

The South African Biting Midges of the Genus *Culicoides* (Ceratopogonid., Dipt.).

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The small blood-sucking Diptera of the genus *Culicoides*, which in many parts of the world constitute a major pest on account of the irritation caused by their bites, in South Africa remained for a long time rather unnoticed, since they practically never attack man. The breeding places of these midges are extremely restricted as most parts of this country are usually very dry so that the midges do not constitute an annoyance even to domestic livestock. *Culicoides*, however, came into prominence from the veterinary point of view when it was shown by R. du Toit (*Onderstepoort Journal*, vol. 19, p. 7, 1944) that these small insects acted as the transmitters of two important African virus diseases, namely horse-sickness of equines and bluetongue of sheep.

A large number of African *Culicoides* has been described but since the descriptions are scattered in the literature they are of limited value from the point of view of ready reference. A critical comprehensive study of the group has as yet not been undertaken. The author considers it necessary, in view of its newly acquired importance, to review the genus, at any rate, as it affects the species occurring in Southern Africa. The aim has been to clear up taxonomic issues on which finality has not been reached up to the present, as well as to provide the worker with a key by means of which he will be able to determine readily all the species concerned.

Altogether it has been possible to identify 22 good species as occurring in the southern part of Africa, three of which represent a new record for the Union. One new species is described, while a second, which had been described previously as a variety, has proved to be a definite species.

The key which follows has been compounded with due regard to De Meillon's "Key for the identification of the *Culicoides* of the Ethiopian Region", published by Colaço (*Anais Inst. Med. Trop.*, Vol. 3, p. 240, 1946). It is intended, however, to make identifications possible by means of a hand lens even under field conditions, and extensive use is made, therefore, of the readily visible pattern of ornamentation on the wings and thorax. The brief illustrated descriptions are recommended for consideration, should any doubt exist regarding the exact determination of any single species. The three external characters of the female, the distal segments of the antennae, the palps and the row of long bristles at the apices of the tibiae, are introduced in addition to the ornamentation of the wing and of the thorax and the genital appendices. These novel characters prove to be absolutely constant for the different species and provide additional, thoroughly reliable criteria which serve to give finality in determination which previously used characters have failed to provide.

THE SOUTH AFRICAN BITING MIDGES.

A comprehensive list of literature references to the *Culicoides* of the Ethiopian region is to be found in Colaço.

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COMMENTS ON THE CULICOIDES SPECIES FOUND IN SOUTHERN AFRICA AND THEIR DISTRIBUTION.

1. *Culicoides ravus* De Meillon (*Publ. S. Afr. Inst. Med. Res.*, 7, 38, 151, 1936). Plate Ia. Specimens of both sexes were determined at Onderstepoort for the first time in March 1949. It is a fairly common species. It could be proved by the male terminalia that the species described as *C. tockwensis* De Meillon (*J. Ent. Soc. S. Afr.*, 5, 97, 1942) actually is the male of the species concerned, as De Meillon already suspected. *C. tockwensis* De Meillon therefore is a synonym of *C. ravus* De Meillon.

Habitat: Southern Rhodesia (♂ type = *C. tockwensis*), Transvaal (Ofcolaco ♀ type, Onderstepoort).

2. *Culicoides engubandei* De Meillon (*Publ. S. Afr. Inst. Med. Res.*, 7, 337, 1937). Plate Ib. It was recorded for the Transvaal, for the first time, in September, 1949. Specimens of both sexes were caught in a light trap at Onderstepoort and some were reared from mud taken from the edge of a pool. A fairly rare species.

Habitat: Zululand (type), Transvaal (Onderstepoort).

3. *Culicoides inornatipennis* Carter, Ingram & Macfie (*Ann. Trop. Med. Par.*, 14, 227, 1920). Plate IIa. Has not yet been captured in the Union, but as a Southern Rhodesian species it is included in the key.

Habitat: Gold Coast (type), Somaliland, Belgian Congo, Southern Rhodesia.

4. *Culicoides schultzei* Enderlein (*Denkschr. Med. naturw. Ges. Jena*, 1, 459, 1908). Plate IIb. This species is fairly common around Onderstepoort.

Habitat: Gold Coast (type), Somaliland, Belgian Congo, Southern Rhodesia, South West Africa (type), Zululand, Transvaal (Komatipoort, Onderstepoort).

5. *Culicoides nivosus* De Meillon (*Publ. S. Afr. Inst. Med. Res.*, 7, 40, 341, 1937). Plate IIIa. A very common species.

Habitat: Portuguese East Africa, Zululand (type), Transvaal (Onderstepoort).

6. *Culicoides cornutus* De Meillon (*Publ. S. Afr. Inst. Med. Res.*, 7, 40, 332, 1937). Plate IIIb. A very common species.

Habitat: Zululand (type), Transvaal (Onderstepoort).

7. *Culicoides punctithorax* Carter, Ingram and Macfie (*Ann. Trop. Med. Par.*, 14, 235, 1920). Plate IVa. This species was found by De Meillon in the Northern Transvaal. It has, however, not yet been caught at Onderstepoort.

Habitat: Gold Coast (type), Transvaal (Tzaneen).

8. *Culicoides nigripennis* Carter, Ingram and Macfie (*Ann. Trop. Med. Par.*, 14, 253, 1920). Plate IVb. One female was caught at Onderstepoort in a light trap in December, 1949, which represents the first record of this species for South Africa. Apparently very rare.

Habitat: Gold Coast (type), Transvaal (Onderstepoort).

9. *Culicoides pycnostictus* Ingram and Macfie (*Bull. Ent. Res.*, 15, 284, 1925). Plate Va. It is one of the most common species around Onderstepoort. The variation of size and coloration is remarkable. A considerable reduction in the extension of pale spots on the wings can often be seen. On the other hand the black markings on the mesonotum can be largely spread and confluent. There is also a great variation in the structure of the terminalia, which led to the description *C. alexis* De Meillon and *C. meeserellus* De Meillon which later on turned out to be synonymous to *C. pycnostictus*. There is still a third form, closely related to this species, which had been described as *C. hysipyles* De Meillon (*Publ. S. Afr. Inst. Med. Res.*, 38, 156, 1936) from a single male caught at Vereeniging, Tvl., and which also is only a variation of *pycnostictus*. All intermediate stages, as well as the form *hysipyles* itself have been found among the males of *pycnostictus* caught at Onderstepoort, and the peculiar shape of the harpes in *hysipyles* turned out to be an artefact. As soon as slight pressure is applied to the abdomen, lying on its one side under the cover-glass, the harpes easily twist together and show this corkscrew-like figure, the number of bends depending on the lengths of the narrow distal ends of the harpes. This phenomenon could be artificially produced by the author. *C. hysipyles* De Meillon therefore, is a synonym of *C. pycnostictus* Ingram and Macfie.

Habitat: Tanganyika, Nyasaland (type), Southern Rhodesia, Zululand, Orange Free State, Transvaal (Johannesburg, Vereeniging, Onderstepoort).

10. *Culicoides distinctipennis* Austin (*Bull. Ent. Res.*, 3, 101, 1912). Plate Vb. It is a very common form around Onderstepoort, especially its variation *egypti* Macfie (*Bull. Ent. Res.*, 15, 66, 1924), the wings of which show an additional pale spot just below and beyond the conspicuous spot at the end of the costa. This spot as well as the pale spot underneath the second radial cell are very variable in intensity and may also be absent. The spermatheca in all specimens studied proved to be uniformly shaped like a peg-top. The aedeagus, however, and to a larger extent the parameres of the male terminalia show a considerable variation in shape (fig. A), and many terminalia have been found to be identical with those of *C. praetermissus* Carter, Ingram and Macfie (*Ann. Trop. Med. Par.*, 14, 240, 1920). It could be proved that the characters of the male terminalia, as given by C.I. and M. for separating *praetermissus* and *distinctipennis*, are not constant, as De Meillon (*J. Ent. Soc. S. Afr.*, 6, 100, 1943) already suspected. Furthermore the var. *egypti* Macfie, fully described in the *Proc. R. Ent. Soc. London, Ser. B.*, 12, 154, 1943, is nothing else but *praetermissus*, the females also having the single spermatheca, shaped like a peg-top. Var. *egypti* Macfie, therefore, is synonymous to *C. praetermissus* C.I. and M., which itself is a variation of *C. distinctipennis* C.I. and M. For this reason the correct name of the variation with the additional pale spot on the wings is *C. distinctipennis* var. *praetermissus* Carter, Ingram and Macfie.

