanotum nude.* *Abdomen* slender, cylindrical; black with peacock-blue reflections; antepenultimate segment enormously dilated, with two large, lateral, silvery patches. Genitalia with the clasps of great length, and the slender basal segment densely clothed with hairs and scales; second segment with a long apical spine.

Length about 4 mm.



FIG. 1. *Eretmapodites inornatus*. WING OF FEMALE. $\times 40$.

Distinguished from *E. quinquevittatus*, Theob., by the presence of narrow-curved golden-yellow head scales, and the absence of paddles to the hind tarsi of the ♂ besides other important details. Theobald makes no reference to the presence of chaetae and scales on the metanotum of *E. quinquevittatus* either in his monograph or in the *Genera Insectorum*, but they are quite evident in this species and also in *E. austenii*,† Theob.; at the same time they are not traceable in the males of either of these species, their absence may, however, be due to abrasions.

* There is no trace of scales or chaetae in either of the two males which were collected.

† Mono. Culcidae, vol. 1, p. 283; this species awaits description.

Localities:—Coquilhatville; Lusambo.

Circumstances of capture:—Adults were caught only in the bush near water. On one occasion they were found in large numbers near a native village. They fed viciously at five in the afternoon; none of some 30 males and females caught at that hour appeared to have previously fed on blood.

Eretmapodites austenii, Theobald

Localities:—Coquilhatville; Stanley Falls; Kasongo.

Circumstances of capture:—Adults were twice caught in the afternoon in European houses. They were also taken in the "bush" near a native village placed on a small forest-covered island; they fed viciously at five in the afternoon.

Stegomyia fasciata, Fabricius

Localities:—Matadi; Wathen; Leopoldville (Dec., 1903); Sendwe; Kasongo (April); Tshofa; Lusambo.

Circumstances of capture:—Adults were caught during the day in the houses of Europeans.

Breeding places:—Adults were hatched in the laboratory from larvae and pupae taken from water collected in old pots and tins and from a foul-smelling pool used for steeping manioc.

Stegomyia argenteopunctata, Theobald

Localities:—Matadi; Kwamouth; Tshumbiri; Kisui.

Circumstances of capture:—Adults were caught only during the day time in the thick forest. At Kwamouth they were exceedingly numerous about a forest spring and bit viciously at mid-day. Those caught in a similar spot at about noon at Kisui did not attempt to feed. There were no huts within 250 yards of either of these places.

Breeding places:—A larva, allowed to develop in the laboratory, was taken from among the grasses along the river's edge at Matadi.

Stegomyia simpsoni, Theobald

Localities:—Matadi; Wathen; Leopoldville (Dec.); Tshumbiri; Kasongo.

Circumstances of capture:—Adults were taken, while feeding, in the houses of Europeans in the afternoon and at night (7.30 p.m., lamps lighted).

Breeding places:—Larvae were taken from water collected in old pots and tins and from a font containing holy water in a mission building. Imagines were bred from them.

Stegomyia luteocephala, n. sp. (Newstead)

(Pl. ii, fig. 5)

Head yellow. Palpi black with white tips. Thorax brown, with two large, anterior, lateral silvery spots, a median yellow stripe, and posterior lateral yellow spots; scutellum white. Abdomen black with pale narrow bands, terminal segments silvery. Legs black with silvery spots and white-banded tarsi.

FEMALE.—*Head* with the large central area thickly clothed with large, loose, flat yellow scales, gradually merging into smoky-yellow in front; a narrow silvery-white line to the anterior half of the eyes formed of a single series of broad, flat, closely appressed scales; between the marginal line and the central yellow patch is a broad band of brownish-black scales, from which, anteriorly, arise several upright forked scales; nape with a few long, thick, straight or slightly curved, pale golden scales, on either side of which is a group of upright-forked scales, intermixed black and yellow; lower basal portion with flat, dusky-white scales, the marginal ones forming two dull silvery spots, sharply divided by a dense black spot. *Antennae* black, nodes white; hairs black; pubescence grey. *Palpi* black; tips with long silvery-white scales. *Thorax*: Prothoracic lobes with flat silvery-white scales; mesothorax with a well-defined median line and two lateral spots of narrow-curved, golden-yellow scales; anteriorly there are also two large spots of flat silvery-white scales, and a few silvery-white scales on the lower margin of the posterior yellow spots; the rest of the mesothorax with rich dark brown scales; scutellum with flat silvery-white scales; pleurae dark brown with two large patches of silvery scales. *Abdomen* rich bronzy-brown; segments 1 to 6 each with a well-defined, narrow, basal band of smoky-yellow scales; penultimate segment with a large lateral patch, and the terminal segment almost covered with brilliant metallic-silvery scales; venter with well-defined more or less triangular patches of metallic-silvery scales narrowing towards the apex, where they appear as two divergent lines; the scales forming the outer lateral angles of the spots projecting at the sides of the abdomen appearing as *outstanding scales*. *Legs* bronzy

blackish-brown; coxae and trochanters, ochreous; anterior and mid femora with scattered metallic-silvery scales; hind femora with a central anterior band and an apical group of silvery scales; anterior and mid tarsi with narrow dull-white basal bands to the first three segments, metatarsal band broadest; hind tarsi with a broad white basal band to the first, a narrow one to the second, and the third segment almost entirely white above, basally it is not so. *Wings* uniformly pale brown rather densely scaled, first sub-marginal cell much longer and slightly narrower than the second posterior.

Locality:—A single specimen of this species was caught in the bush at Kumba.

Stegomyia albomarginata, n. sp. (Newstead)

(Pl. ii, fig. 4)

Head black, anterior margin white. Thorax grey-brown; pleurae grey. Abdomen dark brown with lateral grey angular spots to the fifth segment*; venter pure white. Legs pale bronzy-brown; femora white beneath; hind femora entirely so.

FEMALE.—*Head* with the flat scales uniformly olivaceous-black with dull bronzy reflections, with a well-defined continuous margin of white ones, broadening towards the base; there is also a napal patch of loose flat dusky-white scales, and below them a few narrow-curved, and very short upright forked ones; clypeus black. *Palpi* shining bronzy-black. *Proboscis* with bronzy-brown and ochreous scales, basal half with a median, interrupted, line of white scales. *Antennae* with the basal segment greyish-black, second segment pale brown, remaining segments darker; hairs dark brown or black, pubescence white. *Thorax*: Prothoracic lobes clothed with pure white scales; mesothoracic scales in front narrow-curved, white; at the sides from the base of the wings numerous flat, loose, white ones; dorsally the whole area is sparsely clothed with narrow-curved dark-brown scales intermixed at the sides and posteriorly with a few greyish ones; scutellar scales dull white, with a few shorter black ones at the base of the mid lobe, and also at the base of the marginal hairs to the lateral lobes. *Abdomen* with the first four segments brownish-black; a few dull white scales on the base of the fourth indicating the presence of a more or less imperfect basal band; venter uniformly

* Remaining segments wanting.

white as far as the end of the fourth segment ; the remaining segments wanting. *Legs* with the coxae dusky brown, paler apically, with numerous flat white scales ; scales to anterior and mid-femora smoky-brown above, ventrally they are white ; hind femora clothed with white scales, except a narrow dorsal and a broad apical anterior patch of blackish scales ; tibiae and tarsi of anterior and mid-tarsi blackish ; posterior tibiae with a broad apical white band, tarsi wanting. *Wings* with dark bronzy-brown scales, those on the costa much the darkest, almost black ; first submarginal cell much longer than the second posterior ; posterior cross-vein nearly three times its length from the mid.

Length about 4 mm.

Locality:—Only two specimens of this species were caught, during the day, in a European's house at Kasongo (Dec.).

Scutomyia sugens, Wiedemann

Localities:—Matadi ; Leopoldville (Dec. and March) ; Kisui.

Circumstances of capture:—Adults were caught in the bush at some distance from houses. They were seen to attempt to bite at mid-day.

Breeding places:—One adult was reared from a larva taken from a puddle on clayey ground containing clean rain-water.

Catageiomyia senegalensis, Theobald

A culicid with the habits of this mosquito was observed at Banana. No specimens were taken, but it is believed, from a hasty field examination, that they were referable to this species.

DUTTONIA, nov. gen. (Newstead)

FEMALE.—*Head* clothed principally with flat scales, with narrow-curved ones behind and a row bordering the upper half of the eyes ; upright forked scales on the dorsal area. *Mesothorax* with small, narrow-curved, and minute hair-like scales ; scutellum with flat scales, the lateral lobes small, somewhat tuberculate, and furnished with eight bristles. *Palpi* short. Fork cells long, almost equal ; lateral vein scales long and narrow, but broadening towards the apex of the wing.

MALE.—With the anterior tarsi subchelate.

This genus is apparently related to *Aedimorphus* (Theobald), but differs in the presence of narrow-curved border scales to the eyes and the character of the lateral lobes to the scutellum. The number of bristles to the small lateral lobes are also unusual; and moreover there is a complete absence of flat scales* to the mesothorax.

Duttonia tarsalis, n. sp. (Newstead)

(Pl. ii, figs. 6-8)

Head grey. Thorax rich dull orange-brown with two median pale lines. Abdomen dark brown with silvery-white basal bands; apical segment almost entirely white. Legs pale ochreous-yellow, scales on tibiae and tarsi pale brown, femora faintly speckled.

MALE.—Lateral and median flat scales of the head dull white; the



FIG. 2.—*Duttonia tarsalis*. WING OF MALE. $\times 40$.

narrow-curved ones bordering the eyes pale yellow; napal group of narrow-curved scales pale yellow, in some lights almost white; upright forked scales in front yellow, napal ones black, lateral ones yellow. *Palpi* of four segments, apically furnished with long hairs, pale ochreous with dark brown scales and indications of a faint median band. *Proboscis* dark brown. Segments of *antennae* dusky white; nodes dark brown; hairs silvery-grey and pale brown. *Thorax* deep rich orange-brown,† with a few scattered white scales, numerous minute, almost hair-like, jet black scales, and a few golden-yellow ones in front

* Theobald (Mono. Culicid., Vol. III, p. 290), in his description of the genus *Aedimorphus* says there are no flat scales on the thorax. In the type of *Ae. domesticus* the anterior white spots on the mesothorax are undoubtedly formed of small flat scales of the same size and character as those on the scutellum.

† One of four males has the thorax dark brown.

and towards the scutellum ; the yellow scales also form two lateral spots in front of the wings ; there are traces also of a lateral white line extending from the wings to the front of the mesothorax ; scutellum with flat white scales ; pleurae dull ochreous with patches of white scales. *Abdomen* very pale ochreous, with dark brown and dull ochreous scales intermixed ; basal bands of pearly-white scales ; bands 3 to 5 broader than the rest ; terminal segment almost covered with pearly-white scales ; venter pale ochreous with broad indefinite, basal, dusky-white bands. *Legs* pale ochreous, speckled throughout with ochreous-brown scales ; anterior tarsi with the terminal segment subchelate ; base considerably dilated, ventrally concave ; base with four apparently bilateral spines, apex with a short curved spine, and immediately anterior to it a long plumose hair with a bulbous base ; unguis subequal in length, the larger with a long central tooth, the smaller with a short basal tooth ; mid-ungues unequal, the longest simple, the smallest with a central tooth ; hind unguis approximately equal, simple. *Genital armature* with the basal segment of the claspers furnished with numerous long bristles, two of which, near the inner apical extremity, are narrowly lanceolate ; second segment broadly dilated at the apex with an outer, curved, spine-like projection ; terminal claw small, slender. *Wings* sparsely clothed with small brown scales ; first forked vein narrower and slightly longer than the second posterior.

FEMALE.—*Head* dark brown ; median flat scales smoky-brown, lower laterals forming a relatively large white patch ; median narrow-curved ones yellowish-white, frontals white, marginal series to eyes pale yellow ; upright forked scales numerous, apparently all black. *Antennae* very dark brown, with numerous minute, loose, flat, white scales, giving the segments a mealy appearance. *Palpi* pale brown with darker scales ; tips with dusky white hairs. *Clypeus* very dark brown with minute, scattered, white scales like those on the antennae. *Eyes* yellowish-brown with two to three black spots. *Thorax* as in the ♂, but with a well-marked series of white scales in front of the mesothorax. *Legs* with patches of white scales on the coxae ; underside of hind tibiae clothed with white scales, with a broad apical white band ; the legs are also more uniformly coloured and browner than in the ♂, but the upper surface of the tibiae are speckled. *Abdomen* clothed with dark brown scales with paler ones at the articulations ;

venter with lateral white spots; median area greyish.

Length 4.50 to 5 mm.

Taken in thick bush at noon, October 4th, 1904.

Locality:—Kisui.

Duttonia africana, n. sp. (Newstead)

Head with the palpi and proboscis black. Thorax dark brown in front, paler behind. Abdomen dark brown, paler at the articulations. Legs smoky-brown with pale knee spots; apex of hind tibiae with a white band.

FEMALE.—*Head* clothed principally with flat scales, median and frontal ones blackish, those at the side with dull bronzy reflections, below these there is a narrow curved band of bright ochreous ones,

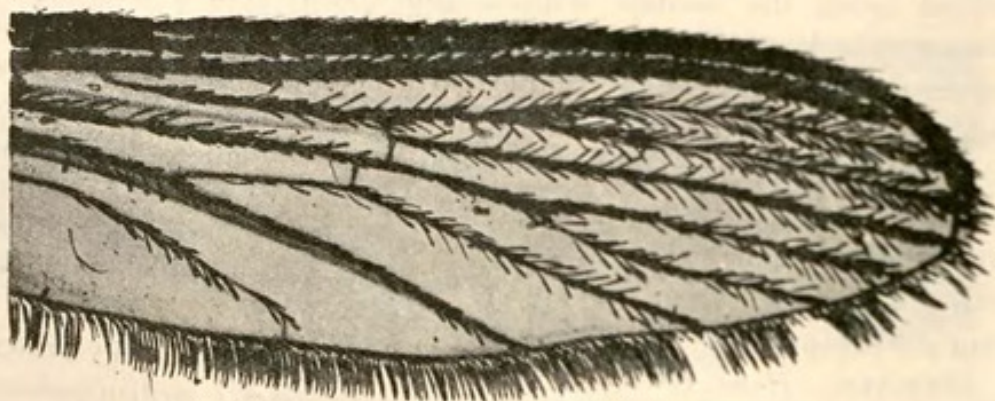


FIG 3.—*Duttonia africana*. WING OF FEMALE. $\times 40$.

which in some lights appear dusky yellow; there is a large patch of narrow-curved, dull yellow scales behind, and a single series of golden ones bordering the anterior half of the eyes; upright forked scales numerous and scattered over the whole of the dorsal area, black. *Antennae* dark brown; basal segment brownish-yellow at the apex, darker at the sides. *Palpi* short, black, and extremely hairy. *Proboscis* clothed with black scales. *Thorax* shining, rich, dark brown in front, paler behind; prothoracic lobes with large, white, narrow-curved scales and black bristles; mesonotum with minute, blackish, hair-like scales, and a few larger, narrow-curved, yellowish scales; there are also numerous black bristles at the sides and on the dorsum in the

region of the wings; scutellum trilobed; mid-lobe with small, flat, dark brown scales, and traces also of a few white ones; lateral lobes small, almost tuberculate, furnished with eight long bristles, and a patch of flat dull white scales. *Abdomen* clothed with dark brown and almost black scales; venter with broad, pale, basal bands interrupted by a median ochreous line which broadens towards the apex. *Legs* uniformly brownish-black; femora pale beneath; knees and tibio-tarsal articulations pale; hind tibiae with a broad apical white band. *Wings* with the first submarginal and second posterior cells about equal in length; posterior cross-vein about its own length distant from the mid.

Length about 5 mm.

Locality:—A single ♀ taken in a water-closet at Kasongo, April 7th, 1905.

Culex albitarsis, Theobald

Localities:—Boma; Kasongo (Feb.).

Circumstances of capture:—Adults were taken during the day in the open, and at night in a European's house.

Breeding places:—Larvae taken from swamps produced adults in captivity. The pupa of this mosquito is particularly large.

Culex annulioris, Theobald

All four specimens of this species were obtained from larvae caught in a grassy swamp near Leopoldville.

Culex dissimilis, Theobald

Specimens were caught in a tent near Tumba, October 26th, 1903.

Culex fatigans, Weidemann

Localities:—Boma; Matadi; Wathen; Leopoldville (Dec.); Mswata; Irebu; Coquilhatville; Bamamia; Lisala; Basoko; Stanley Falls; Kisui; Kasongo (Feb.).

Circumstances of capture:—Imagines were taken by day and by night in the dwelling-places and in the mosquito nets of both Europeans and negroes. They were also caught at noon on steamers

and in thick forest at some distance from any village. At night they were often seen on board the Expedition's steamer.

Breeding places:—Larvae and pupae were found breeding in old tins, in water reservoirs, amongst grass at the edges of rivers, in swamps and in the foul-smelling pools used for steeping manioc.

Field notes:—Enormous numbers of this mosquito, together with *Mansonia uniformis* and its var. *africanus*, were found during the day time in the prison at Bomba. They rested thickly clustered and motionless on the whitewashed walls of the cells, a few inches above a drain used as a urinal by the prisoners; scarcely any of these mosquitoes were seen on the neighbouring tarred portions of the wall. No breeding places existed within 200 yards of the prison.

Culex luteolateralis, Theobald

Localities:—Boma; Bamu Island; Kasongo (March); Lusambo.

Circumstances of capture:—Specimens of this beautiful little culex were caught in the early morning and afternoon, in the forest, in coffee plantations and in the houses and mosquito nets of native servants. They attempted to feed but rarely.

Breeding places:—Larvae were taken from amongst the grasses at the edges of rivers and from swamps. We were successful in obtaining imagines from them.

Culex metallicus, Theobald

Localities:—Miambwe; Lusambo.

Circumstances of capture:—Adults were taken in the bush, near marshy ground and at a few hundred yards from the nearest village.

Culex thalassius, Theobald

A single specimen of this species was obtained from a larva taken from a tub on the mission station at Wathen.

Culex tigripes, Grandpré

Localities:—Boma; Wathen; Leopoldville (Dec.); Tshumbiri; Yambinga; Kasongo (April to Feb.); Miambwe; Lusambo.

Circumstances of capture:—Imagines were caught in forests and marshes, during the day time on board the Expedition's steamer and at night in the houses of Europeans.

Breeding places:—Larvae and pupae, allowed to develop in the laboratory, were taken from among the grass at the edges of rivers, from swamps, from the foul water of stagnant puddles, from collections of rain-water in old tins, and from the foul-smelling pools used for steeping manioc.

This is evidently a variable species. None of the females agree with the typical form in the specific coloration of the head and thoracic scales. In the majority of the females, which agree best with Theobald's* description, the narrow-curved head scales are creamy-white in colour with, in some lights, a trace of pale yellow, especially in the frontal and large median ones; and the thoracic scales are smoky-brown with metallic reflections, almost golden in some lights, with the distribution of the yellow spots and lines as in the type. In addition to these variations, five of the females also possess a distinct median band to the proboscis and other distinctive characteristics. These forms are described below as a distinct variety.

Culex tigripes, var. *consimilis*, n. var. (Newstead)

FEMALE.—*Head* with the narrow-curved scales creamy-white, in some lights with a faint trace of yellow; upright forked scales black with smoky-grey tips; median hairs golden yellow. *Thoracic scales* chiefly of a greyish colour, with dark brown ones intermixed. *Proboscis* brownish-black with a broad and well-defined median band of pale ochreous scales; labella pale ochreous-brown. *Palpi* black or brownish-black with a patch of pale bright ochreous scales at the articulation of the first long segment; apex with dusky white scales. *Abdomen* dark brownish-black with scattered pale brown scales and narrow basal bands; basal segment with two median black apical spots; sixth and seventh segments with two lateral apical pale spots. *Legs* as in the typical forms.

Length 6.7 mm.

Localities:—Tshumbiri (July); Kasongo (Feb., April, May); Yambinga (Sept.); Miambwe; Leopoldville. The example from Leopoldville was bred from a larva procured in a grass swamp near the terminus of the railway. It is important to note that three females and four males of the more typical forms were bred from larvae obtained at the same time.

* Mono. Culicid, II, p. 34, 1901.

Culex viridis, Theobald

Localities:—Boma; Wathen; Leopoldville (Dec., 1903); Coquilhatville; Miambwe; Kasongo (Jan.); Lusambo.

Circumstances of capture:—Imagines were caught during the day in the bush, in the mosquito nets covering the beds of "boys," in houses of Europeans and Africans, and in the state rooms of a steamer on the Upper Congo.

Breeding places:—Larvae and pupae were taken from among the grass along the edges of rivers, in swamps, in dirty, foul-smelling collections of water, such as pools used for steeping manioc, and in water collected in old tins. Imagines were reared from these.

Field notes:—This mosquito has been repeatedly observed to have a distinctly green colour during life.

Culex laurenti, n. sp. (Newstead)

Head grey; thorax brown, abdomen paler; legs uniformly pale brown; venter and pleurae, pale, dull orange-brown; proboscis unbanded.

FEMALE.—*Head* with the narrow-curved scales pale silvery-yellow in front, the rest white; flat scales white; upright forked ones all black. *Antennae* dark brown, pubescence silvery-grey, in some lights with a faint yellow tinge. *Proboscis* clothed with brown scales, and towards the apex a few scattered, pale ochreous ones. *Palpi* very short; rich brownish-yellow; scales brown. *Thoracic* scales dull golden-yellow; pleurae with a few small groups of narrowly-rounded white scales, some of which are practically spindle-shaped. *Abdomen* uniformly pale brown. *Legs* uniformly brown above with pale brown scales, silvery-grey beneath, in some lights; coxae and trochantae rich brownish-yellow with dark brown scales; no knee spots and no bands to tarsi.

MALE.—*Head* scales as in the ♀. *Palpi* long, pale ochreous-brown with pale brown scales, apical segments dark brown densely clothed with long hairs. *Antennae* with silvery brown hairs. *Thorax* with a few white scales opposite the insertion of the wings; the rest, including the pleural scales, as in the ♀. *Legs* pale ochreous beneath, darker above, with pale brown scales; anterior and mid femora with white scales at the sides, posteriorly. *Abdomen* pale brown with

rather dark brown scales; segments 5, 6, 7 and 8 with a few lateral white scales; terminal segment with a broad apical band of creamy white scales; venter pale ochreous, scales pale brown and white intermixed. *Wing* scales dark brown on the basal half of the veins; apical portion with pale ochreous scales.

Locality:—Leopoldville (Oct. and Dec., 1903).

Two males and one female only were taken.

This species is dedicated to the memory of the Botanist, Professor Laurent, who died while on an expedition to the Congo Free State.

Culex par, n. sp. (Newstead)

(Pl. i, fig. 11)

Head and thorax grey. Abdomen dark brown; fifth and sixth segments with lateral pale spots; venter greyish, dark brown basally. Legs brown; femora and tibia freckled, the former much more so than the latter; anterior and mid tarsi with three narrow pale bands at the articulations. Proboscis with a broad median band.

