WEST AFRICAN CERATOPOGONINAE

BY

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AND

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PLATE XXI

This paper is a continuation of the series of papers on the Ceratopogonine Midges of the Gold Coast already published in the *Annals of Tropical Medicine and Parasitology*, and contains descriptions of additional new species. To some extent it is also supplementary, since we are now able to fill in a number of gaps in previous descriptions; for example, particulars are given of the early stages and of the natural habitat of several of the species of *Culicoides* and *Dasyhelea*, facts which are of interest, because they point the way to means of control. It differs from the former papers, however, in that a few species are described which were collected, not in the Gold Coast, but in other parts of British West Africa.

Many of the species belong to genera which were not considered in the previous series; but the number of species referable to each genus is small and insufficient to warrant the inclusion of detailed generic descriptions. For the same reason, keys to the species found in West Africa are not at present necessary. We have found it difficult in some cases to appraise at their proper value the characters employed by Kieffer in separating his smaller genera, and, where we have found only slight divergencies to occur, we have been in doubt whether it would be advisable, as would appear to be strictly necessary, to erect new genera. We regret that in dealing with these species we have not had the advantage of collaboration with Mr. Carter, whose recent appointment as Malariologist in Ceylon has unfortunately made it impossible for us to look to him for the assistance he was ever so ready to give.

Some apology must be made for the figures which compare so unfavourably with those in the previous papers. In the present

paper they are mere outlines traced with the aid of a camera lucida. In figuring the hypopygium of the male we have not often attempted to show it as a whole, but for the sake of clearness and in consideration of our technical shortcomings, have drawn the various organs more or less separated, showing them, unless otherwise indicated, as they appear when seen in a ventral view.

Since our earlier notes on the bionomics of these insects were published (1920) we have located another abundant source of Ceratopogonine midges, namely, the water lettuce *Pistia stratiotes*. This weed, which is exceedingly abundant in rivers, swamps, pools and lagoons in West Africa, and frequently covers large expanses of water, has for many years been recognised as a troublesome mosquito nursery and one very difficult to deal with, not only on account of the association with it of *Mansonioides africanus* but also because it provides protection between its leaves to the larvae of several species of *Anopheles* (*e.g.*, *A. costalis*, *A. mauritianus*, *A. nili*). The very small number of observations which we have made hitherto prove beyond doubt that it is also a fruitful source of midges, for we have reared from it *Culicoides austeni*, *C. distinctipennis*, *Dasyhelea inconspicuosa*, *Prionognathus pseudomaculipennis*, and the species described in the following pages under the names *Kempia ochrosoma*, *Eukraiohelea africana*, *E. versicolor*, *Probezzia pistiae* and *P. stephensi*. Large numbers of *Kempia ochrosoma*, *Eukraiohelea africana* and *Probezzia pistiae* were procured from this source, so that it appears that these species, at any rate, are peculiarly associated with the plant.

The types and co-types of the new species described have been deposited in the museum of the Liverpool School of Tropical Medicine.

Genus *CULICOIDES*, Latr.

Culicoides austeni, Carter, Ingram and Macfie.

Five larvae of this species were found together with numerous larvae of *Ochlerotatus irritans* in a sample of water from a crab-hole. Three of the larvae were reared to the adult stage, the other two were killed and preserved. The larval and pupal pelts of the

specimens reared through to the adult stage were recovered. The following descriptions of the pupa and larva are based on these materials.

PUPA. Length about 2·7 mm. *Respiratory trumpets* short and straight, tapering slightly towards the apex, raised on long stalks; rather strongly chitinised, middle third covered with large squamose spines; length of the trumpet about 0·15 mm., length of the stalk about 0·05 mm. There are no knob-like processes, but the main tracheal trunk gives off in its distal third a continuous row of about nine short blunt processes. *Cephalo-thorax*: anterior marginal tubercle double, highly chitinised, the inner portion large, conical, and bearing a long strong bristle, the outer portion small, unarmed; anterior dorsal very large, highly chitinised, irregularly conical, bearing two stout bristles; dorso-lateral smaller, bearing a long and a short hair; ventro-lateral an irregularly shaped tubercle bearing a long and a short hair and an apparently unarmed socket; ventro-median represented by a moderately long and a very minute hair. External to the ventro-median tubercle and a little posterior to the ventro-lateral is a small, unarmed, nipple-like tubercle which projects prominently outwards. Dorsal tubercles small: anterior single, bearing a minute blunt spine; posterior and lateral each bearing a hair. Immediately in front of, and slightly external to, the the anterior tubercle is a small tubercle which is apparently unarmed; immediately behind, and slightly internal to the posterior, is a small tubercle bearing a very minute spine. Postero-dorsal tubercle small, bearing a hair, and behind it two unarmed sockets. *Abdomen* of the usual form. Anal segment terminating in two sharply pointed, divergent processes which are very highly chitinised, especially at their tips. Tubercles on the abdominal segments small, strongly chitinised; arrangement and armature as in *C. accraensis*.

LARVA. Length about 5·7 mm., greatest breadth about 0·3 mm. *Head*: length about 0·2 mm., greatest breadth about 0·14 mm. Eyes large, bilobed. Bristles small, apparently arranged as in *C. accraensis*. Mental plate with a large, pointed central tooth. Hypopharyngeal sclerite moderately chitinised, bearing on each side usually eleven pointed, finger-like processes which are nearly equal in size, excepting the fifth from the inner margin, which is slightly larger than the others. Mandibles well chitinised, pointed, with a

well-developed central tooth. *Body*: hairs minute, terminal hairs on the anal segment small; anal gills of the usual form.

GOLD COAST: Accra, April, 1921, reared from mud from pools and puddles near the station for the Weshiang Line (Pl. XXI, fig. 2); June, 1921, larvae found in water from a crab-hole. Christiansborg, July, 1921, reared from plants of the water weed *Pistia stratiotes*. Oblogo, June, 1921, reared from banana fibre.

Culicoides distinctipennis, Aust.

Although numerous specimens of this species have been collected at Accra, it is only recently that we have reared it from the early stages. In the samples from which it was reared were also the early stages of several other species of *Culicoides*, and we were unable to identify with certainty the larvae. The pupa was, however, obtained, and is briefly described here.

PUPA. Description based on a single pelt from which a male had emerged. Length 1·7 mm. *Respiratory trumpets*, raised on moderately long stalks; length of the trumpet about 0·2 mm., length of the stalk about 0·04 mm. Distal extremity somewhat darkened, middle portion covered with squamose spines, proximal two-thirds bearing three small knob-like processes. Main tracheal trunk terminating distally in a fan-like arrangement of seven short, blunt processes. *Cephalo-thorax* dark, operculum rather sparsely clothed with large, dark, squamose spines. Anterior marginal tubercle small, bearing a rather short, stout spine; anterior dorsal bearing a short, stout spine and a minute spine; dorso-lateral, small, bearing a hair and a short spine; ventro-lateral, small, bearing two hairs, one of which is quite short and spine-like; ventro-median represented by a moderately long and a very small hair. Dorsal tubercles: anterior double, the two halves separated, the one situated anterior and slightly external to the other, each bearing a short, stout, dark-coloured spine; posterior, small and flat, bearing a minute spine; lateral, small, bearing a hair. Posterior to the lateral of the dorsal tubercles is an unarmed socket, and on the dorsum are several ill-defined darkened patches resembling flat, unarmed tubercles. Postero-dorsal tubercle small, bearing a hair and an unarmed socket. *Abdomen* of the usual form. Anal segment terminating

in two sharply pointed, somewhat divergent, dark-tipped processes which are not closely covered by squamose spines. Dorsal, ventro-lateral, and ventral tubercles as in *C. accraensis*.

GOLD COAST: Accra, February to April, 1921; numerous specimens reared from moist soil and mud taken from the margins of pools and puddles near to the railway station on the Weshiang Line (Plate XXI, fig. 2). Oblogo, March, 1921; reared from plants of *Pistia stratiotes* taken from the river Densu (Plate XXI, fig. 1).

Culicoides eriodendroni, C., I. and M.

In a previous paper a description was given of the female of this species. We are now in a position to add certain points in regard to the male.

MEASUREMENTS (average of two).

Length of body*	1·3 mm.
Length of wing	1·0 mm.
Greatest breadth of wing	0·3 mm.

In general, the description of the female applies also to the male, but the following points may be especially mentioned. Eyes separated. Antenna: last three flagellum segments sub-equal, the fifteenth being, however, slightly the longest and the fourteenth slightly the shortest. Scutellum bearing two central and two lateral bristles, and a few (six) short hairs. Wing: pale spot covering the anterior cross-vein rather diffuse and spreading almost to the costa, pale spots at the apex of the wing and along its posterior border almost or entirely absent; decumbent hairs scanty, but more than a single row in the basal portion of the wing between the fourth and fifth veins.

HYPOPYGIUM (fig. 1). *Ninth segment*: tergite, posterior margin slightly notched in the middle and ending on each side in a well-developed conical process; sternite, deeply excavated. *Forceps*: side-pieces rather long and narrow, covered with relatively short hairs; claspers with a broad, hairy, basal portion, constricting abruptly to meet the terminal portion, which is of the usual form. *Harpes* (fig. 1 *a*): moderately chitinised, somewhat strap-like,

* In all cases taken from the anterior margin of the thorax to the tip of the abdomen of specimens mounted in carbolic.

tapering only slightly, with a short piece at the distal end bent ventrally or ventro-laterally like the end of a cleek. *Aedoeagus* (fig. 1 *b*): form rather unusual; stem very short, highly chitinised, in ventral view shaped like the letter T; limbs long, moderately highly chitinised; ventral wall chitinised for only a short distance from the apex of the arch, membranous portion not spiculated.

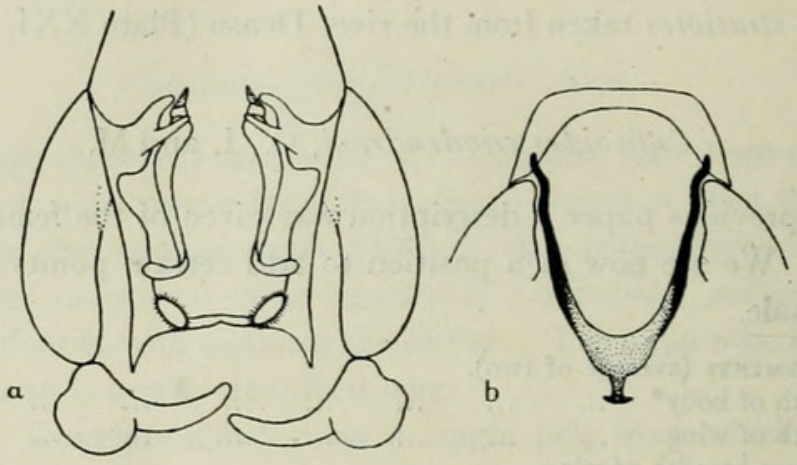

FIG. 1. *Culicoides eriodendroni*, C. I. & M., outlines of male hypopygium, ventral view. *a*—forceps and harpes; *b*—aedoeagus.

GOLD COAST: Nsawam, August and October, 1920; reared from larvae obtained from rot-holes in the stump of a silk-cotton tree and of another tree.

Culicoides grahami, Aust.

Several specimens of this species were reared from material taken from the base of a banana stump. The pupal pelt of one female was recovered, and as it was in some respects peculiar and showed several characteristic features, a brief description of it is given.

PUPA. Length 1·6 mm., moderately well chitinised. *Respiratory trumpets* long and curved; length about 0·17 mm. Stalk or pedicle moderately long. The trumpets are of almost uniform width throughout their length, and are irregularly ringed. The main tracheal trunk gives off during its course through the trumpet a few short lateral branches which terminate in small tubercles scarcely projecting above the general surface level, and ends distally in a fan-like arrangement of the usual form. *Cephalo-thorax*:

anterior marginal tubercle large, covered with squamose spines, bilobed, and formed of an inner rounded portion and an outer conical portion, the latter bearing at its apex a long, strong bristle; anterior dorsal, double, each part bearing a long, stout bristle; anterior dorso-lateral, an irregular tubercle bearing two hairs; ventro-lateral, an irregular tubercle bearing two delicate hairs, ventro-median, apparently absent. The operculum is sparsely covered with squamose spines, most strongly developed along its periphery; near its posterior margin, in the middle line, is a small elevation or tubercle covered with rather coarse squamose spines, but otherwise unarmed. Dorsal tubercles small: anterior, double, bearing a delicate hair internally and a small spine externally; posterior, almost obsolete, bearing a small spine; lateral, bearing a hair. Postero-dorsal tubercle almost obsolete, bearing a delicate hair. *Abdomen*: anal segment bearing two transverse rows of relatively large spicules, the one near the anterior margin and the other about the middle of the segment; these spicules are developed most highly on the dorsal and lateral aspects. A group of similar spicules is present dorsally at the roots of the terminal processes. The terminal processes are short and pointed at their tips, they diverge almost at right angles, and their ends are turned dorsally. Tubercles on the abdominal segments poorly developed, and shaped like large spines. Dorsal tubercles: antero-submarginal, the inner bearing a short spine and the outer a longer hair; postero-marginal, only a single tubercle present, situated posterior to the outer antero-submarginal tubercle, bearing a short spine. Ventro-lateral tubercles small, but little larger than the dorsal and ventral: antero-submarginal bearing a short spine; postero-marginal, the middle one bearing a hair, the other two short spines. Ventral tubercles: the middle one bearing a hair, the outer and inner each a short spine. Each abdominal segment (excluding the last, which has been referred to already) bears a transverse row of relatively well-developed spicules near its anterior margin; these spicules are most highly developed and most numerous on the more posterior segments.

GOLD COAST: Nsawam, 24th July, 1920; reared from material taken from the base of a banana stump.

Culicoides neavei, Aust.

Several specimens of this species were reared from soft mud taken from the edges of pools at Accra. The larvae, together with those of several other species of *Culicoides*, frequented the mud which was very soft and almost semi-fluid. They were of the usual form, but we are unable to give details of their structure because, although we reared one adult from a larva isolated in a small tube, we did not succeed in recovering the larval pelt, and were, therefore, unable to distinguish amongst the numerous larvae in the sample those belonging to this particular species. The pupae also frequented the mud: the description which follows is based on an examination of the pelts of two pupae which had been isolated singly, and from which adult insects were procured.

PUPA. Length about 1·9 mm. Operculum densely covered with dark brown squamose spines. *Respiratory trumpets* similar to those of *Culicoides inornatipennis*, short and raised on relatively long stalks; length of the trumpet about 0·19 mm., length of the stalk about 0·05 mm. The trumpet is infuscated at its distal end, and also, slightly, at its base; it bears three or four quite small knob-like processes, the most distal of which is situated rather far anteriorly. The main tracheal trunk terminates distally in a hand-like group of about six short blunt processes. *Cephalo-thorax*: anterior marginal tubercle small, dark coloured, conical, bearing a relatively long stout spine which is directed ventrally, anterior dorsal well developed, conical, bearing a short stout spine and a minute spine; dorso-lateral prominent, bearing a hair and a short spine; ventro-lateral a rounded hump, bearing a short and a moderately long hair; ventro-median small, bearing a moderately long and a short hair. External to the ventro-median tubercle, and a little posterior to the ventro-lateral, is a small nipple-like tubercle, apparently unarmed. Just in front of and internal to the base of the stalk of the trumpet is a small hair. Dorsal tubercles: anterior double, the two parts being separate and well developed but not large knobs, the one situated anterior to the other, each bearing a short, stout, dark-coloured spine; posterior, poorly developed, bearing a minute spine; lateral, feebly developed, bearing a hair. In front of the anterior tubercle, and a little external to it, is an inconspicuous unarmed tubercle; posterior to the lateral tubercle is a socket-like

mark, apparently unarmed, and there is another similar mark situated more posteriorly. Postero-dorsal tubercle small, bearing a hair and two apparently unarmed, socket-like marks. *Abdomen*: anal segment with sharply-pointed terminal processes infuscated at their tips. Dorsal tubercles of the normal form: antero-submarginal, the inner bearing a short spine, and the outer a hair; postero-marginal, five in number, the outermost bearing a hair, the next a short spine, the innermost a minute spine, and the other two apparently unarmed. Lateral tubercles larger than the others and each with two sharp points, between which are the hairs or spines: antero-submarginal, bearing a spine; postero-marginal, the middle one bearing a hair, the other two, spines. Traces are visible of a second, rudimentary, antero-submarginal tubercle in a more dorso-lateral position. Ventral tubercles of normal form: the middle one bearing a hair, the other two, spines.

GOLD COAST: Accra, February, 1921; reared from soft mud taken from the edges of pools and puddles near the station for the Weshiang railway (Pl. XXI, fig. 2). From the same material were reared also *Culicoides austeni*, *C. distinctipennis*, *C. similis*, *C. schultzei* and *Stilobezzia spirogyrae*.

Culicoides similis, C., I. and M.

At the time when this species was described (1920), the early stages were not known. They have since been collected, and are here briefly described.

PUPA. Length about 1·9 mm. Operculum densely covered with dark brown squamose spines. *Respiratory trumpets* short and raised on rather long stalks; length of the trumpet about 0·19 mm., length of the stalk about 0·03 mm. The trumpet bears on its proximal half three or four small knob-like processes which are infuscated. The distal end of the trumpet is dark brown: in it the main tracheal trunk terminates in a fan-like group of short, blunt processes. *Cephalo-thorax*: anterior marginal tubercle dark brown, rather small, conical, bearing a relatively long, stout, dark-coloured spine; anterior dorsal prominent, irregularly conical, bearing a stout spine and a minute spine; dorso-lateral small, bearing a hair and a minute spine; ventro-lateral a rounded hump, bearing a small and a minute hair; ventro-median represented by two hairs,

one minute. Dorsal tubercles: anterior usually double (in one specimen single on one side), the two parts contiguous or separated but almost side by side, well developed but not large knobs, each bearing a short, stout, dark-coloured spine; posterior, poorly developed, bearing a minute spine; lateral, poorly developed, bearing a hair. In front of the anterior tubercle, and a little external to it, is an unarmed tubercle; posterior to the lateral tubercle is a socket-like mark, apparently unarmed, and there are usually two similar marks situated more posteriorly. Postero-dorsal tubercle small, bearing a small hair and one or two apparently unarmed, socket-like marks. *Abdomen*: anal segment with sharply-pointed terminal processes infuscated at their tips; in the middle line, dorsally and posteriorly, is a small elevation covered with dark squamose spines. Dorsal tubercles of the normal form usually, but on some segments the outer two postero-marginal tubercles tend towards the form of the lateral tubercles: antero-submarginal, the inner bearing a short spine, and the outer a hair; postero-marginal, five in number, the outermost bearing a hair, the next a spine, the innermost a minute spine, and the other two apparently unarmed. Lateral tubercles larger than the others, and each with two sharp points between which arises the hair or spine: antero-submarginal, bearing a spine; postero-marginal, the middle one bearing a hair, the other two, spines. Traces are visible of a second, rudimentary, antero-submarginal tubercle in a more dorso-lateral position. Ventral tubercles of normal form: the middle one bearing a hair, the other two, spines.