Habitat: Sierra Leone, Gold Coast, Southern Nigeria (type), San Thomé, Belgian Congo, Egypt, Uganda, Tanganyika, Transvaal (Onderstepoort).



FIG. A.—Variations of the parameres in *C. distinctipennis*.

11. *Culicoides accraensis* Carter, Ingram and Macfie (*Ann. Trop. Med. Par.*, 15, 241, 1920). Plate VIa. It is a very rare species and was caught for the first time at Onderstepoort in a light trap in January, 1950.

Habitat: Gold Coast (type), Transvaal (Komatipoort, Onderstepoort).

12. *Culicoides eriodendroni* Carter, Ingram and Macfie (*Ann. Trop. Med. Par.*, 15, 317, 1920). Plate VIb. This species had so far been known to occur at the Gold Coast. Two females were caught in a light trap at Onderstepoort in January, 1950, which represents the first record for South Africa. Apparently very rare.

Habitat: Gold Coast (type), Transvaal (Onderstepoort).

13. *Culicoides neavei* Austen (*Bull. Ent. Res.*, 3, 102, 1912). Plate VIIa. A fairly common species.

Habitat: Anglo-Egyptian Sudan, Uganda (type), Gold Coast, Belgian Congo, Transvaal (Onderstepoort).

14. *Culicoides onderstepoortensis* sp. n. Plate VIIb. Apparently a fairly common species during the winter months. Hatched at Onderstepoort from mud at the edge of a pool in September, 1949, and caught in a light trap. According to De Meillon's key of the Ethiopian *Culicoides* this newly found form is similar to *C. remotus* Kieffer (*Ann. Mus. Nat. Hung.*, 16, 54, 1918), but differs in having the wings densely covered with macrotrichia.

Female.—A medium-sized, rather darkish species. Body 1.7 mm. Wings 1.3×0.5 mm. Head and mouth parts dark brown. Oesophageal pump with small teeth in the apical part. Eyes bare, separated by the width of one facet. Third segment of the palpi long and swollen ($85 \times 38\mu$) with a fairly deep sensory pit. Antennae: tori dark brown, flagellar segments brown, the last four of them rather short. Terminal segment with a style. Pleura and scutellum dark brown. Mesonotum with one dark brown, median and two dark admedian stripes stretching backwards from the mesonotal pits. Two longish dark spots are situated laterally to the pits. Legs darkish brown; hind tibia with an apical transverse row of four medium-sized bristles, the second of which is the longest. Abdomen light brownish grey. Halteres white, stalks slightly infuscated. Wings densely clothed with macrotrichia. Pale spots very large and often confluent. A pale, broad, unbroken band stretches from the tip of the costa to the posterior margin and ends in the cubital cell. A second band, which is broken at the fifth vein, extends from the costa across the first radial cell and anterior cross vein down into the anal cell.

These two pale bands have a connection underneath the second radial cell and in the posterior median cell. There are large pale spots in the apical, anterior and posterior median cell along the distal margin of the wing. Further on the base of the wing is covered by a pale area which also enters the anal cell. Resembling *C. pallidipennis*. Spermatheca, three in number, moderately pigmented. The two big ones are pyriform to globular, measuring about 68×40 and $55 \times 36 \mu$. The commencement of their duct is pigmented for about 12μ . The third one is small and very narrow. Male still unknown.

Habitat: Transvaal (Onderstepoort). Type: Three females. The types are in the collection of the South African Institute for Medical Research, Johannesburg.

15. *Culicoides bedfordi*, Ingram and Macfie (*Bull. Ent. Res.*, 14, 57, 1923). Plate VIIIa. A fairly common species. When drawing up the original description the authors actually were not dealing with females of this species but with females of the very similar *C. dutoiti*; the spermatheca in *C. bedfordi* has the duct entirely unpigmented.

Habitat: Tanganyika, Zululand, Transvaal (Naboomspruit and Onderstepoort, type).

16. *Culicoides dutoiti*, De Meillon (*J. Ent. Soc. S. Africa.*, 6, 100, 1943). Plate VIIIb. A less common species, closely related to *C. bedfordi*, but lighter in colour.

Habitat: Transvaal (Onderstepoort, type).

17. *Culicoides babrius* (*J. Ent. Soc. S. Africa*, 6, 112, 1943). Plate IXa. A common species, very similar to *C. similis*.

Habitat: Southern Rhodesia (type), Transvaal (Onderstepoort).

18. *Culicoides similis*, Carter, Ingram and Macfie (*Ann. Trop. Med. Par.*, 14, 255, 1920). Plate IXb. A common species.

Habitat: Gold Coast (type), Transvaal (Onderstepoort).

19. *Culicoides milnei*, Austen (*Ann. Mag. Nat. Hist.*, 8th Ser., 3, 283, 1909). Plate Xa. A common species. The varying grade of completeness of the second radial cell (fig. B) which can even be entirely absent, as in *C. schultzei*, is characteristic for this species. Furthermore the pale markings at the proximal half of the wings can often be largely extended and confluent. On account of these facts *C. zuluensis* De Meillon (*Publ. S. Afr. Inst. Med. Res.*, 7, 37, 145, 1936) can no longer be regarded as a definite species but as a variation of *C. milnei*; it had been separated from *C. milnei* only by reason of its incomplete second radial cell (R_1 intercepted) and by the paler wings. All the other characters in the original description are identically the same as in *C. milnei*.

It can be deduced from the scanty, original description of *C. lugens* Kieffer (*Am. Mus. Nat. Hung.*, 16, 51, 1918), found at Hanover, Natal, that this form is nothing else but the common *C. milnei* Austen.

Habitat: Ethiopia, Kenya (type), Uganda, Southern Nigeria, Portuguese West Africa, Belgian Congo, Zululand, Transvaal (Onderstepoort).

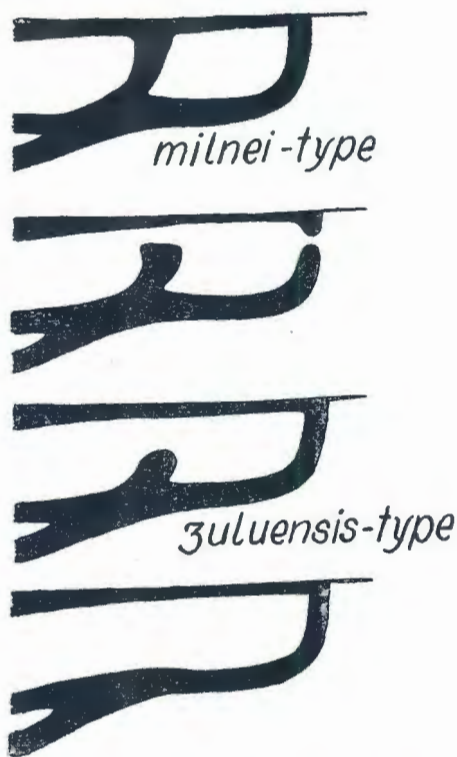


FIG. B.—Variations of the second radial cell in *C. milnei*.

20. *Culicoides pallidipennis* Carter, Ingram and Macfie (*Ann. Trop. Med. Par.*, 14, 265, 1920). Plate Xb. The most abundant species at Onderstepoort.

Habitat: Gold Coast (type), Egypt, Belgian Congo, Southern Rhodesia, Zululand, Transvaal (Onderstepoort).

21. *Culicoides hirtius* De Meillon & Lavoipierre (*J. Ent. Soc. S. Afr.*, 7, 58, 1944). Plate XIa. A less common species at Onderstepoort, very similar to the larger, brown-winged *C. magnus*.

Bedford (11th and 12th Rep. Dir. Vet. Educ. Res. U. of S. Afr., 287, 1927) stated that *C. brucei* Austen occurred in Zululand. But it is very doubtful whether he really had found that species there, as the five specimens in the Onderstepoort collection, which had been collected and determined by himself, actually are *C. hirtius*. So far it is still uncertain whether *C. brucei* does occur in South Africa. The original description of *C. brucei* (*Ann. mag. Nat. Hist.*, 3, 282, 1909) and the illustration given by Austen (*Afr. Blood-sucking flies*, 1909, Pl. I., fig. 2) show a definite difference from *C. hirtius* in the pattern of the ornamentation of the wings. Although the type of *C. brucei* could not be consulted the two forms are to all appearances closely related, yet different species.