FEMALE.—*Head* with the narrow-curved scales creamy-white; upright-forked ones pale ochreous, with a few very dark brown ones at the sides; flat scales few in number, creamy white. *Antennae* wanting. *Palpi* short; apical segment minute, clothed with dark brown scales. *Proboscis* dark bronzy-brown with a broad median creamy-white band; labella paler. *Thorax* dark brown; scales chiefly pale ochreous and creamy-white with a few black ones intermixed posteriorly and on the scutellum, the black ones predominate; there are also indications of four small equidistant black spots. *Abdomen* clothed with very dark brown almost black scales; a few isolated dull creamy-white ones on the first and second segment, a small lateral apical spot on the third, a large spot on the fourth and fifth; remaining segments rubbed; venter with a median pale line; last two segments with dull white basal bands, very pronounced on the penultimate segment; the remaining basal segments are not sufficiently clear to determine. *Legs* uniformly pale brown or ochreous-brown; knee spots faintly indicated; femora and tibiae with pale freckles; articulations of front and middle tarsi with three narrow pale bands; hind tibiae somewhat paler than the rest. *Wings* with pale and somewhat metallic-brown scales; fork cells

with their bases almost opposite; posterior cross-vein about one and a fourth times its length from the mid.

Allied to *C. thallasius* (Theobald), but differs in the absence of basal abdominal bands, the broader band to the proboscis, the predominating pale upright forked scales of the head, and also in the colour of the thoracic scales.

Locality:—A single ♀ taken at Tshumbiri on July 5.

Taeniorhynchus fuscopennatus, Theobald

This mosquito was caught only, near marshy ground, in the bush at Lusambo.

Taeniorhynchus annettii, Theobald

Localities:—Wathen; Coquilhatville; Kalombe; Lusambo.

Circumstances of capture:—This mosquito was only caught in the bush, and as a rule in the neighbourhood of marshy ground. Its larvae were not seen.

Taeniorhynchus aurites, Theobald

Localities:—Tumba; Tshumbiri; Irebu; Kalombe; Lusambo.

Circumstances of capture:—This mosquito was only caught in the bush, and as a rule in the neighbourhood of marshy ground. Its breeding places were not found.

Taeniorhynchus tenax, Theobald

Localities:—Boma; Leopoldville (Dec.); Lusambo.

Circumstances of capture:—Adults were caught in the bush near marshy ground.

Breeding places:—Larvae and pupae, collected from among the grasses at the edges of rivers and from swamps, produced imagines in the laboratory.

Mansonia uniformis, Theobald

Localities:—Boma; Prince's Island; Leopoldville (Dec., June); Bamu Island; Lulanga.

Circumstances of capture:—Adults were taken in the dwelling-places of Europeans and Africans, in the mosquito nets of "boys," and in the bush.

Breeding places:—Larvae of this mosquito were not seen.

Mansonia uniformis, var. *africanus*, Theobald

Localities:—Zambia; Boma; Prince's Island; Tumba; Wathen; Leopoldville (Dec. and May); Bamu Island (Jan.); Telegraph Post No. 4; Tshumbiri; Bolobo; Irebu; "in the bush above Lukolela"; Yumbie; Bamamia; Bumba; Basoko; Kama; Benaburungu; Nyangwe; Kasongo; Kalombe; Tshofa; Lusambo.

Circumstances of capture:—This species is by far the commonest mosquito in the Congo. It is seen almost everywhere in the bush, and lives equally well in grass country or forest. It always bites fiercely and feeds with equal readiness by day or by night. At Bamu Island, near Leopoldville, it was actually observed to pierce through canvas-seated chairs and even through the soft goat-skin leather of Madeira boots. It was noted in the diary of the Expedition as very unusual that no species of *Mansonia* were seen in the bush where camp was pitched for the night on the banks of the Congo a short distance above Lulonga.

Adults were caught in the houses of Europeans and Africans in the day time and at night. They were taken from mosquito nets covering the beds of natives and whites and were captured during the day on steamers, in the bush and on sand banks.

Breeding places:—We were not successful in rearing the imago from the numerous larvae we had from time to time in the laboratory.

Melanoconion rimus, Theobald

Localities:—Boma and Kasongo (Dec.).

Circumstances of capture:—The specimens in the collection were all bred from larvae.

Breeding places:—Larvae were taken from among the aquatic plants at the edges of a river and from a disused pit, in a brickyard, filled with water and overgrown with weeds.

SUB-FAMILY AEDEOMYINÆ

Aedeomyia squammipennis, Arribalzaga

Localities:—Boma; Leopoldville (Oct.)*; Yambinga.

Circumstances of capture:—The specimens in the collection were bred from larvae or caught in the evening on board a river steamer.

* No specimen; recorded from field notes.

Breeding places:—Larvae were taken from a grass-grown puddle of clean water.

Uranotaenia balfouri, Theobald

A single ♀ of this beautiful species was bred at Kasongo, December, 1904, from a larva taken in an "old brick pool 15 feet across." Theobald* states that the mid lobe of his type was ribbed, in this specimen it is clothed with scales. It may be important to add that the scales at the base of the wing are of a delicate pale blue; but in certain lights appear white as described in the type.

Mimomyia uniformis, Theobald

This mosquito was observed only at Boma; the specimens in the collections were hatched in the laboratory from pupae collected in a papyrus marsh and from among aquatic plants at the edge of a river.

Field notes:—The pupae are yellow and possess very long and conspicuous respiratory siphons.

Mimomyia africana, n. sp. (Newstead)

(Pl. i, fig. 4)

Uniformly dark bronzy-brown; legs paler.

FEMALE.—*Head* very dark brown, completely covered with flat paler brown scales, no upright-forked ones visible. *Antennae* dusky ochreous, basal segment darker and not scaled. *Palpi* very short, clothed with very dark brown scales. *Proboscis* (imperfect) dark brown. *Thorax* very dark brown, slightly shiny, with numerous long bristles and minute narrow-curved scales, of the same colour as the cuticle; scutellum with a few narrow-curved scales; pleurae with a dark brown central area covered with creamy-white scales; metanotum nude. *Legs* uniformly dark brown, with paler coppery reflections, nodes pale brown. *Wings* with all the veins clothed with brown scales; fringe paler; first submarginal cell narrower than the second posterior cell; posterior cross-vein about its own length distant from the mid cross-vein.

Length about 3.50 mm.

Described from a single female which, unfortunately, has the abdomen and tip of the proboscis imperfect. Apart from this,

* First report Wellcome Research Laboratories, p. 82, pl. vi, fig. 6.

however, the insect possesses well-marked specific characters and can easily be recognised from any other known species by its uniform dark brown colour.

Locality:—Taken at Nouvelle Anvers, on August 14th, 1904.

Mimomyia malfeyti, n. sp. (Newstead)

(Pl. i, figs. 1-3)

Head dark brown, with pale ochreous scales. Thorax dark brown, with bright blue reflections and clothed with long backward-curved bristles; pleurae pale ochreous. Abdomen brown; apical segment paler; venter ochreous. Legs dark brown, with pale ochreous femora. Wings with a pale spot at the base.

FEMALE.—*Head* brown, covered with rather loose, flat, cream-coloured scales and a napal group of black, upright-forked ones. *Antennae* deep brown; basal segment paler. *Proboscis* swollen apically, but much less so than in the ♂, dark brown; labella, dull ochreous. *Thorax* dark brown, shining, with blue reflections in



FIG 4.—*Mimomyia malfeyti*. WING OF FEMALE. $\times 40$.

certain lights, but this character is much less evident under the microscope than under a pocket lens; hairs dense and long, especially at the sides above the pleurae; there are also one dorsal and two, more or less distinct, sub-dorsal rows of shorter hairs between which is a double series of minute, narrow-curved, ochreous scales, which are very difficult to see and are often wanting; scutellum with four or five narrow-curved, almost hair-like, black scales often wanting; metanotum pale brown, nude. Wings with brown scales and a basal, pale, nude patch; median vein scales in a double row on the subcostal and first longitudinal vein for two-thirds of the basal

portion; in single rows on the remaining veins; outstanding scales present on all but the sixth vein, but are most numerous on the apical half of the wing; first submarginal and second posterior cells about equal in length, the former slightly the narrower; posterior cross vein a little more than its own length distant from the mid cross vein. Halteres creamy; knobs clothed with flat brown scales. *Abdomen* unbanded, pale brown or ochreous, with somewhat scattered, flat, brown scales which give it a more or less mottled appearance; apical segment paler; venter ochreous, with four or five dark marginal triangular spots. *Legs* uniformly brown with pale reflections, except the ventral and basal half of the femora, which are pale ochreous; all the articulations are pale.

Length 2.50 mm.

MALE.—*Head* with dusky ochreous scales. *Thorax* as in the ♀; metanotum darker. *Antennae* densely plumose, dusky brown; basal segment paler. *Proboscis* much swollen from beyond the middle

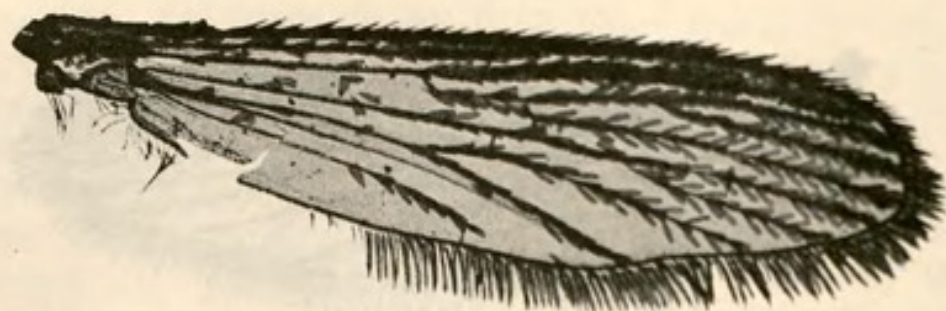


FIG 5.—*Mimomyia malfeyti*. WING OF MALE. $\times 40$.

apically; clothed with dusky ochreous scales; labella slightly darker. *Palpi* long, thin, apparently of three equal segments, tip reaching just beyond the base of the swollen portion of the proboscis. *Abdomen* as in the ♀ but if anything more distinctly mottled. Anterior tibiae with a long, outer, simple spine, and an inner, tridentate falcate spine. *Genital armature* with the basal segment stout; arising from its inner surface, at the base, are four long spinose hairs; second segment about equal in length to the first; terminal claw short; herpes relatively short, with one long and two minute spines.

Length 2 to 2.5 mm.

This species comes very near to *Mimomyia uniformis* (Theobald); but differs in the colour of the head scales, in the presence of a double row of vein scales to the costal and first longitudinal vein, and in the thorax with its regular series of bristles and bright blue reflections, and also the mottled appearance of the abdomen.

The peculiar proboscis and palpi of the ♂ are characteristic also of *Mimomyia uniformis*.

Locality:—This mosquito was observed only at Boma; the specimens in the collection were hatched in the laboratory from larvae taken in a grass-grown puddle of clean water.

This species is dedicated to Major Malfeyt, Haut Commissaire Royal, in recognition of constant courtesy and assistance rendered during the expedition.

POSITION UNCERTAIN

Neomelaniconion palpalis*, n. sp. (Newstead)

(Pl. i, figs. 7-9)

Uniformly brown. Antennae densely plumose; hairs smoky-brown with the apical portions grey; segments clothed with minute white scales; nodes black.

MALE.—*Palpi* long, dark brown, with a few scattered blackish-brown scales; apex faintly clavate and densely clothed with long brown hairs, more especially so at the sides, where they form a long continuous fringe. *Proboscis* straight, pale brown, clothed with dark brown scales; apex extending to base of apical segment of antennae. Central area of *head* clothed with narrow-curved, pale golden-yellow scales, intermixed at the sides with long, flat, dusky-brown scales; sides with flat dark brown scales intermixed with a few yellow and dull cream-coloured ones; nape with a few small, upright-forked, black scales. *Mesothorax* (partly denuded) and scutellum with narrow-curved pale golden-yellow scales; metanotum nude; prothoracic lobes denuded; pleurae with small dull cream-coloured scales. Halteres pale ochreous basally, knobs pale brown, with a few small, flat, brownish scales. *Abdomen*, where denuded, almost black; scales pale brown with faint, dull, greenish-blue and dull coppery reflections; two well-defined sub-median, triangular, black spots at the base of the third

* Theobald, M.S.

segment, and there are traces of similar markings on the second and fourth; fifth and sixth, with a basal band of pale yellow; venter, at the base, with pale golden-yellow scales in the centre, dull creamy ones intermixed at the sides; the remaining segments are rendered invisible by the curved condition of the abdomen. *Wing* scales uniformly brown, darker on the costa; posterior cross-vein about one and a half times its length distant from the mid cross-vein; first sub-marginal cell scarcely longer than the second posterior, the latter with the veins widely divergent; outstanding scales long, narrow, sides parallel, apex convex; fringe scales long, lanceolate. *Legs* uniformly brown; posterior tibiae with a pale apical band; tarsi dark brown.

Length about 2.50 to 3 m. The specimen has the abdomen curved under, so that it is impossible to give the exact measurement.

Locality:—One male bred from a pupa taken in a pool on an island below Basoko, September 3, 1904.

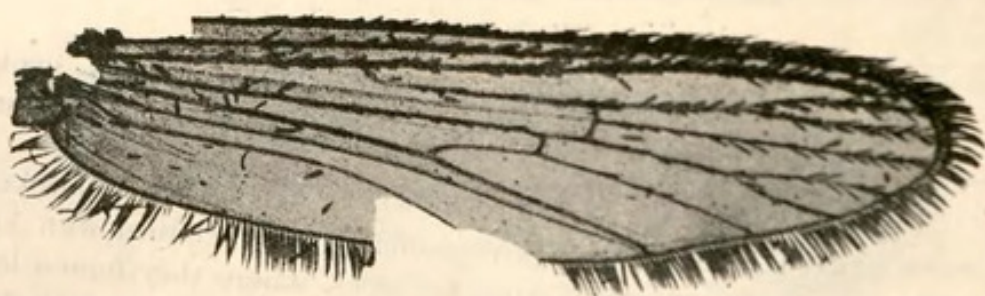


FIG. 6.—*Neomelaniconion palpale*. WING OF FEMALE. $\times 40$.

Anisocheleomyia quadrimaculata, n. sp. (Newstead)

(Pl. i, figs. 5, 6)

Head pale brown with narrow ochreous margins. Antennae dusky. Proboscis swollen at tip; black with scattered bright ochreous scales; labella bright ochreous. Thorax bright ochreous with four black spots, the anterior pair being much the largest; behind the second and smaller pair is a large and somewhat ill-defined black band. Abdomen black with a dorsal series of elongated pale spots. Legs spotted and banded; femora dilated apically. Wings with scattered black scales, those along the costa forming a basal bar and two spots.

FEMALE.—*Head* with both black and pale cream-coloured upright-forked scales, the latter predominating; anterior portion with rather large, narrow-curved, bright fulvous scales, and apparently a few long flat ones, intermixed with the former are a few black ones tipped with bright fulvous; sides with flat, somewhat loose, cream-coloured scales. *Antennae* dusky brown; nodes pale. *Palpi* densely scaled, black, dorsally with white tips. *Proboscis* swollen apically; scales black intermixed with a few cream-coloured ones; swollen portion entirely black; labella bright ochreous. *Legs* with the anterior femora pale ochreous with a black apical patch in the centre of which is a distinct central crescentic band; mid and hind femora black, the former with two, the latter with one yellowish band; tibiae black, each with a sub-apical but somewhat diffused band; tarsi black with bronzy-brown reflections, each with five distinct yellowish bands; ungues equal, simple. *Wings* with bronzy-black and cream-coloured scales; basal half of costa with a long black bar and two irregular spots; all the nervures with irregular groups and isolated black scales; fringe pale; costal scales bronzy-black, becoming paler towards the apex; out-standing scales claviform; a few of the black ones, especially those on the sixth vein, heart-shaped. Halteres cream-coloured with dark brown scales at the tips. *Thorax* with narrow-curved, golden-yellow scales; four lateral spots of black ones, the anterior pair are the largest, and there is a broad indefinite band behind the second pair; scutellum with pale ochreous narrow-curved scales; metanotum black, with three dusky-yellow lines, and a basal, linear, patch of minute, flat, cream-coloured or white scales; prothoracic lobes and pleurae with flat, dull, cream-coloured scales. *Abdomen* clothed with black scales, having brownish coppery reflections; each segment with a long narrow median, basal, patch of dull cream-coloured scales; apical segment only with two lateral pale spots; venter ochreous.

Length 3.75 mm.

Locality:—Boma; bred from a larva which was caught in a marshy pool.

BOYCIA, nov. gen. (Newstead)

Head with a median area of narrow-curved scales, flat, loose, lateral ones, and numerous upright-forked ones. Thorax and

scutellum with narrow-curved scales. Wings with the fork cells relatively short; anterior forked vein slightly shorter than the first posterior; scales resembling those in *Mimomyia*. Palpi short in the ♀, long and clavate in the ♂. Proboscis swollen at the tip in both sexes. The narrow curved scales in the mid region of the head are fewer in the ♀ than in the ♂; and in the former the central ones are arranged in two distinct lines, but are almost completely hidden by the numerous upright-forked scales.

This genus is somewhat difficult to place, but agrees best with the group of Culcinae in which the palpi of the males are swollen at the tips.

Boycia mimomyiaformis, n. sp. (Newstead)

(Pl. ii, figs. 1-3)

Head greyish. Mesothorax grey-brown, with two anterior spots and a broad transverse band opposite the insertion of the wings, black. Abdomen black, with pale narrow basal bands; venter ochreous; pleurae pale ochreous. Legs brown; base of femora and tarsi (in certain lights) paler. Proboscis swollen towards the apex.

FEMALE.—Central area of *head* with narrow-curved, creamy-white scales, those in the centre forming two longitudinal series, intermixed with these are numerous creamy, upright forked ones, extending almost to the front of the head; sides with large, loose, spatulate, creamy scales; nape with numerous upright-forked, black scales; all the forked scales are broadly dilated with, usually, five well-marked dentitions. *Thorax* densely clothed with narrow-curved pale golden-yellow scales; two anterior spots and a broad transverse band of black ones; the band faintly constricted in front giving it, in some specimens, the appearance of two large confluent spots; scutellum with large, narrow-curved, creamy-white scales, those on the lateral lobes with golden reflections; metanotum nude*; pleurae creamy-yellow. *Abdomen* clothed with dark brown and black scales, appearing bronzy-purple in some lights, and narrow basal bands of pale ochreous scales; venter pale ochreous, with lateral, angular, dark brown, spots. *Legs* unbanded, bronzy-brown; femora pale ochreous-

* Two females show a single curved scale, but these are apparently loose ones from the metathorax.

brown at the apices, forming pale knee spots; tibio-tarsal articulations pale; last three segments of tarsi bronzy-ochreous.

Length 2.50 mm.

MALE.—*Head* with a well-defined median, long, angular patch of narrow-curved creamy scales, no regular series as in the female; sides broadly clothed with large, rather loose, flat, cream-coloured scales, and a rather large lateral patch of brown ones; a few short upright forked ones at the nape, black, and a few, very short, creamy ones towards the front of the head. *Antennae* densely plumose, hairs grey with a few black ones intermixed. *Palpi* strongly clavate, with a pale cream-coloured band at the anterior end of the first long segment; the remaining portion of the segment and the basal half of the succeeding one with very dark brown, almost black scales; apical

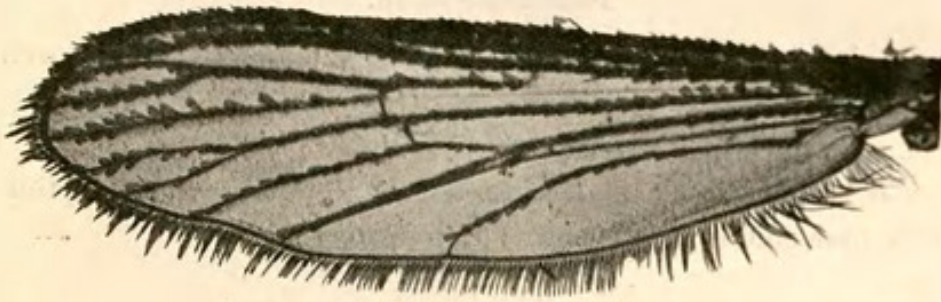


FIG. 7.—*Boycia mimomyiaformis*. WING OF FEMALE. $\times 40$.

segment with short stiff yellow bristles. *Proboscis* swollen apically, dark brown; labella paler, especially at the tips. *Mesothorax* with the narrow-curved scales dusky yellow intermixed with grey and a few black ones, and there are two ill-defined lateral black spots in front of the wings; space between the wings denuded, dark brown; pleurae and legs as in the ♀. *Wings* with pale brown scales; anterior forked vein slightly shorter than the first posterior, the latter much the widest; both are relatively short. *Abdomen* as in the ♀ but the bands are a little more pronounced.

Localities:—All our specimens of this mosquito were bred from larvae caught at Boma (Oct.) in a papyrus swamp and among the aquatic plants of a small stream.

FAMILY CHIRONOMIDÆ

Ceratopogon sp. ?

This fly was only twice observed, once at Binza (Dec.), near Leopoldville, and again near Tumba. In these localities it was the most common bloodsucker observed. Although it is almost invisible its bite raises a large weal which itches for hours.

Chironomus sp. ?

The specimens which we obtained of this insect were bred from larvae, at first sight resembling mosquito larvae, caught in a swamp at Boma. This insect was also seen at Leopoldville.

FAMILY PSYCHODIDÆ

Phlebotomus n. sp. ?

The only specimens which we now possess are not sufficiently well preserved for descriptive purposes.

Localities:—Leopoldville (March); Wanie Numbu.

Circumstances of capture:—Specimens were taken in the daytime in the bush and in rest houses for Europeans.

FAMILY SIMULIDÆ

Simulium damnosum, Theobald

Localities:—Matadi; Lutete; Leopoldville (Nov.); near Miambwe.

Circumstances of capture:—Specimens of this species were caught both near, and at some distance from, water. They bite freely.

Simulium sp. ?

Localities:—Leopoldville (Nov., 1903, to Feb., 1904); M'Swata; Batikalela.

Circumstances of capture:—These flies were caught both near, and far from, water. They sometimes occur in swarms and are often found in houses. They bite freely, are persistent in their attacks, and when crushed emit a peculiar "bed-bug like" odour.

HABITS AND STRUCTURAL CHARACTERS OF THE LARVA OF *SIMULIUM**

As the characteristics of the larvae of the European species of *Simulium* are not likely to differ very materially from their tropical relations the subjoined notes may prove of some guidance to students in other parts of the world. The notes refer to a single species, *Simulium ornatum*, Mg.

Shallow *rapid* streams *fully exposed to the sun* on hill sides, moors and open spaces in woods are the favourite resorts of these curious larvae. They are invariably found where the stream flows



FIG 8.—LARVA OF *Simulium ornatum* in semi-erect position with the fan-like or fringed appendages expanded. $\times 6\frac{1}{2}$.

most rapidly; never in the side pools or in comparatively still water; and very rarely in those portions of a stream which are overshadowed by trees or shrubs. In streams where all the necessary conditions are available the larvae sometimes occur in countless numbers, covering the *undersides* of nearly every submerged leaf or blade of grass, and also, where not too much overshadowed by aquatic plants, on the stones and fragments of rock at the bottom of the stream.

* These notes were compiled from observations made in England and Belgium in the summer of 1906.—R.N.

When massed together on the stones and rocks they look at a short distance remarkably like a waving mass of dark brown or blackish algae or moss; but this resemblance is much less marked in colonies attached to the leaves and stems of plants.