LARVA. Although we did not succeed in recovering the larval pelt of any individual specimen isolated and reared through from the larval stage, we secured from the materials collected at Accra a number of larvae which we believe to be those of *Culicoides similis*. The larvae were found, together with pupae of *C. similis*, in the soft, semi-fluid mud in the specimen jar at a time when this species was the only one emerging from the sample. Moreover, in three of the larvae, apparently almost ready to pupate, the pupal structures, including the respiratory trumpets and many of the cephalo-thoracic and abdominal tubercles, were clearly visible through the cuticle, and appeared to be identical with those of the pupa of *C. similis*.

It is of interest to note the situations in which certain of the pupal structures were seen in the larvae. The trumpets lay in the first body segment, their proximal ends situated dorsally and laterally at the posterior end of the segment, and their free ends situated ventrally on each side of the middle line a little posterior to the head. The dorsal tubercles of the cephalo-thorax were situated dorsally at the anterior end of the second body segment. The terminal processes of the anal segment were turned so that they projected anteriorly, one on each side, with their tips directed dorsally and situated at the anterior margin of the segment.

The following description of the larva is based on the examination of the three larvae alluded to as being apparently ready to pupate.

Length about 3·5 mm. when fully grown, greatest breadth about 0·02 mm. *Head*, length about 0·13 mm., greatest breadth about 0·08 mm. Eyes small. Bristles mostly small; on the ventral surface one pair, admedian, a little posterior to the hypopharyngeal sclerite, two pairs, admedian, almost contiguous, anterior to the hypopharyngeal sclerite, and one pair ventro-lateral; on the lateral surface two pairs, the one anterior and the other central; on the dorsal surface one pair admedian, anterior, two pairs sub-central, slightly separated, dorso-sublateral, two pairs, almost contiguous, posterior, dorso-lateral. Palpi and antennae well developed. Labium broad, blunt, dark coloured, apparently without teeth. Posterior margin of hypopharyngeal sclerite bearing on each side seven or eight sharply pointed, graded, teeth, the middle ones being the longest; these teeth are not very highly chitinised. Mandibles simple, pointed, without teeth. *Body*: appearing almost hairless, but actually bearing a few very small hairs; terminal hairs on the anal segment very small; anal gills of the usual form, deeply cleft distally into two pointed processes.

GOLD COAST: Accra, February to April, 1921; numerous specimens of both sexes reared from soft mud taken from the edges of pools and puddles near the station for the Weshiang railway (Pl. XXI, fig. 2). Oblogo, February, 1921; a few specimens reared from sandy mud taken from the washing-place in the river Densu.

Culicoides corsoni, sp.n.

This insect, of which we possess at present only a single male, resembles in wing markings *Culicoides similis* and *C. citroneus*. From the former it differs in having no pale area covering the middle of the lower ramus of the fourth vein and in the whole of the cross-vein being enveloped in a pale area; from the latter in having only a single pale area between the branches of the fifth vein, the small pale spot in the angle being absent.

MEASUREMENTS.

Length of body (one male)	1·0 mm.
Length of wing	0·8 mm.
Greatest breadth of wing	0·3 mm.

Head: occiput dark brown. Eyes narrowly separated. Proboscis and palpi dark brown; the latter with the third segment somewhat inflated, especially in its basal two-thirds. *Antennae*: infuscated; the thirteenth segment slightly longer than the terminal segment; the plumes only moderately developed. *Thorax* dark brown, with paler brown markings. Owing to the fact that the species was not recognised until the hypopygium had been examined in carbolic, exact details of the thoracic adornment cannot be given, but there appeared to be three large paler areas on each side of the anterior two-thirds of the dorsum, one in front and two behind. Scutellum yellowish-brown, somewhat darker at the sides; bearing one central and two lateral bristles, and a few (three) short hairs. Post-scutellum dark brown. Pleurae dark brown. *Wings* with pale markings resembling those of *Culicoides citroneus*. The pale spot in the middle of the anterior border covers the tip of the distal cell; there is no pale spot covering the middle of the lower ramus of the fourth vein, and the pale spots in the neighbourhood of the bifurcation of the fifth vein are arranged as in *C. similis*. Decumbent hairs scanty, not extending beyond the middle of the wing, and none being present in the anal angle, between the rami of the fifth vein, or at the base between the fourth and fifth veins. Halteres with creamy-yellow knobs. *Legs* infuscated, knees scarcely darker; tibiae with narrow pale bands basally and less distinct pale bands on the femora apically. *Abdomen* dark brown.

HYPOPYGIUM. *Ninth segment:* tergite broad, bearing only a few stout hairs, the most notable of which are four arranged in a

transverse row near the posterior margin; posterior margin notched in the middle, and bearing at each lateral angle a long, slender, finger-like process about five times as long as it is broad at its base; apical lobe-like processes well developed. Sternite deeply excavated centrally. *Forceps* of the normal form; claspers highly chitinised, with rather blunt ends. *Harpes* resembling those of *C. grahami*, but with shorter distal portions. *Aedoeagus* Y-shaped, the limbs and the proximal end of the stem highly chitinised, the distal end of the stem more delicate and ending in a broad lip. The ventral wall of the aedoeagus is highly chitinised from the apex of the arch to about the middle of the limbs, but is not extended anteriorly and centrally as a spine; the membrane joining the aedoeagus to the ninth sternite is without spicules. The hypopygium resembles that of *C. citroneus*, but the following differences, amongst others, may be noted. The long hairs at the posterior end of the ninth tergite are less numerous than in *C. citroneus*, the lateral finger-like processes more slender, and more pointed; the claspers are more highly chitinised; the harpes resemble more closely those of *C. grahami* than those of *C. citroneus*; and the proximal ends of the limbs of the aedoeagus are inverted.

GOLD COAST: Koforidua, April, 1921 (Dr. J. F. Corson); one male taken in a bungalow, on the wall near a lamp. We have pleasure in dedicating this species to the collector, Dr. J. F. Corson.

Culicoides nigeriae, sp. n.

MEASUREMENTS.

Length of body (three females)	1·2 mm.
Length of wing	0·9 mm.
Greatest breadth of wing	0·4 mm.

Head dark brown. Eyes separated, internal chitinous thickening well developed; the eyes are more widely separated than in *C. inornatipennis*, the length of the internal chitinous thickening being about 20μ instead of about 13μ. Proboscis dark brown. Palpi brown, third segment moderately inflated. *Antenna* dark brown; segments four to ten from once to once and a half as long as broad. *Thorax* uniformly dark brown, pollinose, sparsely clothed with dark brown hairs. Scutellum uniformly dark brown; bearing two admedian and two lateral bristles, and a few short hairs. Post-

scutellum dark brown. Pleurae dark brown. *Wings* unspotted; distribution of decumbent hairs similar to that in *C. inornatipennis*, but wings rather less hairy. Halteres darkish brown. *Legs* rather dark brown, almost unicolourous. *Abdomen* dark brown. Spermathecae two, dark brown and very highly chitinised, subspherical to oval, measuring about 35μ by 30μ on an average; only the very commencement of the duct is chitinised.

NIGERIA (Northern provinces): Gimi, Zaria Province, 27th October, 1920 (Dr. W. B. Johnson); 'collected whilst biting.' Duchi-n-wai, about forty miles from Zaria, at an elevation of 2,000 ft. approx., 25th November, 1920 (Mr. L. E. B. Pearse), taken in the act of biting. Ilorin Province, Kaduna river, 21st December, 1920 and 23rd December, 1920; Pategi, 24th December, 1920 (Dr. J. R. C. Stephens); some of the specimens taken on the arm, and undoubtedly biting. Several specimens obtained from each locality, all females.

This species, besides being a much darker brown insect, may be distinguished from *C. inornatipennis* by the following points amongst others: the absence of the characteristic thoracic adornment, the colour of the scutellum and the colour of the halteres.

Culicoides inornatipennis, C., I. and M., var. *rutilus*, var. nov.

A small rufous variety of *C. inornatipennis*, C., I. and M. Length less than 1 mm., usually about 0·8 mm.; length of wing about 0·7 mm., and greatest breadth about 0·3 mm. Hypopygium of the male and spermathecae of the female as in *C. inornatipennis*; other morphological characters also similar. Fourth segment of the palp very small, about half the length of the fifth; scutellum bearing three or four stout bristles, one or two central or admedian and two lateral, and a variable number (about half a dozen usually) of smaller hairs.

Colouration notably different from that of *C. inornatipennis*. Head dark brown. Proboscis and palpi pale brown. Antenna with a dark brown torus and lighter brown flagellum segments, bearing pale brown hairs. Thorax unicolorous, light brown or almost golden-brown. Scutellum light brown; post-scutellum darker but not very dark brown. Pleurae brownish-yellow. Halteres pale

yellowish-brown. Legs pale brown, almost unicolorous, but with knee spots a slightly deeper yellow-brown. Abdomen dark brown.

PUPA. Two pupal pelts were examined, and were found to be indistinguishable from those of *C. inornatipennis*. They were very small, length about 1·3 mm.

GOLD COAST: Nsawam, May to August, 1920; numerous specimens reared from rotting fibrous material taken from the bases of banana stumps. October, 1920; one specimen reared from material taken from a rot-hole in a silk-cotton tree.

Genus *DASYHELEA*, Kieff.

Dasyhelea fuscipleuris, C., I and M.

In a previous paper, Part IV of this study (1921), this species was described. At that time we possessed only two females, taken in buildings, and had identified neither the early stages nor the habitat. Recently we have reared a large number of specimens, and are able to supplement our previous description by giving an account of the pupa. It is interesting to note that all the specimens reared were females and to compare this observation with those previously made on *C. clarkei* and *C. eriodendroni* (1920).

PUPA. Length about 2·1 mm., delicately chitinised and rather slender. *Respiratory trumpets* very long and slender, length about 0·6 mm., breadth about 19μ, raised on small tubercles; the main tracheal trunk is narrow, gives off throughout its length, beginning at its very base, numerous (about fifteen) quite short lateral branches, and ends distally in a cluster of about six short processes. *Cephalothorax* not very strongly chitinised, operculum coarsely shagreened. Anterior marginal tubercle large, conical, bearing a small spine-like hair; dorso-lateral irregularly shaped, bearing two delicate hairs; anterior dorso-median small, bearing two very short, straight hairs; ventro-lateral almost obsolete, bearing two minute hairs, ventro-median represented by a small hair. Dorsum of the thoracic region not infuscated, without tubercles, but with several brownish macules. *Abdomen* feebly chitinised, of the usual form; tubercles small and poorly chitinised, terminal processes widely divergent.

LARVA. The larva is of the usual form. Only a single pelt actually correlated with an adult was obtained, and in it no

characteristic points could be made out. Unfortunately, it was a practical impossiblity to isolate the larvae of this insect from the materials in which they were living, because the sample contained also numerous other species (*Culicoides schultzei*, *C. similis*, *C. austeni*, *C. distinctipennis*, *Stilobezzia spirogyrae* and *Dasyhelea inconspicuosa*).

The single larva reared through to the adult stage was isolated in a small tube containing nothing but a little damp filter paper. The larva buried itself immediately but a day or two later the pupa was observed worming its way to the surface through the mass of filter-paper. The trumpets could not be distinguished with the aid of a hand lens. Two days later a female *C. fuscipleuris* emerged. The pupal pelt was found on the side of the tube half an inch above the filter-paper, a situation which the pupa must have reached by its own unaided efforts. The larval pelt was found embedded in the filter paper near the spot where the pupa was first observed.

GOLD COAST: Accra, April, 1921; numerous specimens (all females) reared from mud taken from the edges of pools and puddles near the station for the Weshiang railway line (Pl. XXI, fig. 2).

Dasyhelea nigricans, C., I. and M.

This species was originally described from two males taken in the laboratory at Accra. The halteres of these specimens had yellowish-brown knobs and dark brown stems. More recently we have received from Dr. W. B. Johnson a number of specimens of a species of *Dasyhelea* taken at Kaduna, Nigeria, in August, 1920, which resembles in every respect *Dasyhelea nigricans*, excepting that in some the halteres are white, and in others yellow. We conclude, therefore, that in this species the colour of the halteres must be variable.

A few of the specimens collected by Dr. Johnson at Kaduna were females, and we are, therefore, able to supplement our previous account by describing the characters of this sex.

MEASUREMENTS.	Female.
Length of body	1·3 mm.
Length of wing	1·0 mm.
Greatest breadth of wing	0·35 mm.

The female resembles the male in most respects, but the following points, including the more important differences, may be mentioned. *Head*: eyes separated. *Antennae*: hairs dark brown, short and scanty; segments of the flagellum gradually elongating from base to apex in a continuous series, that is without an abrupt change of form between the tenth and eleventh segments; segments four to ten from once to nearly twice as long as broad, segments eleven to fifteen from twice to a little over three times as long as broad, the last segment ending in a stylet; long spines present on all the segments excepting the last five. *Thorax*: scutellum almost entirely yellowish-brown; armature of bristles and hairs as in the male. *Wings* rather densely hairy, the hairs extending basally beyond the cross-vein; bifurcation of the fifth vein at about the same level as the termination of the costa; cell formed by the first and third veins at their junction with the costa larger than in the male. Halteres yellow. *Legs*: claws small, simple, equal. *Abdomen* clothed with yellowish-brown hairs; spermatheca single, highly chitinised, sub-spherical (diameter about 42μ), the commencement of the duct chitinised for a considerable distance, about 15μ, most strongly at its end of origin from the spermatheca.

NIGERIA (Northern provinces): Kaduna, August, 1920 (Dr. W. B. Johnson).

Dasyhelea nigeriae, sp. n.

MEASUREMENTS.	Male.	Female.
Length of body	1·1 mm.	1·1 mm.
Length of wing	0·8 mm.	0·8 mm.
Greatest breadth of wing	0·3 mm.	0·3 mm.

Head dark brown. Eyes separated in both sexes. Clypeus and proboscis dark brown. Palpi dark brown; third segment inflated, in the male especially basally, about the same length as the second; fourth segment short, about half the length of the third. *Antennae* unusually short, dark brown, with dark brown hairs; in the female segments four to fourteen gradually lengthening towards the apex, the length varying from two-thirds to once the breadth, the last segment rather larger and longer and ending in a conical tip, but without a stylet, in the male segments four to eleven short, those at the base broader than long and those at the apex sub-spherical,

length varying from about two-thirds to once the breadth, last four segments sub-equal, about four times as long as broad, not binodose but exhibiting the usual sculpturing (compare *D. flava*), the last segment longer and stouter but without a stylet. *Thorax* uniformly dark brown, with paler, somewhat yellowish, humeral patches. Scutellum dark brown, bearing in both sexes one central, two admedian, and two lateral bristles and no short hairs. Post-scutellum dark brown. Pleurae dark brown. *Wings* hyaline, without spots; clothed with decumbent hairs which do not extend basally beyond the cross-vein. Venation as in *D. flava*; interspace very small in the male, more well developed in the female. Halteres with dusky orange-coloured knobs and infuscated stems. *Legs* brown, femora and tibiae dark brown, but lighter coloured in the male than in the female. Claws short, equal, simple; in the male bifid at the tips. Empodium rudimentary, but in comparison with the size of the claws appearing to be larger than usual. *Abdomen* dark brown, venter slightly paler than the dorsum. Spermatheca single, highly chitinised, pyriform (about 42μ by 38μ); chitinised part at the commencement of the duct conical, about 11μ long.

Hypopygium (fig. 2). *Ninth segment*: tergite tapering slightly posteriorly, sparsely clothed with strong hairs, posterior margin not

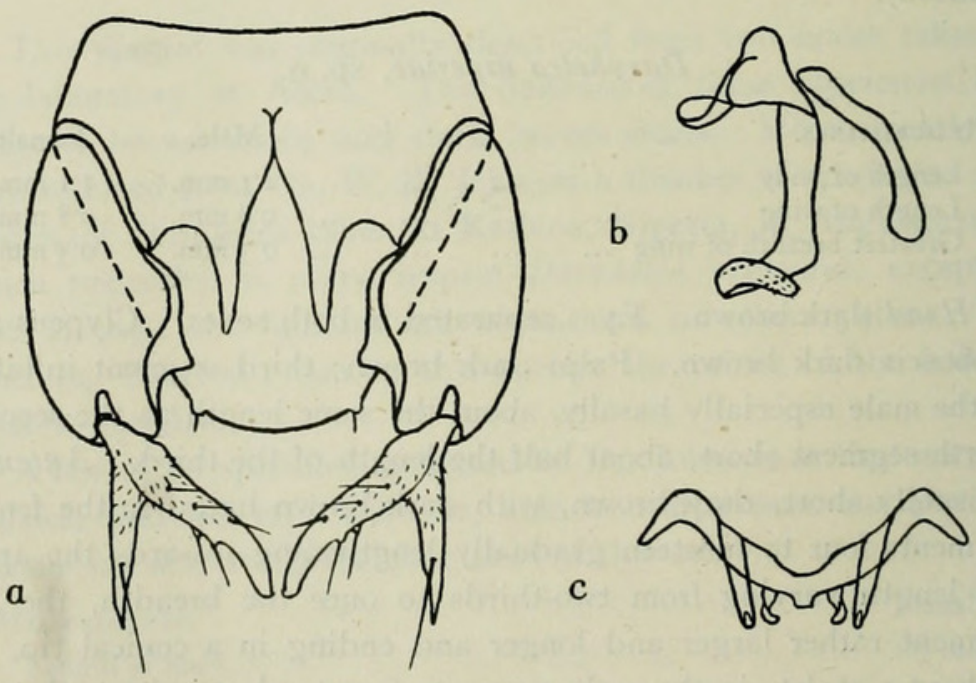

Fig. 2. *Dasybelea nigeriae*, sp.n., outlines of male hypopygium, ventral view. *a*—ninth segment and forceps; *b*—harpes; *c*—aedoeagus. (× 375 circa.)

notched, and without finger-like lateral processes; sternite prolonged posteriorly on each side of the middle line into a highly chitinised, pointed, finger-like process. *Forceps*: side-pieces short and stout, broader apically than basally, rather scantily clothed with moderately long hairs, and bearing on the inner aspect a highly chitinised conical projection; claspers bifid, both parts well developed, pubescent on their basal halves and bearing also a few longer hairs. *Harpes*: basal portions unequal, highly chitinised; from the right basal portion, which is the broader, arises a rather lightly chitinised posterior extension (shaped as shown in the figure), the distal end of which is twisted and covered by minute hairs. *Aedoeagus* broadly-ending, the processes on each side of the horizontal band highly chitinised, finger-like, and curved ventrally at their tips.

NIGERIA (Northern provinces): Kaduna, August, 1920 (Dr. W. B. Johnson). This insect resembles *D. flava* in some respects, but is of an entirely different colour; the hypopygium of the male is characteristic.

Dasyhelea boothi, sp. n.

MEASUREMENTS.