Habitat: Zululand, Transvaal (Onderstepoort, type).

22. *Culicoides magnus* Colaço (*Anais Inst. Med. Trop.*, 3, 236, 1946). Plate XIb. A very large and fairly common species. It was described as a variation of *hirtius* despite its constant larger size, different thoracic ornamentation and the number and extent of the pale spots in the anterior median cell of the wings. A thorough examination of the two species concerned, however, revealed an additional number of constant characters, by which they differ from each other; namely the proportions of the last segments of the antennae, the third segments of the palps, the number of long bristles at the apex of the hind tibiae, the pale markings in the cubital cell of the wings, the spermathecae and even the male terminalia. Colaço regarded the male terminalia of the two species as being absolutely identical and, therefore, merged both forms in one species, which otherwise can easily be differentiated. It must be borne in mind, however, that the structure of the male terminalia of all three brown-winged *Culicoides* species, found in South Africa (*C. milnei*, *hirtius* and *magnus*), are very similar. Therefore the likeness of this organ alone cannot be used as the single criterion for distinguishing the species. On account of the numerous divergent characters lately established *C. magnus* Colaço must be regarded as a definite species.

Habitat: Transvaal (Onderstepoort, type).

THE SOUTH AFRICAN BITING MIDGES.

KEY TO THE SOUTH AFRICAN CULICOIDES SPECIES.

- | | |
|---|--------------------------------------|
| 1. Wing without distinct spots..... | 2 |
| or wings with dark or pale spots..... | 4 |
| 2. Mesonotum with only two admedian lighter stripes..... | 3 |
| or mesonotum with seven pairs of lighter spots (Sometimes reduced in number, esp. in males)..... | <i>ravus</i> (Pl. Ia) |
| 3. Mesonotum very dark, apical part of prescutellar area light, with two dark spots..... | <i>engubandei</i> (Pl. Ib) |
| or prescutellar area also dark..... | <i>inornatipennis</i> (Pl. IIa) |
| 4. Wings without radial cells..... | <i>schultzei</i> (Pl. IIb) |
| or one or both radial cells complete..... | 5 |
| 5. Thorax spotted with small, dark dots..... | 6 |
| or thorax unspotted..... | 8 |
| 6. Pale, round markings on the wings greatly enlarged, mainly confluent, macrotrichia very dense..... | <i>nivosus</i> (Pl. IIIa) |
| or pale markings more restricted, macrotrichia absent or very scanty..... | 7 |
| 7. Wings with only one pale spot between the tip of the costa and the upper branch of the fourth vein..... | <i>punctithorax</i> (Pl. IVa) |
| or wings with four pale spots in this area..... | <i>cornutus</i> (Pl. IIIb) |
| 8. Wings with a pale spot just below the conspicuous dark spot at the end of the costa..... | 9 |
| or wing without such a pale spot..... | 10 |
| 9. The five pale spots around that spot underneath the second radial cell forming a circle..... | <i>pycnostictus</i> (Pl. Va) |
| or the five or four spots forming a rectangle..... | <i>distinctipennis</i> (Pl. Vb) |
| 10. A pale spot covers the anterior cross-vein..... | 11 |
| or the spot is confined to the base of the apical cell against the cross-vein..... | <i>accraensis</i> (Pl. VIa) |
| 11. This spot does not reach the costa..... | 12 |
| or the spot reaches the costa..... | 13 |
| 12. The anal-, cubital- and median cells without pale spots..... | <i>nigripennis</i> (Pl. IVb) |
| or those cells with pale spots..... | <i>eriodendroni</i> (Pl. VIb) |
| 13. The four pale spots, extending from the end of the costa to the cubital cell forming a transverse band..... | 14 |
| or wings with pale spots not forming such a band..... | 15 |
| 14. Wings with four sharply defined, pale spots, forming an interrupted transverse band..... | <i>neavei</i> (Pl. VIIa) |
| or wings with four confluent, pale spots, forming an uninterrupted band..... | <i>onderstepoortensis</i> (Pl. VIIb) |
| 15. Wings with only one pale spot above the upper branch of the fourth vein (or a very pale, second spot across the upper branch of the fourth vein)..... | 16 |
| or wings with more spots in that region..... | 17 |

16. Wings darkish, densely covered with macrotrichia *bedfordi* (Pl. VIIIa)
 or wings light, very few macrotrichia; none in the anal cell and none proximal to the
 end of the costa *dutoiti* (Pl. VIIIb)
17. Wings with a pale spot underneath the one at the tip of the costa 18
 or wings without such a spot 19
18. This pale spot reaching or covering the upper branch of the fourth vein *babrius* (Pl. IXa)
 or this spot does not touch the fourth vein *similis* (Pl. IXb)
19. Cubital cell with an irregular to round, pale spot 20
 or cubital cell with a ring or ring-like, pale spot or the entire cell is pale with a dark
 round spot in the middle 21
20. Pale markings at the distal part of the wings rounded. Dark space between the pale
 spot at the tip of the costa and the spot near the tip of the wing is twice the width of the
 distal spot *milnei* (Pl. Xa)
 or pale markings mainly elongated. Dark space between the spots in the apical cell
 less than half the distal spot *pallidipennis* (Pl. Xb)
21. Pale ring in the cubital cell seldom touching both branches of the fifth vein, often
 incomplete proximally. Small species *hirtius* (Pl. XIa)
 or pale ring mostly touches both branches of the fifth vein, often incomplete distally.
 Large species *magnus* (Pl. XIb)

SHORT ILLUSTRATED DESCRIPTION OF THE ADULTS.

1. *Culicoides ravus* De Meillon. Plate Ia.

A very small, light species with unspotted wings.

Antennae.—Brown. Last four segments rather short and oval with relative lengths and widths of $\frac{12}{6} \times \frac{12.5}{6} \times \frac{13.5}{6} \times \frac{21}{6.5}$ (Fig. 1).

Palps.—Brown. Third segment is very much inflated ($46 \times 40\mu$) with very large sensory pits (fig. 2). This segment is very small and slender ($36 \times 18\mu$) in ♂ (fig. 3).

Thorax.—Pleurae and scutellum brown. Mesonotum with seven pairs of light spots, which sometimes are very insignificant, especially in male; one single one in front of scutellum (fig. 4). Halteres whitish throughout.

Legs.—Light brown. Apex of hind tibiae with four, medium long bristles, the first of which is the longest with 40μ (fig. 5).

Wings.—♀ 1.0×0.4 mm. Entirely unspotted, rather densely covered with macrotrichia (Fig. 6), which are less abundant in male (Fig. 7), where the radial cells are very narrow.

Spermatheca.—Two, unpigmented, pyriform in shape, measuring, $48 \times 41\mu$ and $44 \times 36\mu$. Their ducts are chitinised for about $10-14\mu$ (Fig. 8).

Male terminalia.—Claspers normal. Parameres branched, ventral branch short, almost reaching the slender, dorsal branch, which ends in six filiform processes (Fig. 9). Aedeagus (Fig. 10) highly pigmented, triangular; limbs narrow with a short spine at each side; stem short and narrow, ending in a ventrally bent hook (Fig. 11).

2. *Culicoides engubandei* De Meillon. Plate Ib.

A small, very dark species with unspotted wings.

Antennae.—Blackish. Last four segments very short with relative length and width of $\frac{11.5}{5.5} \times \frac{12.5}{5.0} \times \frac{12}{5.5} \times \frac{18.5}{5.5}$ (Fig. 12).

Palps.—Blackish brown. Third segment moderately swollen, $58 \times 24\mu$ (Fig. 13).

Thorax.—Pleurae and scutellum very dark brown. Mesonotum with two paler admedian stripes which join in the prescutellar area. Pale areas besides the mesonotal pits varying in shape (Fig. 14). Crown and part of the stalk of the halteres creamy, rest infuscated.