The larva, when at rest, attaches itself to a fixed object by means of its anal sucker, standing in a semi-erect position (fig. 8) with its head pointing down stream; but in very rapid rivulets the body lies almost prone with the object upon which it rests, or the extremities may be brought together so that the body forms a distinct

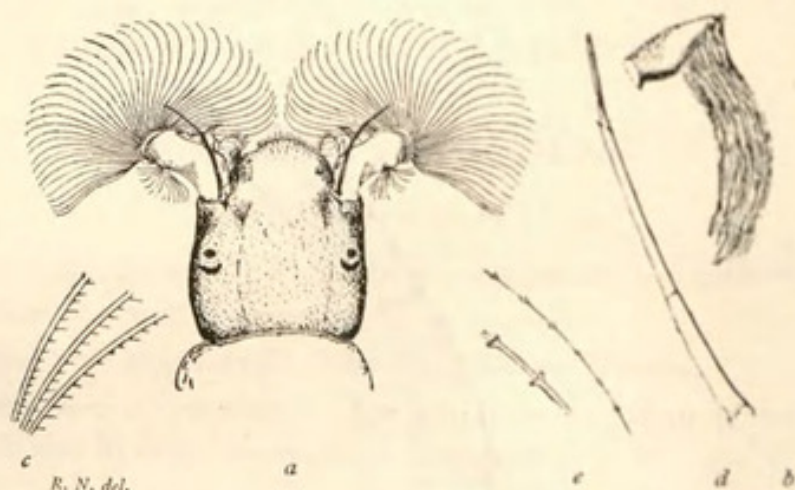


FIG 9.—LARVA OF *Simulium ornatum*:—*a*. head of larva with the fringed appendages expanded, $\times 40$; *b*. fringed appendages closed; *c*. portions of the fringe showing lateral cilia, $\times 600$, about; *d*. antenna, $\times 150$, about; *e*. silken threads showing the characteristic nodes (enlarged).

loop. The head is provided with a pair of beautiful fan-like processes with which the animal sweeps the particles of food into its mouth. Unlike the larvae of mosquitoes they have little or no power of swimming, and when migrating from place to place, their method of progression strongly resembles that of the larvae or looper caterpillars of the geometrid moths. As they progress from place to place silken threads are spun in all directions, forming an irregular web or network along which they can travel with great ease. When forcibly dislodged from their resting places they immediately float down stream to distances varying from two to fourteen inches, suspending themselves by a slender silken thread, freshly spun, or by the network of threads

which may have already existed. Many of them will immediately commence to haul themselves back again by walking along the silken thread or threads, and this they accomplish by forming the body into a succession of loops, in the same way as they progress along stones and plants—the mouth or sucker feet grip the thread firmly while the posterior sucker is brought forward until it almost touches the anterior segments—the action being repeated until a place of safety is reached. Many, however, float down stream supporting themselves by their threads until some fixed object is reached. If a leaf or stem supporting a colony of larvae be pulled partly out of the water the larvae will all crawl back again to the stream and usually fix themselves to the submerged portions of the same leaf or stem.



R. N. del.

FIG 10.—LARVA OF *Simulium ornatum*:—a. maxilla and palpus; b. mandible; c. labrum; d. labial plate. $\times 125$.

If placed in still water the larvae soon become sluggish and death takes place in about 17 hours, but if completely removed from the stream and kept in a thoroughly moist vessel they will survive for a much longer period.

When about to pupate the larva spins for itself a little elongated cocoon, shaped somewhat like the toe of a slipper, with a large opening at the broad end, and this is almost invariably placed with the opening pointing down stream. From this the head of the pupa, with its external respiratory filaments, projects and a sufficient supply of oxygen is thus obtained.

The period of pupation is only of a few days' duration: the minimum being two, the maximum six days. On bright sunny days they begin to hatch as early as 9 a.m. and continue to emerge during the heat of the day. A few examples also hatched in the laboratory during the night, but this was apparently an exception to the rule.

In order to rear the imagines the cocoons should be removed from the stream immediately they are formed; and the leaves and stones to which they are attached should be placed in glass jars covered with fine muslin or chiffon. All that is necessary is to keep the material perfectly moist; however, many imagines were successfully reared from pupae which had become perfectly dry. On no account should the pupae be left in standing water.

On the emergence of the imago the skin of the pupa splits along the median line of the thorax and the fly rapidly pushes itself forwards, being at the same time surrounded by air which gives it a greyish or silvery appearance, especially at the bases of the wings. The moment the insect has freed itself of the pupa case it is instantly carried to the surface when it grips the first object with which it comes in contact in its rapid course down stream, and having gained a foothold instantly takes to wing.* Occasionally the insects were seen completely immersed in the water, where they seemed at perfect ease either when walking along the stems of the plants or cleaning their legs and antennae. In such cases the wings were folded partly round the abdomen so that they tapered to a point behind, and in this way were seen to form a large air cavity. This remarkable trait was observed in still water only.

Description of the larva.—Body cylindrical, swollen posteriorly. Legs in two, coalescent, pairs; the anterior pair are attached to the first thoracic segment and project forward beneath the head and are provided with little hooklets; the second pair (fig. 11) are placed at the anal extremity and form a broad flat sucker which is surrounded by a band of hooklets arranged in regular transverse series.

Head (fig. 9, *a*) relatively large, elongated; labium broadly rounded in front. Eyes represented by two bilateral spots. Antennae (fig. 9, *d*)

* Some species evidently dry their wings before taking flight.
Austen, 'Brit. Blood-sucking Flies,' p. 29 (1906).
Miall, 'Aquatic Insects,' p. 186.

slender, almost filiform, of apparently three segments, of which the first is extremely short, the second about half the length of the third. Immediately below the antennae is a large stout process furnished at the end with a long fan-like fringe of hairs, with a much smaller, but similar group of hairs arising from the centre of the lower lateral margins of the same process. The hairs forming the large fans are provided with an inner lateral fringe of delicate short hairs. *Mandibles* furnished at the tip with two stout and slightly curved spines and long silken hairs. *Maxillae* each with a long slender sub-terminal spine which is sometimes completely hidden in the dense tuft

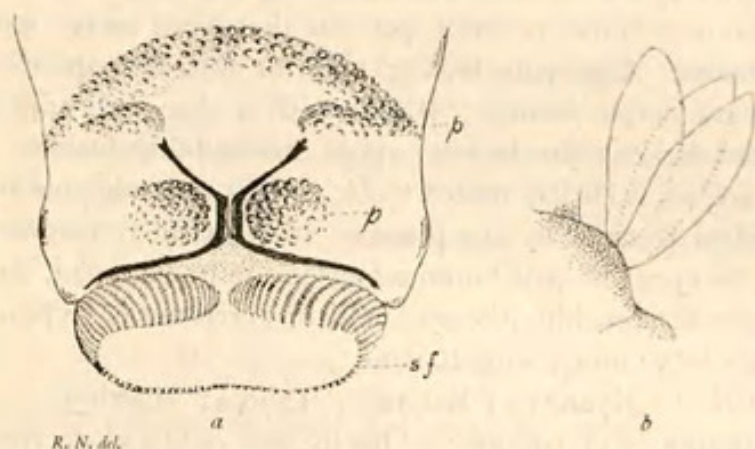


FIG 11.—LARVA of *Simulium ornatum*:—a. anal segment; p. papillae, sf. sucker foot with its coronet of hooks ($\times 45$); b. anal appendages ($\times 45$).

of silken hairs. *Antennae* short, stout, of two segments, the terminal one being about one-fifth the length of the first. Labial plate broad and angular; the anterior margin emarginate and furnished with nine strong teeth or spines, the outer teeth bidentate, the median tooth slightly the longest; anterior half of the lateral margins strongly serrate; and there is a submarginal row of long stiff bristles.

Length of fully matured larva 7.50 to 8.50 mm.

FAMILY TABANIDÆ

Hæmatopota duttoni, n. sp. (Newstead)

(Pl. iv, fig. 3)

Face dark brown, clothed with grey pubescence, with two black spots. *Palpi* dull yellowish-brown, sparsely clothed with black

pubescence above, grey at the sides. *Antennae* pale brown, tips black; first segment almost cylindrical, the third slightly longer than the first and second together. *Frontal callus* pale yellowish-brown, attaining the eyes, slightly produced in front; a broad rectangular spot of light rich chestnut between the eyes and a paler but ill-defined spot above it in the centre of the callus; paired spots large, black, and slightly reniform; unpaired spot distinct. No markings on the vertex. *Thorax* dark brown with three equidistant cinereous stripes. *Abdomen* brown, with golden pubescence; first and second segments with several rather large black spots; the remaining segments are spotted only at the sides with the exception of the two last ones, which also bear traces of small spots on the dorsal areas; scutellum dull cinereous. *Legs* pale brown; anterior tarsi and apical half of tibiae almost purple brown. *Wings* with a chequered appearance, apical third darker than the rest; upper rosette fairly distinct.

This species is closely related to *H. similis* (Ricardo), but may be distinguished from it by the presence of a broad rectangular spot between the eyes, the pale brown colour of the frontal callus, the large paired spots not reaching the eyes, and the presence of clypeal spots.

Length 10.50 mm.; wing 10 mm.

Localities:—Nyangwe; Kasongo; Tshofa; Miambwe.

Circumstances of capture:—This fly was caught along rivers and about cattle.

Hæmatopota trimaculata, n. sp. (Newstead)

(Pl. iv, fig. 2)

Head and thorax brownish-black; abdomen smoky-brown; legs black, tibiae dusky-white or pale ochreous; wings smoky-brown with three, equidistant, oblique dusky-white elongated spots.

FEMALE.—*Head*: Vertex with a deep triangular depression behind; uniformly black, shining. *Proboscis* and *palpi* brownish-black; pubescence greyish-black. *Thorax* finely punctate; dark brownish-black with two sub-median, obscure, narrow brownish streaks; transverse suture at the sides, and posterior angles paler than the rest; pubescence scanty, dusky-yellow. *Abdomen* smoky-brown, the last three segments darker; pubescence scanty, darker brown than that of the thorax; venter scarcely lighter than dorsum. *Legs* with the coxae and femora brown; anterior and hind tibiae ochreous-

white, apices dark brown; mid-tibiae entirely ochreous-white; tarsi black; first segment of posterior tarsi ochreous, the remaining segments brown-black; first segment of mid-tarsi pale at the basal half, the remainder brown, the other segments are wanting. *Wings* narrow, uniformly smoky-brown; with three costal dusky-white spots; the first, about midway between the base and apex of the wing, is placed below the costa and immediately above the first transverse vein; the second about midway between the first and third spots, forms a continuous oblique band extending from the costa to the base of the first forked vein; the third is slightly narrower and extends from the costa to the hind margin, leaving the extreme tip of smoky-brown.

Length 9 mm.; length of wing 8 mm.; greatest width of wing 2.75 mm.

A clearly distinct species, easily recognised by the curious coloration of the wings.

Locality:—Two specimens were caught in a European's house at Yakusu.

Hæmatopota brunnipennis, Ric.

Localities:—Coquilhatville; Nyangwe; Kasongo.

Circumstances of capture:—These flies were only caught on the river.

Hæmatopota spp.

Several rather worn specimens belonging to this genus were taken on cattle and horses at Matadi. Just to the north of the Limposo river one flew into the carriages of a moving train.

Chrysops dimidiatus, v. d. Wulp.

(Pl. iv, fig. 1)

Localities:—Banana (Dr. Etienne); Matadi; N'Kussu; Wathen; Tshumbiri; Lisala (reported by Rev. K. Smith); Yakusu.

Circumstances of capture:—Specimens were taken both near and at short distances from water. One was also caught in a European's house.

Atylotus nigromaculatus, Ric.

This fly was caught in a European house placed on high ground at the mouth of the Gambia River.

Tabanus canus, Karsch.

(Pl. iv, fig. 9)

Localities:—Lutete; Matadi; Lukolela; Ikelemba and Lopori rivers (March and Nov., Major Malfeyt).

Circumstances of capture:—This fly was only taken by persons travelling in canoes. It is reported to fly very rapidly and its bite is said to be very severe.

Tabanus dorsivitta, Walk.

(Pl. iv, fig. 4)

The only specimen we obtained was collected by the Rev. and Mrs. Billington at Tshumbiri.

Tabanus fasciatus, Fabr.

(Pl. iv, fig. 14)

This species is given to somewhat marked variation.

In several of the examples there is an entire absence of the apple-green colour on the abdomen and it is also of a more decided buff-yellow than is seen in the type. Other examples may be considered as transitional between *T. fasciatus* and the sub-species *niloticus*, Austen.

Localities:—Matadi; Leopoldville (Nov., Dec.); Lopori River (March, Major Malfeyt); Nouvelle Anvers; Tubila; Kasongo; Basongo; and at many places along the Gambia.

Circumstances of capture:—This insect was seen only near water. Most of the specimens were taken while travelling by steamer or in canoes. Two specimens were, however, caught in the houses of Europeans.

Field notes:—While living this fly is a very beautiful object. The eyes are a bright, metallic, pea-green, and the colours of the body are very much brighter than in dried specimens. It flies strongly, and is often seen on board steamers over 100 yards from the river's bank.

Tabanus gabonensis, Macq.

(Pl. iv, fig. 15)

Localities:—Lukolela (July, Rev. Whitehead); Ikelemba and Lopori rivers (March, Nov., Major Malfeyt); Baringa (July, Dr. Angela); Nouvelle Anvers (April, Dr. Müller).

Circumstances of capture:—Most of the specimens were taken by persons travelling on the rivers by steamer or in canoes.

Tabanus gratus, Loew

This species was caught in March, 1903, on the Kunchau Creek, about 175 miles up the Gambia River.

Tabanus par, Walk.

(Pl. iv, fig. 6)

A single specimen of this insect was caught on board a steamer plying on the Gambia River.

Tabanus pluto, Walk.

(Pl. iv, fig. 7)

This Tabanid was caught in the Congo near the river at Matadi and Kisantu.

Tabanus rufipes, Macq.

(Pl. iv, fig. 8)

Localities:—Matadi (?); Tshumbiri (April, Nov., Rev. Billington); Bolengi; Lulanga; Lisala; Stanley Falls; Wanie Numbu; Kasuku; Tshofa; Pania Mutombo; Lusambo.

Circumstances of capture:—This fly was caught only near water, usually while attempting to bite passengers in canoes or steamers.

Field notes:—They fly very rapidly and strongly, and have been seen at over 100 yards from the banks of the river. They seem to be very local. For example, near Pania Mutombo ten or a dozen were seen at the same moment darting about a canoe. A little further down the river towards Lusambo none were seen for miles.

Tabanus tarsalis, Adams

(Pl. iv, fig. 13)

This insect was only seen once, at Lutete.

Tabanus unimaculatus, Macq.

(Pl. iv, fig. 5)

One specimen of this fly was collected in November, 1903, at Matadi by Dr. Bourguignon.

Tabanus alboventralis, n. sp. (Newstead)

Thorax dark brown with three narrow lines; abdomen darker brown, with a bilateral series of oblique white spots. The whole of the ventral surface, including the head, white. Legs pale ochreous, with the tarsi and apices of the tibiae dark brown.

FEMALE.—*Head*: Space between the eyes ochreous-grey, with two broad transverse brown bands, the whole of the under-surface of the head, as well as the posterior surface, clothed with dense white pubescence. *Antennae* pale brown. *Palpi* pure white and wax-like. *Thorax* dull grey-brown, with a median and two sub-median greyish lines; margins grey, as well as the posterior margin of the scutellum. *Abdomen* dark brown, with narrow pale apical bands; the first to the fifth segment with a sub-median, oblique, elongated spot of greyish-white, the spots gradually diminish towards the posterior extremity, so that the last is scarcely visible, while that on the second segment extends right across the segment, terminating at the apical band; there is also a faint median line formed by patches of golden-yellow hairs; venter pale brownish clothed with white powder and pubescence, apical margins to all the segments with a distinct, narrow, ochreous border. *Legs* with the coxae, trochantae and femora white; tibiae pale ochreous with the apical third brown; tarsi all dark brown. *Wings* transparent, without markings.

Length 10 mm.; length of wing 8 mm.

Locality:—Caught during September and October, 1902, in the neighbourhood of Oyster Creek, near the mouth of the Gambia River.

It is closely allied to *T. obliquemaculatus* (Macq.), but Mr. A. E. Austen, to whom specimens were submitted, thinks that it is an undescribed species.

Tabanus billingtoni, n. sp. (Newstead)

(Pl. iii, fig. 1; Pl. iv, figs. 10-12)

Female black; margin of thorax and basal segment clothed with ochreous pubescence; second, third and fourth segments with a narrow pale apical band. Wings with a narrow median dark zigzag

line and a broad sub-apical band; apex with a clear triangular space; the anterior basal, and succeeding cell clearer than the rest. Male: Thorax red-brown, covered with grey dust. Abdomen black, with narrow grey bands to all the segments. Nervures of wing all margined with brown. Fore tibiae in both sexes white; the remaining segments blackish.

MALE.—*Head*: Eyes dull bronzy-brown (in dry specimen); ocelli ochreous; space between the eyes black, shining, brown below; clypeus and cheeks grey, the latter with long, silken, white pubescence; posterior surface of head dull grey. *Antennae* black, basal segment clothed with grey dust, the rest with ochreous-brown pubescence. Proboscis and labium black. *Thorax* in front of transverse suture, dull castaneous, with a narrow, faintly-indicated median line, and two narrower sub-median lines, which terminate in front as two black depressions; margins dusky greyish-brown; suture opposite the sub-median lines orange-brown, continued downwards as a short narrow streak; posterior half of thorax slightly darker than the anterior; the whole is covered with a greyish powder, and scanty black pubescence; scutellum and pleurae grey, but the latter are paler than the former. *Abdomen* smoky-black with narrow grey apical bands to the segments, these gradually diminish towards the apex, until they entirely disappear on the last one; venter of the same colour and banded as on the dorsum. *Legs* black; mid femora dark piceous; upper two-thirds of anterior tibiae dull white, the remaining third black. *Wings* with the nervures dark brown, all with a broad diffuse band of orange-brown surrounding them.

Length 16 mm.; length of wing 15 mm.

FEMALE.—*Head* as in the male, but the face is pale ochreous. *Thorax* rich dark brown, with two, narrow, sub-median pale fulvus lines which gradually darken and entirely disappear at the transverse suture; margins with a well-defined band of pale fulvus pubescence which is continued round the margin of the scutellum, and in front extends over the pleurae. *Abdomen* black, piceous in some lights, basal segment pale fulvus with the fringe of the pubescence paler; second, third and fourth segments with a conspicuous narrow grey apical band; venter with similar bands on the second to the fifth segments. *Legs* as in the male, but the anterior tibiae have the basal half only of a pale ochreous or dull white colour.

Length 17 to 20 mm.; length of wing 16 mm.; expanse of wing 34 to 35 mm.

Localities:—Several females of this species were first sent to us by Rev. and Mrs. Billington, from Tshumbiri. It has received its specific name as a mark of our appreciation of the interest shown in the work of the Expedition by the collectors. A female was also caught, near the river, at Bolengi. The only male we possess was sent to us by the Rev. M. Ave, from near Matadi.

It is an extremely well-marked insect, and is easily recognised from the other African species of *Tabanus* both by the banding of the abdomen and the markings of the wings.

Tabanus spp. incert.

Six additional species of this genus were taken in the localities named below; but the specimens have all suffered from mould and other injuries, so that it is impossible either to identify them with any certainty or to give adequate descriptions of them. One can only add that two of these specimens are referable to the *Socialis* group.

Localities:—Luano on the Kwilu River (Major Malfeyt, June, 1905); Matadi; Wathen, Leopoldville (Dec.); Lukolela (Rev. Whitehead, Aug.); Kuzu, in the region of the Lower Congo.

Circumstances of capture:—Two of the specimens were caught in a European's house.

FAMILY SARCOPHAGIDÆ

Sarcophaga spp.

Localities:—The representatives of this genus were collected at Leopoldville (Dec.); at Lokolengi on the Lopori river (Sept., Major Malfeyt); and at Kasongo (April); but the genus is a very widely distributed one throughout the Congo Free State.

Circumstances of capture:—Specimens were caught in the open and in privies. Adults were hatched in the laboratory from larvae brought by natives in mistake for larvae of *Auchmeromyia luteola*. Some species are viviparous, and their larvae are very rapidly deposited. Within a very few minutes freshly excreted faeces are often almost covered with them.

FAMILY MUSCIDÆ

Pycnosoma marginale, Wied.

Specimens of this beautiful species were collected only at Leopoldville.

Pycnosoma elara, Walk.

This fly was only observed at Leopoldville. The specimens were hatched from larvae brought by natives in mistake for the maggots of *Auchmeromyia luteola*.

Pycnosoma putorium, Wied.

Specimens of this insect were collected at Wathen. It was not seen in any other locality.

Pycnosoma sp. ?

The only specimen we possess is not in a sufficiently perfect condition for verification. It was captured, in company with others, at Tshumbiri.

Lucilia fuscina, Walk. ?

Localities:—Tshumbiri; Kutu; Basoko; Nya Lukemba (Jan., Dr. De Maria).

Circumstances of capture:—These flies were caught in the bush and were hatched from larvae found in the mud floor of a native hut. They are said to follow cattle.

Lucilia spp. ?

Several additional specimens of this genus were caught at Wathen and at Kutu (Feb.).

Auchmeromyia luteola, Fabr.

(Figs. 12-14)

Localities:—San Salvador; Noki; (Portuguese Congo, reported); Lukungu; Matadi; Wathen; Kimfuti; Leopoldville (Oct.-June); M'Swata; Tshumbiri; Lukolela; Irebu; Bikoro (Rev. Clark); Bamamia; Lisle; Upoto; Bongandanga (Rev. Gamman); Basoko; Loeka (reported); Yalembe; Yandongi; Romee; Yakusu; Stanley Falls; Wanie Numbu; Ponhierville; Kirundu; Utikakadjia; Kumba;

Lokandu; Sendwe; Nyangwe; Kasongo (Nov. to April); Molembe; Tshofa; Miambwe; Kabinda; Lusambo; Portuguese Angola (Bastian, interpreter at Lusambo); Lake Tchad (Monsieur Chevalier); ? Lagos (native reports); Sierra Leone (reported by Captain Grattan).

Circumstances of capture.—Most of the specimens were taken during the day time in or near the houses of natives and Europeans. One or two were caught at night as they buzzed loudly about a European's house.

Bionomics.—We have little to add to the description of the habits of this fly published in Memoir XIII of this School. The flies were again noticed to be attracted by the sleeping mats of natives. As before, the pupa usually took from a fortnight to three weeks to develop. The shortest period observed was ten days (temperature not unusually high).

The larva of this fly has already been described and figured*; but the mouth parts and stigmata need further elucidation to enable students to distinguish it from other allied species.

The great mouth hooks.—The anterior half of these organs is free, the remaining half subcutaneous; they are slightly falcate and bluntly pointed, the bases being emarginate, dorsally, with a clear nuclear space (? perforation) near the margin on the opposite side (fig. 12, *m.d. 2*). The *cephalo-pharyngeal sclerites* or processes (*c.s.*) for the first fifth of their entire length are of the same diameter as the mouth hooks, but at this point they suddenly dilate, forming a broad bifurcated plate; the lower or ventral half being broadest and longest with a deep posterior cleft. The *hypostomal sclerite* (*h.s.*), which lies between the anterior arms of the pharyngeal sclerites, is somewhat rectangular in shape, and resting upon it is a (? free) sclerite with three pairs of minute perforations; the anal angles of this plate carry a spine-like process.

External teeth.—There are three bilateral groups of these. The median pair (*c.t.*) are bidentate, and lie between the great mouth hooks; the anterior laterals (*p.s.*) form a distinct palmate group of nine stout teeth or spines; the posterior lateral groups (*p.s. 2*) are arranged in a similar way, but the outline is much more elongated

* First Interim Rep. of the Exped. to the Congo. Memoir XIII of the Liverpool School of Tropical Medicine.