Length of body (one male)	1·0 mm.
Length of wing	0·8 mm.
Greatest breadth of wing	0·25 mm.

Head dark brown. Eyes narrowly separated. Clypeus, proboscis and palpi brown. Third palpal segment not inflated, about as long as the fourth and fifth together, fifth about as long as the fourth. *Antennae*: torus dark brown, flagellum brown; segments four to eleven sub-spherical to ovoid, length from about once to once and a third the greatest breadth; segments twelve to fifteen elongated, sub-equal, but the fourteenth slightly the shortest, the twelfth, thirteenth and fourteenth about three to four times as long as broad, binodose, the fifteenth broader, not ending in a stylet. *Thorax* dark brown. Scutellum pale brown, slightly darker at the sides; bearing two lateral and four centro-marginal bristles, and one small central hair. Post-scutellum dark brown. Pleurae brown. *Wings* sparsely clothed with hairs which extend between the fourth and fifth veins to the level of the cross-vein; venation as usual. Halteres

with brown stems and yellow knobs. *Legs* uniformly brown; claws small, equal, simple, bifid at the tips. *Abdomen* dark brown.

Hypopygium (fig. 3, *a* to *d*). *Ninth segment*: tergite sparsely clothed with relatively short hairs, tapering distally, posterior margin not notched and bearing double lateral processes; sternite bare, prolonged posteriorly in the middle as a triangular process. *Forceps* not very highly chitinised or hairy: side-pieces rather short

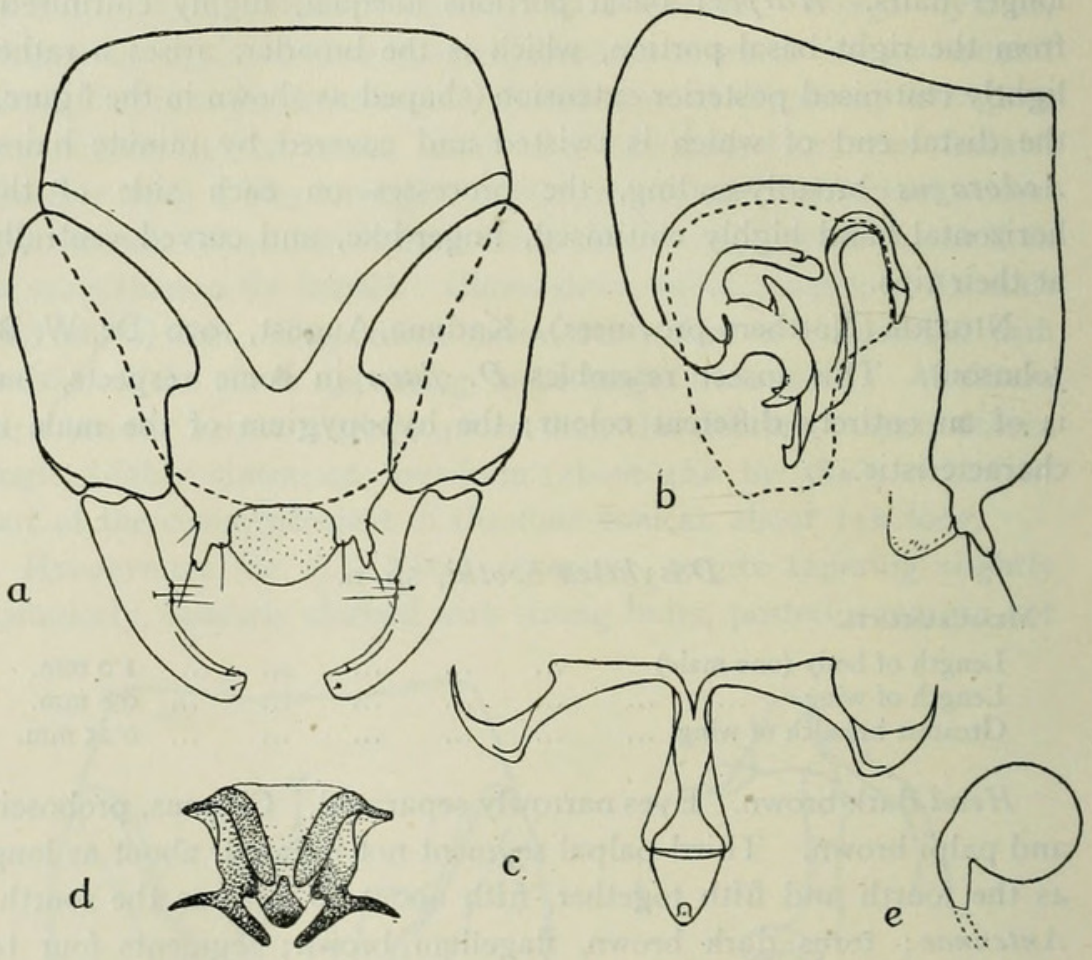

Fig. 3. *a* to *d*—*Dasybelea boothi*, sp.n., outlines of male hypopygium; ventral view: *a*—ninth segment and forceps; *c*—harpes; *d*—aedoeagus; *b*—lateral view. *e*—*Dasybelea retorta*, sp.n., spermatheca. (× 300 circa.)

and broad, with a hairy internal apical process; claspers moderately chitinised, with somewhat squared ends, the proximal two-thirds pubescent, bearing three short, stout, hairs about the middle of the inner border. *Harpes* (fig. 3, *b* and *c*) moderately well chitinised, almost symmetrical, composed of a large and irregularly shaped basal plate on each side, and a median common posterior extension which is complex, expanded distally, and with a terminal ventral

barb-like process. *Aedoeagus* (fig. 3, *b* and *d*) very highly chitinised in parts, apparently composed of a pointed median process which is bent ventrally at its tip and in ventral view is pyriform, two short and broad limbs, and external to them somewhat T-shaped extensions.

NIGERIA (Cameroons): Victoria, April, 1921 (Dr. L. H. Booth). We have pleasure in dedicating this species to the collector, Dr. L. H. Booth.

Dasyhelea retorta, sp. n.

MEASUREMENTS.

Length of body (one female)	1·35 mm.
Length of wing	0·9 mm.
Greatest breadth of wing	0·3 mm.

Head dark brown. Eyes very narrowly separated dorsally. Clypeus, proboscis and palpi dark brown. The third segment of the palp cylindrical, not inflated, about as long as the fourth and fifth segments together; the fifth segment shorter than the fourth, widest at its distal end and rounded. *Antennae* dark brown, with dark brown hairs and long curved spines on all the segments of the flagellum; third segment slightly broader than the fourth; segments four to fourteen forming a continuous series, gradually elongating and becoming more flask-shaped, their length varying from about once to once and a half the greatest breadth; the last segment broader and longer, about three times as long as broad, ending in a stylet. *Thorax* dark brown with small yellowish humeral patches. Scutellum almost entirely yellow, sides only slightly infuscated; bearing two lateral and four centro-marginal bristles, and a single central hair. Post-scutellum dark brown. Pleurae brown, lighter than the dorsum. *Wings* with decumbent hairs extending to the base between the fourth and fifth veins. Costa reaching the middle of the anterior border, and terminating beyond the bifurcation of the fifth vein. First and third veins forming a small cell. Halteres with yellow knobs with brown basal infuscation, and brown stems. *Legs* light brown, with dark knee spots and slight infuscation of the distal tarsal segments; hind femora slightly infuscated in the middle dorsally. Claws simple, equal. *Abdomen* dark brown, venter paler than the dorsum, yellowish pigmentation (which

disappears in caustic potash) visible laterally and between the segments. Spermatheca single, highly chitinised, shaped something like a chemical retort (fig. 3 *e*); distal portion sub-spherical, length 44μ, greatest breadth 38μ; proximal portion, the chitinised commencement of the duct, curved, arising obliquely, length about 30μ, width at its middle about 11μ.

SIERRA LEONE: Freetown, May, 1920; one female taken about noon upon a window in the Royal Hotel.

Genus *ATRICHOPOGON*, Kieff.

Atrichopogon africanum, sp. nov.

MEASUREMENTS.

Length of body (one female)	1·4 mm.
Length of wing	1·3 mm.
Greatest breadth of wing	0·4 mm.

Head dark brown, with dark brown hairs. Eyes broadly contiguous above, bare. Clypeus, proboscis and palpi dark brown. First and fourth palpal segments short, second and third longer, fifth somewhat dilated at its distal end; third segment slightly inflated and furnished with a moderately large sensory pit in its distal third. *Antennae* dark brown: segments four to ten short and broad, the tenth sub-spherical; last five segments (eleven to fifteen) elongate, sub-equal, four or five times as long as broad, the fifteenth terminating in a relatively long stylet. *Thorax* uniformly dark brown; clothed with a few short, dark-brown hairs. Pleurae dark brown. Scutellum dark brown, but not so dark as the mesonotum, bearing two sub-median and two lateral bristles and a few (about half a dozen) short hairs. Post-scutellum dark brown. *Wings* (fig. 4) generally similar to those of *A. xanthoaspidium*, unspotted

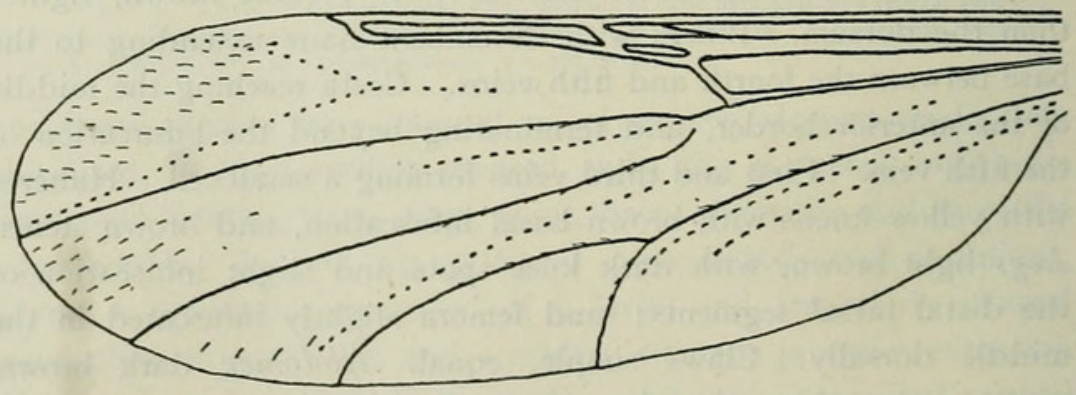

FIG. 4. *Atrichopogon africanum*, sp.n., outline of wing of female. (× 90 circa.)

but slightly infuscated, anteriorly somewhat darker than posteriorly; anterior veins brownish. Surface uniformly covered with microtrichia, and bearing decumbent hairs, which, however, are more scanty than in *A. xanthoaspidium*, none being present between the branches of the fifth vein or in the anal fold, and only a very few between the lower ramus of the fourth vein and the upper ramus of the fifth. Petiolate portion of the fourth vein about the same length as in *A. xanthoaspidium*. Halteres with dark brown knobs. *Legs* almost uniformly brown, but distal segments slightly darker. First tarsal segment of hind legs rather over three times as long as second. Claws simple, equal, about half the length of the fifth tarsal segment. Empodium well developed, as long as the claws. *Abdomen* dark brown, ventral surface slightly paler. Spermatheca (fig. 5) single,

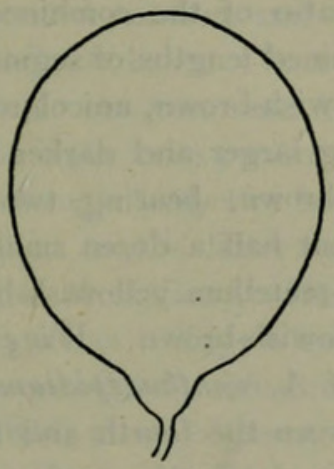

FIG. 5. *Atrichopogon africanum*, sp.n., spermatheca. (× 375 circa.)

large (length 107μ, greatest breadth 84μ), pear-shaped, heavily chitinised; a short portion (about 15μ) of the duct, which is narrow, is chitinised.

GOLD COAST: Accra, August, 1920, one female taken in the evening upon a window in the laboratory.

Atrichopogon elektrophaeum, sp. n.

MEASUREMENTS.

Length of body (one female)	1·4 mm.
Length of wing	1·3 mm.
Greatest breadth of wing	0·5 mm.

Head yellowish-brown. Eyes contiguous above. Clypeus, proboscis and palpi yellowish-brown. First segment of the palp

short; second, fourth and fifth sub-equal, about twice the length of the first; third rather shorter than the combined lengths of the fourth and fifth segments, slightly inflated in the middle, furnished with a sensory cup opening at the junction of the middle and distal thirds; fifth segment somewhat infuscated and tapering distally. *Antennae* brown: first segment poorly chitinised, bearing several short hairs; torus rather a light brown colour, sub-spherical, bearing a few short hairs; third segment wider than any of the other basal segments; segments four to ten short and broad, their lengths varying from about three-quarters to a little over once the breadth; segments eleven to fifteen elongate, cylindrical, sub-equal, four or five times as long as broad, the last the longest and ending in a nipple-like process. All the basal segments of the flagellum bear long, curved, pointed spines. The ratio of the combined lengths of segments three to ten to the combined lengths of segments eleven to fifteen as 0·6 to 1. *Thorax* yellowish-brown, unicolorous, clothed with small brown hairs and bearing larger and darker hairs above the wings. Scutellum pale yellow-brown, bearing two sub-median and two lateral bristles, and about half a dozen small hairs which are dark brown in colour. Post-scutellum yellowish-brown, darker than the scutellum. Pleurae yellowish-brown. *Wings* with a pale yellowish tint, similar to those of *A. xanthoaspidium* but with fewer hairs, none being present between the fourth and fifth veins nor between the rami of the fifth vein, and only a row of eight along the false vein in the anal angle. Halteres with pale yellow-brown knobs. *Legs* almost uniformly yellowish-brown, terminal segments of the tarsi, however, slightly darkened. First tarsal segment on all the legs about three times as long as the second. Claws simple, equal, about half the length of the fifth tarsal segment. Empodium well developed, as long as the claws. *Abdomen* yellowish-brown, rather darker than the thorax; venter paler than the dorsum. Spermatheca single, highly chitinised, oval, large, length 106μ, greatest breadth 80μ; the duct not chitinised.

GOLD COAST: Accra, 1920; taken in the evening upon a window in the laboratory.

Atrichopogon perfuscum, sp. nov.

MEASUREMENTS.

Length of body	1·3 mm.
Length of wing	1·1 mm.
Greatest breadth of wing	0·4 mm.

Head dark brown, clothed with dark brown hairs. Eyes broadly contiguous above, smooth. Clypeus, proboscis and palpi dark brown. *Antennae* dark brown; segments four to ten short and broad, the tenth sub-spherical the others broader than long, the length varying from two-thirds to three-quarters the breadth; the last five segments (eleven to fifteen) elongate, about three times as long as broad. *Thorax* uniformly dark brown. Pleurae dark brown. Scutellum dark brown, but rather lighter coloured than the mesonotum, bearing two sub-median and two lateral bristles and several (six to eight) short hairs. Post-scutellum dark brown. *Wings* clear, unspotted; venation and decumbent hairs as in *A. xanthoaspidium*, but fewer hairs present between the rami of the fifth vein and in the anal angle (only two being present in the former situation and one or two in the latter in one of the specimens examined, rather more in the others). Halteres with buff-coloured knobs and dark brown stems. *Legs* almost uniformly yellowish-brown, but tarsal segments slightly infuscated. Claws equal, about half the length of the fifth tarsal segment, each with a very small sub-apical tooth. Empodium well developed, as long as the claws. *Abdomen* dark brown. Spermatheca single, highly chitinised, oval; length from 70μ to 87μ, greatest breadth from about 57μ to 65μ, the duct chitinised for only a short distance (about 5μ) at its commencement.

GOLD COAST: Accra, October, 1920; three females collected in the evening upon the windows of the laboratory.

Atrichopogon chrysosphaerotum, sp. nov.

MEASUREMENTS.

Length of body (two females)	1·15 mm.
Length of wing	0·9 mm.
Greatest breadth of wing	0·35 mm.

Head dark brown, clothed with dark brown hairs. Eyes broadly contiguous above, bare. Clypeus, palpi and proboscis dark brown.

First palpal segment short; second, third and fourth longer, subequal; fifth rather shorter; third segment moderately inflated and furnished with a well developed sensory pit. *Antennae* dark brown, segments four to ten short and broad, the tenth sub-spherical, the others broader than long, the length varying from half to about two-thirds the breadth; last five segments (eleven to fifteen) elongate, from two and a half to three times as long as broad, the fifteenth terminating in a relatively large stylet. *Thorax* uniformly dark brown, scantily clothed with brown hairs. Pleurae dark brown. Scutellum dark brown, bearing two sub-median and two lateral bristles and no short hairs. Post-scutellum dark brown. *Wings* clear, unspotted, the anterior veins brownish; venation as in *A. xanthoaspidium*, but first cell larger; decumbent hairs absent, wing surface covered by microtrichia. Halteres with yellow knobs and pale straw-coloured stems. *Legs* almost uniformly yellowish-brown, but tarsal segments slightly infuscated. Fourth tarsal segments not cordiform; first tarsal segment of hind legs nearly four times as long as second; dorsal hairs on the tarsal segments rather long. Claws equal, apparently simple or with a very minute sub-apical tooth, about half the length of the fifth tarsal segment. Empodium well developed, as long as the claws. *Abdomen* dark brown with a yellowish tint, pigmented with a substance which does not clear in carbolic acid but which is removed by caustic potash. Spermatheca single, highly chitinised, oval; length 57μ, greatest breadth 46μ, only the very commencement (about 4μ) of the duct is chitinised.

GOLD COAST: Accra, November, 1920; a single female, collected in the evening upon a window in the laboratory. Oblogo, May, 1920, reared from rotten wood from a canoe in the river Densu.

Atrichopogon homoium, sp. nov.

This species, of which we possess only a single female, agrees with the foregoing (*A. chrysosphaerotum*, sp. nov.) in size, colouration, and apparently in every other particular excepting in the distribution of the hairs on the wings and the scutellum. On the scutellum are four short hairs, two on each side, in addition to the bristles. On the wings are a few decumbent hairs; seven to ten at

the tip of the wing, one near the periphery between the rami of the fourth vein, and a few along the distal portion of the anterior ramus of the fourth vein (fig. 6).