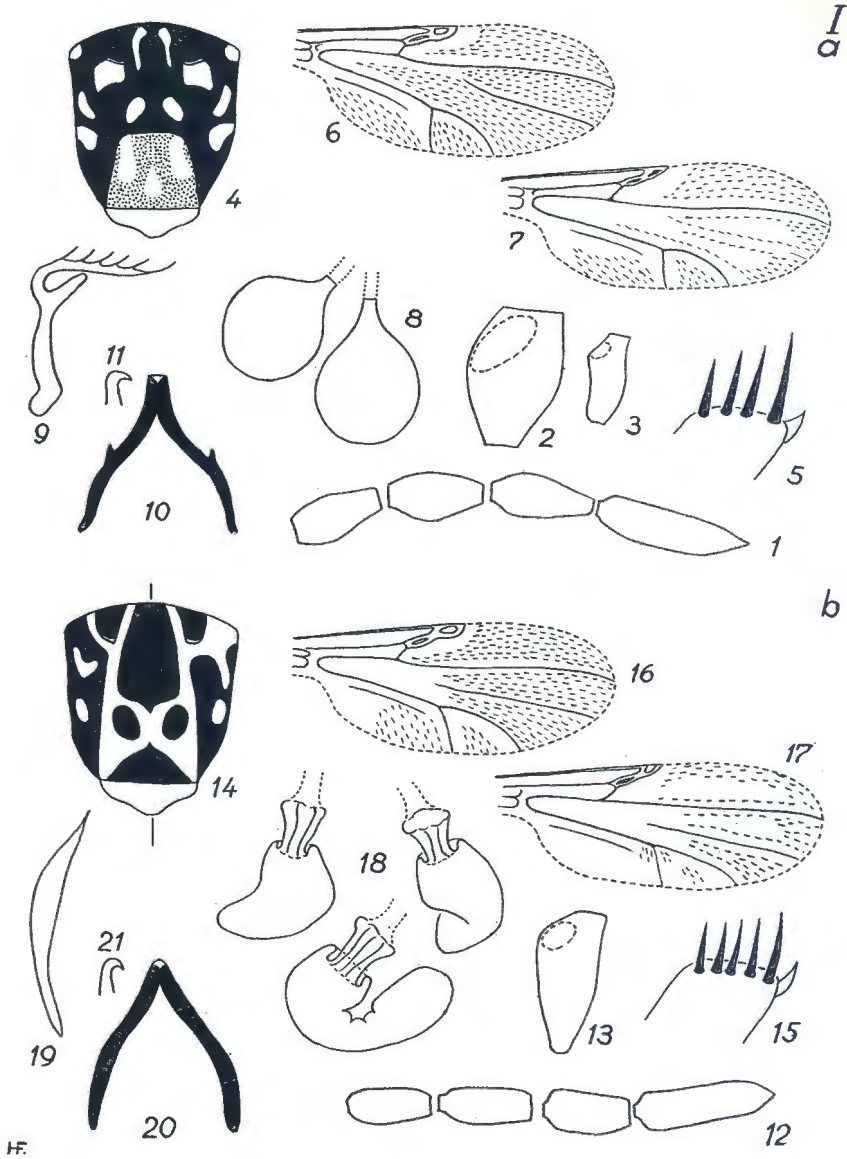
Legs.—Uniformly dark. Apex of hind tibiae with five rather short bristles, the first of which is the longest with about 30μ (Fig. 15).

Wings.—♀ 1.3×0.4 mm. Without markings (Fig. 16). The wing of ♂ is less hairy, the radial cells are narrower (Fig. 17).

Spermatheca.—Three, entirely unpigmented, shaped like a bag or sausage. The two distal ones are smaller ($44 \times 30\mu$), while the third and proximal one is bigger ($80 \times 30\mu$). The outlet-parts are wide, slightly conical cylinders with their commencement retracted into the spermatheca (Fig. 18).

Male terminalia.—Claspers ending bluntly. Parameres consist of two stout strips of chitin, somewhat sword-shaped (Fig. 19). Aedeagus (Fig. 20) shaped like a wish-bone, its short stem ending in a hook (Fig. 21).

PLATE I.



3. *Culicoides inornatipennis* Carter, Ingram and Macfie. Plate IIa.

A small, dark species with unspotted wings.

Antennae.—Dark brown. Last four segments rather short and slender with relative lengths and widths of—

$$\frac{15}{5.5} \times \frac{16.5}{5.5} \times \frac{16.5}{5.5} \times \frac{20.5}{5.5} \text{ (Fig. 22).}$$

Palps.—Brown. Third segment slightly swollen, $50 \times 20\mu$ (Fig. 23).

Thorax.—Pleurae dark brown, scutellum uniformly light greyish brown. Mesonotum with two lighter, admedian stripes and several light spots (Fig. 24). Halteres cream-coloured, base of knobs infuscated.

Legs.—Rather pale brown. Apex of hind tibiae with four, rather long bristles, the first of which is the longest with about 45μ (Fig. 25).

Wings.—♀ 1.0×0.4 mm. Entirely unspotted. Macrotrichia moderately dense, most abundant in the apical portion. Radial cells narrow (Fig. 26).

Spermatheca.—Two, moderately pigmented, oval to pyriform in shape, measuring $50 \times 36\mu$ and $44 \times 36\mu$. The commencement of the duct is only chitinised for a very short distance of 4μ (Fig. 27).

Male terminalia.—Claspers normal. Parameres simple, tapering distally with end portions twisted like a cork-screw (Fig. 28). Aedeagus Y-shaped; stem rather narrow, gutter-like, with a blunt apex; limbs thin and highly chitinised (Fig. 29).

4. *Culicoides schultzei* Enderlein. Plate IIb.

A medium sized species.

Antennae.—Dark brown. Last four segments rather short and rounded with relative lengths and widths of—

$$\frac{15.5}{6.5} \times \frac{13}{8.5} \times \frac{13.5}{7.5} \times \frac{22.5}{6} \text{ (Fig. 30).}$$

Palps.—Dark brown. Third segment moderately swollen, $50 \times 22\mu$ (Fig. 31).

Thorax.—Pleurae dark brown; scutellum with two admedian light patches. Mesonotum with a very variable pattern of dark stripes and small, dark dots (Fig. 32). Halteres with white knobs and greyish stalks,

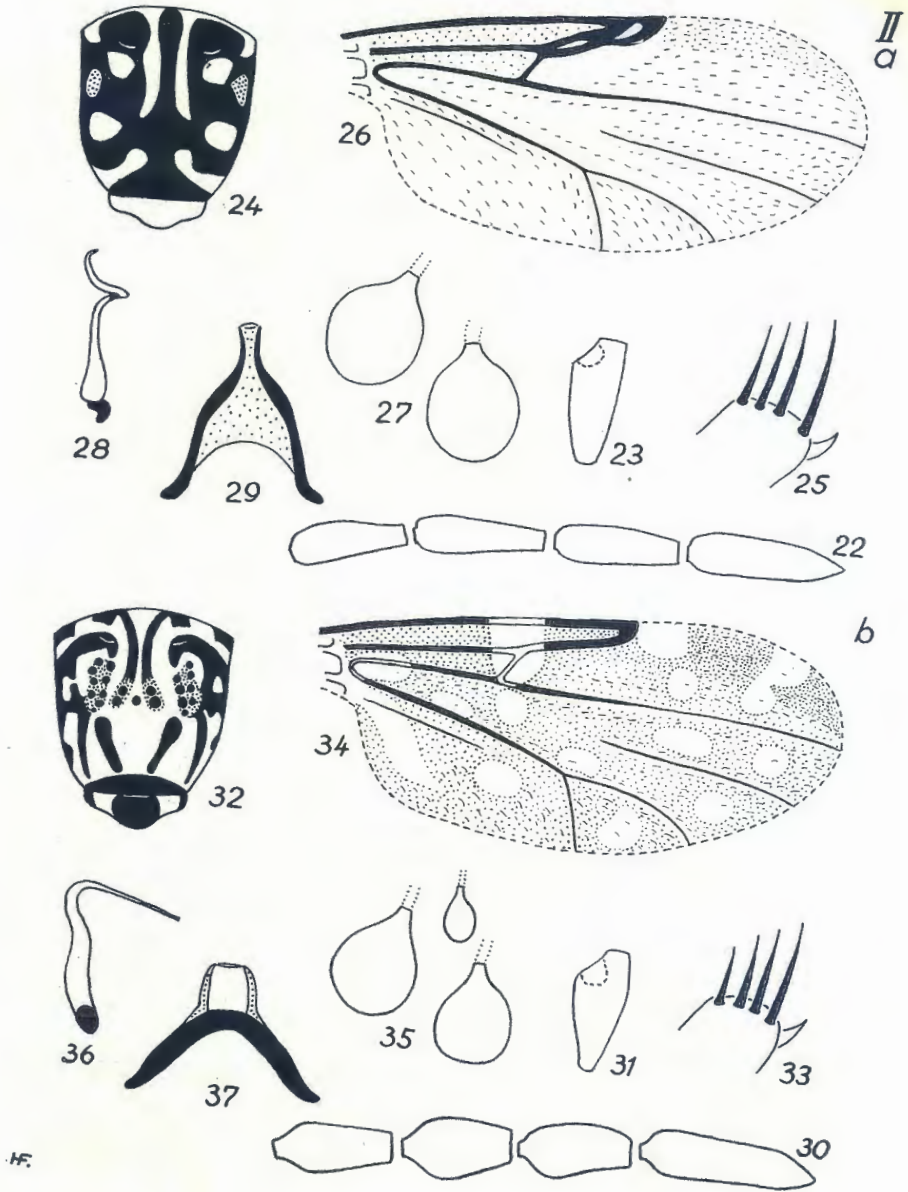
Legs.—Brown. Apex of hind tibiae with four medium long bristles in female, the first of which is the longest with about 40μ (Fig. 33). The male has five bristles.