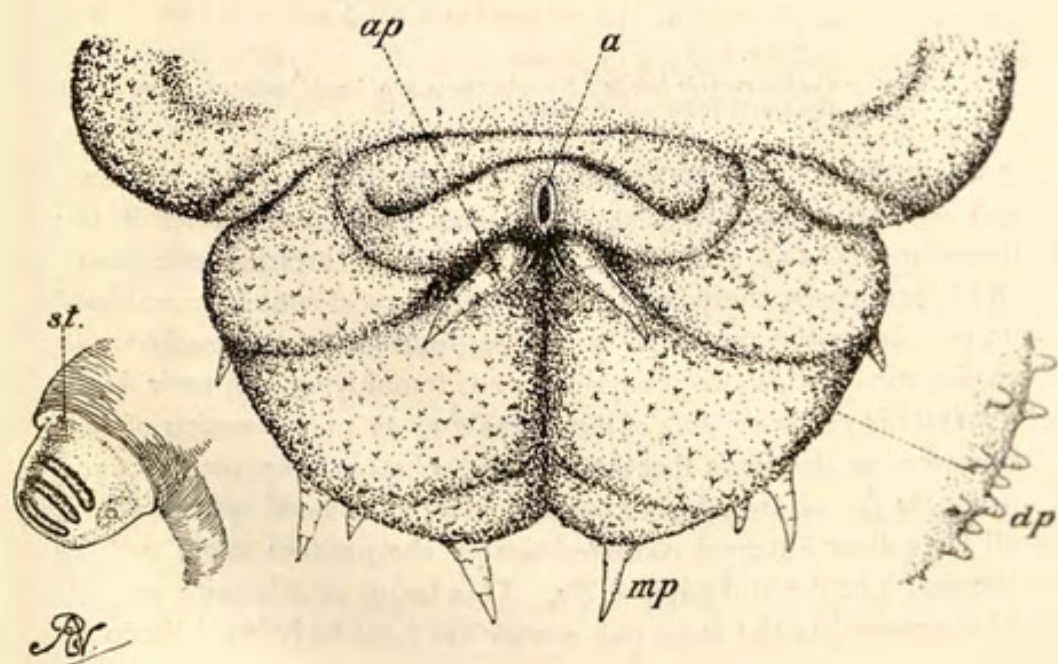
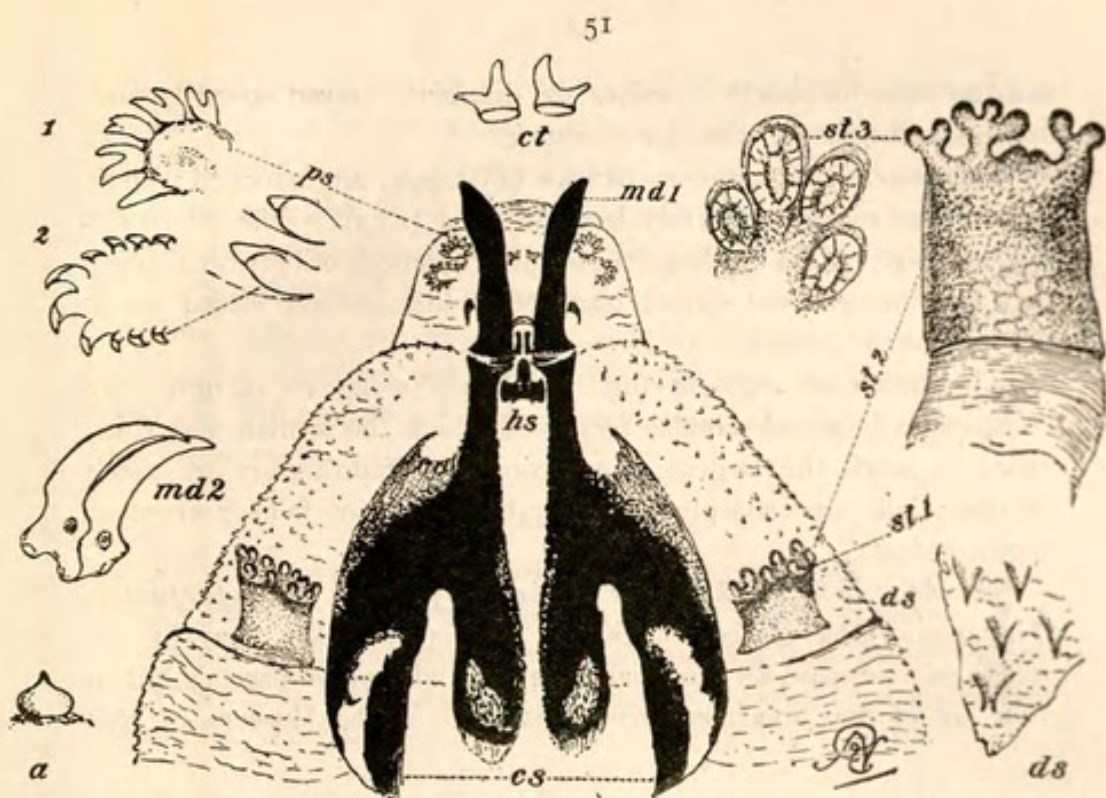


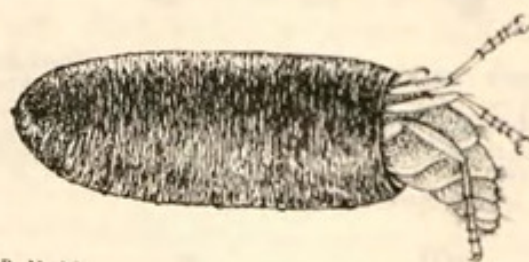
FIG. 13.—*Anchmeromyia luteola*. ANAL SEGMENT OF LARVA:—*a*, anus; *ap*, anal papillae; *mp*, marginal papillae; *dp*, dorsal papillae; *st*, posterior stigmen. (All greatly enlarged.)

and the individual teeth or spines are distinctly curved upwards and inwards, and none of them are bidentate.

The *anterior* stigmata or spiracles (*st. 1, 2, 3*) are branched; each with ten to twelve relatively large orifices (*st. 3*). The *posterior* stigmata (fig. 13, *st.*) are large obconical projections of brown chitine; each presenting three darker transverse slits, partially closed by a fine transverse grating.

The posterior segment (fig. 13) bears along its margin four conspicuous bilateral papillae (*m.p.*), of which the median and third pairs are much the largest; the second and fourth pairs are much smaller; all are sharply attenuated and bear faint traces of segmentation.

On the method of the escape of the imago from the puparium.—The anterior pole of the puparium is invariably broken away by the imago on its escape, as is normally the case with other insects; but in four out of five specimens now preserved in the Museum of this



R. N. del
FIG. 14.—*Auchmeromyia luteola*. Showing escape of imago backwards from the puparium. $\times 7$, about.

Institute the position of the imagines is reversed and the abdomen and legs are seen partly extruded from the anterior pole of the puparium (fig. 14), showing a very remarkable breach presentation. In all these cases, therefore, the imprisoned insect must have reversed its position in the puparium before the final instar was reached. In confirmation of this two pronymphs were found lying with their heads *against the posterior pole* of the puparium; as an explanation of this, however, one also finds that the *final larval stage is not reached until after the formation of the puparium*: the imprisoned larva retaining all the salient external characteristics of the previous stage, such as the mouth-hooks and papillae, &c. This being so, it is quite possible to conceive that the larva may reverse its position before it becomes

a propupa; though why it should do this is not clear. Neither is it possible with the limited material at hand to say whether the reversed position of the imago is abnormal or not. It is certain, however, that the pupa may also lie in its normal position with its head at the anterior pole of the puparium, as in dissecting out a number of puparia one imago was found in this position.

Thus we have a very remarkable anomaly; in the first instance the true larval stage is continued until after the formation of the puparium, and secondly, a large percentage of the flies escape backwards from the puparium.

Musca spp.

One species was taken on cattle at St. Louis, Senegal (May, 1903); another on cattle at Kasongo, and a third at Wanie Numbu. The specimens have, unfortunately, suffered somewhat from mould and are therefore unsuitable for descriptive purposes. Two of the species are apparently new to science.

A new Genus and Species of Blood-sucking Fly, allied to Musca

Several specimens of these interesting flies were caught on cattle and donkeys at St. Louis, Senegal, May, 1903, and also at Zambie on the Congo in September of the same year. All the specimens captured were forwarded to the British Museum in 1903 and 1904, and a series of five were returned to this Institute. Mr. Austen has given us to understand that he wishes to publish a description of this insect, and we await his publication* with interest.

Lyperosia minuta, Bezzi

Many specimens were caught on horses in a stable at Salikaine Creek, Gambia River.

Mr. E. E. Austen considers these as a new sub-species, having darker legs than the typical forms.

Lyperosia ? sp.

Specimens of a species allied to the above were caught on camels at St. Louis, Senegal, in May, 1903. We have not been able to identify these; but they are probably new.

* Mr. Austen has now (Jan. 18, 1907) very kindly promised to publish the diagnosis of this insect in an early number of this publication.

GENUS GLOSSINA (TSETSE FLIES)

NATIVE NAMES.—Only occasionally did the names given below accurately specify the insects for which they were used. For example, the word designating "tsetse fly" meant often only "a fly of medium size which bites," and therefore the same term was sometimes employed without distinction for *Glossina*, *Tabanus*, *Haematopota*, and even *Stomoxys*. In the same way the words given for "floor maggot" sometimes signified almost any maggot or even "a crawling thing which bites." *Glossina palpalis* is by far the commonest tsetse in the Congo. The names given for "tsetse fly" were obtained from natives by showing specimens of it.

The various languages are mentioned in the order in which the tribes speaking them were visited. When names are given from places off the route of the expedition the name of the informant is mentioned.

The names of native places and tribes are spelled according to the usage of the Congo Free State publications. The names of parasites are written in accordance with the rules proposed by the Royal Society for the orthography of geographical names.

DISTRICT OF THE LOWER CONGO.

Baongo language.

Tsetse fly	-	<i>mavekwa</i> (<i>vekua</i>)
Maggot	-	<i>m'vidi</i> (at Matadi); <i>n'tungwa</i> (at Wathen, is a general name for all maggots)
Maggot fly	-	<i>kuluyanzi</i>

TSHUMBIRI.

Bateke language

Tsetse	-	{ <i>eyibi</i> (S)	-	<i>eyiyi</i> (S)
		{ <i>beyibi</i> (P)	-	<i>biyiyi</i> (P)

Bobangi language

Note these words signify almost any *Tabanus* or tsetse; they are further distinguished by *etsii* = small, or *enene* = large.

Maggot	-	{ <i>mozeu</i> (S)	-	<i>libinzu</i> (S)
		{ <i>mezeu</i> (P)	-	<i>mabinzu</i> (P)

IREBU.

Kundu language

Tsetse - *entune*Maggot - *n'kisu*Tabanus - *wovoko*

Lusakani language

Tsetse - *vii*Maggot - *kisu*chelifer (also bed bug)—*silibonga*

LULONGA.

Elehu language

Tsetse - *yi yi*Maggots - *mabinzu*Maggot fly (*Auchmeromyia luteola*) - *maboio*

UPOTO.

N'gombe language

Tsetse - *ipokupoku*Maggot - *lutu*Tabanus - *eholoholo*Chrysops - *motuna*Mosquito - *ngungu*

BUMBA.

Bangala language

Language (?) men from

Loeka (Itembiri river)

Tsetse - *etuna* - *motoke*Maggot - *kiso* - *n'kusu*

BASOKO.

Language (?)

Tsetse - *difu* or *lifugu* (seems to be special name)

YAKUSU.

Keli language

Tsetse - *makuku* (also signifies Tabanus)

STANLEY FALLS.

Bagenia language

Bakumu language

Tsetse - *kowowo*Maggot - *kalombo* or *bio* (?) - *kusu*(At Taritubu general name
for all maggots is *kiyo*)Tabanus - *dikuku*

WANIE NUMBU.

Language (?)

Tsetse - *bungu* (*ngi* = any fly)Mosquito - *m'bu*People just below Wanie Numbu called *Glossina palpalis* 'kabobo.'

KIRUNDU.

Swahili language (local dialect)

Tsetse - *chafua*

TO THE EAST OF THE CONGO RIVER AT LOWA.

Bujero language

Bakumu (?) or Babemo people

Tsetse - *otjapara*, said - *sumo* (S)
to be specific *basumo* (P)

KUMBA.

Language (?)

Tsetse - *karboiboi*

KASONGO.

Swahili language (current trade language
in the eastern part of the Congo Free
State)

Bakusu language

Tsetse - *kibou kidogo*, i.e., a small
biting fly - *mazanga*Tabanus - *kibou makubwa*, i.e., a
large biting flyStomoxys - *ngi*, i.e., a flyMaggot - *funza* or *funga* - *lukusu*

Bango Bango language

Maggot - *kivinya*

KATANGA DISTRICT.

Language (?) (Dr. Ascenso and others)

Tsetse fly - *kisembe* (*kasembe*) *kasembele*

CABINDA.

Basonge language

- Tsetse - *kiboua* (*lundo* at Miambwe); same name is
used for Haematopota
Maggot - *kifinya*

LUSAMBO.

Baluba and Bakuba people present

Basongomeno language

- Maggot - *kikusu* (S) Tsetse - *bohembe*
bukusu (P)

ANGOLA DISTRICT.

Language (?) (Bastian, native interpreter at Lusambo)

- Tsetse - *dibubulu* (S)
mabubulu (P)
Maggot - *dindwe* (S)
mandwe (P)

LADO ENCLAVE.

Miza language (Commandant Charles Lemaire)

- Tsetse - *cwe*

IN THE NORTH OF THE FREE STATE.

Mangbetu

Azande (natives of these tribes)

- Maggot - *ngousu* - *agbiti*

AT KOUSSOUR ON THE SCHARI RIVER NEAR LAKE TCHAD.

- Maggot - *tadi*
Maggot fly - *acon*

This information was given by an intelligent lad in the service of the expedition led by Monsieur Chevalier.

Glossina palpalis, Rob.—Desv.

(Pl. iii, figs. 7-9)

Larva.—Orange-yellow; hood or anal segment black. Form somewhat cylindrical. Segments very pronounced; transversely wrinkled, and finely tessellated, the individual tesserae being flat and

shiny. Mouth hooks minute, contiguous and black. Anal segment or "hood" with the tumid lips deeply divided and widely separated.

When fully matured the larva almost completely fills the abdominal cavity of the parent, and lies with its posterior extremity ("black hood") towards the vaginal opening. A female which died while in the act of parturition has been preserved with the anterior extremity of the larva still attached to the vaginal orifice. This interesting phase in the bionomics of this tsetse fly is illustrated on Pl. iii, fig. 7.

Length 4.50 mm.; width 1.75 mm.

These measurements were taken from larvae laid by captive flies among whom abortion is frequent. These larvae may, therefore, not be quite fully matured.

Pupa.—This agrees so well with the description given by Austen* that it is necessary only to call attention to the following details:—Colour, in a bright light, dull steel-blue, but traceable only in perfectly clean specimens. The tumid lips are divided to their bases and widely separated.

Length 5 to 5.75 mm.; width 3 mm.

Localities:—*Glossina palpalis* is considered to be certainly present at the localities mentioned in the following list. Places at which specimens were obtained by the expedition are, as usual, simply mentioned. If the specimens were donated by friends their names and the date are given.

The names of several villages, from which no specimens have been obtained, appear on the list. *G. palpalis* is believed to have been present at them because of the proximity of places in which it has been seen and because of the evidence asserting its presence. The nature of this evidence is in every instance mentioned. It is indicated whether persons unacquainted with the name of the fly were shown specimens and *recognised* it as being present, or whether it was *reported* as present by those knowing its name. As a rule such evidence cannot be accepted as indicating more than the presence of a small tsetse (not *G. fusca* or *longipennis*). A second and supplementary list has therefore been prepared of places from whose neighbourhood specimens have not been received, at which "tsetse flies" have been reported to exist. In Map II the markings indicating the

* Monograph of the Tsetse Flies. Brit. Mus. Nat. Hist., p. 26 (1903).

distribution of *Glossina palpalis* are based upon the first list; those showing the distribution of undifferentiated species of "tsetse flies," partially depend upon the second list.

Banana (Oct., Dr. Etienne); Shiloango, Lukula and Lubengi Rivers (reported, June, 1905, de Laval); Banza Manteka (reported); Lufu River (reported, Rev. Morgan); Tumba; Wathen; Kuzu; Kisantu; Sabuka; Leopoldville (Nov., 1905, to July, 1905); Brazzaville; Bamu Island (Jan.-Feb.); Lisha (April, June, July, 1905); M'Swata; Kwamouth; Kitoto; Tshumbiri (seen ten miles inland, said to exist along all small streams of neighbourhood); Bolobo (recognised as present); Yumbi; Lukolela; Irebu; Bikoro (reported by natives and Rev. Clark); Bolengi; Coquilhatville; "All along Lulonga River to Baringa" (July, Dr. Angela); Ikelemba River (Nov., Major Malfeyt); Eala; Bamamia; "All along overland route from Boyembe to Lulonga" (July, reported, Rev. Gilchrist); Lulonga; Monsembe; Nouvelle Anvers; Bosesera (reported, Jan., Chef de Poste); Mobeka; Bokanga; Lisala, Bwela, Bosogodo (May, reported, Rev. K. Smith); "Along Congo from Lisala to Bumba and up the Itimbiri River" (reported, Dr. De Valkeneer); Bumba; Botsali; Yambinga; Bopamba; Basoko; Yalembe; Isangi; Yarbumbo (recognised by natives); Yandonge (recognised by natives); Yakusu (recognised by natives and Rev. Milman); Stanley Falls (recognised by natives); Katanga (recognised by natives); Batikalela; Wanie Bakula; Kewe; Wanie Numbu; Kisui; Ponthierville; Kirundu; Lalowa River; Utikakadjia; Lulindi River; Kumba; Kasuku; Maboka; Lokandu; Ukungwa; Kamimbi; Sendwe; Makula; Mfunkiva; Kibombo; Kundu River (Dec., reported, Commandant Verdick); Nyangwe; Salt Springs (Oct., reported, Monsieur Sappen); Kasongo (Oct. to May); East Bank of Lake Albert (April, Commandant Engh); Lado Enclave, 6° 33' N., 29° 58' E. (March, Commandant Lemaire); "*Glossina palpalis* is everywhere present in Uele, even in the smallest rivers" (Feb., 1906, reported, Dr. Hosselet); Kalombe (May, recognised by natives); Muadi River; Maomedi; Tshofa; Miambwe (recognised as present by natives); Kabinda; Kiambi; Katanga (Aug., Major Malfeyt); Pania Mutombo; Batampas; Lusambo (none at post itself, many along Lubi River, just opposite, and up and down Sankuru River); Lubefu; Basongo; Luano (Kwilu River, July, Major Malfeyt). There were but few *G. palpalis*

among the grass-covered islands of the Lower Kasai. They were, however, numerous in every patch of forest. In the Gambia (Sept., 1902, to April, 1903) *Glossina palpalis* was everywhere present along the river and its tributaries from its mouth to a point some fifty miles above Fatotenda.

Circumstances of capture:—On reviewing this list and comparing it with Maps I and II, it is apparent that *G. palpalis* is probably present in almost every part of the Congo Free State.

Tsetses were usually only found near water. If there be a fringe of forest or brush, perhaps 200 yards in breadth, along the water's edge, more flies will be seen by gently paddling in a canoe along the bank or by walking on the land side just at the edge of the belt of brush than by even a prolonged stay in the forest itself. The collection of water need not be large. *G. palpalis* and *fusca* have been caught along very small forest streams.

Their numbers were found to vary greatly in different localities. For example, along the Congo at Sabuka, near Coquilhatville, near Sendwe and near Kasongo, on the Lurimbi River at Tshofa, and at Batampas and Lubefu on the Kasai it was, as at many other places, almost impossible to avoid being bitten; but at Zambie, about the outskirts of Boma and Matadi, at Bolobo, Lisala, Romée and Stanley Falls, all places at which we believe *Glossina palpalis* to be present, not a single fly could be found. Careful search was made during our stay in each of these places, both by ourselves and by our fly-catching boys; it may be that we were unfortunate in visiting some of them on days when the flies were not visible, since it has been repeatedly noticed that the number of tsetse flies present in any locality may vary considerably from day to day without apparent cause.

On October 15th one member of our expedition left Maboka on the Upper Congo for Kaya. No tsetse flies were seen during the first half of the journey, and only one during the latter half. Ten days later the remaining members of the expedition travelled over the same piece of river and found large numbers of flies along the whole route. (See also Memoir XIII, Liverpool School of Tropical Medicine, page 106).

Again the flies may have been absent from some of the places named because they were comparatively free from brush along their water fronts.

It seems certain that the number of tsetses in the immediate neighbourhood of a post of any size may be considerably reduced if

all thick underbrush and rank grass, either near the water or a few hundred yards inland, be carefully removed.*

The station of Irebu, a military training post on the middle Congo, is beautifully kept. We remained there for three days and saw no tsetse, although there were many only a few hundred yards further up or down the river. A little over 1,000 yards outside the station was a trading factory placed in the middle of a patch of rank grass. *Glossina palpalis* existed there. Besides searching for tsetse on the station ourselves we sent out five boys trained to catch them, together with 60 soldiers. Between them all only a dozen specimens were taken. All were caught in a patch of rank grass, about 350 yards from the river, that had not been cut for two or three months. There were many scores of acres of cultivated land on the station, mostly consisting of well-kept, but shady, cocoa and coffee plantations. In them not one tsetse was found.

As Leopoldville develops and the surrounding brush is kept down tsetse become fewer, and we are told they are not nearly so numerous within the Protestant mission station as they formerly were. During our stay in Leopoldville *Glossina palpalis* was much more often caught in the house of the Rev. Mr. Morgan than in the building occupied by our expedition. The mission house was surrounded by a grove of palm trees which extended uninterruptedly to the river's edge, while the house of the expedition stood in an open piece of ground.

The experimental farm of the Government of the Congo Free State at Eala possibly may be considered to be an exception to this rule.

This farm is comparatively free from undergrowth. It is extensive and well kept, yet *Glossina palpalis* is quite frequently seen on it. There is a herd of 43 cattle and a fair amount of other live stock on the farm. It is believed that the flies are attracted by them.

It often happened, however, that no, or extremely few, tsetse were found, even after a careful search, in places where everything, shade, shelter and water, apparently favoured their presence.

Near Yaminga a search (of several hours), made on a bright day, along the thickly wooded banks of the main river of a small stream failed to find *Glossina palpalis*, although they were present in the near neighbourhood.

At Yakusu several hours in the middle of a fine dry day were spent in a canoe paddling along the banks of the river and about wooded islands. Tsetse flies were not seen.

The late Rev. W. Holman Bently told us that at a place called Vela in the Lower Congo *G. palpalis* was absent. The natives noticed this and decided that they were suffering from a want of the beneficent blood-letting enjoyed by their neighbours who lived in places where the fly existed. Men were therefore sent out to catch tsetse, bring them back and let them loose at Vela!