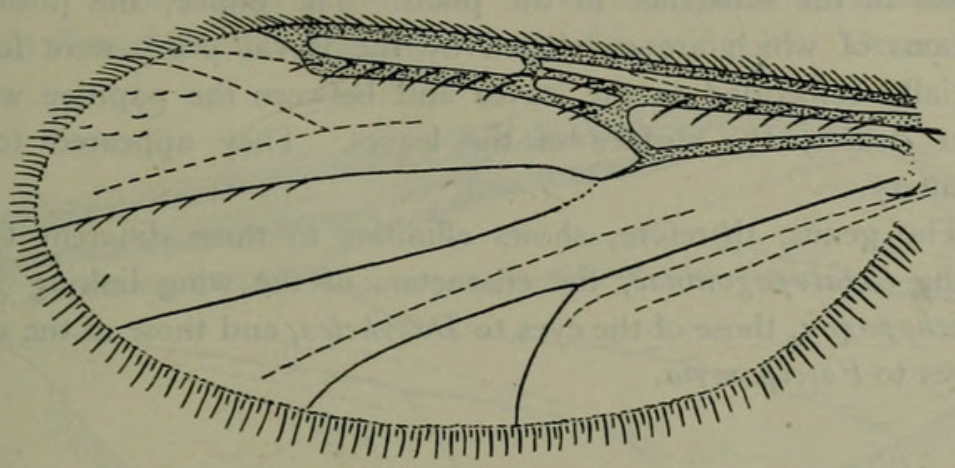

FIG. 6. *Atrichopogon homoium*, sp.n., wing of female. (× 120 circa.)

The distribution of the hairs on the wings and the scutellum appear to be important specific characters, and therefore, notwithstanding the similarity of this insect to *A. chrysosphaerotum* and the paucity of our material, we feel compelled to regard it as a separate species.

GOLD COAST: Oblogo, September, 1920; a single female reared from material taken from a canoe.

Genus *KEMPIA*, Kieff.

This genus, originally described by Kieffer (1913) as a sub-genus of *Dasyhelea* and subsequently raised to generic rank by its author and removed to the *Atrichopogon* group, appears to be characterised chiefly by the presence of a well developed empodium on the legs and of pubescence on the eyes, and the absence of the longer hairs from the wings. We have referred the insect described below to the genus *Kempia*, notwithstanding the fact that it bears on its wings a few decumbent hairs, because, as stated elsewhere, we are inclined to regard this character as of specific rather than generic value. It may be noted, however, that in the case of *Prokempia* the absence of the longer wing hairs appears to have been considered by Kieffer sufficient justification for its separation from *Dasyhelea*.

The larvae and pupae resemble those of *Forcipomyia*. The larvae were found living upon the water lettuce *Pistia stratiotes*, but were normally seldom seen alive, probably because they were buried in the substance of the plant. The pupae, the posterior portions of which are enveloped by the larval pelts, were found partially embedded in the leaves and between the papillae which cover densely the surface of the leaves. They appeared to be sedentery.

The genus, therefore, shows affinities to three different types of the *Ceratopogoninae*, the characters of the wing linking it to *Atrichopogon*, those of the eyes to *Dasyhelea*, and those of the early stages to *Forcipomyia*.

Kempia ochrosoma, sp. nov.

Measurements.

Length of body	1·3 mm.
Length of wing	1·1 mm.
Greatest breadth of wing	0·35 mm.

Head straw-yellow, clothed with yellow hairs. Eyes pubescent: in the female contiguous, but with the facets narrowly separated; in the male separated. Clypeus, palpi and proboscis pale straw-yellow, with similarly coloured hairs. First palpal segment small, second and fourth sub-equal, fifth short and somewhat expanded at its distal end, third longer than any of the others, slightly inflated in its middle third, and furnished with a deep sensory cup. *Antennae*: first segment and torus straw-yellow; in the female, flagellum segments slightly infuscated, especially the more distal ones, segments eleven to fifteen dark brown; in the male, segments three to eleven pale yellow, segment twelve dark distally, and the last three segments dark brown; whorls of hairs pale straw-yellow. In the female, segments four to ten sub-spherical, the length varying from a little less than to about the same as the breadth, segments eleven to fifteen elongate, from twice to three times as long as broad, the last segment terminating in a stylet. In the male, the last three segments elongate, sub-equal, the thirteenth slightly the longest and the fifteenth terminating in a stylet. *Thorax* uniformly coloured, ochraceous, almost the same hue as the head; clothed with short, curved, yellow hairs dorsally, and with a few longer, spine-like,

yellow hairs posteriorly. Pleurae ochraceous. Scutellum slightly paler yellow than the mesonotum, bearing two admedian and two lateral bristles and a few (ten in the female, eight in the male) short hairs. Post-scutellum ochraceous. *Wings* unspotted, the anterior veins yellowish; venation as shown in the figure (fig. 7). Decumbent

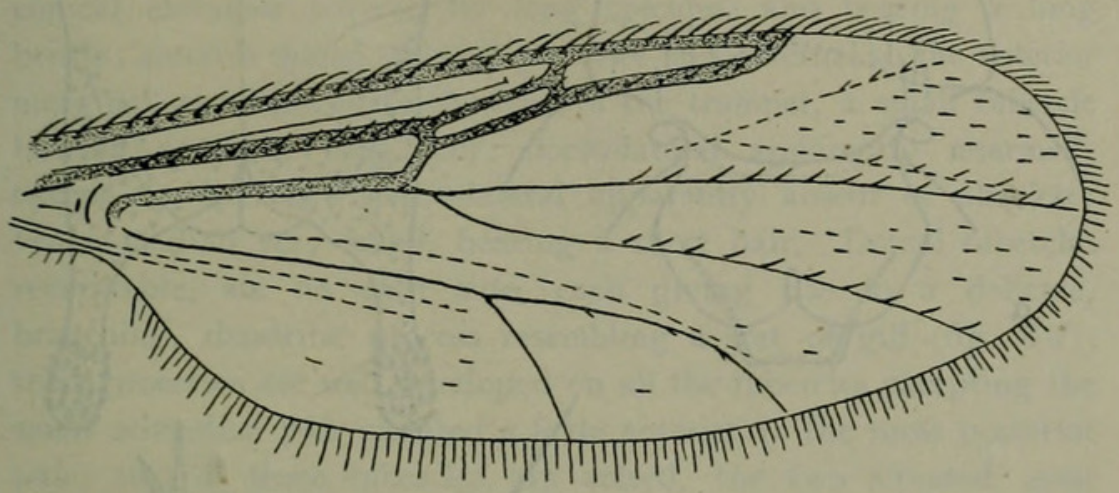

FIG. 7. *Kempia ochrosoma*, sp.n., wing of female. (× 90 circa.)

hairs scanty: in the female, limited to the distal third of the wing and a few near the posterior margin; in the male, almost entirely wanting. Surface of the wing closely covered with microtrichia. Halteres with pale straw-yellow stems and white knobs. *Legs* almost uniformly pale straw-yellow; unarmed. Claws in both sexes equal, about half the length of the fifth tarsal segment; in the female, each with a very small, sub-apical tooth, in the male, deeply bifurcated at the tips. Empodium well developed, hairy; at least as long as the claws. *Abdomen* ochraceous, rather paler yellow than the thorax. Hypopygium of the male of a similar colour and feebly chitinised. Spermatheca single, rather feebly chitinised, obovate and very large; length about 230μ, greatest breadth about 150μ, the duct chitinised at its commencement for a short distance (about 10μ). The abdomen, and also the thorax and the knobs of the halteres, containing a yellowish pigment which is not cleared by carbolic acid but which dissolves in caustic potash.

HYPOPYGIUM (fig. 8 *a* and *b*). *Ninth segment* feebly chitinised; tergite rather short and hairy, posterior margin rounded, without lateral, finger-like processes. *Forceps*: side-pieces normal, feebly chitinised; claspers also feebly chitinised, about as long as the

side-pieces, tapering distally, hairy almost to their tips. *Harpes* apparently absent. *Aedoeagus* feebly chitinised, a large ventral median structure with a central and two lateral processes; when fully

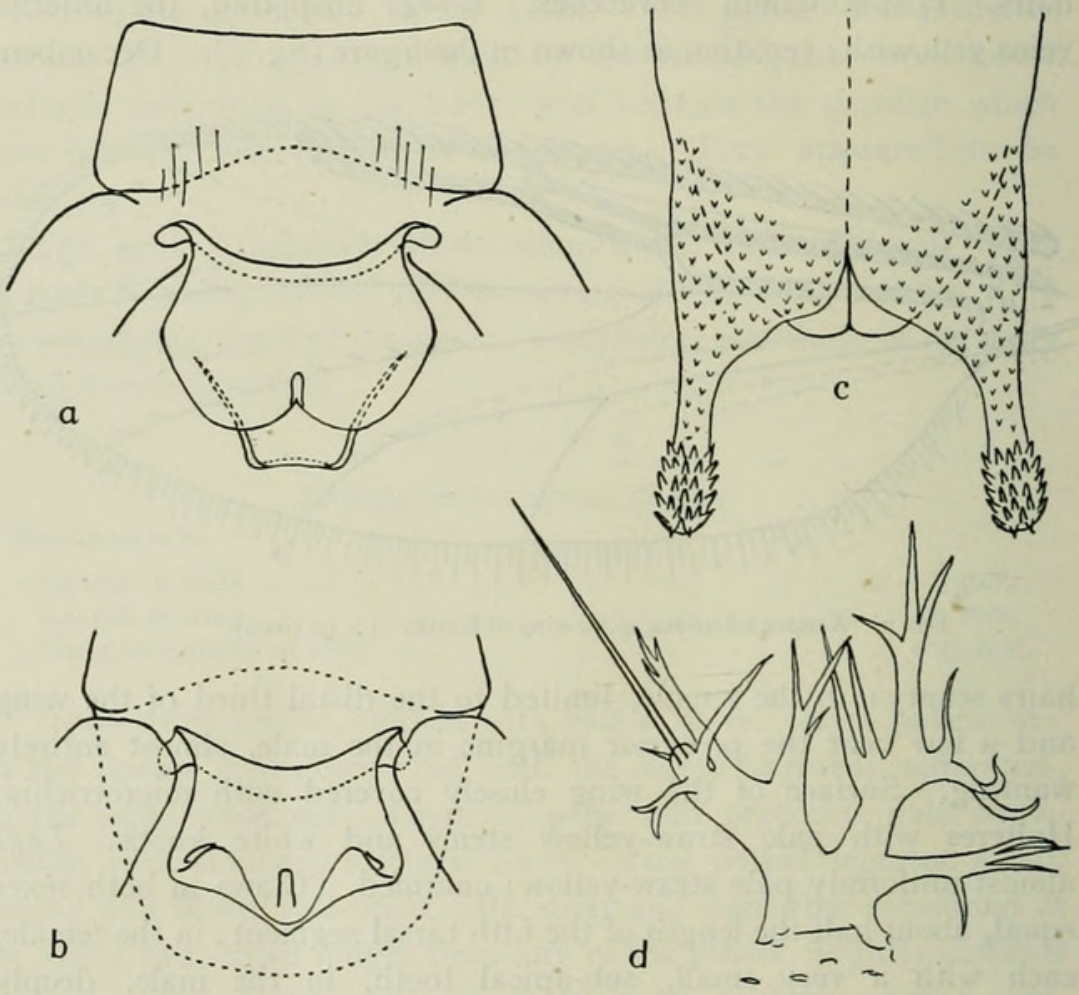

FIG. 8. *Kempia ochrosoma*, sp.n. *a* and *b*—Male hypopygium, ventral view of aedoeagus; *c*—posterior end of abdomen of pupa; *d*—dorsal gill-like tubercle of cephalothorax of pupa. (*a*, *b*, and *c* × 250 circa; *d* × 400 circa.)

expanded as shown in fig 8 *a*, but perhaps more frequently appearing as in fig. 8 *b*. We are not able at present to suggest what are the homologies of the median structures.

PUPA. Length about 2·1 mm., feebly chitinised; the posterior half of the abdomen (from the fifth segment) enclosed within the larval pelt, which is much shrivelled and discoloured. Integument irregularly covered with rather sparsely scattered spicules. *Cephalothorax* relatively large and broad, somewhat of the *Forcipomyia* type but with no dorsal extension over the middle of the first abdominal segment. Respiratory trumpets almost smooth, short and nearly straight, length a little less than 0·2 mm.; they arise from

small tubercles and are without stalks. Main tracheal trunk does not give off any lateral branches, and ends distally in a double row of rather long, blunt processes. Operculum feebly chitinised, sparsely spiculated; at its posterior angle is a small tubercle covered with long spicules. Anterior marginal tubercle an irregularly conical elevation covered by long spicules, and bearing a long bristle; anterior dorsal situated posterior and external to the anterior marginal and anterior to the base of the trumpet, a small tubercle bearing a rather long hair; dorso-lateral apparently unarmed, except by spicules, ventro-lateral apparently absent or obsolete; ventro-median very small, bearing a short hair. Dorsal tubercles remarkable, six on each side, each giving rise to a delicate, branching, dendritic process resembling a sort of gill (fig. 8 *d*); these processes are well developed on all the tubercles excepting the small admedian pair situated a little anterior to the most posterior pair; two of these tubercles are armed, the two situated most anteriorly and internally, and bear long spines. *Abdomen* directed straight backwards, tapering rather rapidly, the last segment terminating on each side in an almost straight process which is slightly dilated at its distal end, and is covered with long spicules directed anteriorly, which no doubt function as hold-fasts (fig. 8 *c*). The segments, which are enclosed within the larval pelt, bear only rudimentary tubercles; on the other segments (one to four) are a pair of dorsal admedian, and a pair of lateral tubercles similar to those on the dorsum of the cephalo-thorax—that is, dendritic processes resembling gills—the dorsal ones bear large spines.

LARVA. Length about 3 mm. when fully grown, brownish in colour. *Head* moderately chitinised, more or less conical, bearing a few relatively large hairs or bristles. Horn-like appendages on the dorsum (which are connected with the distal ends of the antennae of the adult) small, narrow, about 0·06 mm. long, straight, arising from quite small tubercles. Eyes large, bilobed. Mandibles densely chitinised, black, terminating in three or four teeth. Hypopharyngeal sclerite very highly chitinised, the posterior part armed on each side with a comb-like row of about ten short, pointed teeth. *Body* composed of twelve visible segments; cuticle covered with coarse spicules. Armature of bristles, spines, etc., modified at the anterior and posterior ends, but general arrangement as follows.

A pair of finger-like, admedian dorsal tubercles, bearing long spines, which are more or less barbed at their bases; three pairs of very long (about 0·8 mm.) and delicate dorso-lateral processes; four pairs of ventral spines, two central, the one admedian and the other ventro-lateral, and two postero-marginal, both ventro-lateral, these spines are relatively short and are freely barbed. The long dorso-lateral processes are the most conspicuous features of the larva, they bear lateral spines or bristles, are directed backwards, and trail behind the larva. The pro-thoracic pseudopods are partially fused, highly spiculated, each armed with a group of about ten large, well developed hooks, and anteriorly with numerous small hooks. The anal pseudopods are armed with similar large hooks arranged in two transverse rows.

GOLD COAST: Oblogo, February to March, 1921; reared from plants of the water lettuce (*Pistia stratiotes*) taken from a swampy pool, and from backwaters of the river Densu (Pl. XXI, fig. 1).

Genus *MONOHELEA*, Kieffer.

This genus is stated by its author to possess the characters of *Stilobezzia*, Kieff., but the petiole of the fourth longitudinal vein is very short, the fourth tarsal segment is long and cylindrical, the claws of the fore and middle legs of the female are simple, equal, two-thirds the length of the last tarsal segment, and the claws of the hind legs single, longer than the last tarsal segment. The species described below, of which at present we possess only a single female, appears to belong to this genus, although not conforming exactly to the generic description given above (for example, the claws of the fore and middle legs are not simple). The insect superficially resembles *Stilobezzia*, and when at rest holds its wings in a manner similar to *S. spirogyrae*, that is, diverging slightly, and not folded one on top of the other on the dorsum of the abdomen.

Monohelea litoraurea, sp. n.

MEASUREMENTS.

Length of body (one female)	1·3 mm.
Length of wing	1·0 mm.
Greatest breadth of wing	0·4 mm.

Head: occiput dark grey to brown, clothed with dark brown hairs. Eyes smooth, contiguous dorsally. Clypeus and proboscis

dark brown. Palpi dark brown, third segment slightly inflated and furnished with a sensory cup; fifth segment rather long and narrow, with a terminal group of four hairs. *Antennae* darkish brown: first segment rather large, dark brown, bearing a few dark hairs; torus dark brown, bearing a few dark hairs; flagellum segments paler, gradually elongating and deepening in colour towards the distal end of the antenna; fourth to tenth segments sub-cylindrical, from about one and a third times to twice as long as broad; segments eleven to fifteen elongate, from about three to a little over four times as long as broad, the last segment being the largest and the longest and tapering at its extremity, but not terminating in a definite stylet. Whorls of hairs small and the constituent hairs short; there is a hair just before the tip of the last segment. *Thorax*: dorsum dark grey with many dark brown spots and patches, and with the antero-

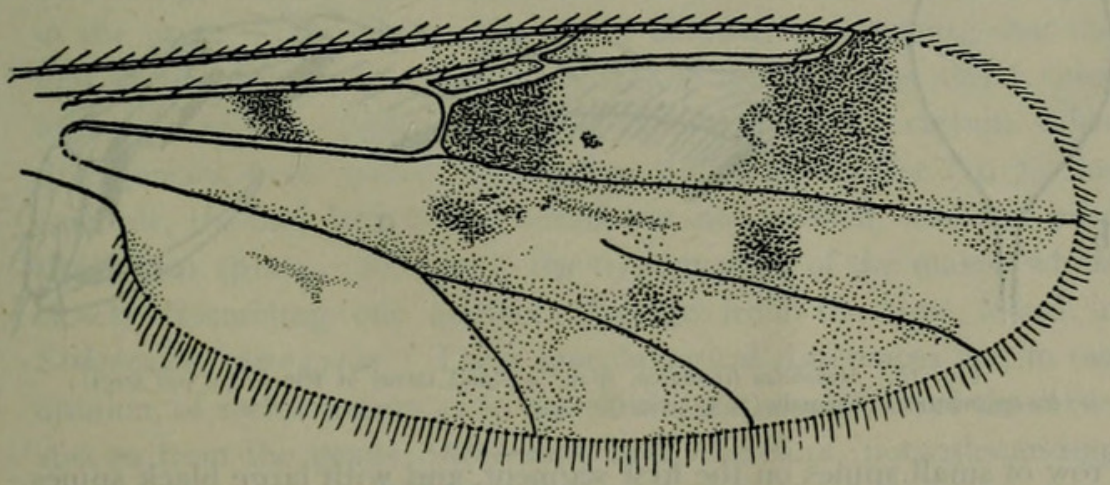

FIG. 9. *Monobelea litoraurea*, sp.n., wing of female. (× 105 circa.)