Wings.—♀ 1.2×0.4 mm. Macrotrichia more confined to the distal part of the wing. Pale spots always distinct. Radial cells usually missing (Fig. 34).

Spermatheca.—Three, well pigmented. The two big ones are pyriform with a conical outlet ($46 \times 32\mu$ and $40 \times 30\mu$). The duct is only chitinised for a very short distance. The third one is variable in size and shape, either tube-like or pyriform, measuring up to $22 \times 12\mu$ (Fig. 35).

Male terminalia.—Claspers normal. Parameres unbranched and long, narrow, tapering strips, ventrally bent near the middle almost at right angle. (Fig. 36). The tip bears few minute hairs. Aedeagus broad at the base; the stem is a short, thick and gutter-like process (Fig. 37).

PLATE II.



THE SOUTH AFRICAN BITING MIDGES.

5. *Culicoides nivosus* De Meillon. Plate IIIa.

A large, dark species with orange-brown wings.

Antennae.—Brown. Last four segments elongated and rather broad with relative lengths and widths of—

$$\frac{19}{8.5} \times \frac{21}{8.5} \times \frac{23}{8} \times \frac{32.5}{7.5} \text{ (Fig. 38).}$$

Palps.—Dark brown. Third segment considerably swollen ($90 \times 40\mu$) with a large sensory pit (Fig. 39).

Thorax.—Pleurae brown; scutellum brown in the middle and yellowish on either side. Dark ornamentations of the mesonotum varying considerably. Usually the two admedian, zig-zag stripes join a short distance behind the mesonotal pits. Numerous small dark dots always present. (Fig. 40). Halteres are creamy throughout.

Legs.—Brown. Apex of hind tibiae with four medium long bristles, the first of which is the longest, about 45μ (Fig. 41).

Wings.—♀ 1.5×0.5 mm. Densely and evenly clothed with macrotrichia. Pale spots more or less orange coloured, always very large and often confluent (Fig. 42).

Spermatheca.—Single, very large, up to $106 \times 64\mu$, ovoid with a conical outlet, well pigmented. Duct entirely unpigmented. (Fig. 43).

Male terminalia.—Claspers normal. Parameres consist of narrow stripes, feebly pigmented apically to end in a filamentous S-shaped hook similar to *C. pycnostictus* (Fig. 44). The aedeagus has two narrow, well pigmented limbs; the broad stem is only slightly chitinised (Fig. 45).

6. *Culicoides cornutus* De Meillon. Plate IIIb.

A very large, darkish species.

Antennae.—Dark brown, last four segments rather short and broad with relative lengths and widths of—

$$\frac{16}{7} \times \frac{16}{7} \times \frac{18}{7} \times \frac{33}{7} \text{ (Fig. 46).}$$

Palps.—Dark brown; third segment long, only slightly swollen, $94 \times 28\mu$ (Fig. 47).

Thorax.—Pleurae dark brown; scutellum dark brown at the middle and yellowish laterally. Mesonotum grey with many rows of dark brown dots or ill-defined stripes (Fig. 48). Halteres pale brown.

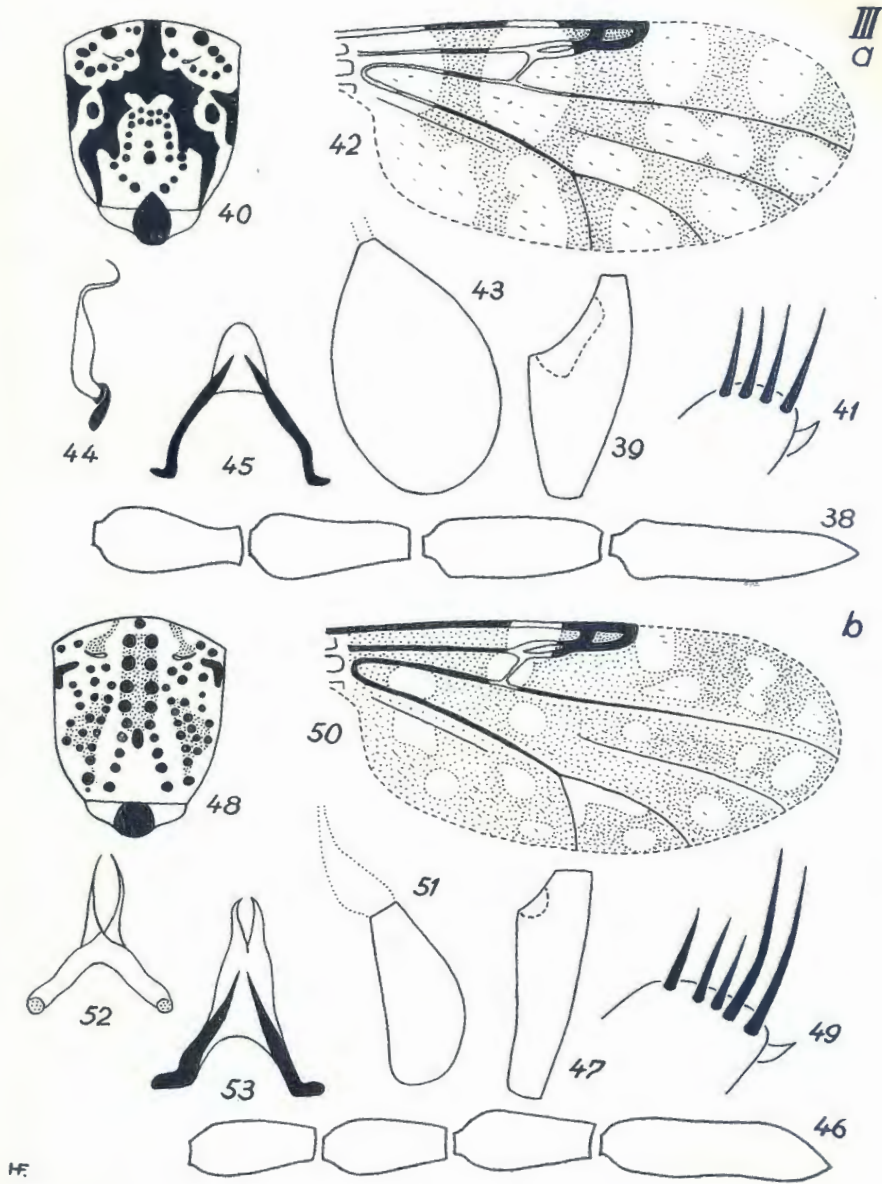
Legs.—Brown. Apex of hind tibiae with five bristles, the two first about double the length (70μ) of the three others (33μ) (Fig. 49).

Wings.—♀ 2.0×0.8 mm. Macrotrichia very sparse. Wings dark in females, but very light and iridescent in males. (Fig. 50).

Spermatheca.—Single, well pigmented with many small, light dots ($31 \times 15\mu$). Outlet very wide (8μ), duct not pigmented (Fig. 51).

Male terminalia.—Tip of claspers somewhat blunt. Parameres with long basal arms; joined basally, but separated apically, ending in two narrow, short strips (Fig. 52). Aedeagus scoop-shaped, basal arms prominent, apex divided and turned down (Fig. 53).

PLATE III.



7. *Culicoides punctithorax* Carter, Ingram and Macfie. Plate IVa.

A small, dark species.