Behind the soldiers' lines at Lusambo runs a brush-covered stream which never

* d'Aguiar. La maladie du sommeil et la tse-tse à Novo Redondo. Reports of the Fifteenth International Congress of Medicine at Lisbon, Fascicle 2, page 294. It is stated in this publication that *Glossina palpalis* is not seen in well-kept plantations nor at a higher altitude than 400 metres above the sea. This latter assertion is negated by an observation of Commandant Charles Lemaire, who sent us specimens of the fly from the banks of the Ialo River (6° 33' North; 29° 58' East) caught at an altitude of 530 metres, and also by Lieutenant Brohez, who caught *Glossina* at an altitude of 1,600 metres, in places where the morning temperature went down to 0° C. (*loc. cit.*, *vide infra*).

goes dry, and in the wet season measures from ten to twenty yards in breadth. One could not imagine a place better-suited for tsetse; yet three competent observers (Dr. Broden, Dr. Polidori and J. L. T.) during a period of several months saw none there, although they were looked for many times. The observation might be explained by the fact that the stream is used as a latrine, and in hot weather reeks with effluvia. If this explanation be accepted it seems strange that *G. palpalis* has twice been seen in latrine sheds.

Tsetse flies will sometimes follow persons or animals for a considerable distance.

In the Lower Congo the belief that *G. palpalis* follows pigs is very common. We have not confirmed the observation. We are told that in the neighbourhood of Leopoldville *G. palpalis* was called by some of the natives "the pig fly" (Dr. Broden).

At Kilobala, a cattle station in the Lower Congo, it is definitely asserted that tsetse were formerly absent. Pigs were introduced, and with them appeared the flies! (?)

In the Gambia we lived for a time in a house placed almost a mile from the brackish water of a mangrove swamp where there were a good many *G. palpalis*. Flies were twice carried into the house by persons who had just come over the road through the swamp. These were the only occasions that tsetse were seen about these buildings during a residence of three months.

At Lokandu on the Upper Congo, no tsetse had been seen about the house we used as a laboratory. Two tame antelopes were brought to be examined; two or three *G. palpalis* followed them.

Apart from these observations no information was gathered in the Congo to support the idea that tsetse flies are dependant on large game. On the contrary, many *G. palpalis* were seen in localities where there was exceedingly little game of any sort.

Apparently because of this habit tsetse flies were occasionally not seen at places where they were ordinarily present.

When the expedition reached the Lomami River, during the journey overland from Kasongo to Pania Mutombo, it employed some 300 porters. These natives reached the river first, and not a single tsetse was seen by the European members of the expedition during the hour and a half at midday spent in ferrying the caravan across the river. The flies were later frequently seen in large numbers at this spot at all times of the day.

It is probably for this reason that tsetse flies were not found at several of the small streams crossed near Kalombe, Dibwe, Miambwe and Lukola during the overland journey of the expedition. Search was usually made at the fords and bridges after a considerable number of porters had passed or while they were still present. The flies were not found in several instances, although the natives asserted their presence and although human trypanosomiasis existed locally. A search of one or two hours discovered tsetse at a couple of streams where they had at first seemed to be absent. At other water-courses a search during a like period was without result, and it seems possible therefore that *G. palpalis* only occurs in small numbers at the following places where human trypanosomiasis is frequent—the

percentage of resident natives having enlarged cervical glands without apparent cause is indicated—Kalombe (17 per cent.), Dibwe (18 per cent.), Miambwe (7 per cent.), Lokula (6 per cent.).

A proportion of the infected persons probably contracted their disease elsewhere. These villages have a considerable immigrant population; they supply many carriers and a large proportion of their people are continually absent, collecting rubber, in the forest near rivers where tsetse flies are said to exist.

Had the flies been present in as large numbers as, for instance, at Kamimbi, it is quite inconceivable that the passage of even 300 men should have enticed them all away from their usual haunts.

The occasional presence of *G. palpalis* in places at a considerable distance from any collection of water may perhaps be explained by their habit of following animals.

In the Gambia, and again in the Congo, a single *G. palpalis* (?) has been seen on a dry plateau a couple of hundred feet above and about a mile distant from the nearest stream.

As would be surmised from what has already been said, *Glossina palpalis* is able to fly quickly and for comparatively long distances.

They are said to occasionally fly into the railway carriages as they pass near Palabala in the Lower Congo. They are frequently seen on steamers or canoes in mid-river, and distant 300 to 500 yards from either bank. On entering a moving vehicle the flies seek sheltered spots, and it is under the sunshade of the canoe or in corners of a cabin sheltered from the wind that they take refuge.

On one occasion in the Gambia a *G. palpalis* (?) persistently followed one of us (J. E. D.), who was riding rapidly on a bicycle, for several hundred yards.

At Tshofa, *G. palpalis* was frequently seen on the verandah of our house, although it was placed on high ground and at least two hundred feet above the river, which was about half a mile away.

Although *G. palpalis* has such extensive powers of flight, it seems to be very local in its habits. As has often been observed, not a single fly may be seen at 100 yards from a river although its banks swarm with them.

At M'Swata, however, *G. palpalis* was regularly seen along a little-frequented path on high ground and in open park country at a distance of 500 yards from the water and of 250 yards from the edge of the fringe of brush bordering the river. In partial explanation it should be stated that there was a good deal of game in the neighbourhood.

It has been often noticed that *G. palpalis* is most numerous at, and seems to lie in wait by, fords or frequented paths. Its habits have seemed to be more or less regular.

On one occasion, while resting by the side of a path, a *G. palpalis* was noticed to return on three occasions to the same spot on the sheltered under surface of a grass stalk after having been driven off by a native porter whom it was trying to bite.

Tsetse flies were practically never seen during rain and wind. They were most conspicuous and seemed most vivacious on bright,

warm days. In the cool of the early morning or on chilly days they were sluggish and were certainly much more easily captured; under these conditions tsetse flies have often been caught with the hands ordinarily almost an impossibility.

Glossina palpalis is often seen in native villages and in the houses of Europeans living within a few yards of the river's edge.

The Rev. Mr. Morgan asserted that they most often entered his house on warm days. At Monsembe, on a cool morning (minimum temperature 71° F.) *G. palpalis*, so sluggish that they were caught between finger and thumb, were seen in the house of the resident European.

Field notes on the Bionomics of tsetse flies.—These notes are based on observations made on the captive flies, used during our attempts to transmit trypanosomes by their bites, and on flies seen in freedom during our stay in Africa.

When a tsetse prepares to feed* it spreads its legs, particularly the first pair, and so brings its whole body nearer its host; thus, as it were, "settling down to business." The palps are retracted until they form an angle of about 135 degrees with the bared proboscis. There is occasionally a moment or two of hesitation before the proboscis is inserted. Ordinarily there is none and in a second or two the whole proboscis is buried to its bulb.

The proboscis seems very powerful and the flies easily pierce socks and ordinary white drill or duck clothes. They were, however, on more than one occasion seen to be quite unable to penetrate the tightly woven texture of a pair of riding breeches made of a patented cloth.

The penetration of the skin by their proboscis sometimes causes considerable pain. Occasionally it is unfelt.

Specimens of *G. palpalis* have frequently been watched filling themselves with blood from the backs and legs of unconscious paddlers.

While coming down the Kasai river, a small deck cabin was fitted up as a laboratory. Doors and windows were guarded by wire gauze, but through carelessness three tsetses had been allowed to enter the room. When they were found all were gorged with blood. The occupant (J. L. T.) had felt no bite. The weals, evidence that he had been bitten, soon appeared.

The proboscis, ordinarily completely inserted at the commencement of feeding, is usually withdrawn for a short distance just before the fly commences to visibly fill with blood. Often blood is not obtained on the first trial, and either the proboscis is withdrawn altogether and operations are commenced in a new place, or it is partially withdrawn to be re-inserted in, apparently, a new direction. The following observations will perhaps explain the way in which this

* *G. palpalis* was watched with a pocket-lens while feeding.

may be done. It seems that *G. palpalis* flexes its proboscis in two distinct ways. The first, the more usual, is a sharp bending of the labella. Flies who had just fed were often seen, while preening themselves, to sharply flex their labella so that they stood out, almost at right angles, from the palps. The second movement was only seen in flies from whom the palps had been removed preparatory to dissection. In these the whole proboscis bowed until it described a well-marked curve directed ventrally. The second movement is probably due to the contraction of the powerful "tendons" lying in the labium.*

G. palpalis does not fill with blood so quickly as is usually imagined. The length of time between the insertion of the proboscis at the commencement of feeding and its withdrawal was noted in 25 flies carefully fed on an experimental animal. The greatest care was taken to avoid disturbing them. The longest fed for eleven minutes, the shortest for $1\frac{1}{2}$ minutes, while the average was slightly over three minutes.

The extraordinary way in which tsetses distend themselves with blood is well known.

A female *G. fusca* was watched steadily filling itself with blood for six minutes. It was stopped feeding then lest it should burst itself. Its abdomen was so distended that there was a space of almost a millimetre between each of the dark coloured chitin plates on the dorsal surface of its abdomen.

In about a minute after feeding commences a drop of yellowish or brownish, opaque, but liquid faeces is extruded and a minute later—while still feeding—clear serum rolls, drop by drop, from the anus.

Sometimes tsetses who were plainly in need of food absolutely refused to attempt to feed. Others frantically probed animal after animal and failed to get blood. It has occasionally been thought that in captivity male flies did not seem to be so eager for blood as were the females.

In the cool of the early morning or evening *G. palpalis* is not nearly so voracious as at mid-day.

One is, however, occasionally surprised, as at Lubefu on the Kasai, in finding them active and biting freely early on a cold damp morning, or as at Kasongo and Lukolela in seeing them feed until dusk and fly actively about after dark. *G. palpalis* has twice been caught about the lamps at night.

These flies sometimes seem to prefer natives to Europeans, and dark to light coloured clothes. This first point is frequently commented on by Europeans travelling in canoes. They see that the native paddlers are worried by the flies while they are themselves often comparatively unmolested.

* Memoir XVIII of the Liverpool School of Tropical Medicine, page 53.

One day while coming down the Kasai the Captain, finding it cold, put on a blue cloth jacket. Many more tsetses were noted to settle on his coat than on the white duck suits of the European passengers and of the negro steersman.

The flies seem to find their hosts rather by sight than by smell, since in a given locality a moving person is usually more troubled by them than is one who sits still.

The persistency with which *Glossina palpalis* resumes its attacks despite slapping and brushing is very characteristic. As has already been stated, its flight is ordinarily rapid and darting. It is usually accompanied by a peculiar and characteristic buzzing. This fly can nevertheless, if it wishes, fly as noiselessly as an *Anopheles*. A fully gorged fly is exceedingly heavy on the wing, and usually flies only a yard or two before taking refuge in some quiet corner, where it quickly lightens itself by the rapid extrusion *per anum* of large quantities of colourless serum. Immediately after feeding the fly goes through an elaborate toilet and carefully cleans its proboscis. Sometimes just after feeding a drop of blood has been seen adhering to the outside of the proboscis at about its middle.

If a tsetse (*G. fusca* or *G. palpalis*) be held by its wings, or otherwise irritated, it can often be made to exude a tiny drop of clear fluid from the tip of its proboscis. Koch has made a similar observation.*

It has often been said that tsetses are frequently found in association with a particular tree or shrub. In the Congo two such plants were pointed out to us. One was a peculiar sort of palm, the other a variety of mimosa. Both grew on low-lying land along the river bank, and therefore were always seen where tsetses existed. Needless to say, the flies have been frequently seen in places where both were absent.

Certain reports to the expedition as well as the fact that *Glossina* was found to be absent from places apparently well suited to it have raised the question whether the numbers of tsetse flies present in a given locality may not vary very greatly through seasonal or other influences. No satisfactory answer has been obtained. The following observations are, however, interesting in this connection.

At Matadi and elsewhere in the Congo, as also in the Gambia, we were told that tsetse flies (*G. palpalis*) were much more numerous in the wet season. Lieutenant Brohez† asserts the contrary, and states that in Katanga they are more numerous and bite more fiercely in the dry season (*G. morsitans*, *G. longipalpis*, *G. palpalis* present).

* Koch, Vorläufige mittheilungen über die Ergebnisse einer Forschungsreise nach ostafrika; Deutsche medizinische wochenschrift, No. 47. Nov. 23, 1905.

† *loc. cit. infra.*

In April, just at the end of the dry season, a camp was made on the banks of the Upper Gambia river. *Glossina palpalis* was very numerous, but, strange to say, caused but little trouble; there was a great deal of game in the neighbourhood.

It has been reported that certain localities were infested with tsetses which at an earlier period were free from them. These statements have not been substantiated, and they seem sometimes to have resulted from insufficient observation. The possibility of their accuracy must not, however, be forgotten, especially since it is frequently asserted that the area over which *Glossina* exists is widening.

Observations on captive Glossina palpalis.—During our attempts, in the Gambia,* to transmit trypanosomes by the bites of tsetse flies, we found that they would not feed well in small cages and died in the course of two to four weeks. It was thought that this might have been one of the reasons why our Gambian experiments had been unsuccessful, and when we recommenced our experiments in the Congo we determined to reproduce, as nearly as possible, the natural surroundings of the fly by keeping them out of doors in larger cages containing water and growing grass. Cubical cages of wire gauze measuring 18 inches along each side were employed. In each cage was placed from 20 to 70 flies. These larger cages were kept in a large mosquito house, measuring 13 by 8 by 9 feet, made of wire gauze. It was placed in a thick clump of bamboos, distant about 100 yards from the river. The flies were sheltered by the bamboos from the mid-day sun and, on two sides, from strong winds. Food was supplied to them by experimental animals, guinea-pigs and rats, which were immobilised and placed in the cages. *Glossina palpalis* certainly lived better under these conditions than they had done in smaller cages in the Gambia. They frequently lived for over 30 days; 43 and 59 days were the longest lives noticed. In addition they seemed not to require food so often as had been necessary in the Gambia, and they were frequently left for 48 hours without an opportunity of feeding. This may be explained in part by their being out of doors and more exposed to cold and damp. Under such circumstances tsetses are certainly more sluggish in their movements.

The disadvantages of this method of keeping flies were however great. It was almost impossible in such large cages to count exactly the number of flies which had fed or to estimate the number present. They seemed to seek concealment and hid themselves in the smallest crevices. It was difficult to feed flies kept in this way on monkeys and the cages were too large to be easily transported.

* Memoir XI, Liverpool School of Tropical Medicine.

If they were left without an opportunity to feed for much more than 24 hours they died very quickly, about 91 per cent. in 37 hours. Neither sex seemed particularly resistant.

To feed the flies the cage was simply pressed against an infected person or animal, and so long as the victim kept fairly still the flies



FIG. 15. METHOD OF FEEDING TSETSE FLIES.

fed without difficulty. They showed no preference for human blood, and practically the same percentage of flies fed on whatever animal (man, monkey, guinea-pig, &c.) was offered. On one occasion they were persuaded to suck blood from a frog.

It is calculated from observations on several thousand flies that on an average 80 per cent. of our flies fed when the opportunity offered. In special cases, when great care was used to keep animal and cage perfectly still and the feeding was persisted in for some hours, much larger percentages were obtained—frequently 100 per cent. Flies which had only partially filled themselves could often be persuaded to at once resume their meal on a second animal. It was practically

impossible to get flies which had been allowed to gorge themselves to again feed within from three to five hours' time, although they would do so readily eight hours after a first feed.

It has already been stated that *G. palpalis* may buzz loudly while flying. When at rest, often just after feeding, it sometimes produces a shrill, high-pitched note. A wingless fly was watched with a pocket-lens while sounding in this way. The tips of its halteres were seen to be depressed downwards and forwards, but the mechanism by which the note was produced was not ascertained.

Glossina palpalis, var. *wellmani*, Austen

Localities:—On the Congo River, between Nyangwe and Kasongo; on the Gambia River, near its mouth, at Oyster Creek.

Circumstances of capture:—So far as was observed the habits of these flies were quite similar to those of *Glossina palpalis*.

Glossina morsitans, Westwood

Localities:—Specimens have been received, through Monsieur Brohez, only from the Katanga district. The exact locality and the circumstances under which they were caught are not certain, but they were probably taken along the Luvua River near Pueto. Dr. Hosselet definitely reports that this fly is everywhere present in the zone of Uele, but we have seen no specimens.

Glossina fusca, Walker

Larva (dissected from body of parent but fully matured).—This consists of twelve strongly defined segments; surface finely tessellated, the individual tesserae being circular, flat, and shiny. Form, rather short ovate. Mouth-hooks relatively large, black, rather widely separated, but not porrected. Anal segment or "black hood" very coarsely rugose, the space between the converged points of the tumid lips one-third the diameter of one lip. Colour white, with a trace of lemon-yellow; hood or anal segment black.

Length 5.50 to 6 mm.; width 3 to 4 mm.

Pupa much more tumid and ovate than that of *G. palpalis*, especially so posteriorly. The tumid lips are also more depressed, and being continuous at their bases and only slightly divided posteriorly form a deep siphon-like tube or crateriform process, so

deep that it is impossible to see the stigmata which lie in the interior. Colour, dull steel-black, without any trace of the dull steel-blue seen in the puparium of *G. palpalis*.

Length 7.50 to 8 mm.; width 4 to 4.50 mm.

Localities:—Leopoldville (Dec.; reported, all the year round); Tshumbiri; Yumbie (Dr. Rodhain); Lukolela (Rev. Whitehead); Bolengi (Dr. Dye); Coquilhatville (Dr. Mordighlia); Nouvelle Anvers; Bwela (reported, Rev. Kenred Smith (*longipennis*?)); Aruwimi River; Lulu River (reported, Commandant Lund (*longipennis*?)); near Lalowa; near Utikakadja; Sendwe; Mfunkiva; Kasongo (Oct.-May).

Circumstances of capture:—This fly occurs in very much smaller numbers than *G. palpalis* and it is the rarest thing for more than one to be seen at a time. Most of our specimens were caught in the bush or from canoes paddled slowly along the edge of a wooded stream. None were seen to fly on board the steamer used by the expedition on their journey from Leopoldville to Stanley Falls, although a dead *Glossina fusca* was found in one of the cabins. *Glossina fusca* has frequently been observed in the Congo to be more or less nocturnal in its habits.*

A buffalo was shot. Part of the carcass was sent by canoe to camp, where it arrived about an hour after nightfall. By the light of a lamp a large *fusca* was caught trying to feed—there was no blood in its stomach—on the buffalo's neck. A night or two later a pair of *G. fusca* were caught, *in coitu*, about the lighted lamp in a tent. On two occasions specimens have been caught after nightfall in the illuminated tents of the expedition.

One or two observations on the bionomics of this fly have been included in the notes on captive *Glossina palpalis*.

Glossina pallidipes, Austen

A single specimen of this fly was obtained at Kasongo. No others were seen, although 1,053 tsetse flies, caught for transmission experiments, were carefully examined.

Glossina longipalpis, Wiedemann

Localities:—This fly has only been sent to us from the Katanga district. Two lots of specimens were received. One reached us through Major Malfeyt, the other was sent by a local official from the Upper Luapula.

* Memoir XIII, Liverpool School of Tropical Medicine.

Field notes.—It is asserted locally that these flies are more persistent and feed more viciously than *Glossina palpalis*.

Glossina maculata, n. sp. (Newstead)

(Pl. iii, figs. 5, 6)

General appearance.—Very dark brown; posterior surface of head cinerous, spotted with black; thorax dark brown and faintly cinerous in places, with elongated transverse black spots; pleurae, coxae and femora cinerous with conspicuous black spots; first and second segments of hind tarsi dark. (The remaining segments wanting.)

FEMALE.—*Head* with the frontal stripe rich ochreous brown; frontal margins and ocellar spot bright yellowish-white to pale ochreous; ocelli black; posterior surface of head cinerous *with large well-defined irregular black spots*. *Antennae* dull red-brown in front, sides with a cinerous surface; arista dull reddish-brown. *Palpi* blackish above, paler beneath. Bulb of *proboscis* dark castaneous, shining. *Thorax* dark brown and cinerous with numerous irregular elongated black spots placed transversely; anterior angles pale brown. The scutellum spotted like the thorax, margin pale brown; pleurae cinerous and pale brown, with numerous, irregular, and more or less confluent, black spots. *Abdomen* very dark brown; the narrow basal segment cinerous, with numerous black spots; the broad second segment with the large median area, the anterior angle, and broad hind margin, cinerous, with black spots; the remaining segments, with the exception of the last, with a narrow well-defined median stripe, and hind margins narrowly cinerous; lateral margins of segments three to five with a cinerous triangular patch; the hind margins with an occasional, more or less obscure, black spot, with the exception of the sixth, which has a regular series of ten or eleven on the grey cinerous band; last segment darker than the rest with a lateral greyish spot in the centre of which is a small black one. *Legs*: All the coxae cinerous and pale reddish-brown, with numerous more or less confluent black spots; anterior and mid femora cinerous basally and apically bright red-brown, cinerous area with numerous confluent black spots; hind femora with the basal third and apex pale red-brown, the rest faintly cinerous with a few large, faint, dull brown blotches; anterior and hind tibiae pale brown, mid tibiae slightly darker with, in some lights, faint indications of dark spots; anterior

tarsi and first segment of the mid pale brown; first and second segment of hind tarsi dark brown. (The remaining segments of the mid and hind tarsi are unfortunately wanting.) *Wings* uniformly brown.

Length,* exclusive of proboscis, 9 mm.; length of wing 9 mm.

A single specimen of this fly was sent to us by the Rev. and Mrs. Billington. It was collected by them at Tshumbiri in 1905.

This interesting species may be readily recognised from all other members of the genus, by the curious spotted or mottled appearance of the thorax, pleurae, and femora. To the unaided eye it looks very like a dark specimen of *Glossina palpalis*, R.D.; but a pocket lens immediately reveals the peculiar markings.

FURTHER NOTES ON THE DISTRIBUTION OF TSETSE FLIES

Trustworthy persons frequently stated that tsetse flies of small size (not *fusca* or *longipennis*) existed in various localities. They were, however, unable to further identify the fly, and did not procure specimens. We have therefore compiled the following supplementary list of places in which tsetse flies occur. The names occurring in it have been considered in the preparation of the map showing the distribution of the *Glossinae*.

Matadi; Loeka; Redjaf, Lado Enclave (reported, Dr. Bignami); Makanga, Maniema (reported, April, 1905, Chef de Poste); Bene Kamba, on the Lomami River (recognised by natives); "All along the road from Kasongo to Baraka" (reported 1905, Bishop Roelens). confirmatory reports have been received from the following places along this route: Piani Lusangi, Kabambare, Kalembelembe, Yambayamba; Kibonga, Lake Tanganyika (reported, Chef de Poste); Lake Kivu (reported, Commandant Crone); Upper Luama River (reported, Bishop Roelens); "Places where tsetses do not exist in the Katanga district are so few as to be negligible"† (reported Feb. 4th, 1905, Monsieur Baillon, Chef de Secteur). Places in Katanga at which

* The abdomen is curved considerably, but this has not been allowed for in the measurement.

† This statement is in every way supported by numerous reports received by us, a few of them are cited, and by a recently published pamphlet entitled "La Mouche Tsetse et la Colonisation au Katanga, par le Lieutenant Brohez 1905, published by Vanderauwera et Cie, 59 rue de la Montagne, Brussels."

tsetses are definitely said to exist are: Ankoro; along the Lubili River; on Lake Tanganyika at Mpala and Vua; * Lusaka; Kiambi; Mpweto; Lukonzolwa; Kilwa; Lukafu; Kasenga; Kambove; Tenke; Shiniama; Kalonga and along the Lualaba, Lufira and Luapula Rivers; Upper Kasai and Luebo Rivers (reported, Mr. Verner); Angola (reported, Bastian, Interpreter at Lusambo); Popokabaka (reported, Dr. Hollebeke).