lateral angles brownish-yellow. The arrangement of the spots and patches is somewhat like that on the thorax of *Culicoides schultzei*. The mesonotum is clothed with rather short, dark hairs. Pleurae dark brown. Scutellum darkish brown, but not so dark as the mesonotum, paler in the middle than at the sides, bearing two admedian and two lateral bristles and a few (six) short hairs. Post-scutellum dark brown. *Wings* grey, with large white patches; the arrangement of the patches and the venation as shown in fig. 9. Lower ramus of fourth vein obsolete at the proximal end. The surface of the wing is covered by microtrichia, but without larger decumbent hairs. Halteres pale, with white knobs. *Legs* brown, femora and tibiae more or less infuscated. Fore and middle

femora brown, somewhat infuscated, especially at their apices, not swollen and without strong spines; hind femora uniformly very dark brown, slightly swollen, without strong spines. Fore and middle tibiae brown, infuscated; hind tibiae uniformly very dark brown, somewhat swollen. Tarsal segments brown, paler than the proximal segments: fore and middle tarsi without regularly arranged rows of spines, fore tarsi with a well developed black spine at the apex, the base, and sometimes the middle of the first segment and somewhat smaller but similar spines at the apex of the second and third segments, middle tarsi with several similar but less well defined spines, on the first segment and at the apex of the second and third segments, hind tarsi (fig. 10 *a*) with a regularly arranged ventral

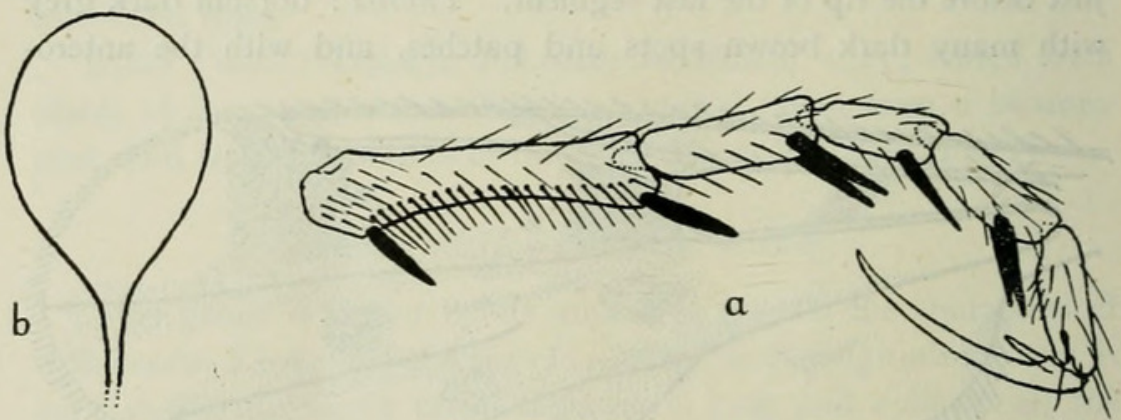

FIG. 10. *Monobelea litoraurea*, sp.n. *a*—hind tarsus of female (× 190 circa); *b*—spermatheca of female (× 375 circa).

row of small spines on the first segment, and with large black spines, one at the apex and one at the base of the first segment, two at the apex of the second segment, one at the apex of the third segment, and two at the apex of the fourth segment. Fourth tarsal segment on all the legs cylindrical. Claws on the fore and middle legs small, about half the length of the fifth tarsal segment, equal, each with a small basal tooth and a bifid extremity; claws on the hind legs single, with a very long tooth (as long as the fourth and fifth tarsal segments together), and a short tooth apparently fused with the large tooth at the base. Empodium rudimentary. *Abdomen* very dark brown, excepting at its extreme proximal end, where it is yellowish-brown; distal end almost black. Dorsal surface very sparsely clothed with short, dark hairs, which are almost entirely restricted to the sides. Spermathecae (fig. 10 *b*) two, unequal,

highly chitinised, pyriform (measurements about 80μ by 55μ, and 65μ by 55μ); the commencement of the duct, which is narrow (about 4μ), is chitinised for some distance (about 20μ).

GOLD COAST: Accra, 27th March, 1921; collected on a window in the laboratory at 6 p.m.

Genus *EUKRAIOHELEA*, nov.

The two following species show kinship to the genus *Stilobezzia*, Kieff., the chief generic characters of which are, according to Kieffer (1919)—wings glabrous, the first and third veins forming two radial cells of which the second is the longer, the fourth vein petiolate, the fourth tarsal segment cordiform in both sexes, and the claws long, simple, and very unequal in the female, short and equal in the male. Thy possess the above characters excepting that the first radial cell of the wing is obsolete, the first and third veins forming only a single large cell, but they show certain other divergencies from earlier descriptions given by Kieffer (1917), for example, the fore femora are armed but not swollen, and the hind tibiae bear spines. Moreover, the hypopygium of the males, whilst closely resembling one another, diverge from the type found in *Stilobezzia spirogyrae*. These morphological differences are, in our opinion, of such a nature as to necessitate the separation of these two species from the genus *Stilobezzia*, and, therefore, notwithstanding their close similarity in other respects to species of that genus, we propose to regard them as belonging to a new genus, for which we suggest the name *Eukraiohelea*.

Eukraiohelea africana, sp. n.

MEASUREMENTS.	Male.	Female.
Length of body	1·3 mm.	1·4 mm.
Length of wing	1·2 mm.	1·3 mm.
Greatest breadth of wing	0·4 mm.	0·5 mm.

The ground colour of this insect is olive green, on which are superimposed the brown markings. *Head* brown. Eyes smooth; narrowly separated in the female, more widely in the male. Clypeus and proboscis dark brown. Palpi dark brown, moderately long,

the third segment slightly inflated distally and furnished with a shallow sensory cup near its apex. Mouth-parts well developed in the female. *Antennae*: first segment small; torus yellowish-brown, sub-globular, very large in the male, bearing a few short hairs; flagellum pale brown proximally, the last three segments in the male and five in the female dark brown. Plume of the male moderately well developed, pale brown; hairs of the flagellum of the female very short, brown. In the male, the last three segments of the flagellum elongated, the thirteenth and fourteenth about five and twelve times as long as broad respectively, the fifteenth much longer, about thirty times as long as broad, and ending in a short, stout process. In the female, segments four to ten pale brown proximally, dark brown distally, and segments eleven to fifteen all dark brown; segments four to ten sub-cylindrical, rather wider in the middle than at either end, sub-equal, about three times as long as broad;

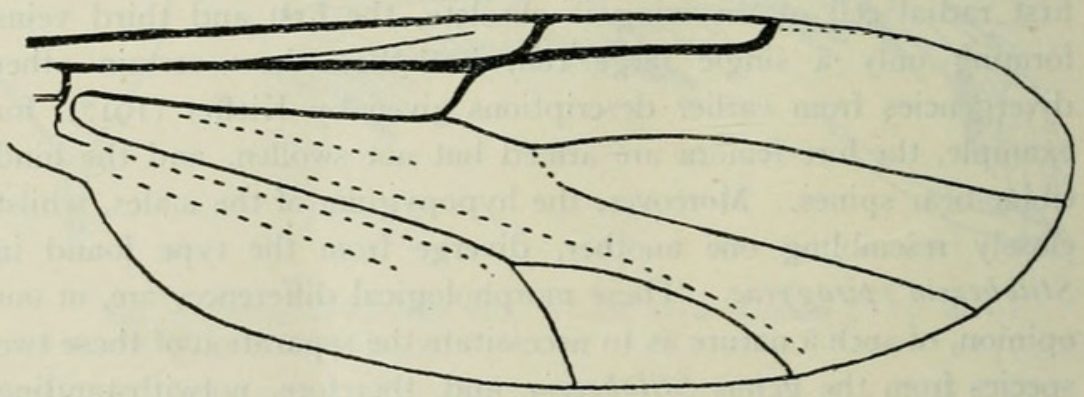

FIG. 11. *Eukraiohelea africana*, sp.n., venation of wing of male. (× 90 circa.)

segments eleven to fourteen elongated, about ten times as long as broad; the last segment much longer, about twenty times as long as broad, ending in a short, stout process. *Thorax* blue-green, with brown infuscation on the dorsum; hairs large, scanty, dark brown. Pleurae blue-green; a dark brown spot on the coxae of the fore and middle legs. Thoracic pits absent. Scutellum blue-green in the middle, and brown, with a blue-green tint, at the sides; bearing two admedian and two lateral bristles and a few (two to four, but often absent in the male) short hairs. Post-scutellum dark brown with a greenish-blue tint. *Wings* unspotted, without decumbent hairs. Wing surface covered by microtrichia. Venation as shown in the figure (fig. 11); first radial cell obsolete; in the female, the fourth

vein forks distally to the fifth, in the male, they both fork at about the same level. Fringe very short on the distal part of the wing. Halteres with greenish-blue knobs; stalks almost white, bases of the knobs infuscated. *Legs* pale brown, almost colourless, with dark knee spots; the infuscation on the hind legs extending beyond the knee nearly half way down the tibia. Fore femora armed with two short, stout, ventral spines, middle and hind femora unarmed; hind femora slightly swollen, fore and middle normal. Fore tibiae with the usual long apical spine; hind tibiae with a ventral row of spines, three long ones on the middle third and four short ones more distally. On all the legs the first tarsal segment at least twice as long as the second, third small and almost cordiform, fourth very small and strongly cordiform, fifth slightly infuscated, about as long as the second and longer than the third and fourth together. Rows of bulbous spines present on the first and second tarsal segments of all the legs; a stout basal spine on the first tarsal segment of the middle and hind legs; on the proximal half of the fifth tarsal segment of the fore and middle legs are two pairs of stout spines, on the hind legs a single pair. Claws alike on all the legs: in the female, single, with a long tooth (as long as the fifth tarsal segment), and a tooth about half this length apparently fused with it at the base, which is, moreover, somewhat extended as a process; in the male, shorter (about two-thirds the length of the fifth tarsal segment), bifid at the tips, composed of two equal parts fused at their bases. Empodium absent. *Abdomen* green, with brown infuscation (which is most marked in the female) at the sides and posterior dorsal margins of the segments. First segment with conspicuous lateral tufts of hairs. Spermathecae two, highly chitinised, pyriform (about 46μ by 35μ); the commencement of the duct chitinised for a short distance (about 7μ) only.

Hypopygium (fig. 12). *Ninth segment*: tergite rather feebly chitinised, moderately hairy; posterior margin broad, not cleft, without finger-like lateral processes; apical lobe-like processes moderately well developed, hairy; sternite apparently not excavated in the middle posteriorly. *Forceps*: side-pieces moderately long and hairy, distal ends infuscated; claspers rather broad, not strongly chitinised, tips infuscated, clothed with very delicate minute hairs and bearing a few longer hairs. *Harpes* in form somewhat

resembling those of species of *Dasyhelea*, but with the distal extensions bilateral and separate. Basal portions irregularly shaped, broad laterally; posterior extensions long, lath-like processes directed almost straight backwards, with bluntly pointed tips, reaching posteriorly as far as, or a little further than the margin

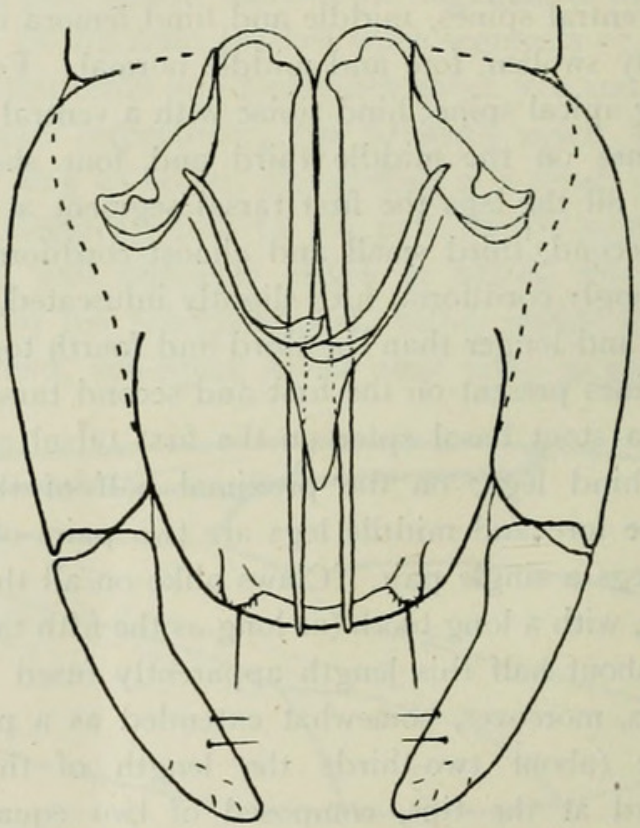

FIG. 12. *Eukraiohelea africana*, sp.n., outline of male hypopygium, ventral view. (× 375 circa.)

of the ninth tergite. *Aedoeagus* apparently composed of two separate chitinised lateral rods corresponding to the limbs of the arch in other genera, and a delicate membranous portion enclosing them and prolonged posteriorly in the middle line as a conical process. Ventral wall not spiculated.

GOLD COAST: Swamp between Koforidua and Tafo, a little north of Accra, April, 1921; Weshiang, June, 1921; reared from plants of the water-weed *Pistia stratiotes*.

Eukraiohelea versicolor, sp. n.

Measurements.	Male.	Female.
Length of body	1·3 mm.	1·3 mm.
Length of wing	1·0 mm.	1·1 mm.
Greatest breadth of wing	0·3 mm.	0·4 mm.

This insect resembles the last species, but the ground colour is white instead of blue-green. In the following account, only the more important points of difference between it and *Eukraiohelea africana* will be given.

Head dark brown; occiput dark brown in the middle, paler at the periphery; median occipital hairs long, dark brown. Eyes during life metallic green; smooth, separated in both sexes. Proboscis dark brown, well developed in the female. Palpi dark brown, as in *E. africana*. *Antennae*: torus yellowish-brown; flagellum very pale brown at the base, last five segments in the female and three in the male completely dark brown, apical portions of the fourth to the tenth segments in the female infuscated. Plume in the male moderately well developed, pale brown, hairs in the female short, pale brown. In the male, the last three segments elongated, about five, twelve, and twenty-two times as long as broad respectively, the last segment tapering to a conical tip. In the female, segments four to ten as in *E. africana*; segments eleven to fourteen elongate, sub-equal, about eight or nine times as long as broad; segment fifteen longer, about twelve times as long as broad, ending in a conical tip. *Thorax*: ground colour white; anterior half of the dorsum almost entirely dark brown in the male, in the female more or less infuscated and dark brown, but with median pale areas on each side of the middle line; in front of the scutellum is a triangular dark brown mark with its base directed posteriorly. Pleurae white. Over the bases of the coxae is a small, oval, dark brown patch. Scutellum dark brown, armature of bristles and hairs as in *E. africana* Post-scutellum dark brown. *Wings* as in *E. africana*. Halteres white. *Legs*: ground colour white; distal half of the hind femora and apical sixth of the hind tibiae dark brown; fifth tarsal segments hardly infuscated. Coxae infuscated. Femora shaped and armed as in *E. africana*. Tibiae shaped and armed as in *E. africana*, but hind tibiae bearing only three long spines. Tarsal segments as in *E. africana*; spines

on the fifth segments, however, less well developed, arrangement in the female as in *E. africana*, in the male only one pair present on all the legs. Claws as in *E. africana*. *Abdomen* white, with dark brown markings arranged as follows: small lateral patches on the first, fourth, and seventh segments, large dorso-lateral patches, reaching almost to the middle line dorsally, on the second, third, fifth and sixth segments. Lateral hair tufts on the first segment not so prominent as in *E. africana*. Spermathecae similar to those of *E. africana*; two, highly chitinised, pyriform (about 35μ by 30μ), the commencement of the duct chitinised for a short distance (about 4μ) only.

Hypopygium (fig. 13). Hypopygium darkish brown, rather small. *Ninth segment*: tergite moderately hairy, tapering slightly distally, posterior margin nearly straight, with a trace of a median

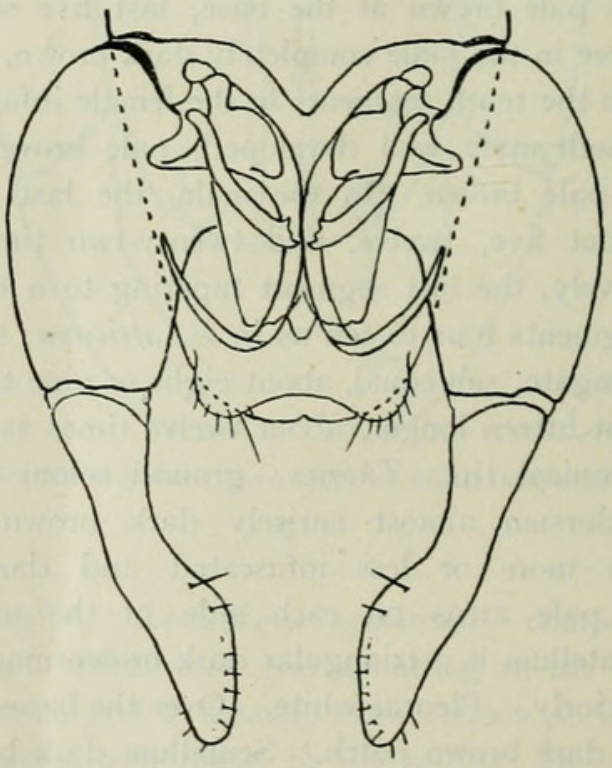

Fig. 13. *Eukraiohelea versicolor*, sp.n., outline of male hypopygium, ventral view. (× 375 circa.)

cleft, but without lateral finger-like processes; apical lobe-like processes well developed, hairy; sternite apparently prolonged posteriorly as a delicate, median, cone-shaped process. *Forceps*: side-pieces rather short and stout, moderately hairy; claspers long, stout, feebly chitinised, especially at their distal ends, entirely

covered by very delicate minute hairs and bearing at the posterior extremity a few rather larger hairs. *Harpes* similar to those of *E. africana*, but basal portions more expanded laterally, and posterior extensions longer and bent sharply in an anterior direction at about their middles. *Aedoeagus* somewhat similar to that of *E. africana*, delicate membranous part apparently with large lateral folds; ventral wall not spiculated.

GOLD COAST: Swamp between Koforidua and Tafo, a little north of Accra, April, 1921; reared from plants of the water-weed *Pistia stratiotes*.

Genus *SCHIZODACTYLUS*, nov.

This genus is allied to *Xylocrypta*, Kieff., and *Xenohelea*, Kieff., genera which have been separated by Kieffer (1917) from *Sphaeromias* (Stephens), Curtis, and *Palpomyia*, Mergele, by the characters of the fourth tarsal segments, which are cylindrical in both sexes, and the antennae of the males, only the last three segments of which are elongated. From the former it may be distinguished by the facts that the eyes in the male are separated and the body is not squat; from the latter by the fact that the claws of the female are equal. The chief generic characters are as follows:—Eyes smooth, separated in both sexes; widely in the male, narrowly in the female; last three segments of the antenna of the male elongate; wings covered by microtrichia but without longer decumbent hairs, costa reaching beyond the middle of the wing, first and third veins forming two radial cells, the distal of which is the longer, cross-vein not very oblique and not twice as long as the base of the cubitus, fourth vein sessile; femora armed, fourth tarsal segments cylindrical, claws in the female long and equal, those on the fore legs with long basal barbs, empodium rudimentary.

Schizodactylus telmatoscopus, sp. n.