Antennae.—Brown. Last four segments shorter than usual, from two to three times as long as broad.

Palps.—Dark brown. Third segment moderately swollen.

Thorax.—Pleurae dark brown, scutellum of the same colour with greyish lateral areas. The conspicuous light grey markings on the mesonotum with numerous small dark dots (Fig. 54). Halteres with the knobs cream-coloured, stems pale brown.

Legs.—Brown.

Wings.—♀ 1.1 × 0.4 mm. Thickly clothed with macrotrichia. Distribution of pale spots as in Fig. 55.

Spermatheca.—Two, highly pigmented, oval about 60 × 40 μ and 54 × 50 μ . The chitinised commencement of the duct short and conical. (Fig. 56).

Male terminalia.—Distal end of claspers rounded. Parameres simple, rather strongly chitinised basally, tapering posteriorly with the apical fourth bent ventrally, similar to *C. hirtius* (Fig. 57). Aedeagus forming a rather narrow arch; limbs highly pigmented, forming a gutter on the feebly chitinised stem (Fig. 58).

8. *Culicoides nigripennis* Carter, Ingram and Macfie. Plate IVb.

A medium sized, dark species with dark grey wings.

Antennae.—Brown. Last four segments rather long with relative lengths and widths of
20 20.5 23 33
—×—×—×—×— (Fig. 59).
6.5 7 7.5 8

Palps.—Dark brown. Third segment strongly swollen, 76 × 41 μ (Fig. 60).

Thorax.—Pleura and scutellum dark brown. Mesonotum with two admedian, pale stripes bending to the sides in front of the mesonotal pits as in *C. eriodendroni* (Fig. 61). Halteres with darkish brown knobs and paler stalks.

Legs.—Dark brown. Apex of hind tibiae with only three long bristles, the first of which is the longest, about 57 μ (Fig. 62).

Wings.—♀ 1.35 × 0.5 mm. Rather dark, densely covered with macrotrichia, with only three pale spots as shown in Fig. 63.

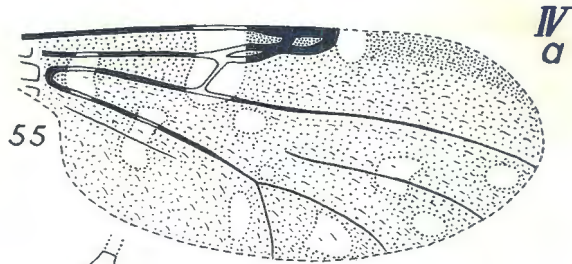
Spermatheca.—Three, highly pigmented. Two of them are very large, globular in shape up to 92 × 84 μ ; the duct is pigmented for a distance of about 25 μ . The third one is very long (45) μ and narrow (Fig. 64).

Male terminalia.—Males still unknown.

PLATE IV.



54



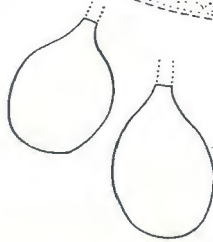
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a



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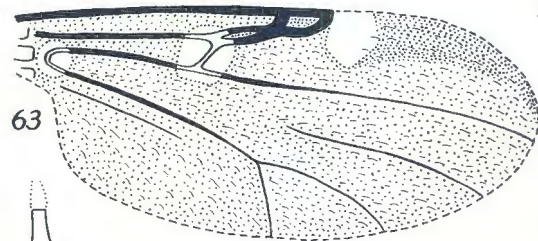
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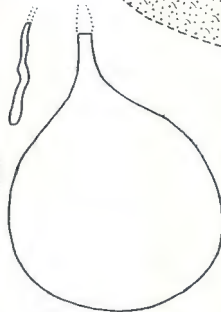
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b



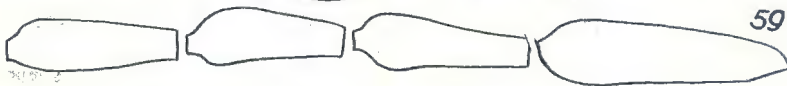
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F

9. *Culicoides pycnostictus* Ingram and Macfie. Plate Va.

A large, dark species normally with very dark wings.

Antennae.—Dark brown. Last four segments rather big with relative lengths and widths of
 $\frac{16.5}{7.5} \times \frac{20}{7.5} \times \frac{20}{7.5} \times \frac{28.5}{8}$ (Fig. 65).

Palps.—Dark brown. Third segment rather swollen, $86 \times 40 \mu$, with a deep sensory pit (Fig. 66).

Thorax.—Pleurae dark brown; scutellum grey with a dark patch at the middle. Pattern on the mesonotum varies considerably, but the lateral, dark bars never reach the mesonotal pits (Fig. 67). Halteres darkish brown with white crowns.

Legs.—Dark brown. Apex of hind tibiae with four rather short bristles, the first of which is the longest, about 40μ (Fig. 68).

Wings.—♀ 1.4×0.6 mm. Rather dark and densely covered with macrotrichia. The size of the pale spots is variable. The two spots underneath the second radial cell and the one at the tip of the costa are sometimes very faint. (Fig. 69).

Spermatheca.—Single, pyriform, not highly pigmented, up to $94 \times 62 \mu$ in size. Duct only pigmented for a very short distance (Fig. 70).

Male terminalia.—Claspers normal. Parameres with a sharp bend about the middle, tapering to fine, almost filiform ends (Fig. 71). The stem of the aedeagus consists of a triangular plate which tapers distally; the limbs are usually narrow forming a wide, rounded arch (Fig. 72).

10. *Culicoides distinctipennis* Austen. Plate Vb.

A large, dark species normally with dark wings.

Antennae.—Dark brown. Last four segments rather slender and uniform with relative lengths and widths of—

$$\frac{19}{6.5} \times \frac{22}{6.5} \times \frac{22}{6.5} \times \frac{27}{6.5} \quad (\text{Fig. 73}).$$

Palps.—Dark brown. Third segment swollen ($76 \times 36 \mu$) with a very deep sensory pit (Fig. 74).

Thorax.—Pleurae dark brown; scutellum with grey patches at either side. Ornamentation of mesonotum varying considerably, very similar to *C. pycnostictus*, but the two lateral dark bars always reach the mesonotal pits (Fig. 75). Halteres darkish with white crowns.

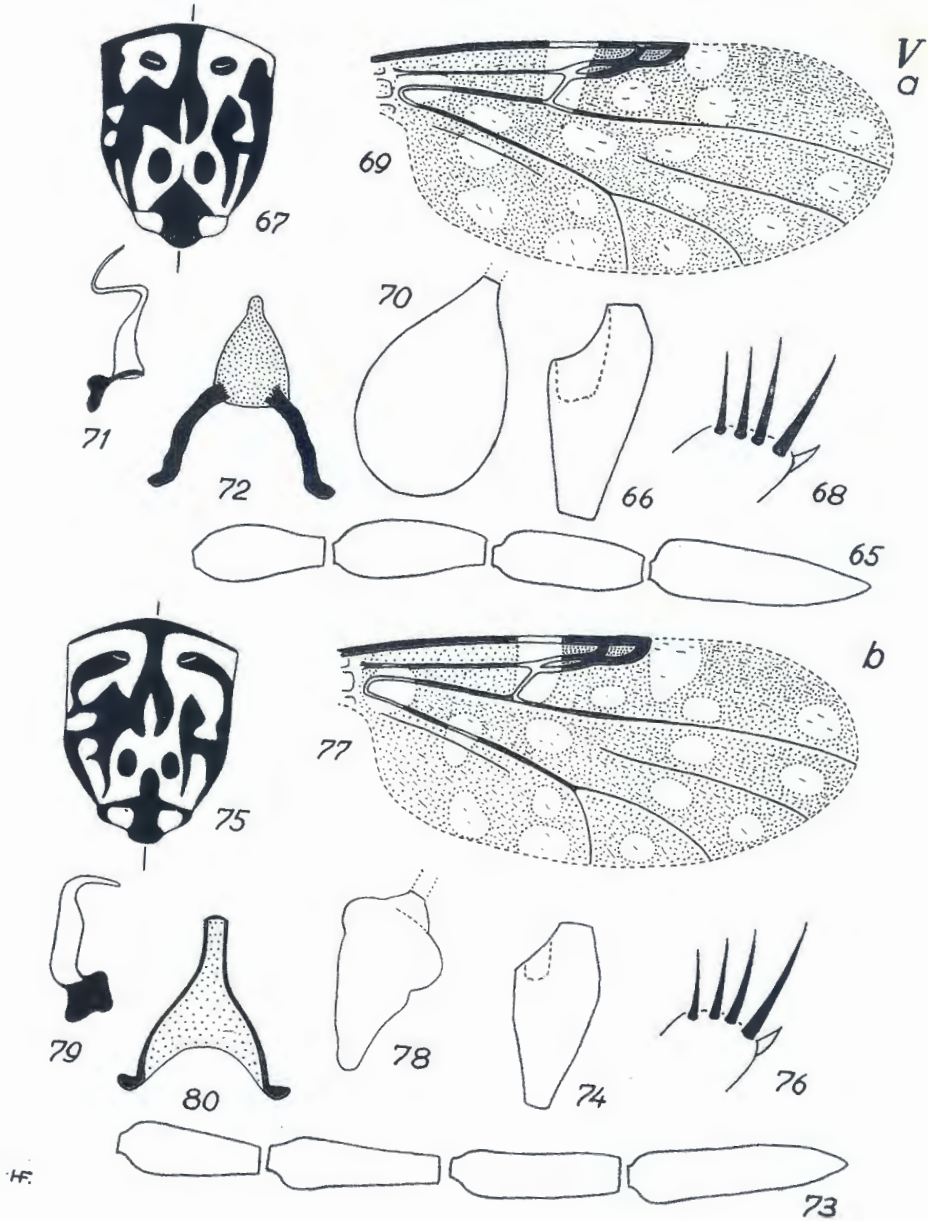
Legs.—Dark brown. Apex of hind tibiae with four bristles, the first of which is the longest, about 50μ (Fig. 76).