Map II has been prepared to show the distribution of *Glossinae* in the Congo Free State. For the sake of uniformity we have used the same signs as Mr. Austen to indicate the various species of *Glossinae*. As will be noted, our observations confirm his map in many instances and amplify it in others. In it has been incorporated the information contained in the article on tsetse flies by Austen, published in Volume VI of the Reports of the Sleeping Sickness Commission of the Royal Society and in a communication, on the same subject, made by Laveran to the Académie des Sciences.†

Remarks.—An important deduction to be made from the above notes on the *Glossinae* is that *Glossina palpalis*, at least, cannot be said to be absent from a given spot until several careful searches have been made at considerable intervals of time.

A careful study of the bionomics of tsetse flies is still urgently needed. Comparatively little is known at present concerning their habits; especially lacking is accurate information on the variation of their numbers in various localities ("fly belts") and on the causes governing their appearance or disappearance. On only one occasion did any hint of a natural enemy of these flies reach us.

The Rev. Mr. Grenfell had slightly wounded a bird (a darter?—native name, *ullinga*). It was taken living into the canoe in which he was travelling, and it was seen to eagerly catch the tsetse flies flying about the native paddlers.

GENUS STOMOXYS

Stomoxys calcitrans, Linn.

(Pl. iii, fig. 4; Pl. v, figs. 1-8)

Localities:—Lulango; Lusambo; in the Gambia at Bathurst and McCarthy Island.

* Dr. Noble has recently identified the tsetse flies "plentiful at Vua" as *G. palpalis*.

† "Comptes rendus des séances de l'Académie des Sciences, t. cxli, p. 929, 4 décembre, 1905."

Circumstances of capture:—This fly was caught in the open and in the houses of Europeans. It feeds on all mammals, but seems to be especially fond of feeding at the tips of dogs' ears. Both on the Gambia and on the Congo dogs were often seen with their ears raw and bleeding from the attacks of this pest.

*It is, I believe, over 60 years since Bouché discovered the larvae of *Stomoxys calcitrans* in warm stable-manure. Since that time no additional information on the habits of this insect has apparently been given†; and the characteristics of the earlier stages and also the metamorphoses have remained practically unknown. It was resolved therefore to:—

1. Trace out the life-history and metamorphoses by rearing the insect from the egg; and

2. To find the natural habitat for the eggs, larvae and pupae.

The first was accomplished with comparatively little trouble; but the finding of the natural habitat for the earlier stages of this insect proved no light task, and involved a considerable amount of time and diligent searching. In the end, however, I succeeded in solving these problems; and it is hoped that these notes will not only prove of interest, but also of some practical value to those students who are engaged in the study of insects in connection with the transmission of disease by blood-sucking flies.

During the month of August an unremitting search was made for the larvae and pupae of this insect in the faeces of nearly all the domesticated animals, both in the farm-yards and the fields, but without success; manure heaps both old and recent were also searched, but none were discoverable. A number of females were

* Newstead. Reprinted from the Journ. Econ. Biol., vol. i, No. 4, pp. 157-166, pl. xii, 1906.

† Howard, whose excellent paper on "A contribution to the study of the insect fauna of Human excrement" (Proc. Washington Acad. of Science, Vol. II, p. 578) I had overlooked, says:—"Our first experience with the breeding habits of this fly was in 1889, when studying the horn fly of cattle. August 20, 1889, four specimens of *Stomoxys calcitrans* were reared from horse manure collected at Washington, and on the 19th of the same month large numbers of adults were observed by Mr. Marlatt, attracted to freshly-dropped horse manure. January 20 and May 14, 1890, other specimens were reared from horse manure, the last lot of manure being collected on November 27, 1889, so that the insect hibernates in either the larval or pupal condition (probably the latter) in or just under old manure."

"This species has not been bred from human excrement, but has been observed in out-of-door privies at Snickers Gap, Virginia; Alexandria, Virginia; and at Charlestown, West Virginia."

then captured and placed in a large cage well supplied with light and air, and fresh faeces of the horse, sheep, and rabbit. A small percentage of the insects laid their eggs under these conditions; but the eggs were invariably removed to receptacles which were more convenient for the study of the metamorphosis. It was found that two important conditions were necessary for the development of the larvae, viz., an almost complete absence of light and *an abundance of moisture*. Such conditions as these could only obtain in a state of nature in large faeces in shady or damp situations, or in heaps of manure.

Towards the end of September the earlier stages of this insect were found under natural conditions, and the facts relating to them are given under the heading of additional field notes.

HABITAT.—Farm-yards and stables are evidently the favourite haunts of this fly; it occurs also in the fields, parks, and open woods, especially where cattle are grazing, but is much less numerous in such places. It is evidently also by no means uncommon in some of our large towns, and numbers were seen at rest on the shop-fronts in the main streets of both Liverpool and Chester. It is fond of resting on surfaces fully exposed to the sun, such as doors, gates, and rails, and to a less extent also on stone and brick walls. Painted surfaces are also attractive to it, and the greatest number seen congregated together were disporting themselves on the sunny side of a red-painted iron tank at the old Chateau de Goumont, Waterloo, Belgium. They are very active; but their flight is quite inaudible at a short distance, the noise produced being very feeble. When disturbed they frequently return to the same spot, but more especially so in favourite resting-places. At night they retire to some sheltered spot, and numbers may be found at rest on the beams and rafters in open sheds in farm-yards, where they remain, almost inert, till the morning sun tempts them out again. They will also occasionally enter stables in the day time, and they were seen to enter such places through a narrow opening or a crack in the door.

They frequently clean their wings when in captivity, and this is accomplished with great precision, the hind legs being used for this purpose. The under surface of the wings are first combed, then the upper, the legs are then rubbed together, and the process is again repeated in exactly the same order.

POSITION WHEN AT REST.—The front part of the body is often slightly raised, but not invariably so; and the wings, which invariably touch at their bases, are widely divergent and carried in a horizontal position, lying practically in the same plane as the abdomen.

RATIO OF SEXES.—During the heat of the day the males preponderated;* but towards evening the sexes occurred in about equal numbers; the captured females were, however, nearly all freshly emerged ones, and a large proportion of the eggs which they laid in captivity proved infertile.

FOOD OF THE ADULT.—During a period of 14 days a careful watch was kept on both cattle and horses in various farm-yards where the flies were common, but no flies were seen either to alight upon the animals or to suck blood from them; at the same time several examples of both males and females were captured which were fully engorged with blood. Moreover, a freshly emerged male readily sucked blood from the writer's own hand. There is, however, no lack of authentic evidence as to the blood-sucking habits of this fly which need not be repeated in this communication.

Two specimens were seen to settle on fresh cow dung, and apparently feed upon the moisture on it, passing the extended proboscis rapidly over the surface; such habits were apparently exceptional or rarely seen in a state of nature; but in captivity they readily fed on the fresh faeces of the horse and sheep, more especially so on the latter. A female was also seen to drive its proboscis into the thorax of a dead companion and apparently suck up the juices of its body. Three specimens fed upon some sugar and water, and some also sucked up the moisture from a decayed and fetid potato.

MOVEMENTS OF THE PROBOSCIS.—The base of the proboscis is frequently depressed so that the palpi become fully exposed, but the tip of the labium remains practically in the same position, or is very slightly elevated. The elbowed joint in front of the palpi is very flexible, and can be instantly inflated so that the entire proboscis can be completely straightened, and either extended horizontally or depressed vertically. The labella can also be:—

1. Straightened, taking the same plane as the labium proper.

This is the normal resting position.

* The ratio was about 3 males to 1 female.

2. Curved upwards and outwards, with a quick alternate movement to either the right or left, or repeatedly and rapidly curved to one side only. As the labella curve upwards the *anterior* portion of the labium also gives a distinct lateral twist, so that the dorsal groove is presented laterally.
3. The teeth of the labella can be curved outwards and ventrally, giving them a bilobed appearance; the teeth also apparently move rapidly backwards and forwards, and a clear fluid was seen to pass down the tube when the insect was slightly pinched between the fingers.

In sucking blood from the writer's hand the insect sat high upon its legs, but the anterior pair were much elbowed, and all the joints of the tarsi generally rested upon the skin of the host. The whole of the proboscis was straightened and held vertically, and the anterior third was driven into the flesh.* During the process, which lasted altogether for a period of 15 minutes, the proboscis was constantly, but somewhat slowly, moved up and down, and also with an occasional semi-rotary movement, reminding one somewhat of the action of a quarryman's hand drill. This action was continued until the fly had pumped its body full of blood. The initial pain was trifling compared with that of a mosquito; but there were two subsequent pricks which were quite as irritating as the first. A small drop of blood was left over the puncture, and when this was washed away a small roseola was revealed; but there was no subsequent irritation or soreness of any kind. A clear fluid was passed from the anus four times during the process, and on several occasions subsequently, and judging from the size of the abdomen the food was rapidly assimilated. This fly died twelve hours after feeding.

DURATION OF LIFE.—In captivity they lived for several days; but they were supplied with abundance of fresh air and some moist faeces. The females died either immediately or shortly after laying their eggs.

EGG-LAYING.—When the female is about to lay its eggs the ovipositor becomes fully extended, and nearly equals the length of the abdomen proper. The eggs are passed rapidly down the ovipositor at intervals of a few seconds,† and were usually laid in an irregular

* In thick-skinned animals the proboscis would in all probability be driven in still further.

† 5-30 seconds.

heap. In some instances the female was seen to separate the eggs by carefully passing her proboscis between them, and then drag them away or scatter them with her legs. In cases where the eggs were laid during *extremis* the female generally died on the spot, and made no attempt to scatter them. Counts were made of seven batches, the maximum being 71, the minimum 48; the actual counts were 48, 48, 54, 57, 59, 62, 71. The incubation period, at an average temperature of 72° F. in the day and 65° F. at night, was two to three days.

TIME OF APPEARANCE.—They are especially abundant during August and September; but gradually diminish in numbers during the early part of October;* and few examples are seen after a spell of cold wet weather.

THE EGG.—Coriaceous; white at first, but changing to creamy white. Those which were laid on faeces, fully exposed to the sun, had the exposed portions tinged with pinkish-brown, but this colour eventually disappeared. Form very elongate, shaped somewhat like a banana, being curved on one side and almost straight on the other; the straight side with a broad deep groove which widens at the anterior end giving it a spatuloid form. Surface with faint polygonal reticulations. The larva effects its escape by splitting the broad end of the groove, leaving it slightly raised (see Pl. v, fig. 4), and apparently intact on the opposite side.

Length, 1 mm.

THE LARVA.—Colour, creamy-white to pale ochreous, translucent, shining and almost glass-like; sub-cutaneous mouth parts black; the convoluted alimentary tract when filled with food gives the posterior half a blackish or greenish-black colour; tracheal tubes forming two-submedian white lines and delicate lateral branches. Posterior stigmata black; thoracic stigmata ochreous. Form long, tapering to a point in front, widely rounded posteriorly. Segmentation not very pronounced. Epidermis without hairs. Head with two large divergent mammiform processes, at the extremity of which are the minute retractile antennae, apparently of four sub-equal segments. The mouth armature consists of five distinct parts: a strongly falcate hook in front, which articulates with a broad, thick and somewhat rectangular hypostomal sclerite; immediately below the great hook is

* A single specimen was seen in Liverpool on a bright sunny day during the first week in November.

a small dentate sclerite; the hypostomal sclerite articulates with two large bifurcated cephalo-pharyngeal sclerites, and in front of the upper arms of these plates is a small perforated sclerite. In a freshly prepared specimen both the retractor and extensor muscles to these sclerites can be distinctly traced. Ventral surface of the last seven segments furnished with raised bands of tactile tubercles. Posterior stigmata two in number, circular; thoracic stigmata placed sub-laterally on the third segment, each consisting of apparently five circular orifices, these are connected posteriorly with a large bilateral air sac which extends along the fourth segment.

Length of adult, 11 mm.

Young larvae are much more transparent and glass-like, and the large anterior mouth-hook is not developed, a blunter process taking its place.

HABITS OF THE LARVAE.—They move rapidly along a smooth surface, pulling themselves along chiefly by means of the large mouth-hook; and proceed practically in a straight line, moving the head rapidly but irregularly from side to side or up and down. There is, however, no regular alternate movement of the head during progression as in some muscid larvae. Their progress through the burrows in their food is much more rapid than on a smooth surface, and when disturbed they disappear with extraordinary rapidity. The larval stage lasted, under favourable conditions, from 14 to 21 days; *but the absence of excessive moisture* and the admission of a little light materially retarded their development, which then extended over a period of from 31 to 78 days.* The larvae exposed to such conditions produced much smaller pupae and correspondingly small imagines.

METHOD OF PUPATION.—This is completed in about two hours. At first the larva rapidly shortens itself, chiefly by contracting the anterior segments, and becomes barrel-shaped. At this period it is of a creamy-white colour, and the mouth parts of the larva are still visible through the soft integument. The colour rapidly changes to bright ochreous, and in the space of two hours or even less, the integument hardens and the puparium assumes its normal colour. In cases where soil was placed below the faeces the larvae generally burrowed into the former to a depth of about half an inch, but a few also pupated

* A few specimens still remain in the breeding cage, and may possibly pass the winter in this stage.

in the dryer portions of the dung. Where no soil was provided the larvae generally pupated at the bottom of the breeding cage.

THE PUPARIUM OR PUPA.—Colour bright terra-cotta red, changing to dark chestnut-brown a few days before the emergence of the fly. Form barrel-shaped, slightly narrowed in front, broadly rounded behind. Eleven segments only are visible, the anterior one bearing the minute bilateral thoracic stigmata of the larva; posterior segment with two large disc-like stigmata; all the segments with fine transverse striae, the striae, under the microscope, producing a slight iridescence; dorsally the articulations have a double series of minute papillae, one series being more minute than the other; the posterior segment has also a median longitudinal series which terminates between the stigmata; ventrally the papillae are replaced by a regular series of fine ridges, forming a distinct and relatively broad band; the last segment also bears a somewhat lunular or angular-shaped patch of more or less rounded papillae. This stage lasted from 9 to 13 days.

Length, 5 to 5.50 mm.

The larvae fed on comparatively dry faeces produced much smaller pupae—3.50 to 4 mm.

DEVELOPMENT OF THE NYMPH.—A few days before the emergence of the insect the cuticle of the puparium darkens and eventually splits anteriorly along the lateral and median lines and also transversely along the fourth segment; the section falls away, and the fly escapes. Prior to this the nymph undergoes its final ecdysis, pushing its effete skin off backwards into the posterior end of the puparium. On its emergence it appears as a small dark-grey fly, with thick rudimentary wings of a dull leaden colour and a deep notch in the mid costa, below which are strong convoluted folds. The head is much larger and wider than the thorax, and the abdomen is attenuated. Its subsequent development may be conveniently divided into the following stages:—

1. An extremely active period, which lasts for approximately half an hour. During this period the insect devotes nearly the whole of its attention to the escape from its environment. If placed in a glass tube with a barrier of loose cotton wool in it, the fly immediately endeavours to effect a passage through it, and this it accomplishes with marvellous rapidity.

making headway by constantly inflating the frontal sac, at the same time pushing itself forward with the legs. When liberated, a great deal of time is devoted to combing out the hairs on the arista of the antennae, this being accomplished in the following way: the head is turned either to the right or left, as desired, and the frontal sac is then inflated on that side farthest from the thorax; this process lifts the antennae into a prominent position, and the long hairs of the arista are then rapidly and carefully combed out with the under surface of the anterior tibiae. The frontal sac also receives a share of attention, and so also does the abdomen, and occasionally the rudimentary wings. This stage is remarkable, in that nature so provides that, under normal conditions, the insect may successfully escape from its larval habitat before the wings develop, and so impede its progress or render its escape impossible.

2. In this stage the frontal sac is usually contracted, and the head presents a more normal condition; the fly also becomes quiescent, and remains as a rule in a fixed attitude, with the legs well displayed, and the head extended forwards, so that the narrow neck is stretched to its fullest extent. Air is then pumped into the body by repeated and alternate contractions and extensions of the abdomen. The body increases in size, and the integument becomes *extremely pallid in colour*. At this stage the wings are apparently filled with air, which passes rapidly along the costal region, then across to the hind margin, and finally the tip unfolds, sometimes aided by the use of the hind legs. The first portion of this stage sometimes occupies over twenty minutes; but the wings develop as a rule in about three minutes.

3. The fly still remains more or less quiescent, but gives some attention to cleaning itself, and when the integument and the wings are sufficiently hardened the proboscis is raised from the ventral to its normal horizontal position; when this is accomplished the insect takes flight.

Defaecation takes place shortly after the imago is perfected; the faeces being milk-like both in substance and colour.

SUMMARY OF LIFE CYCLE.

*Larvae fed on moist sheep's dung.**Eggs procured from captive females.*

Average day temperature	-	-	-	-	72° F.
Average night temperature	-	-	-	-	65° F.
Month	-	-	-	-	August.
Ova—Incubation period	-	-	-	-	2—3 days.
Larval stage	-	-	-	-	14—21 "
Pupal stage	-	-	-	-	9—13 "
Complete cycle	-	-	-	-	25—37 "

SUMMARY OF LIFE CYCLE.

*Food allowed to partly dry and some light admitted.**Temperatures as above, during the month of August.*

Ova—Incubation period	-	-	-	-	2—3 days.
Larval stage	-	-	-	-	31—78 "
Pupal stage approximately as above,	-	-	-	-	
Complete cycle	-	-	-	-	42—78 "

Some larvae of this brood may hibernate through the winter.

ADDITIONAL FIELD NOTES.

While this paper was going through the press I continued my search for the larvae at various places within a few miles radius of Chester, and on 21st September my efforts were at last rewarded by finding the insect in all stages of its metamorphosis. The habitat was on the outside of a cucumber bed, at Rossett, Flintshire. Here both males and females were disporting themselves on the cucumber frame and also on some matting used for covering the glass. My attention was first given to an examination of the stable manure forming the hot-bed, but this was quite unproductive, as I ventured to think that it would be, owing to the rather dry nature of the outer walls. But lying alongside the cucumber bed was a heap of grass-mowings which had accumulated during the season. The uppermost layer had only recently been deposited, and this was quite hot (90° to 98° F.), below this the grass was quite rotten and sodden with moisture, but registered a temperature of 70° F. It was in this layer that I found the

first lot of larvae. They were chiefly full-fed, and some of them pupated during the next two or three days. Continuing my search further I also found numbers of larvae and pupae, in the still older and quite cold deposits, some of them were only a few inches below the surface, others were deeper down; they sometimes occurred singly, in other cases several were found together, some were mature, others only partly developed. On disturbing the newer deposits they naturally gave off the strong smelling fumes characteristic of heated grass, and this produced a result which I had neither hoped for nor anticipated. A female *Stomoxys* was seen to alight on the hot and freshly disturbed grass and to quickly disappear among the interstices, there she remained for a minute or so and then flew away. The grass was carefully examined, and amongst it, at a depth of nearly three inches, were found a number of her eggs. A regular succession of females then followed, and very soon three of them were engaged in laying their eggs in a small area which could have been covered with a crown piece; the first-comer being not in the least disturbed by a companion running completely over her body. In all cases the abdomen was depressed, and pushed into the material as far as possible, and in two instances the wings were partly extended, in order, apparently, to secure a firmer support. One female remained in the same spot for five minutes, and then changed her position to another a few inches away. A second female was occupied for twelve minutes in laying her eggs, but she did not change her position during the time. All three females flew away immediately afterwards, and did not seem in any way weakened by the process. For how long they survive in a state of nature it is impossible to say, but some females that were caught immediately after egg-laying died on the fourth or fifth succeeding days. Some females which were caught in glass tubes as they alighted on the grass laid their eggs immediately afterwards, and these also survived until the fourth and fifth days.

Reference has already been made to the almost noiseless flight of these flies when disporting themselves over and about their favourite haunts during the heat of the day. But I found that when the females were negotiating the habitat previous to laying their eggs the noise was distinctly audible, and resembled the characteristic hum produced by other muscids.

The day on which the foregoing observations were made was a delightfully bright and sunny one, and the hour from 3 to 3.45 in the afternoon; later, when the sun had lost its power, the flies disappeared, in their usual way, to find some sheltered spot in which to pass the night.

The eggs which were procured on this occasion were kept at a temperature varying between 64° and 67° F.; under these conditions the larvae did not begin to hatch until the *eighth day*, thus the incubation period was greatly prolonged; had they been left in the warm grass, where the temperature near the surface was 70° F., they would in all probability have hatched, as they did in the summer months, on the second or third day.

Whether the larvae of these autumn broods will pupate before the winter is at present impossible to say, but judging from the high temperature of the habitat, which will certainly be maintained for a fortnight at least, it is reasonable to assume that they will do so, and we shall probably find that the winter is passed chiefly in the pupal stage.* Any material disturbance of the habitat in question would result in complete loss of the artificial heat and a sudden check to the development of the larvae. In such a case the larvae would probably hibernate through the winter and pupate in the following spring or early summer. Fortunately this is not likely to obtain in this instance, as the owner has very kindly given me undisturbed possession of the whole of the material, so that it will, it is hoped, be possible to continue the observations through the winter and spring, though little of economic importance can now be added to the habits of the insect in this country.

Stomoxys sitiens, Rond.

Localities:—Nouvelle Anvers; Lulongo; Nyangwe; Kasongo.

Circumstances of capture:—Specimens were caught about cattle and in a European house. It feeds vigorously.

Stomoxys sitiens ?

A large series of specimens were caught on cattle at Zambie. They were preserved in alcohol and cannot therefore be definitely fixed.

* On Jan. 13th, both larvae and pupae were found in this habitat; the former were quite dormant, but became active in a warm temperature. Both stages occurred in the decayed grass about 6 inches below the surface.

Stomoxys omega, n. sp. (Newstead)

(Pl. iii, figs. 2, 3)

Wings dusky, strongly iridescent in a bright light. Thorax blackish, shining, anterior half in front of transverse suture pale greyish-blue, with a distinct Ω -shaped black design in the male; in the female the submedian black lines blend with the black colour in front of the suture so that the up-curved terminals of the Ω -shaped markings become indistinct. Abdomen, smoky-brown.

MALE.—*Head*: Eyes almost meeting, the narrow space between them, above, velvety black; frontal margins and clypeus silvery-white. Basal segment of antenna blackish; second segment brown; apical segment silvery-grey; arista brown; posterior surface of head velvety-black; lower angles silvery-white with black hair. *Proboscis* black, shining; labella with many, very long, fine outstanding hairs. *Thorax* in front of the median transverse suture grey-blue, with a large Ω -shaped black design, consisting of two distinct broad submedian longitudinal stripes which curve upwards before reaching the suture and form two conspicuous rounded dilations; thorax *below the transverse suture* black, shining, with a rather broad band of dusky grey-blue in front of the scutellum, which is continuous to the base of the wings; scutellum smoky-brown, shining; with one central and two lateral black bristles; the thorax is also clothed with fine blackish hairs, and there are three bilateral black bristles at the sides in front of the wings; pleurae in front delicate grey-blue, a small area at base of wing pale brown. *Abdomen* hairy; smoky-brown, the segments gradually darkening towards the apical margins, especially so at the sides; in perfect specimens there is a broad basal band on the second, third and fourth segments of faintly greenish-grey dust, each band is interrupted in the middle; the last segment almost entirely clothed with a paler grey dust; venter pale dusky-brown. *Legs* relatively long, smoky-brown, blackish in some lights; knees pale brown.

Length, exclusive of proboscis, 6 mm.; length of wing 7 mm.