MEASUREMENTS.

Length of body (two males)	2·8 mm.
Length of wing	1·5 mm.
Greatest breadth of wing	0·5 mm.

Head dark brown, large, wider than the thorax. Eyes glabrous, widely separated. Proboscis dark brown, very short. Palpi

brown, very small; third segment not inflated, sensory pit small or rudimentary. *Antennae* rather dark brown, especially the torus and the three terminal segments. First segment without hairs; torus sub-spherical, very dark; third segment rather larger than the following segments; fourth to twelfth segments almost cylindrical, from one and a third to two and a half times as long as broad, sharply separated from one another; last three segments elongated, the fifteenth being the longest and not ending in a stylet. Hairs not very long, pale coloured, arranged somewhat irregularly and not forming a single whorl. *Thorax* uniformly dark brown; small pro-thoracic lobes present; no tubercle on the front margin of the thorax in the middle; dorsum almost devoid of bristles, and without either anterior or posterior pit-like depressions. Scutellum dark brown, bearing a few (twelve to fourteen) hairs, but no large bristles. Post-scutellum dark brown. Pleurae dark brown. *Wings* unspotted and without long decumbent hairs; surface closely covered with minute upright spicules; fringe short; stronger hairs on costa scanty. Venation as shown in the figure (fig. 14); first cell

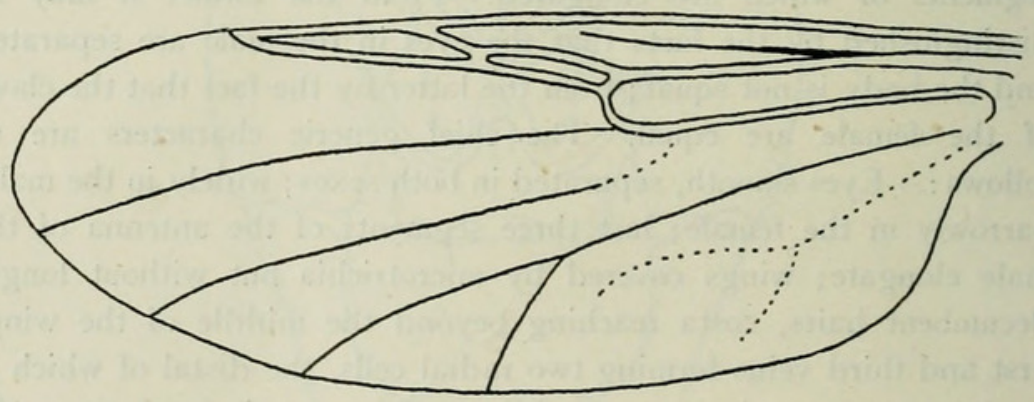

FIG. 14. *Schizodactylus telmatoscopus*, sp.n., venation of wing of male. (× 70 circa.)

rather large and long. Halteres with pale brown knobs. *Legs*: femora and tibiae dark brown; first four tarsal segments pale coloured with slightly infuscated apices, last segment entirely dark. Trochanters with small, paired, curved spines. Femora not unusually broad, bearing on all the legs two or three stout, short, dark spines on the under surface near the apex. First tarsal segment about twice the length of the second on all the legs; last segment rather elongated, fourth not cordiform. Regular rows of small spines are situated ventrally on the first tarsal segments of

the middle legs and on the first and second tarsal segments of the hind legs; those on the first tarsal segments of the hind legs arranged in a double row. Apically the fore tibiae bear a long, pale-coloured, ventral spine, the middle tibiae a strong, dark-coloured spine, and the hind tibiae the usual double row of bristles. First four tarsal segments of the middle and hind legs with a pair of strong, dark spines apically, those on the fourth segments being more slender. Claws about half the length of the fifth tarsal segment, equal, simple, but with bifid ends; empodium rudimentary. *Abdomen* dark brown; venter slightly paler than the dorsum.

Hypopygium (fig. 15). Dark brown, well chitinised, relatively rather small. *Ninth segment*: tergite bearing few bristles, terminating distally on each side in a large hairy process bearing two relatively long bristles; sternite deeply excavated in the middle,

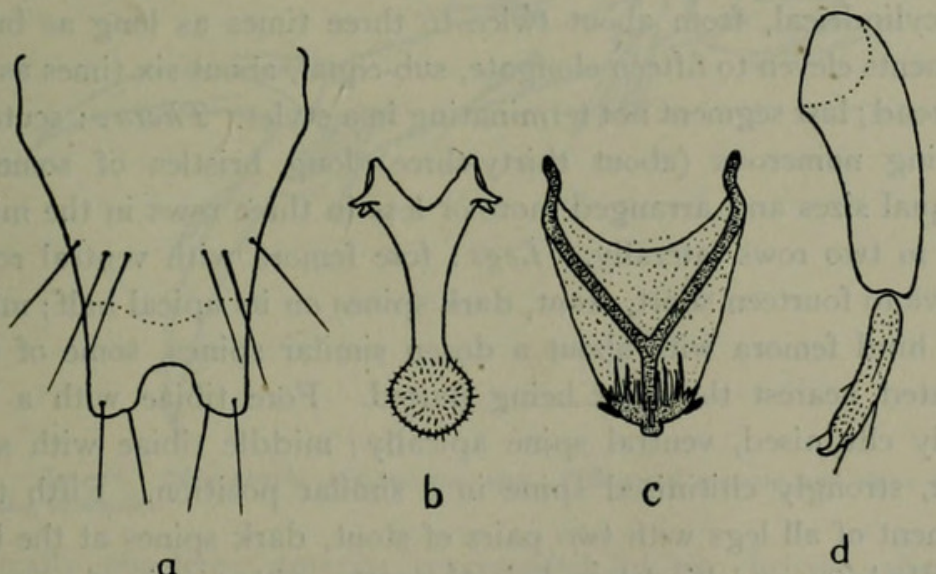

Fig. 15. *Schizodactylus telmatoscopus*, sp.n., male hypopygium. *a*—dorsal view; *b*, *c* and *d*, ventral views. *a*—ninth tergite (small hairs not shown); *b*—harpes; *c*—aedoeagus; *d*—forceps (hair on side piece not shown). (× 150 circa.)

reduced to a narrow band of chitin. *Forceps*: side-pieces rather narrow, hairs not very long; claspers short, bearing at the distal end a small claw. *Harpes* fused into a median, strongly chitinised rod; proximal extremity bifurcated, each half with two processes; distal end expanded, rounded in ventral view but slightly spoon-shaped in lateral view, not highly chitinised, closely covered with minute hairs. *Aedoeagus*: Y-shaped, chitinised portion with lateral flaps of spiculated membrane on each side; distal end broad, with a small

spine at each side, and an irregularly chitinised fringe extending anteriorly; ventral wall between the limbs of the Y well chitinised, spiculated; membrane connecting the aedoeagus with the ninth sternite with a very few spicules at its distal border only.

FEMALE. The following morphological details of the female were made out in a specimen extracted from a pupa of the same sample, and which was apparently identical with those of the males. *Head*: eyes narrowly separated. Palpi longer than in the male, and segments relatively more slender; first segment small, second, third, and fifth longer and sub-equal, fourth somewhat shorter. Third palpal segment not inflated, without a definite sensory cup but with a slight anterior depression from which arise a number of sensory hairs, the extremities of which are only slightly dilated. *Antennae*: first segment bearing four hairs; torus somewhat pyriform and bearing a considerable number of short hairs; segments four to ten cylindrical, from about twice to three times as long as broad; segments eleven to fifteen elongate, sub-equal, about six times as long as broad; last segment not terminating in a stylet. *Thorax*: scutellum bearing numerous (about thirty-three) long bristles of somewhat unequal sizes and arranged more or less in three rows in the middle and in two rows laterally. *Legs*: fore femora with ventral row of twelve to fourteen short, stout, dark spines on its apical half; middle and hind femora with about a dozen similar spines, some of those situated nearest the apex being paired. Fore tibiae with a long, feebly chitinised, ventral spine apically; middle tibiae with short, dark, strongly chitinised spine in a similar position. Fifth tarsal segment of all legs with two pairs of stout, dark spines at the base; middle legs, and hind legs less distinctly, with a pair of somewhat similar spines at the apex of the first, second, and third tarsal segments. Double row of small spines on the first tarsal segment of the hind legs complete. Claws long, equal, almost as long as the fifth tarsal segment; those of the fore legs (fig. 16) with a rather large basal barb, which is not present on the other legs. Empodium rudimentary. *Abdomen*: spermathecae two, highly chitinised, oval; length 123μ to 133μ, greatest breadth 106μ to 121μ; only the very commencement (about 4μ) of the duct chitinised.

PUPA. Length about 4 mm. to 5 mm. Form similar to that of *Culicoides*, and, therefore, the description will be given on the same

lines as was done in the case of that Genus. The pupa is very dark coloured and highly chitinised, especially at the anterior part of the cephalo-thorax. *Respiratory trumpets* short, broad, and straight, arising from rather depressed tubercles and without definite stalk; length about 260μ, breadth in the middle about 65μ. The main tracheal trunk is very broad, straight, without lateral branches, at its distal end terminating in a semi-circular, fan-like arrangement of about fifteen short processes. *Cephalo-thorax.* Anterior marginal tubercle small, bearing a small bristle; anterior dorsal small, bearing a small bristle; dorso-lateral small, bearing two bristles; ventro-lateral small, bearing two or three short bristles; ventro-median obsolete, represented by two small hairs. Dorsal tubercles

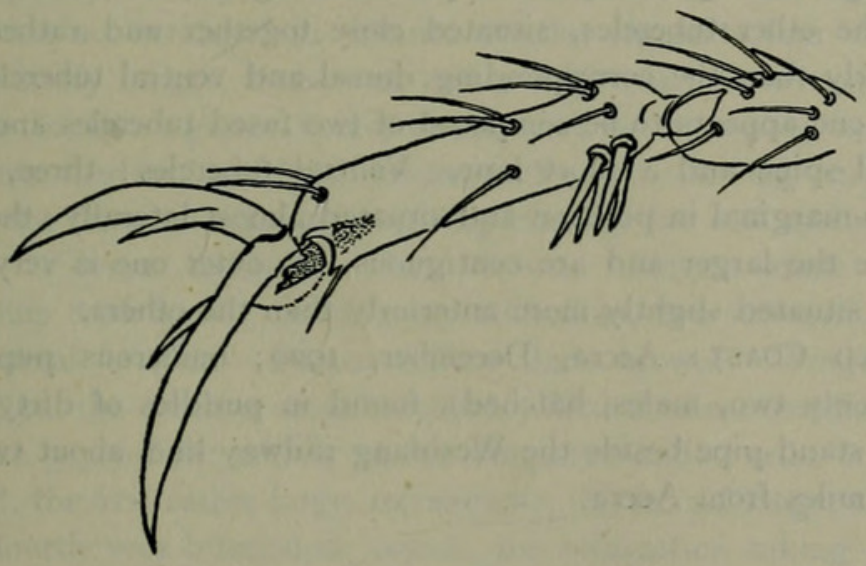

FIG. 16. *Schizodactylus telmatoscopus*, sp.n., fifth tarsal segment and claws of foreleg of female.

practically obsolete: anterior represented by two bristles slightly separated from one another; posterior by a single bristle; and lateral by a bristle and a socket-like mark, apparently unarmed, a little external to it. The dorsum is highly chitinised and very dark, the integument closely covered by small dark granulations; there is a transverse band of dark patches on the anterior third similar to that seen on many species of the Genus *Dasyhelea.* The postero-dorsal tubercle apparently obsolete. The posterior margin of the dorsum is rounded, not prolonged backwards as a median process. *Abdomen*: first segment, very short, second, long and broad; third to eighth, sub-equal but tapering towards the posterior extremity,

almost square; ninth, short and small, with two short, sharply-pointed, divergent terminal processes. There are a few dark spots on the integument of most of the segments: dorsally, two sub-lateral anterior, two admedian central, and a central a little farther back; ventrally, two sub-lateral anterior, and a central somewhat heart-shaped spot between and behind them. The tubercles are all small, and bear only small spines or hairs. The following may be distinguished on each side of a typical segment. Dorsal tubercles: antero-submarginal, two, very small, the outer being situated almost laterally; postero-marginal, three, small, the inner one situated posterior to the inner antero-submarginal tubercle, the outer two contiguous, situated almost laterally. Lateral tubercles: antero-submarginal, single, very small; postero-marginal, two, rather larger than the other tubercles, situated close together and rather more anteriorly than the corresponding dorsal and ventral tubercles, the dorsal one appears to be composed of two fused tubercles and bears a small spine and a short hair. Ventral tubercles: three, small, postero-marginal in position and situated almost laterally; the inner two are the larger and are contiguous, the outer one is very small and is situated slightly more anteriorly than the others.

GOLD COAST: Accra, December, 1920; numerous pupae (of which only two, males, hatched), found in puddles of dirty water near a stand-pipe beside the Weshiang railway line, about two and a half miles from Accra.

Genus *SPHAEROMIAS* (Stephens), Curtis.

This genus includes those midges in which the eyes are bare, the wings bare except for minute, point-like hairs visible only with a microscope, third vein extending beyond the middle of the wing, second radial cell longer than the first, fourth vein forking almost under the cross-vein, femora unarmed and not swollen, fourth tarsal segments cordiform, fifth not swollen, empodium absent or rudimentary. It is apparently the same as the Genus *Johannsenomyia* erected by Malloch to include those species, which he had previously included in *Johannseniella*, 'which have the media furcate proximad to the cross-vein.' One male of a single species of this genus was obtained near Accra.

Sphaeromias litoraurea, sp. nov.

Measurements.

Length of body (one male)	1·6 mm.
Length of wing	1·2 mm.
Greatest breadth of wing	0·4 mm.

Head dark brown. Eyes widely separated, smooth. Clypeus and proboscis dark brown. Palpi dark brown: all five palpal segments short, but the third and the fifth rather longer than the fourth; third palpal segment slightly longer than broad, not inflated, with a few long, knob-ended sensory hairs on its inner side anteriorly which arise from a very shallow depression. *Antennae* dark brown: plume poorly developed, composed of relatively few and short hairs which are not arranged in distinct whorls; segments four to eleven progressively longer, from once and a half to a little over twice as long as broad; segment twelve about three times as long as broad; segments thirteen to fifteen longer, sub-equal, bearing only short hairs, the terminal segment tapering distally but not ending in a stylet. *Thorax* uniformly dark brown. Pleurae dark brown. Scutellum dark brown, bearing two admedian, two sub-median, and two lateral bristles. Post-scutellum dark brown. *Wings* clear, unspotted, the anterior veins brownish. Third vein extending some distance beyond the middle of the wing; two radial cells, both well formed, the first rather large, rectangular, the second longer than the first; fourth vein bifurcated, sessile, the bifurcation taking place a little proximal to the cross-vein. Wing surface covered by microtrichia but otherwise bare, without decumbent hairs. Halteres with dark brown knobs. *Legs* almost uniformly brown, but with indications of darker knee-spots and with the tarsal segments slightly infuscated. Trochanters with usual pair of stout, curved spines. Femora unarmed, not swollen. First tarsal segments much longer than second, fourth cordiform. First and second tarsal segments of hind legs with conspicuous ventro-lateral row of small spines. Tibiae of fore legs with a long ventral spine at the apex. Tibiae and first two tarsal segments of middle legs with small, paired, apical spines; first tarsal segment bears also several similar spines on its ventral border. Claws equal, about half the length of the fifth tarsal segment, bifid. Empodium absent. *Abdomen* dark brown.

Hypopygium (fig. 17). *Ninth segment*: sternite reduced to a narrow strip of chitin; tergite not highly chitinised, bearing apparently only two long bristles dorsally near its middle, the chitinisation of the tergite interrupted a little posterior to them, the posterior margin with a short hairy process on each side, the ventral surface thickly covered by short hairs, the lobe-like processes well developed, covered by short hairs, and bearing one or two longer bristles. *Forceps*: side-pieces rather long and narrow; claspers short, terminating in strong, pointed hooks, basal two-thirds hairy.

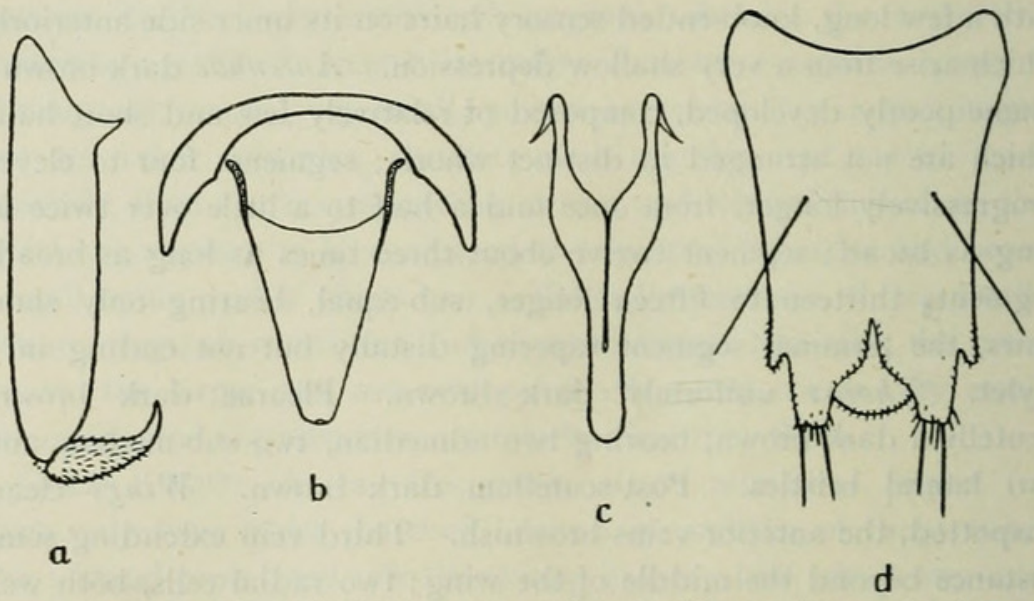

Fig. 17. *Sphaeromias litoraurea*, sp.n., outlines of male hypopygium. *a*, *b*, and *c*—ventral views; *d*—dorsal view. *a*—forceps (bristles and hairs of side-piece not shown); *b*—aedoeagus; *c*—harpes; *d*—ninth tergite (small surface hairs not shown).

Harpes dark brown, highly chitinised, with a double dorso-ventral curve; distal extremities fused to form a blunt, rather broad, process. *Aedoeagus* conical, proximal portions of the limbs narrow and highly chitinised, distal portions less highly chitinised; distal extremity broad, with a slight ventral lip; ventral wall slightly chitinised to about the level of the middles of the highly chitinised portions of the limbs; membrane joining the aedoeagus to the ninth sternite not spiculated.

Gold Coast: Odorkor, a small village near Accra, November, 1920; one male, obtained from a drain situated near a stand-pipe. Weshiang, near Accra, June, 1921; one male, reared from plants of the water-weed *Pistia stratiotes*, taken from the river Densu.