Wings.—♀ 1.4×0.6 mm. Macrotrichia numerous. Two pale spots, comprising the one below the second radial cell as well as that one underneath the large light spot at the tip of the costa, vary greatly in size and intensity (Fig. 77). The latter is absent in the nominal form.

Spermatheca.—Single, shaped like a peg-top, slightly pigmented at the bottom, up to $72 \times 44 \mu$, outlet part conical (Fig. 78).

Male terminalia.—Claspers normal. Parameres well chitinised, variable in shape (see also Fig. A on page 6). Basal portion more or less enlarged, terminating distally in a sharply pointed hook (Fig. 79). Aedeagus Y-shaped, stem broad, less highly chitinised than the limbs (Fig. 80.)

PLATE V.



11. *Culicoides accraensis* Carter, Ingram and Macfie. Plate VIa.

A medium sized, dark species.

Antennae.—Blackish brown. Last four segments of medium size and feature with relative lengths and widths of—

$$\frac{15}{6} \times \frac{15}{6} \times \frac{17}{6} \times \frac{17}{6} \text{ (Fig. 81.)}$$

Palps.—Dark brown. Third segment only slightly swollen, $60 \times 28\mu$ (Fig. 82).

Thorax.—Pleurae blackish, scutellum brown. Mesonotum with two light, admedian stripes which often end a short distance before the anterior margin. One to two light patches at either side (Fig. 83). Halteres white, with stalks greyish.

Legs.—Dark brown. Apex of hind tibiae with four bristles, the first of which is the longest, about 60μ (Fig. 84).

Wings.—♀ 1.2×0.5 mm., with very few macrotrichia (Fig. 85).

Spermatheca.—Three. Two are big and pyriform, well pigmented, $60 \times 40\mu$ and $58 \times 38\mu$. Outlet part conical, duct pigmented for a short distance. Third one smaller (32μ) and narrow (Fig. 86).

Male terminalia.—Claspers normal. Parameres branched; ventral branch short, knob-like; dorsal branch long. Arching ventrally and ending in a broad blade with five to seven filiform processes (Fig. 87). The stem of the aedeagus is narrow and long, forming a gutter-like process; the limbs show lateral thickenings with highly chitinised edges (Fig. 88).

12. *Culicoides eriodendroni* Carter, Ingram and Macfie. Plate VIb.

A small, dark species with dark grey wings.

Antennae.—Dark brown. Last four segments slender with relative lengths and widths of—

$$\frac{17}{6} \times \frac{19}{6} \times \frac{21}{6} \times \frac{29}{6} \text{ (Fig. 89).}$$

Palps.—Dark brown. Third segment rather swollen, $60 \times 24\mu$ (Fig. 90).

Thorax.—Pleurae dark brown; scutellum light brown. Mesonotum with two light, admedian stripes which continue along the apical and lateral margins (Fig. 91). Halteres with dark grey knobs and lighter stalks.

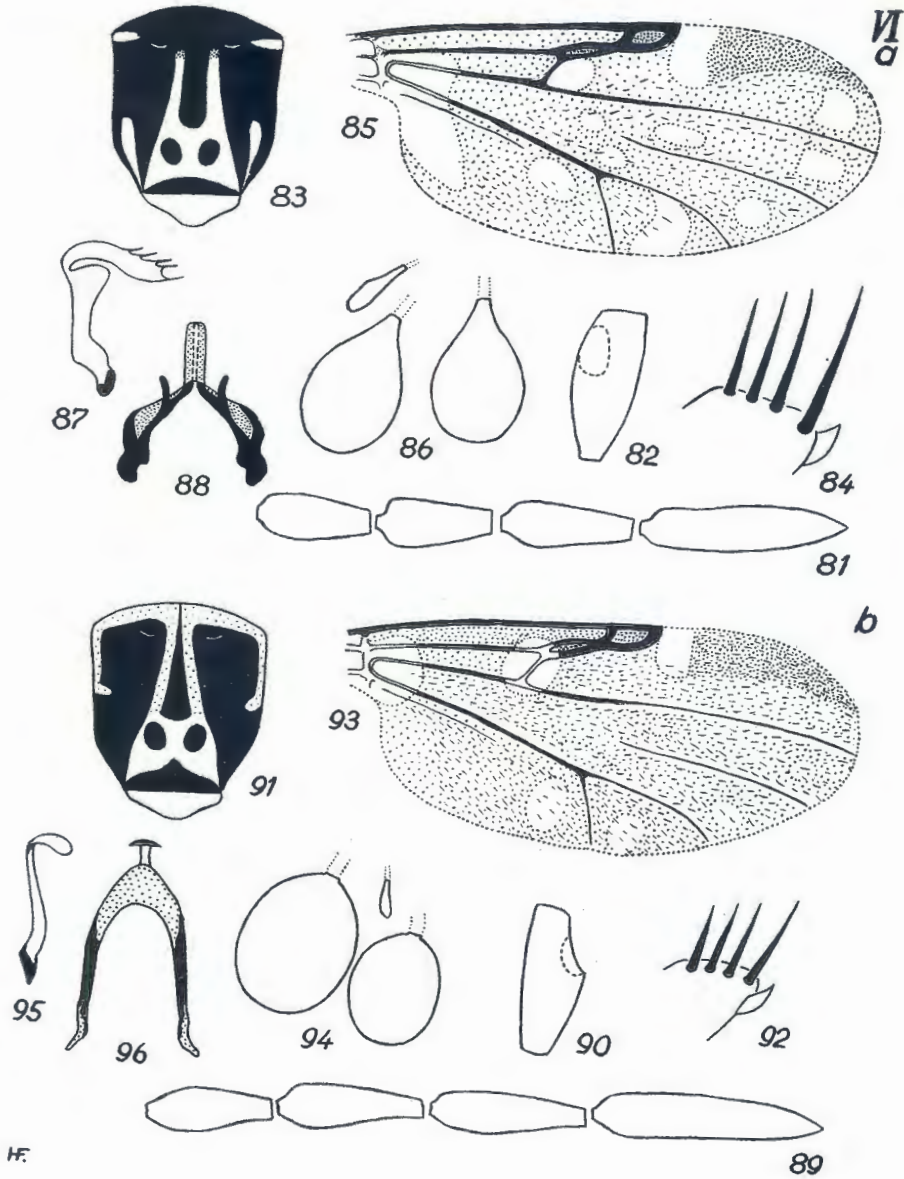
Legs.—Brown. Apex of hind tibiae with four, rather short bristles, the first of which is the longest, 40μ (Fig. 92).

Wings.—♀ 1.0×0.4 mm. Densely covered with macrotrichia (Fig. 93).