FEMALE.—*Head* with the space between the eyes relatively narrow; vertex, blackish, shining; margins and clypeus pale bluish-grey, bright but scarcely silvery; posterior surface of the head similar to that in the male, but the sides below have a broader margin of blue-grey. Apical segment of *antenna* dusky-grey. *Thorax* in front

of the median transverse suture grey-blue, with two short, well-defined submedian black lines in front, these gradually merge into large and somewhat ill-defined black areas, leaving the blue-grey ground visible only at the sides and between the black longitudinal bands; thorax behind the suture as in the ♂; scutellum black, paler in the centre, shining; pleurae and legs as in the ♂. *Abdomen* similar to that in the male but *without the grey, dust-like margins*.

Length, exclusive of proboscis, 6 mm.; length of wing 6.50 mm.

Easily distinguished by the beautiful pale blue of the anterior half of the thorax, with, in the ♂, the distinct black Ω -shaped pattern.

The relatively narrow space between the eyes in both sexes is also noteworthy, these characters being much more pronounced than in the species of the *calcitrans* type.

Localities:—Ukungwa; Sendwe.

Circumstances of capture:—This fly was seen only near water. Some were caught in canoes, others on a buffalo shot in a marsh, on which they were feeding. When the buffalo was first seen it was lying half-covered in water, no doubt to avoid the *Stomoxys*, which were present in almost incredible numbers.

CUTANEOUS MYIASIS

? *Ochromyia anthropophaga* (E. Blanch.), in man.

We are greatly indebted to Dr. Grenade of Leopoldville for three specimens of a larva or "bot" closely resembling that of an oestrid fly, taken from a coloured patient in hospital at Leopoldville. Two of them occurred in the scalp, the other in the neck.

These larvae agree so well with the description given of *Ochromyia anthropophaga*, E. Blanch, that they possibly belong to this species or a closely related one.

Larva of a Muscid Fly in a Rat

The following description of a larva or maggot taken from the tail of a tame white rat at Kasongo, February 16th, 1905, may eventually lead to the identification of the insect; so far we have been unable to fix it.

Description.—Length 11 mm. Cylindrical, but slightly flattened; rather suddenly tapering in front, rounded behind but *not truncat*.

Segmentation very pronounced and regular above but convoluted ventrally; all the segments, with the exception of the antepenultimate which carries the anterior stigmata, almost covered with very short and rather blunt spines, the majority of which have dark brown or piceous tips; these spines are arranged in short straight transverse lines, each group consisting usually of from three to five spines, in some cases there are but two and in others more than five. The great mouth hooks are black; and there is a lateral palmate group of external teeth as in the larva of *Auchmeromyia luteola* (q.v.). Posterior stigmata on the last segment, subdorsally placed, and very close together.

Further details cannot be given, as it has been thought well to preserve the specimen intact.

Larvae of a Muscid Fly in a Mule

The mule illustrated in fig. 16 was brought to us at Kasongo. In the centre of a large and very conspicuous oedematous swelling on its abdomen was a deep-seated ulcer, some three inches in diameter. On inspection, the whole ulcer, below the level of the epidermis, was found to be so closely set with the larvae, described below, that it was impossible to see any part of its base.

The mouth parts of the larva were invariably directed inwards and the bodies of the parasites were so deeply buried in the tissues of the host that their posterior extremities were alone visible. It was found that there were two layers, one above the other, of larvae, packed side by side closely together. It seems probable that they were able to burrow in the tissues of their host, since a few larvae were found in the sloughing tissues at a depth of some five centimetres from the apparent surface of the ulcer. None of the larvae penetrated into the abdominal muscles. About 160 to 180 larvae were taken from this lesion, which healed quickly after a thorough curetting and dressing with iodoform. A description of the larva is herewith appended:—

Length 11 mm.; greatest width 2·25 mm.

Colour, in formol, dull pink, with the anterior segments paler; some examples were almost white. Form spindle-shaped, tapering from the mid region almost to a point in front, and slightly so posteriorly. Great mouth hooks prominent, unidentate, and black. Segmentation very pronounced, each with a strongly marked ridge forming

a complete ring round the body ; all the ridges furnished with short brownish-coloured spines, which to the naked eye appear as distinct equidistant rings ; anal segment somewhat truncate, but deeply wrinkled, and furnished dorsally with four very short papillae and ventrally with two much longer ones. Anal stigmata, brown or dark castaneous, almost touching ; irregularly ovate, with three transverse slits.

Attempts to raise the fly from these larvae were unsuccessful.



FIG. 16.—*Cutaneous myiasis*. Mule showing oedematous swelling on abdomen, containing larvae of a Muscid Fly.

FAMILY HIPPOBOSCIDÆ

Hippobosca equina, Linn.

(Figs. 17, 18)

A few examples of this species were found on cattle, shipped at Las Palmas, Canary Islands, while on board ship on their way to the

Congo Free State (September 15th, 1903). This is an important record, and furnishes a further proof of the ready means by which these parasites may be introduced into a new and uninfected region.

Flies of this genus were also caught on camels and cattle at St. Louis, Senegal, May, 1903; their freshly deposited larvae were marked with very delicate tracings. Unfortunately the specimens and drawings were lost while in the hands of the Authorities of the British Museum and cannot now be traced.

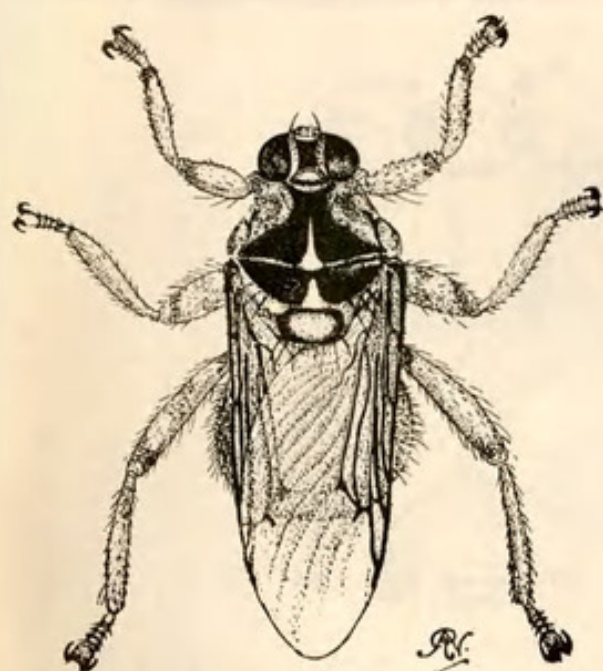


FIG. 17.—*Hippobosca equina*, ♀. × 6.



FIG. 18.—*Hippobosca equina*
Puparium about twelve
hours after extrusion.
At this stage the anal
tubercles are black; the
rest of the integument
terra-cotta red. × 6.

*Lipoptena** *paradoxa*, n. sp. (Newstead).

(Figs. 19, 20)

FEMALE.—Specimens preserved in Canada balsam and alcohol are bright red-brown inclining to orange-brown at the sides of the abdomen; claws black; base of abdomen with a bilateral patch of darker chitin, the median area of the remaining segments also with darker markings, but these are both irregular and inconstant in the preserved examples. *Head* as wide as the anterior part of the

* *Lipoptera* of Siebold and Loew.

thorax; ocelli absent. Mouth parts rudimentary. Outer margin of eyes with a double series of spinose hairs. *Thorax* narrower in front than behind, with a submedian series of about nine long spinose hairs forming a curved line, and a short submarginal series of usually four similar ones terminating opposite the insertion of the mid legs; posterior margins with four long spinose hairs on either side of the scutellum; the last-named organ is also furnished with four similar hairs. *Abdomen* short ovate almost sub-circular, with numerous spinose hairs arranged as shown

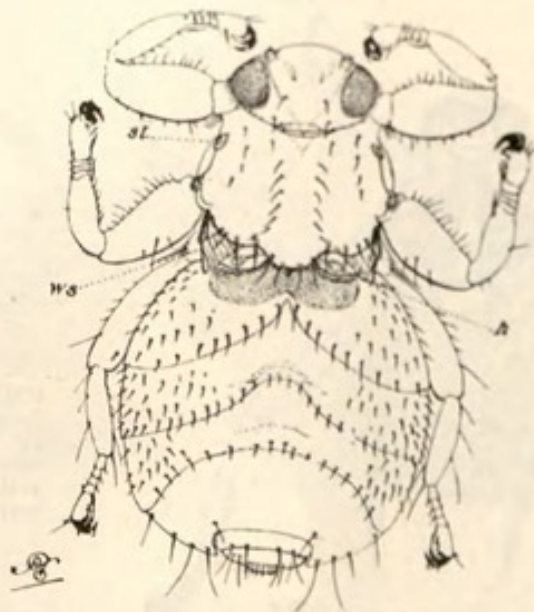


FIG. 19.—*Lipoptena paradoxa*, ♀ × 15. *st.* stigmata; *ws.* wing stumps; *h.* halteres.

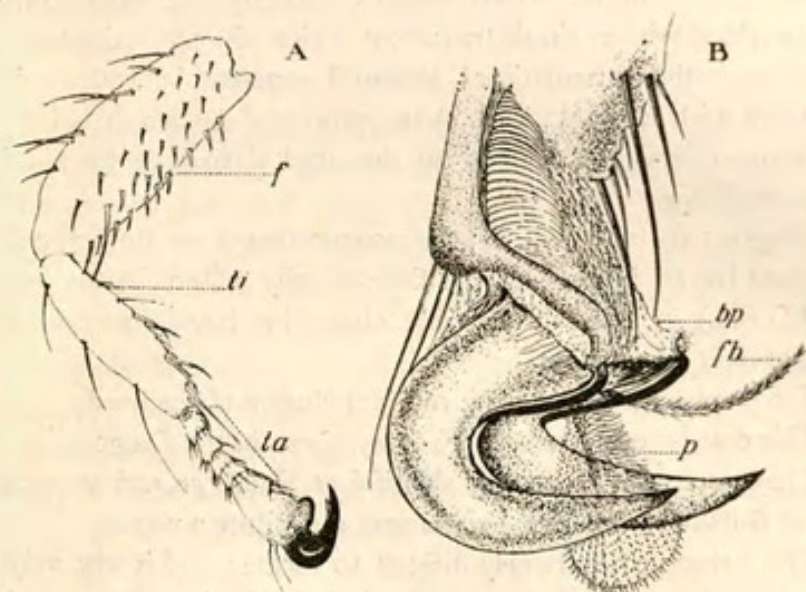
in the figure. Venter with numerous short spinose hairs; median convex area with numerous minute equidistant tubercles bearing slender spinose hairs, the spaces between the tubercles finely but strongly rugose. *Legs* short, stout, sparsely clothed with hairs of varying lengths and varying degrees of thickness; the posterior pair not extending beyond the tip of the abdomen; tibial spine to anterior and mid legs stout; tibial spine to posterior legs long, slender; pulvillus broadly dilated from the middle outwards, finely spinose; feather-bristle strongly spinose; the upper surface with only one series of spines, the inner with two or three; ungues very faintly and irregularly toothed on the inner margin.

Length 4 mm.; width of abdomen 2 mm.

Habitat: Taken from an antelope at Kasongo, January 28th, 1905.

All four specimens are females. The same host also harboured a number of ticks. (q.v.)

The absence of ocelli in the female is rather remarkable. There is also an almost entire absence of *external mouth* parts, including the labial sheath; the only indication of these organs being a minute truncated cone, the exact nature of which could not be determined in the limited supply of material.



R.N. del.

FIG. 20.—*Lipoptena paradoxa*, ♀. A. $\times 35$; f. femur; ti. tibia; ta. tarsus.
B. claws $\times 140$; bp. basal process; fb. feather bristle; p. pulvillus.

FAMILY PULICIDÆ

Dermatophilus (Sarcopsylla) penetrans, Linn.

(Pl. vi, figs. 1, 2)

Larva long, cylindrical, of fourteen almost equal segments. Head slightly longer than the second segment, narrowest in front, but rather widely rounded. Antennae short, apparently of three segments, the basal and apical segments very short; apex with a central long slender spine and two to three minute ones. Surrounding the base of the antenna ventrally is a semicircular group of blunt spines, the two

nearest the base of the antenna much the largest. Mandibles large, slightly curved, unidentate. Cuticle below the buccal cavity with a curved row of short, stout, and backwardly curved spines; on either side of this series of spines are two divergent subcutaneous sclerites the ventral one extending almost to the articulation of the head with the thorax; the upper sclerite about half the length of the ventral one; both are narrow and rod-like; the base of the ventral sclerite is also much dilated, and at the point where it meets the upper one it is unequally bifurcated and spine-like. Cuticle of all the segments presenting a strongly marked scale-like appearance; each segment is also provided with a single transverse series of long equidistant hairs, placed near the articulations; terminal segment bilobed, each lobe furnished with a single short stout spine and numerous hairs, these lobes are somewhat analogous to the anal claspers in certain Lepidopterous larvae.

Length 1.50 to 2 mm. These measurements are from apparently immature larvae, but seeing that the sexually mature insects are very small (1 mm.), it is highly probable that the larva does not attain much greater dimensions.

The number of segments given is inclusive of the head.

This pest is found practically everywhere in the Congo.

They were seen to be very plentiful at Nyangwe, and we were told that at Rutshuru and Beni they almost constitute a plague.

The larvae are extremely difficult to locate; and it was only after a prolonged search that we succeeded in finding three specimens. They occurred among the dust from the floor of a native hut which was literally swarming with chiggoes.

FAMILY PEDICULIDÆ

Pediculus capitis, De Geer.

This louse was only noted on cases of human trypanosomiasis at Leopoldville and Kasongo. Their distribution is most probably much wider.

Pediculus vestimenti, Leach.

These vermin were only noticed at Boma and Leopoldville; their distribution is very probably much wider.

ORDER HEMIPTERA

FAMILY CIMICIDÆ

Cimex lectularius (Common Bed-bug)

Localities:—Banana (Dr. Etienne); Tshumbiri (Rev. Billington); Nouvelle Anvers (Dr. Müller); Tshofa; Kabinda; Lusambo.

Circumstances of capture:—Specimens were taken from the crevices in the cane beds and grass-cloth pillows of natives.

ORDER HYMENOPTERA

Melipona, sp.

One or more species referable to this genus were seen in several places in the Congo Free State. They were particularly numerous at Leopoldville and Dibwe. They caused intense annoyance by the persistent manner in which they swarmed about one and crawled into one's mouth, eyes, nose and ears. When crushed they emitted a peculiar and characteristic odour.

At Leopoldville a colony of these stingless bees had taken up their quarters in a large lock and rendered it quite useless by the great accumulation of wax which they had formed. In this instance it was interesting to note a waxen tubular opening, about 4 c.m. in length and about the thickness of a pencil, projecting from the keyhole. A species of *Melipona* has been noticed to have very similar habits in the Soudan.*

INSECTS OF NON-ECONOMIC IMPORTANCE

In addition to the insects dealt with in the foregoing chapters of this Report, a large number of insects, representative of various orders, were also collected; but as they are of no economic importance it has been thought desirable to deal with these elsewhere. We would add, however, that among the more remarkable species is a new *Dejeania* which was discovered among the *Glossinae* in the fly cages at Kasongo. It had evidently been caught by one of the boys in mistake for an engorged tsetse, which it very closely resembles. We also obtained several specimens of a rather remarkable species of

* 2nd Report Wellcome Research Laboratory, Department of Education, Soudan Government, 1906, page 89.

Notocanthis of a uniformly blackish colour, with numerous white spots on the wings. These flies were only observed in one locality in the bush about a native village situated on high, dry, sandy soil, near Lisala (July, 1904). We possess no particulars concerning its habits. Whilst at Boma (Oct. 27, 1904) we also found a number of larvae or "rat-tailed maggots" apparently belonging to the genus *Eristalis*.

ORDER ACARINA

FAMILY HYDRACHNIDÆ

Ectoparasites of Mosquitoes

The larvae of four distinct species of *Acari* belonging to this family were observed on several species of mosquito. The site preferred by these ectoparasites was invariably the dorsal area of the abdomen, and generally, on the first few segments. Most of them, though not all, were fixed to the articulations of the segments, to which they seem firmly attached. The mosquitoes most subject to the attacks of these acarids were the following:—

Myzorrhynchus paludis.—About 30 per cent. of these mosquitoes had the parasites attached to them. In one case as many as five were found clustered together on the articulation of a single segment. The species met with on this host (when dry) is of a bright ochreous colour with a dull orange scutum and rather large black eye-spots. The localities were Kumba, Kasonga and Lusambo.

Mansonia africana.—A large percentage of these insects also carried parasites, of which there were three well-marked species: one of a uniformly orange-red colour and another of a creamy-white or pale ochreous. In life some of these acarids were pink or yellow. Localities: Leopoldville, Tshumbiri, Kasongo and Lusambo.

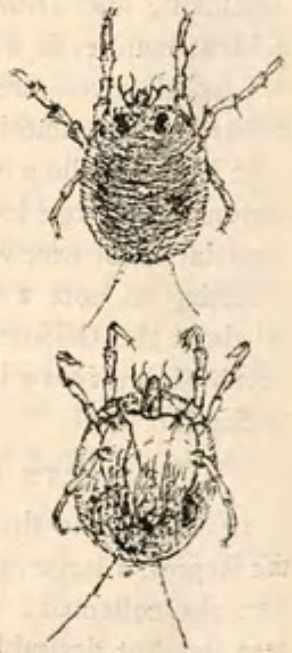


FIG 21.—*Ectoparasites of Mosquitoes*. $\times 20$, about. From a sketch by the late Dr. J. E. Dutton.

FAMILY SARCOPTIDÆ

A case of Symbiotic mange occurred on a rabbit which was imported from Europe for experimental purposes. The condition was severe and the external ear was entirely filled with the parasites and the very profuse epithelial desquamation they had excited. On macerating the dead specimens in potash, one finds that they are a species of *Symbiotes* (now referred to the genus *Chorioptes*) and agree best with the descriptions given of *Symbiotes communis* var. *cuniculi*.

FAMILY DERMANYSSIDÆ

Pneumonyssus duttoni, Newstead and Todd

Memoir xviii, Liverpool Sch. Trop. Med. p. 4 (with plate), 1905.

Since the publication (l.c.) of the description of the adult mite Dr. J. W. B. Hanington has been successful in discovering the earlier stages of this acarid, and a description of them is appended below:—

Ovum.—Rather narrowly ovoid; faintly yellowish-white and, as seen by transmitted light, rather granular in appearance.

Length .32 mm.

Hexapod larva.—Short ovate, narrowed in front, widely rounded behind. Capitulum prominent. *Palpi* of five segments furnished with short slender hairs with the exception of the apical one, which has several long stiff hairs; basal segment broadest, but scarcely longer than the apical one; second, third and fourth shortest and nearly equal in length; formula (1, 5) (234); tip of the apical segment reaching to the middle of the third segment of the anterior legs. *Legs* directed forwards; all the segments with whorls of hairs near the articulations, those on the basal segments are mostly short and slender, while those on the remaining segments are long and stiff; tarsi longer than the two preceding segments; all with very long hairs, and a few short slender spines; claws simple, placed on a long pedicel which is much narrower at the articulation; pulvillus scarcely wider than the dilated claws, but the end extends beyond them.

Length .50 mm.; width .30 mm.

FAMILY TROMBIDIDÆ

The larvae of an acarid belonging to the genus *Trombidium* were found in considerable numbers attached to the naked skin on the muzzles of horses at Kasongo. They appeared to the unaided eye as minute crimson specks, and were evidently the cause of an intense eruption. The skin was pink, rough, and dotted here and there with tiny spots of dried blood; still attached to the skin or on slightly raised hairs were numerous profuse crusts of desquamated epithelium and dried serum. Although a careful search was made the parasites were not found elsewhere on these animals nor on any other host in that locality.

The larval forms of these acarids are well known for the intense itching and soreness which they cause by burrowing under the skin of man and other animals. It is generally an unnatural position for the mites, and as a rule they soon die; though one species which is often found on the ears of cats in this country (Great Britain) lives for many days, causing great annoyance to the infected animals.

The adult mite is not parasitic but predaceous, living on small insects and their ova. The only adult form collected in the Congo (Leopoldville, Oct.) was *Trombidium grandidissimum*, a large spider-like creature completely covered with a brilliant crimson pubescence which is so dense as to appear quite velvety in texture.

FAMILY IXODIDÆ*

The fourteen species of ticks here catalogued include two that are new and undescribed.

The only member of the Argasidae which we met with was *Ornithodoros moubata*; this important species has already been described and figured in the Report on the nature of Human Tick fever.† We therefore only add here a few additional notes on its bionomics.

A few hundreds of these ticks were brought to Liverpool in September, 1905; they have since been kept in an incubator at a temperature of between 19° and 22° C., where they have reproduced freely, but under these conditions the eggs take two or three days

* This collection was very kindly identified by Prof. G. Neumann.

† Liverpool School of Tropical Medicine Memoir XVII (Plates and map).

longer to hatch-out than was noted in the Congo. Many of the original ticks are still alive; they have of course been well and frequently fed. One female raised in the laboratory from an egg has now been under observation for 25 months; during this period she has moulted six times. This seems to be rather less often than is usual, since ten out of fourteen ticks raised from the eggs moulted six to nine times during the year. Not infrequently ticks do not seem to be able to shed their old skin, and die while moulting. As a rule the ticks would not feed properly more often than every seven to ten days. Ticks remained alive on several occasions without food for four months, and in one instance for over six months. Adult ticks caught before April, 1905, or their progeny, which have never been fed upon an infected animal, are still (November 22, 1906) able to infect susceptible animals by their bites.

Amblyomma hebraeum (Koch), var. *splendidum*, Gieb.

Forty-three males and eight females were taken from a Buffalo (*Bos nanus*) which was shot in a marsh near Tshumbiri. In life the ground colour of this beautiful tick is of a soft green, with brownish ornamentation; there is little or none of the iridescence so conspicuous in specimens preserved in alcohol.

Amblyomma variegatum, Fab.

On cattle, Kasongo (Feb.). Associated with *Hyalomma aegyptium*, *Rhipicephalus sanguineus* and *Margaropus annulatus*.

Amblyomma variegatum?, Fab.

A single male was caught on a bovine at Kasongo (Feb.).

Hyalomma aegyptium, L.

Three females were caught on cattle at Kasongo (Feb.). They were associated with the preceding species.

Haemaphysalis leachi, And.

This tick is the recognised carrier of Malignant Jaundice (*Piroplasma canis*) in dogs.

Thirteen males and two females were taken from a leopard at Tshumbiri by the Rev. Billington (June); and Dr. Etienne sent a single specimen (host not mentioned) from Banana (Oct.).

Margaropus annulatus, Say.

Common on cattle at Kasongo (Feb.), Zambie and Coquilhatville. The specimens collected were all females.

Margaropus annulatus, var. *calcaratus*, Bir.

In all the active stages, on cattle at Coquilhatville.

Rhipicephalus bursa, Can. and Fanz.

Collected by the Chef de Poste on cattle at Nya Lukemba to the North of Lake Tanganyika. A single female was also caught on a bovine at Kasongo.

This species is the carrier of Carceag or Malignant Jaundice in sheep.

Rhipicephalus capensis, Koch

Eight females and four males were taken on cattle at Nyangwe.

Rhipicephalus nitens, Neumann

Locality:—One male and three females were taken from an antelope (*Tragelaphus scriptus*) shot at Kasongo (Feb.).