Genus *BEZZIA*, Kieff.

The chief characters of this genus, according to Kieffer (1919), are—eyes glabrous, the last three or four antennal segments in the male elongated, the wings bare or covered by microscopic setae, the first and third veins not united by a cross-vein and forming a single cell, the bifurcation of the fourth vein scarcely proximal to or under the cross-vein, the femora on the fore legs at least armed with one or more ventral spines in both sexes, the fourth tarsal segment cordiform, the fifth unarmed in both sexes, and the claws small, not half the length of the fifth tarsal segment, simple in both sexes, or sometimes with a small median tooth in the female. Up to the present we have not collected at Accra any specimens referable to this genus, but we have received from Lagos a single female of one species, and of this a description is given here.

Bezzia foyi, sp. n.

MEASUREMENTS.

Length of body (one female)	2·1 mm.
Length of wing	1·4 mm.
Greatest breadth of wing	0·5 mm.

Head dark brown, clothed with rather short dark brown hairs. Eyes smooth, narrowly separated. Clypeus, proboscis and palpi dark brown. Mouth-parts well developed, mandibles particularly highly chitinised, and bearing strong teeth on their inner edges. First palpal segment small, second short and broad, third, fourth, and fifth sub-equal, about twice as long as broad; the third segment scarcely at all inflated and without a sensory cup, but bearing a patch of sensory hairs on its inner aspect; the fifth segment pyriform, its distal end broad and rounded, bearing a few rather long hairs. *Antennae* dark brown, the terminal segments rather paler at their bases; hairs short, dark brown. First segment small; torus sub-spherical, bearing numerous short hairs; third rather longer than the fourth, with a short stem; segments four to ten oval, slightly constricted at their bases, their lengths varying from once and a half to twice the greatest breadth; segments eleven to fifteen elongate, about three or four times as long as broad, the last segment the longest and ending in a conical tip without a stylet. *Thorax*

uniformly very dark brown, clothed with short, dark brown hairs, and bearing above the wing bases a few longer, strong hairs. Pleurae dark brown. Scutellum dark brown, not so dark as the dorsum; bearing two lateral and two centro-marginal bristles and very numerous short hairs. Post-scutellum dark brown. *Wings* clear, slightly infuscated near the anterior borders, the stronger veins brownish. Venation as shown in the figure (fig. 18 *a*). The costa does not extend as far towards the tip of the wing as in the female of *Probezzia pistiae* (p. 365); the fork of the fourth vein under the cross-vein. The surface of the wing covered by microtrichia and devoid of longer decumbent hairs; fringe very short on the apical third of the wing. Halteres with pale brown stems and dark brown knobs; knobs bearing a few short hairs. *Legs* dark brown, conspicuously banded. Femora dark brown, especially those of the

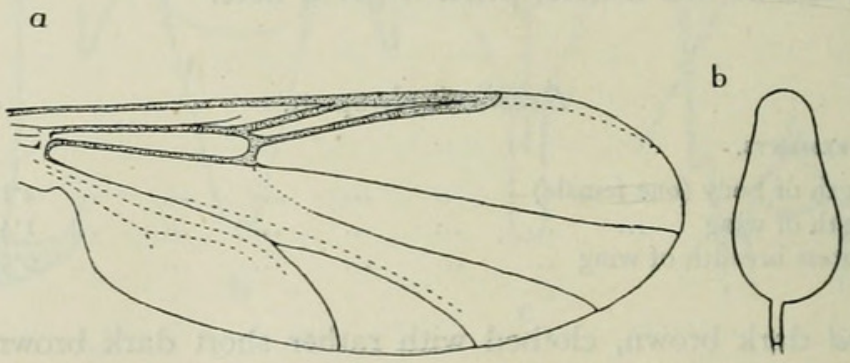

Fig. 18. *Bezzia foyi*, sp.n. *a*—venation of wing of female (× 50 circa.); *b*—spermatheca (× 210 circa.)

hind legs, slightly paler basally, and in the case of the fore and middle legs with a narrow pale band near the apex; knees dark brown; tibiae dark brown, with a narrow pale band near the base, and a less distinct, pale, sub-apical band; tarsi paler, last two segments infuscated. Femora not swollen; fore femora armed with two short, dark, ventral spines on its apical third, middle and hind femora unarmed. Tibiae unarmed, not swollen. First tarsal segment about twice as long as the second on the fore legs, relatively longer on the middle and hind legs; bulbous hairs conspicuous on the hind tarsus, forming two rows on the first and second segments, and one on the third, on the middle legs are single rows of similar hairs on the first and second segments. Fourth tarsal segment cordiform; fifth unarmed. Claws simple, equal, short, less than one-half the length of the fifth tarsal segment. Empodium

rudimentary. *Abdomen* dark brown, venter paler than the dorsum, scantily clothed with short dark brown hairs. Spermathecae two, highly chitinised, unequal, oval or egg-shaped and slightly constricted sub-apically (fig. 18 *b*); lengths about 103μ and 84μ in the single female examined, and greatest breadths 53μ and 49μ respectively; the duct narrow (about 4μ), and chitinised for some distance (about 25μ).

NIGERIA (Southern provinces): Lagos, July, 1921 (Dr. H. Andrew Foy); a single female taken in the evening upon the white lining of a lamp-shade. We have pleasure in dedicating this species to the collector, Dr. H. Andrew Foy, to whom we are also indebted for numerous other specimens of *Ceratopogoninae* from Lagos.

Genus *PROBEZZIA*, Kieff.

The chief generic characters of *Probezzia*, according to Kieffer (1919), are—eyes glabrous, last four antennal segments in the male elongated, wings bare or covered with microscopic setae, first and third veins separated for their entire length, bifurcation of the fourth vein scarcely proximal to or under the cross-vein, femora unarmed, fourth tarsal segment cordiform, fifth unarmed in both sexes, and claws small, about one-third the length of the fifth tarsal segment, equal and simple in both sexes, or with a small median tooth in the female. The two species which we have assigned to this genus differ slightly in two respects from the above description, namely, in having only the last three antennal segments definitely elongated, the twelfth segment being but slightly longer than the eleventh, and the fourth tarsal segment short and broad but not definitely cordiform. These differences are very slight, or may even depend on the manner of interpretation of the terms elongated and cordiform.

Both the species described here were reared from plants of the water lettuce *Pistia stratiotes*, but we were successful in procuring for examination the early stages of the first species only. The larvae are slender, almost white, eel-like organisms similar to those of *Culicoides*, but larger and with relatively longer and narrower heads. They resemble the figure of the larva of *Palpomyia longipennis*

given by Malloch (1915). They appear normally to inhabit the basal portions of the roots of the *Pistia* plants, and were reared to the adult stage from plants taken from the water and brought, or sent through the post, to the laboratory, and subsequently kept merely moist. They are, however, capable of leading an aquatic existence, and move very rapidly in water, swimming about in a manner similar to the larvae of *Culicoides*. At the posterior end of the body are long, stout hairs, which are an aid to progression. The pupae are similar in form to those of *Culicoides*. They are able to survive in water, but when placed in it quickly make for the side and wriggle themselves above the surface. In the latter situation they remain practically sedentary if undisturbed. The duration of the larval stage was not determined, that of the pupal stage was two to four days.

Probezzia pistiae, sp. n.

Measurements.	Male.	Female.
Length of body	1·6 mm.	2·5 mm.
Length of wing	1·1 mm.	1·9 mm.
Greatest breadth of wing	0·4 mm.	0·6 mm.

The male is a much smaller, and much darker brown insect, than the female. *Head*: occiput dark brown, with brown hairs. Eyes glabrous, separated in both sexes. Clypeus and proboscis brown, with brown hairs. Palpi dark brown, rather slender; the first segment short, segments two, three and five sub-equal, about twice as long as broad, the fourth segment rather shorter; third segment not inflated, without a sensory cup but with a few sensory hairs situated distally on its inner side. *Mouth-parts* somewhat similar to those of midges of the Genus *Prionognathus*. Labium soft and hairy. Labrum rather strongly chitinised, the proximal two-thirds broad, the distal third tapering, fringed with delicate hair-like processes. Hypo-pharynx broad, tapering distally to a rounded apex, and fringed. Mandibles (fig. 21 *d*), in the female, similar to those of *P. marmoratus*, and similarly situated, but without teeth and with only a few delicate hair-like processes on the outer edge; the teeth on the inner edge are seven, large and strong, and proximal to them is a row of delicate hair-like processes; in the male, mandibles smaller, less highly chitinised and without strong teeth, but with about five delicate hair-like processes on the inner side.

Maxillae rudimentary. *Antennae*: dark brown, the last five segments in the female, and the last three in the male, darker than the rest. First segment small, bearing a few short hairs in the female. Torus yellowish-brown in the female, dark brown in the male; bearing a few short hairs. Flagellum segments subcylindrical: in the female, segments four to ten from twice to nearly two and a half times as long as broad, segments eleven to fifteen elongate, from nearly five to seven times as long as broad, the fifteenth segment being the longest and ending bluntly; in the male, the twelfth segment about two and a half times as long as the last three segments elongate, from three to five times as long as

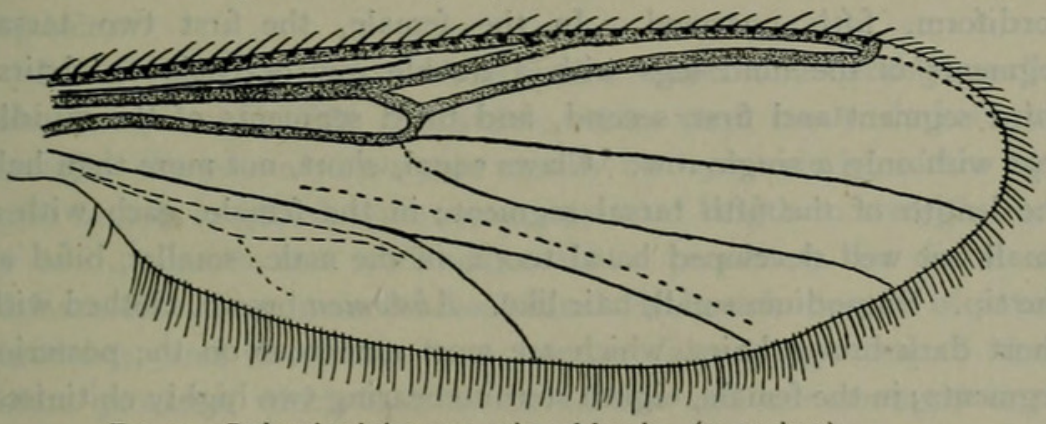

FIG. 19. *Probezzia pistiae*, sp.n., wing of female. (× 50 circa.)

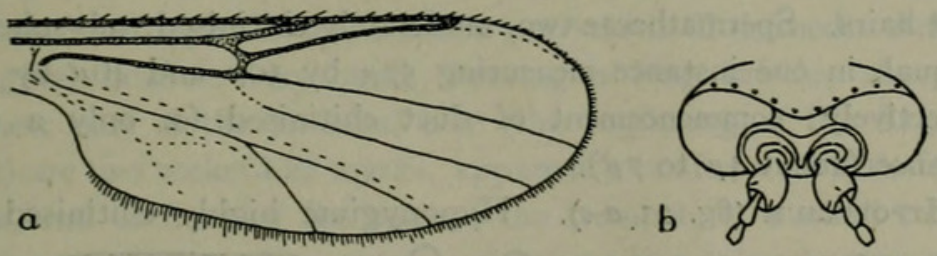

FIG. 20. *a—Probezzia pistiae*, sp.n., wing of male. (× 50 circa); *b—Probezzia stephensi*, sp.n., head of male. (× 60 circa.)

broad, the fifteenth segment being the longest and ending bluntly. Hairs short and scanty in the female; plume of the male poorly developed. *Thorax*: dorsum uniformly dark or darkish brown, clothed with short dark brown hairs and bearing laterally and posteriorly a few dark brown bristles. Pleurae darkish brown. Scutellum darkish brown, bearing a transverse row of six to eight bristles, and in the female numerous scattered short hairs; in the male are usually only six bristles, and the hairs are more scanty. Post-scutellum dark brown, without a pit. *Wings* unspotted. Venation as shown in the figures (figs. 19 and 20 *a*); costa in the

female extending further towards the tip of the wing than in the male. Surface of the wing closely covered with microtrichia; no macrotrichia present. Halteres pale brown, with dark brown knobs. *Legs* almost uniformly infuscated in the male; in the female, more or less banded, femora with a dark band before the apex, tibiae with a dark apical band and a dark band a little beyond the base, distal ends of first four tarsal segments and whole of fifth infuscated. Femora not inflated and without strong spines. Tibiae moderately hairy; fore and middle legs with a dark apical spine. Tarsus with first segment more than twice as long as the second, fourth short and broad, almost (especially in the male) but not definitely cordiform, fifth unarmed. In the female, the first two tarsal segments of the hind legs with a double row of 'bulbous' hairs, third segment and first, second, and third segments of the middle legs with only a single row. Claws equal, short, not more than half the length of the fifth tarsal segment; in the female, each with a small but well developed basal tooth, in the male, smaller, bifid at the tip. Empodium small, hair-like. *Abdomen* brown, clothed with short dark brown hairs, which are most numerous on the posterior segments; in the female, eighth sternite bearing two highly chitinised plates, one on each side of the vulva, clothed distally with numerous short hairs. Spermathecae two, moderately chitinised, sub-spherical, unequal, in one instance measuring 57μ by 50μ and 46μ by 40μ, respectively; commencement of duct chitinised for only a short distance (about 4μ to 7μ).

Hypopygium (fig. 21 *a-c*). Hypopygium highly chitinised and

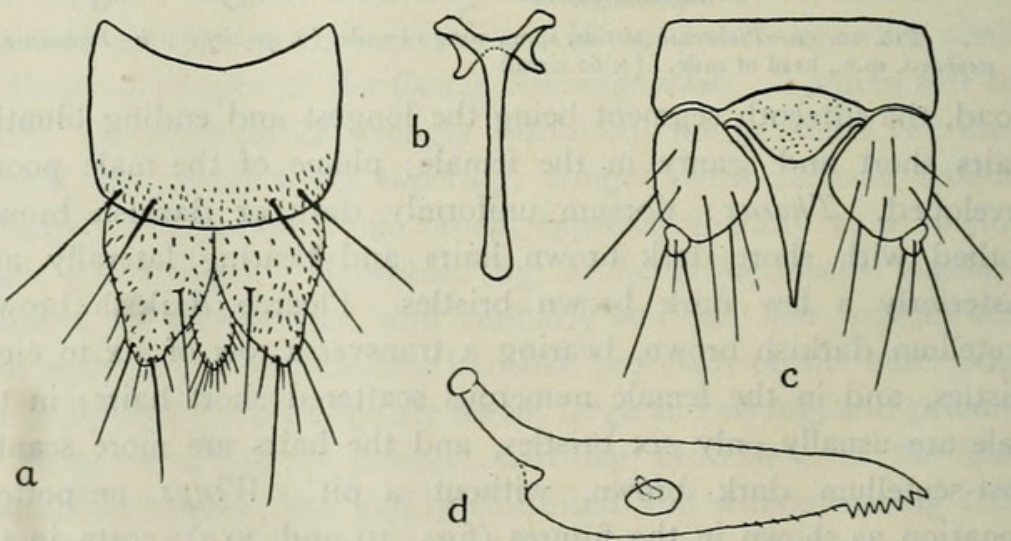

Fig. 21. *Probezzia pistiae*, sp.n. *a* to *c*—male hypopygium. *a*—ninth tergite; *b*—harpes; *c*—forceps and aedoeagus. *d*—mandible of female.

dark brown, rotated so that the forceps lie dorsally.* *Ninth segment*: tergite short, bearing at its posterior end two large, hairy, lateral lobes, between which the spiculated lining membrane of the tergite projects as a blunt process; sternite deep, slightly excavated in the middle. *Forceps*: side-pieces short and broad, about as broad as long, tapering slightly distally; claspers reduced to a small knob bearing a few long hairs. *Harpes* highly chitinised, fused in the middle line to form a stout chitinised rod, with a rounded, somewhat expanded distal extremity. *Aedoeagus* highly chitinised, tapering gradually to a narrow distal extremity; membrane joining the ventral wall of the aedoeagus to the ninth sternite studded with spicules.

PUPA. Length, female, about 3 mm., male, considerably smaller, about 2·7 mm. Well chitinised; male very much darker than female. *Respiratory trumpets* usually bent posteriorly, rather short and broad, length about 0·2 mm., ratio of length to breadth about 7 to 1, smooth and without knob-like processes, the distal end infuscated. The main tracheal trunk is broad, devoid of lateral branches, and terminates in a number (about eighteen) of short, blunt processes which lead to the surface and are arranged in the form of an inverted U. *Cephalo-thorax* of the usual form, but the separation of cephalic and thoracic portions is ill-defined. Anterior marginal tubercle very small, bearing a long bristle; above the highest part of the antennal case (the beginning of the flagellum part) are two socket-like marks, apparently unarmed; a little further back, and in front of the base of the trumpet, is a small tubercle bearing a minute spine; anterior dorso-median tubercle very small, bearing two small sockets, the inner unarmed, the outer bearing a short, spine-like hair, dorso-lateral situated very close to the base of the trumpet, rounded and irregular in form, bearing a long and a shorter hair and an apparently unarmed socket; ventro-lateral ill-defined, bearing a short hair and an unarmed socket; ventro-median represented by two moderately long hairs. Dorsal tubercles much reduced: anterior double, each half bearing a moderately long hair, lateral bearing a similar hair, posterior bearing a rather smaller one. Anterior to the dorsal tubercles is a transverse row of

* It will be convenient, however, for descriptive purposes to continue to refer to the surface on which lies the tergite as the dorsal, and to that on which lie the sternite and the aedoeagus as the ventral.

highly chitinised rugae, and posterior and external to the lateral tubercle is an unarmed socket. Postero-dorsal tubercle obsolete. Posterior margin of dorsum rounded, not extended backwards as a median process. *Abdomen*: first segment small and narrow, second large and broad, the others decreasing progressively in breadth towards the apex. Integument spiculated, especially in the male, and with pigmented areas similar to those of *Stilobezzia spirogyrae*. Anal segment with acutely pointed, slightly divergent, dark-tipped processes. Dorsal tubercles: antero-submarginal, small, situated close together and almost contiguous, each bearing a hair, the outermost the larger; postero-marginal, four, the inner small, bearing a minute hair, the next merely an apparently unarmed socket, the outer two larger, contiguous, each bearing a hair. Ventro-lateral tubercles: all arising from a central projection of the segment; antero-submarginal, small, bearing a hair, and a little dorsal and slightly posterior to this tubercle an apparently unarmed socket; postero-marginal, two, well developed, the ventral bearing a hair, the dorsal double and bearing two hairs. Ventral tubercles: postero-marginal, three, almost contiguous, the inner bearing a short hair, the other two longer hairs.

LARVA. The larva is eel-like and slender, pale coloured or nearly white; length 7 mm. to 9 mm., greatest breadth about 0·2 mm. to 0·3 mm. *Head* yellowish-brown, long and narrow, length about 0·4 mm., greatest breadth about 0·1 mm. Eyes black, bilobed or reniform, situated laterally a little anterior to the middle of the head. Antennae and palpi small. Hairs quite small, and some apparently unarmed tubercles also present: on the dorsal surface, one pair anterior admedian situated about the level of the mandibles, two pairs (the more anterior with a divided hair) and a pair of small, apparently unarmed, tubercles anterior dorso-lateral situated at about the level of the comb-like part of the hypopharyngeal sclerite, one pair of apparently unarmed tubercles central dorso-lateral, two pairs posterior dorso-lateral, and two pairs bearing small spines posterior admedian at the extreme posterior end of the head; on each lateral surface, one anterior, two about the level of the eye, and a small tubercle, apparently unarmed, a little more posteriorly; on the ventral surface, two pairs anterior admedian, and one pair central ventro-lateral. Mental plate with a strong, pointed,

central tooth, and two more delicate teeth on each side. Hypopharynx not very strongly chitinised, the posterior sclerite comb-like, bearing about a dozen pointed teeth. Mandibles large and highly chitinised, base expanded, distal portion a powerful hook. *Body* cylindrical, composed of twelve elongated segments each bearing a few minute hairs. On the distal end of the anal segment are fourteen stronger hairs arranged as follows: dorsally and ventrally two pairs of long, stout, dark hairs about half the length of the anal segment, and two shorter hairs; laterally, on each side a single short hair; these hairs are usually turned anteriorly, and in life appear to be of assistance in progression. Anal gills of the usual form, rather short, being about one quarter the length of the anal segment, deeply cleft into two pointed processes.

GOLD COAST: Oblogo, near Accra, December, 1920, to June, 1921, numerous specimens reared from plants of the water lettuce (*Pistia stratiotes*), taken from a swamp and from the river Densu (Pl. XXI, fig. 1). The larvae, while quite capable of leading an aquatic existence, appeared normally to frequent the roots of this plant, and were frequently reared to the adult stage in plants kept merely moist.

Probezzia stephensi, sp. n.

This insect, of which at present we possess only a single male, resembles *Probezzia pistiae*, and, indeed, was originally included among some examples of that species in our collections on account of its almost identical colour markings. Subsequently certain morphological differences were observed, particularly in the hypopygium, which warrant its separation as a distinct species. Only the chief differences between this species and *P. pistiae* are here given.

MEASUREMENTS.

Length of body (one male)	1·7 mm.
Length of wing	1·0 mm.
Greatest breadth of wing	0·4 mm.

Head (fig. 20 b) facets of eyes very widely separated (by about 105 μ) dorsally; anterior median angle of the occiput broad and obtuse. *Thorax* with rather fewer hairs on the dorsum, and some

of them larger than those in *P. pistiae*; scutellum bearing two submedian and two lateral bristles, and a few (about a dozen) short hairs. *Legs*: hind legs with a single row of 'bulbous' hairs on the first tarsal segments only. Claws with terminal fork deeper. *Abdomen* bearing shorter and more scanty hairs.

Hypopygium (fig. 22). *Ninth segment*: sternite reduced to a narrow strip of chitin; tergite short, tapering, bearing only two large bristles which are situated one on each side near the posterior margin, continued posteriorly as two large processes, bearing hairs and a few bristles, which are separated from each other in the middle, and with a large, hairy, lobe-like process on its under surface. *Forceps*:

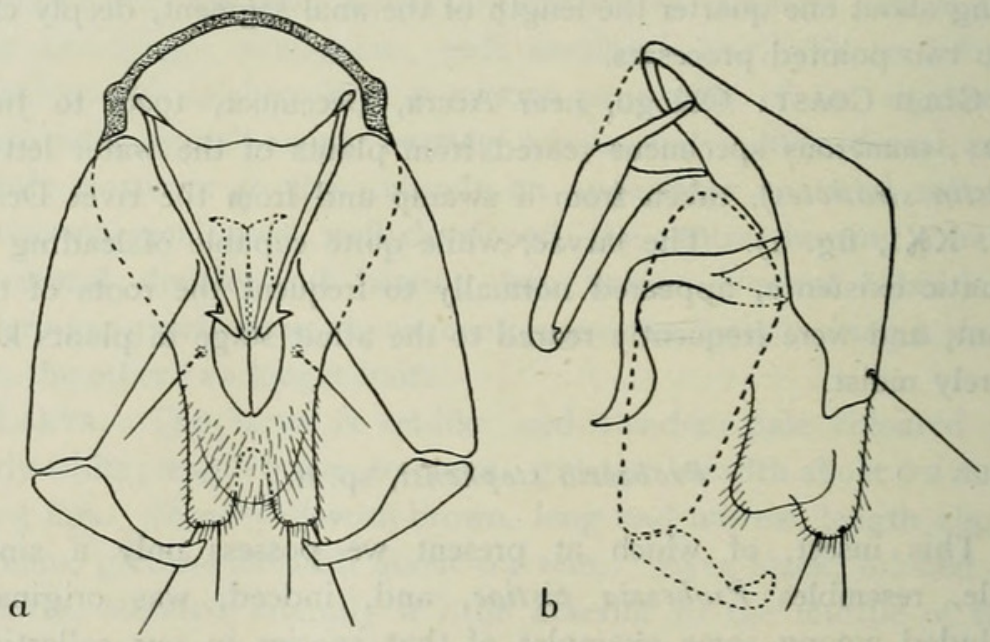

Fig. 22. *Probezzia stephensi*, sp.n., outlines of male hypopygium. *a*—ventral view; *b*—lateral view. (× 250 circa.)

side-pieces of usual form, moderately hairy; claspers of usual form, rather short (about half the length of the side-pieces), broad and without large hairs at the base, narrowing abruptly in the middle, and terminating in a somewhat spoon-like end. *Harpes* in lateral view bent in the middle at a right angle (see fig. 22 *b*), the distal halves somewhat beak-shaped; in dorso-ventral view the distal halves appear as two contiguous chitinous plates (see fig. 22 *a*). *Aedoeagus* broad, tapering, bearing on each side at the distal end a barb-like process; ventral wall chitinised almost to the base; membrane joining the aedoeagus to the ninth sternite devoid of spicules.

GOLD COAST: Oblogo, near Accra, March, 1921; reared from some plants of the water lettuce (*Pistia stratiotes*), taken from the river Densu. (Pl. XXI, fig. 1). We have much pleasure in dedicating this species to Dr. J. R. C. Stephens, to whom we are indebted for numerous interesting collections of biting midges from the Ilorin Province, Nigeria.

Genus *DICROBEZZIA*, Kieff.

The chief characters of this genus, which otherwise resembles *Bezzia*, according to Kieffer (1919), are—wings with the third vein reaching as near to the wing apex as the anterior branch of the fourth vein, femora unarmed, fourth tarsal segment cordiform, fifth tarsal segment in the female armed with several pairs of black 'batonnets,' in the male unarmed, and the claws in the female equal, bifid, the large branch two-thirds the length of the fifth tarsal segment, the small branch two-thirds the length of the large branch, in the male small and simple. We have referred the following species to this genus largely on account of the fact that the fifth tarsal segment in the female is armed with short, dark spines, but it should be pointed out that in other respects it does not entirely agree with the generic description given above. The differences are considerable, and would, perhaps, warrant the erection of a new genus.

The species closely resembles *Probezzia pistiae*, both as regards the general morphology of the adults, including the structure of the hypopygium of the male, and the characters of the pupa. In the following description, therefore, only the chief points of difference are noted.

Dicrobezzia nigritibialis, sp. n.

This insect, of which at present we possess only a single male and a single female, resembles closely *Probezzia pistiae*; the chief differences between it and the latter species are as follows:—

MEASUREMENTS.	Male.	Female
Length of body	2·3 mm.	2·7 mm.
Length of wing	1·7 mm.	2·2 mm.
Greatest breadth of wing	0·4 mm.	0·6 mm.

The female is darker than the male. *Head* very dark brown. Eyes separated in both sexes. Palpi in the male small, stumpy, tapering distally, all the segments very short; in the female, longer, as in *P. pistiae*. *Antennae*: torus almost black in both sexes: middle segments of the flagellum paler brown in the male, in the female, antenna entirely dark brown. *Thorax*: dorsum uniformly dark brown, almost black; hairs scanty. Pleurae very dark brown. Scutellum very dark brown, bearing in the male, two sub-median and two lateral bristles and a few short hairs; in the female four sub-median and two lateral bristles and numerous short hairs. *Wings* very delicate and with a white appearance, venation as in *P. pistiae*; microtrichia extremely small and delicate. Halteres with pale yellowish-brown knobs, and darker stems. *Legs*: femora and tibiae very dark brown, first four tarsal segments pale, slightly infuscated at their apices, last tarsal segment entirely dark. Fourth tarsal segment in the male longer than in *P. pistiae*, cylindrical; in the female, shorter, especially on the fore legs. Claws of the male small, equal, bifid at the tips; those of the female large, each with a well developed basal tooth. Fifth tarsal segment in the female armed with numerous (twelve on the fore legs, fourteen on the middle and hind legs) strong, black spines; in the male unarmed. *Abdomen* dark brown, but not so dark as the thorax, and in the female paler proximally; in the female, eighth sternite bearing a few long, stout hairs on each side of the vulva. Spermathecae two, highly chitinised, sub-spherical and unequal (diameters about 76μ and 60μ, respectively); commencement of the duct chitinised for a short distance (about 10μ).

Hypopygium (fig. 23). Hypopygium very dark and highly chitinised. *Ninth segment*: sternite deep, excavated in the middle posteriorly; tergite not very highly chitinised, bearing at its posterior end two prominent, hairy, lobe-like processes, spiculated portion of its lining membrane prominent. *Forceps*: side-pieces moderately developed, hairs not very long, distal extremity conical; claspers obsolete. *Harpes* very densely chitinised, fused in the middle line, and projecting backwards as a process which does not expand at its end, but appears to be double; in dorso-ventral view the posterior projection appears to be straight but not all in the same focus, in lateral view it is seen to be bent sharply towards the

tergite near its distal end. *Aedoeagus*: form somewhat similar to that of *P. stephensi*, but more densely chitinised. Membrane joining the aedoeagus to the ninth sternite studded with spicules.

PUPA. The pupa is very highly chitinised, especially that of the female, and coarsely spiculated. Length, male 3·6 mm., female 4·3 mm. It differs chiefly from the pupa of *P. pistiae* in the following points. *Respiratory trumpets* not turned backwards, relatively shorter and broader than those of *P. pistiae*, terminal branches of the tracheal trunk only about ten in number. *Cephalothorax*: dorso-lateral tubercle bearing, apparently, only a single

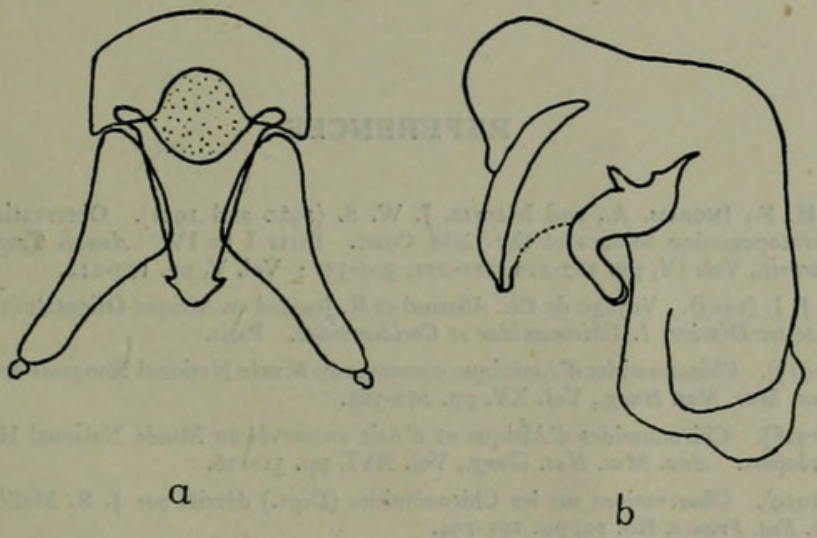

FIG. 23. *Dicrobezzia nigritibialis*, sp.n., outlines of male hypopygium. *a*—ventral view of forceps and aedoeagus; *b*—lateral view, middle focus showing harpes and aedoeagus. (× 190 circa).

hair, ventro-lateral composed of two small nipple-like processes, each armed with a stout hair; ventro-median apparently represented by a very minute hair. Dorsal tubercles very small: anterior double, the one part anterior to the other, each bearing a minute spine; lateral bearing a long hair; posterior bearing a minute spine. *Abdomen*: cuticle coarsely shagreened; large, dark, lateral macules at the anterior margin of the segments dorsally, in addition to the macules noted in *P. pistiae*. Anal segment: cases for forceps small and dark coloured. Dorsal tubercles: antero-submarginal not contiguous, a small hump with a socket-like mark posterior to the outer one; postero-marginal, three, the innermost small, bearing a small spine, the other two situated much more laterally, the inner rather large, bearing a short spine and having on its inner side an

unarmed socket, the outer small, bearing a hair. Ventro-lateral tubercles: antero-submarginal two, the dorsal one bearing a small spine, the ventral a hair; postero-marginal, two, well developed, each bearing a small spine. Ventral tubercles, three, practically contiguous, the inner bearing a short spine, the middle a long hair, and the outer a short hair.

GOLD COAST: Weshiang, near Accra, June 29th, 1921; two pupae found in a sample of the algae growing in one of the reservoirs of the Accra waterworks. We are indebted to Mr. R. Simmons for bringing these specimens to the laboratory.

REFERENCES

CARTER, H. F., INGRAM, A., and MACFIE, J. W. S. (1920 and 1921). Observations on the Ceratopogonine Midges of the Gold Coast. Parts I to IV. *Annals Trop. Med. & Parasit.*, Vol. IV, pp. 187-210, 211-274, 309-331; Vol. V, pp. 177-212.

KIEFFER, J. J. (1913). Voyage de Ch. Alluaud et R. Jeannel en Afrique Orientale (1911-1912). *Insectes Diptères I. Chironomidae et Cecidomyidae.* Paris.

——— (1917). Chironomides d'Amérique conservés au Musée National Hongrois de Budapest. *Ann. Mus. Nat. Hung.*, Vol. XV, pp. 292-364.

——— (1918). Chironomides d'Afrique et d'Asie conservés au Musée National Hongrois de Budapest. *Ann. Mus. Nat. Hung.*, Vol. XVI, pp. 31-136.

——— (1919). Observations sur les Chironomides (Dipt.) décrits par J. R. Malloch. *Bull. Soc. Ent. France*, No. 10, pp. 191-194.

——— (1919). Chironomides d'Europe conservés au Musée National Hongrois de Budapest. *Ann. Mus. Nat. Hung.*, Vol. XVII, pp. 1-160.

MALLOCH, J. R. (1915). The *Chironomidae* or Midges of Illinois with particular reference to the species occurring in the Illinois River. *Bull. Ill. State Lab. Nat. Hist.*, Vol. X, Article VI, May.

EXPLANATION OF PLATE XXI

Fig. 1. The river Densu at Oblogo, near Accra, showing the *Pistia* plants from which were reared the following midges:—*Culicoides distinctipennis*, *Dasyhelea inconspicuosa*, *Prionognathus pseudomaculipennis*, *Kempia ochrosoma*, *Probezzia pistiae*, and *P. stephensi*.

Fig. 2. Pool at Accra, from the marginal mud of which were reared the following midges:—*Culicoides austeni*, *C. distinctipennis*, *C. neavei*, *C. schultzei*, *C. similis*, *Dasyhelea fuscipleuris*, *D. inconspicuosa*, and *Stilobezzia spirogyrae*.

PLATE XXI

FIG. 1

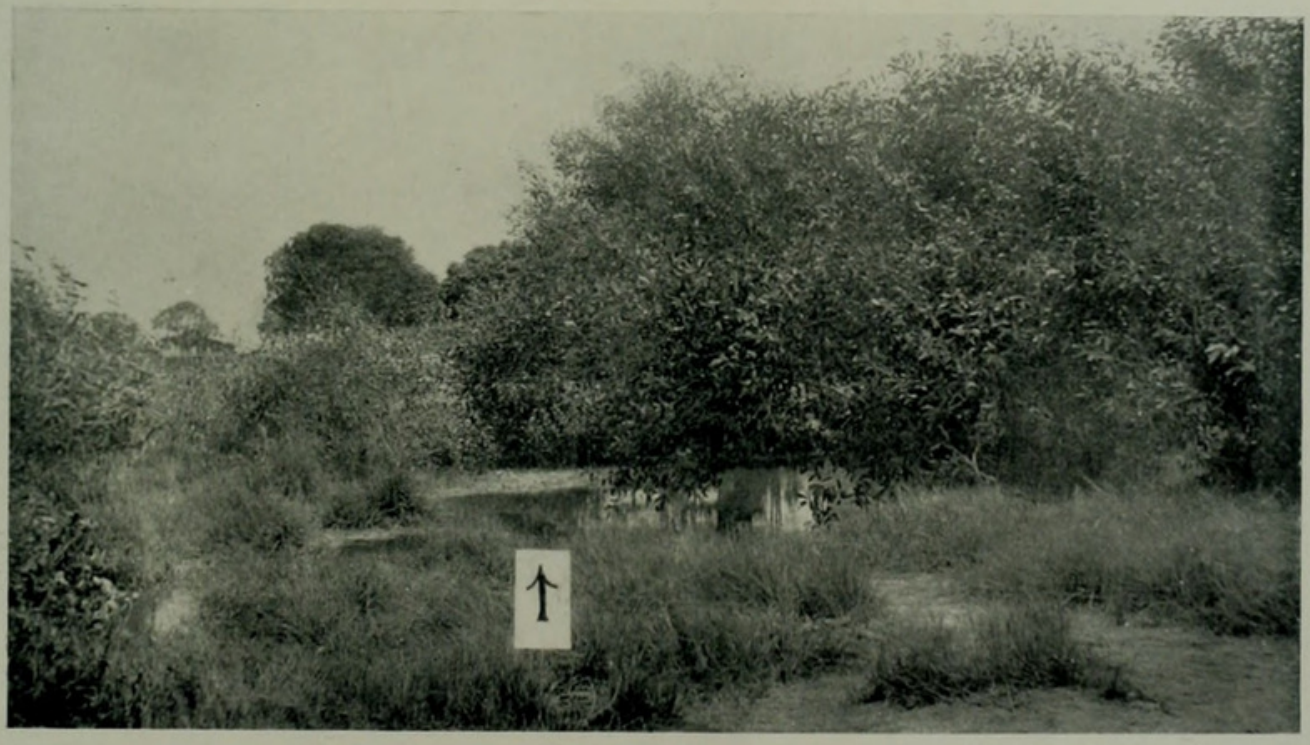

FIG. 2

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