Rhipicephalus simus, Koch

This is said to be one of the carriers of *Piroplasma parvum*, Theiler. Two males and one female taken at Kasongo (Feb.); and three males at Banana (Oct., Dr. Etienne). The name of the host was not obtained in either case.

Rhipicephalus sanguineus, Latr.

Locality:—At Banana (Oct.), collected by Dr. Etienne, host not named; at Kasongo, common on cattle; occurs in association with preceding species and *R. longus*.

In addition to the above, two species of Ixodidae new to science were also discovered. These are described by Prof. Neumann in the succeeding paper.

ERRATA.

Plate iv. For Tabanide read Tabanidae.
Map ii. Delete "(see pages)."

EXPLANATION OF PLATE

MIMASIA ALBERTA (Page 103)

- Fig. 1. Head of female showing the character and distribution of the scales. $\times 25$ above.
- Fig. 2. Head of male showing the character and distribution of the scales. $\times 25$.
- Fig. 3. Head of male showing the character and distribution of the scales. $\times 25$.

MIMASIA ALBERTA (Page 103)

- Fig. 4. Head of female showing the character and distribution of the scales. $\times 25$ above.

MIMASIA ALBERTA (Page 103)

- Fig. 5. Head of female showing the character and distribution of the scales. $\times 25$ above.
- Fig. 6. Head of female showing the character and distribution of the scales. $\times 25$ above.

MIMASIA ALBERTA (Page 103)

- Fig. 7. Head of male showing the character and distribution of the scales. $\times 25$ above.
- Fig. 8. Head of male showing the character and distribution of the scales. $\times 25$ above.
- Fig. 9. Head of male showing the character and distribution of the scales. $\times 25$ above.

MIMASIA ALBERTA (Page 103)

- Fig. 10. Head of male showing the character and distribution of the scales. $\times 25$ above.

MIMASIA ALBERTA (Page 103)

- Fig. 11. Head of male showing the character and distribution of the scales. $\times 25$ above.

All the figures are reproduced the same size as the original drawings from which they are taken.

EXPLANATION OF PLATE I.

MIMOMYIA MALFEYTI. (Page 29.)

- Fig. 1.—Head of female showing the character and distribution of the scales. $\times 25$, about.
 Fig. 2.—Tibial spines of male. $\times 75$.
 Fig. 3.—Genital armature of male (left half). $\times 75$.

MIMOMYIA AFRICANA. (Page 28.)

- Fig. 4.—Head of female showing the character and distribution of the scales. $\times 25$ about.

ANISOCHOLEOMYIA QUADRIMACULATA. (Page 32.)

- Fig. 5.—Head of female showing the character and distribution of the scales. $\times 25$, about.
 Fig. 6.—Proboscis of the female. Enlarged.

NEOMELANICONION PALPALE. (Page 31.)

- Fig. 7.—Head of male showing the character and distribution of the scales. $\times 25$, about.
 Fig. 8.—A few segments of the antennae of the male. Enlarged.
 Fig. 9.—Male palpus. Enlarged.

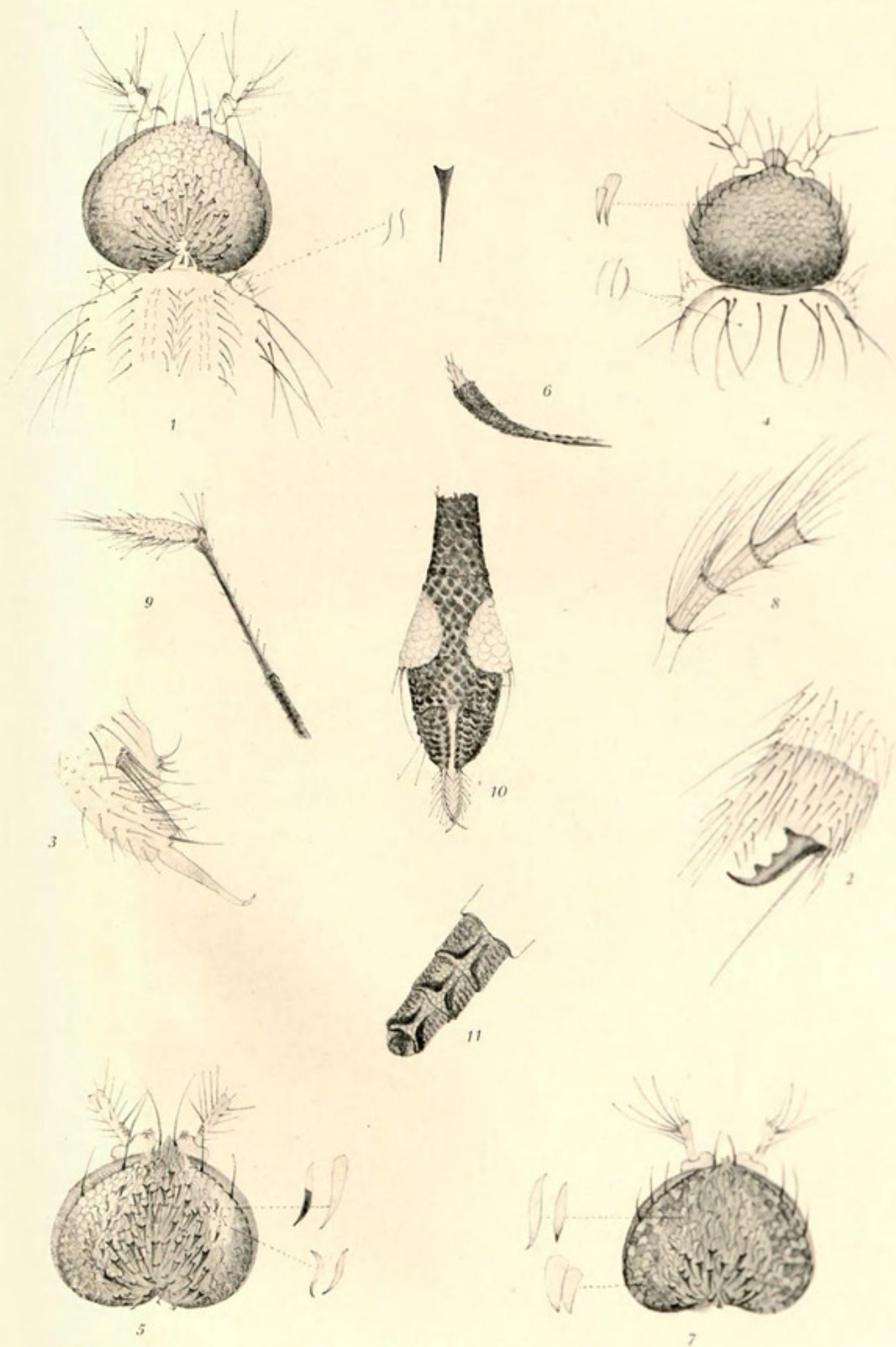
ERETMAPODITES INORNATUS. (Page 12.)

- Fig. 10.—Terminal segments of male abdomen. Enlarged.

CULEX PAR. (Page 25.)

- Fig. 11.—End of Abdomen of female (ventral). Enlarged.

All the figures are reproduced the same size as the original drawings from which they are taken.



EXPLANATION OF PLATE II.

BOYCIA MIMOMYIAFORMIS. (Page 34.)

- Fig. 1.—Head of female showing the character and distribution of the scales. $\times 25$ about.
 Fig. 2.—Head of male showing the characters and distribution of the scales. $\times 25$, about.
 Fig. 3.—Palpus of male. Enlarged.

STEGOMYIA ALBOMARGINATA. (Page 16.)

- Fig. 4.—Head of female showing the character and distribution of the scales. $\times 25$, about.

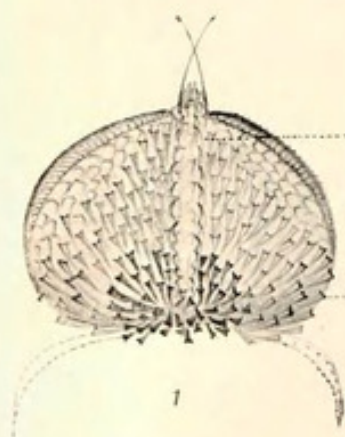
STEGOMYIA LUTEOCEPHALA. (Page 15.)

- Fig. 5.—Head of female showing the character and distribution of the scales. $\times 25$, about.

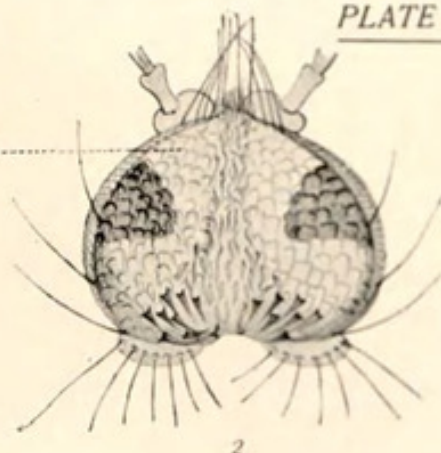
DUTTONIA TARSALIS. (Page 18.)

- Fig. 6.—Anterior tarsus of male. $\times 75$.
 Fig. 7.—Palpus of male. Enlarged.
 Fig. 8.—Genital armature of male. $\times 25$.

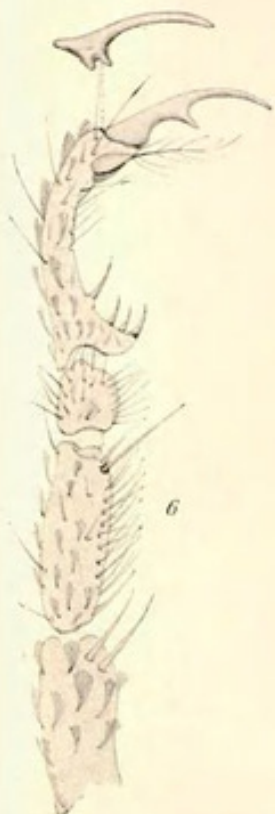
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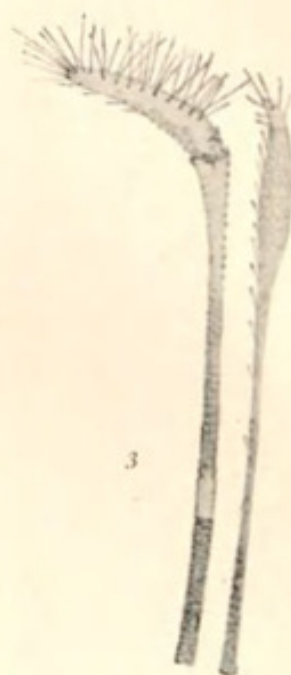
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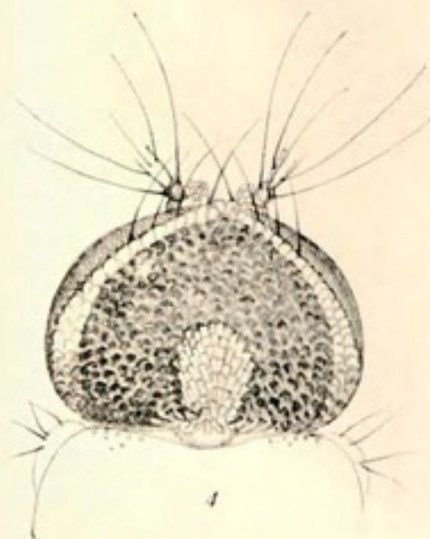
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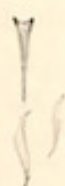
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EXPLANATION OF PLATE III.

TABANUS BILLINGTONI. (Page 46.)

Fig. 1.—Female with wings displayed. $\times 2\frac{1}{2}$.

STOMOXYS OMEGA. (Page 87.)

Fig. 2.—Female with wings displayed. $\times 4$

Fig. 3.—Male with the wings omitted. $\times 4$

STOMOXYS CALCITRANS. (Page 75.)

Fig. 4.—Female with wings omitted. $\times 4$

(In cutting away the background, the block-maker has inadvertently removed a portion from the left side of the abdomen.—R.N.)

GLOSSINA MACULATA. (Page 73.)

Fig. 5.—Female with the wings displayed. $\times 4$

Fig. 6.—Female with the wings at rest (profile). $\times 4$

GLOSSINA PALPALIS. (Page 57.)

Fig. 7.—Female in the act of parturition. $\times 4$

Fig. 8.—Puparium before the escape of the imago. $\times 4$

Fig. 9.—Puparium after the escape of the imago. $\times 4$

All the figures are reproduced the same size as the original drawings from which they are taken.



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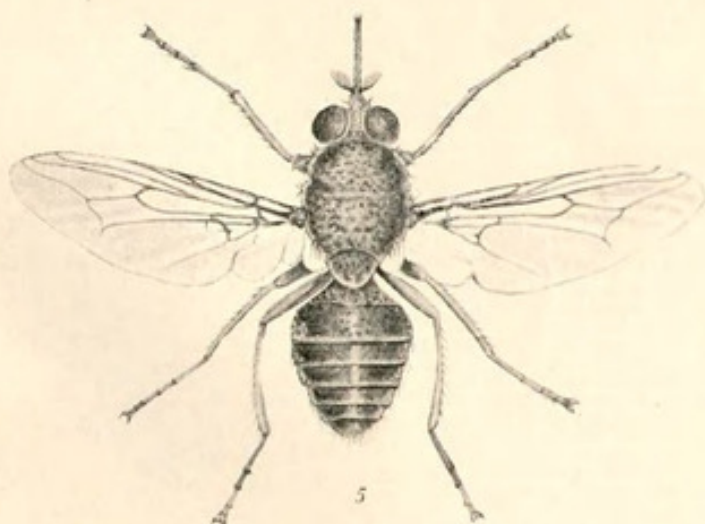
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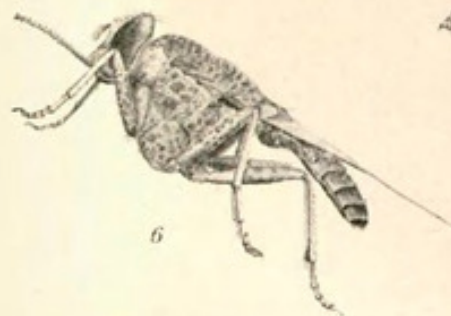
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EXPLANATION OF PLATE IV.

Fig. 1. CHRYSOPUS GIBBOSUS (Page 43)

Fig. 2. TABANUS BELLINGTONI (Page 44)

Fig. 3. TABANUS BELLINGTONI (Page 44)

Fig. 4. TABANUS BELLINGTONI (Page 44)

Fig. 5. TABANUS BELLINGTONI (Page 44)

Fig. 6. TABANUS BELLINGTONI (Page 44)

Fig. 7. TABANUS BELLINGTONI (Page 44)

Fig. 8. TABANUS BELLINGTONI (Page 44)

Fig. 9. TABANUS BELLINGTONI (Page 44)

Fig. 10. TABANUS BELLINGTONI (Page 44)

Fig. 11. TABANUS BELLINGTONI (Page 44)

Fig. 12. TABANUS BELLINGTONI (Wing, dorsal) (Page 44)

Fig. 13. TABANUS BELLINGTONI (Page 44)

Fig. 14. TABANUS BELLINGTONI (Page 44)

Fig. 15. TABANUS BELLINGTONI (Page 44)

All the figures are the actual size of the original photographs.



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AFRICAN TABANIDE.

EXPLANATION OF PLATE V.

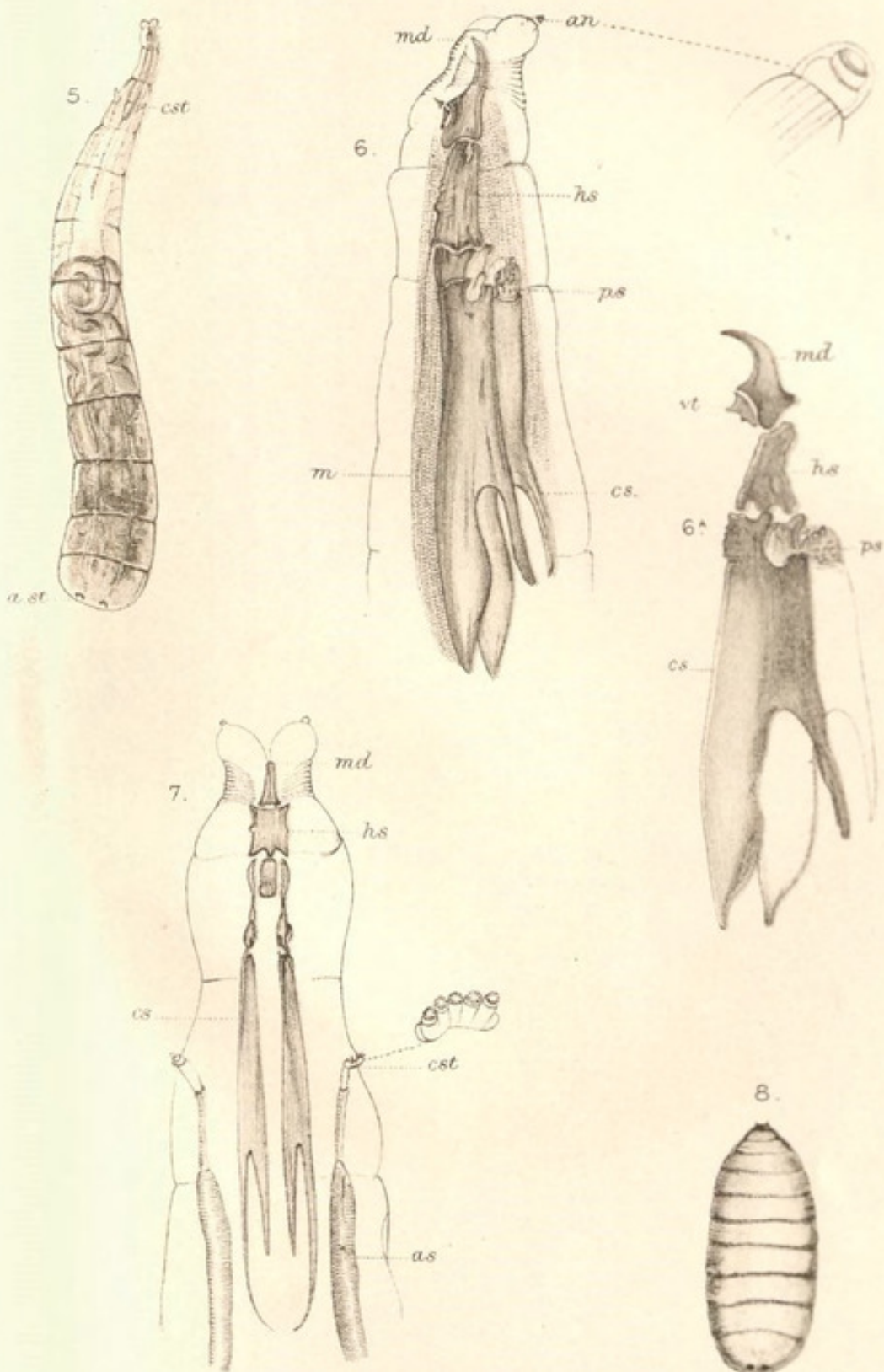
Illustrating Mr. Newstead's paper on "The Life-history of *Stomoxys calcitrans*, Linn." p. 75.

- Fig. 1.—Eggs twice natural size.
- Fig. 2.—View of the curved side of the egg. $\times 65$.
- Fig. 3.—Egg in semi-profile showing the deep spatulate groove. $\times 65$.
- Fig. 4.—Empty egg as seen in profile, with the semi-detached capsule at the anterior end. $\times 65$.
- Fig. 5.—Dorsal view of larva showing the intestinal tract and course of the main tracheae. $\times 7$.
- Fig. 6.—Three terminal segments of the larva in profile, with the internal mouth armature: *an*, antennae; *m*, muscles; *ps*, perforated sclerite; *md*, mandible or great hook; *hs*, hypostomal sclerite; *cs*, cephalo-pharyngeal sclerites; *vt*, ventral tooth. $\times 60$.
- Fig. 6A.—Chitinised mouth armature dissected out. Reference letters as in the preceding fig. $\times 60$.
- Fig. 7.—Three terminal segments of larva, dorsal: *cst*, compound thoracic stigmen; *as*, trachea forming internal air sac. Other reference letters as in fig. 6. $\times 60$.
- Fig. 8.—Puparium or pupa. $\times 7$.



R. Newstead, del. ad. nat.

STOMOXYS



Huth, Lith^r London.

EXPLANATION OF PLATE VI.

DERMATOPHILUS (SARCOPSYLLA) PENETRANS (Chigger Flea)
(Page 93.)

Fig. 1.—Plantar surface of human foot with chiggers *in situ*. Actual size.

(aa) Group of eleven females.

(bbbb) Isolated females.

(cc) Pits or cavities left after the removal of the females.

(d) Section of epidermis with two females *in situ*. (Lateral view.)

Fig. 2.—

(a) Larva showing the squamose character of the epidermis. $\times 60$.

(b) Outline of a younger larva. $\times 60$.

(c) Antenna of larva with its accompanying group of blunt spines. $\times 250$.

(d) Mandibles of larva. $\times 250$.

(e) ? Cephalo-pharyngeal plate of larva. $\times 250$.

(f) Buccal spines of larva. $\times 250$.

(g) Empty cuticles of ova. $\times 60$.



Fig. 1. Human Foot with "Chiggers" in situ.

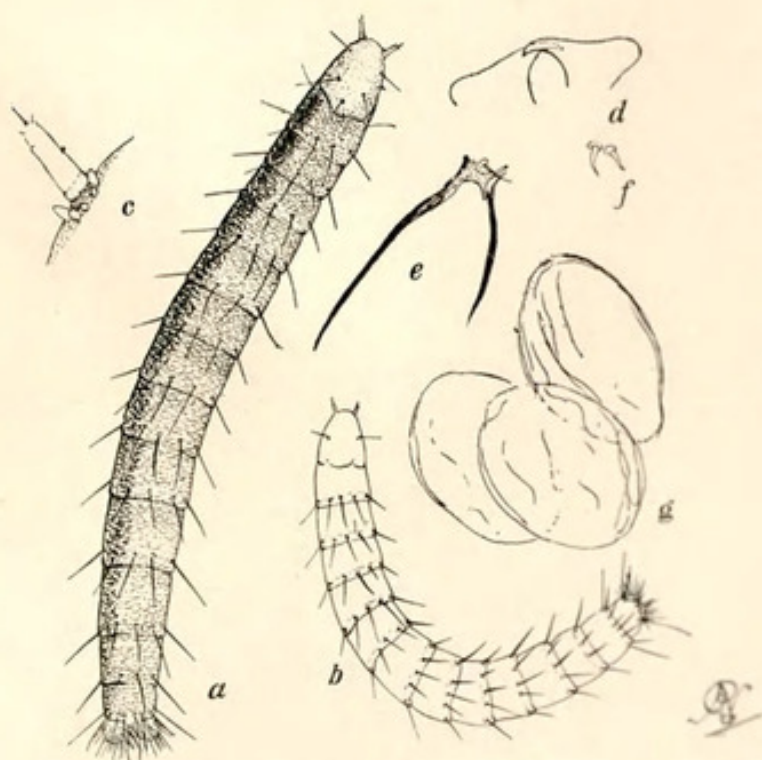


Fig. 2. *Dermatophilus (Sarcopsylla) penetrans*.
Details of Larva, etc.



Newstead, Robert et al. 1907. "Insects And Other Arthropoda Collected In The Congo Free State." *Annals of tropical medicine and parasitology* 1(1-5), 3-113.
<https://doi.org/10.1080/00034983.1907.11719252>.

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