Spermatheca.—Three. Two big, oval ones, well pigmented, unequal in size, $58 \times 43\mu$ and $45 \times 38\mu$. Ducts entirely unpigmented. Third one small (20μ) and narrow. (Fig. 94.)

Male terminalia.—Claspers with a broad, hairy basal portion constricted abruptly to meet the terminal portion. Parameres somewhat like the end of a cleek (Fig. 95). The stem of the aedeagus is very short, its top end shaped like the letter T; limbs long (Fig. 96).

PLATE VI.



13. *Culicoides neavei* Austen. Plate VIIa.

A large, dark species with rather dark wings.

Antennae.—Brown. Last four segments rather long and narrow with relative lengths and widths of—

$$\frac{22}{6.5} \times \frac{22.5}{6.5} \times \frac{26}{6.5} \times \frac{40}{6.5} \quad (\text{Fig. 97}).$$

Palps.—Dark Brown. Third segment moderately inflated, $66 \times 30 \mu$, with a large sensory pit (Fig. 98).

Thorax.—Pleurae dark brown; scutellum with a dark patch in the middle. Mesonotum with three more or less interrupted darker stripes. Two to four dark spots in the prescutellar area (Fig. 99). Halteres with whitish knobs, stalks slightly infuscated.

Legs.—Brown. Apex of the hind tibiae with four long bristles, the first of which is the longest, about 55μ (Fig. 100).

Wings.—♀ 1.4×0.6 mm. Macrotrichia dense. Pale spots always distinct (Fig. 101).

Spermatheca.—Three, highly pigmented. The two big ones ($64 \times 55 \mu$ and $54 \times 48 \mu$) are globular, their duct is only pigmented for the very short distance of 2μ . Third one rudimentary and tubular (Fig. 102).

Male terminalia.—Claspers bluntly rounded distally. Parameres of even width throughout the bent, distal end with four filiform processes, similar to *C. dutoiti* (Fig. 103). Aedeagus with a narrow gutterlike stem; the highly pigmented limbs are swollen in the middle, and inwardly bent (Fig. 104).

14. *Culicoides onderstepoortensis* m. Plate VIIb.

A darkish species with light wings.

Antennae.—Brown. Last four segments short and broad with relative lengths and widths of—

$$\frac{16}{6.5} \times \frac{17.5}{7.5} \times \frac{19.5}{7.5} \times \frac{23.5}{8.0} \quad (\text{Fig. 105}).$$

Palps.—Brown. Third segment long and swollen, $85 \times 38 \mu$ (Fig. 106).

Thorax.—Pleurae and scutellum dark brown. Mesonotum with one dark brown, median and two dark admedian stripes (Fig. 107). Halteres white, stalks slightly infuscated.

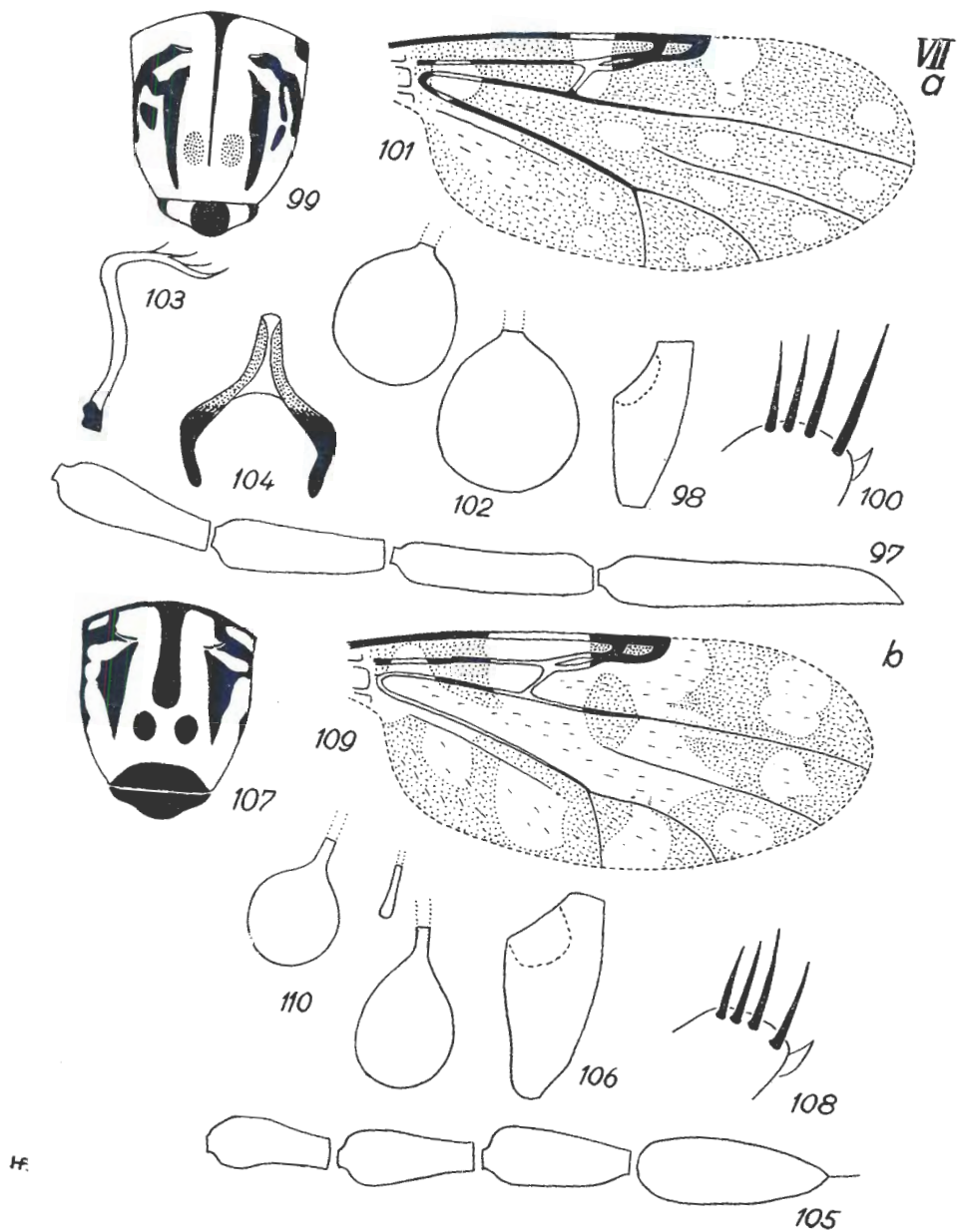
Legs.—Dark brown. Apex of the hind tibiae with four bristles of medium length, the second of which is the longest, about 45μ (Fig. 108).

Wings.—♀ 1.3×0.5 mm. Densely covered with macrotrichia. Pale spots very large and often confluent, forming two transverse bands (Fig. 109).

Spermatheca.—Three, moderately pigmented. The two big ones more or less pyriform, about 68×40 and $55 \times 36 \mu$. The commencement of the duct pigmented for about 12μ . Third one small (24μ) and very narrow. (Fig. 110.)

Male terminalia.—Males still unknown.

PLATE VII.



Hf.

15. *Culicoides bedfordi* Ingram and Macfie. Plate VIIIa.

A medium sized, dark species with dark grey wings.

Antennae.—Brown. Last four segments rather short and thick with relative lengths and widths of—

$$\frac{15.5}{6} \times \frac{16.5}{6.5} \times \frac{16.5}{6.5} \times \frac{22}{7} \text{ (Fig. 111).}$$

Palps.—Brown. Third segment slightly swollen, $66 \times 32\mu$ (Fig. 112).

Thorax.—Pleurae and scutellum darkish brown. Mesonotum with two light, more or less continuous, admedian stripes, which turn to the sides in front of the mesonotal pits, and two pairs of light spots laterally (Fig. 113). Halteres greyish with white knobs.

Legs.—Brown. Apex of hind tibiae with four, rather short bristles about 40μ long (Fig. 114).

Wings.—♀ 1.2×0.5 mm. Densely covered with macrotrichia (Fig. 115).

Spermatheca.—Three, highly pigmented. The two big ones ($45 \times 32\mu$ and $44 \times 30\mu$) are ovoid to globular, with ducts entirely unpigmented. Third one very small (12μ) and narrow. (Fig. 116).

Male terminalia.—Claspers ending bluntly. Parameres in the form of long, narrow, unbranched processes (Fig. 117). Stem of the aedeagus large and broad; limbs highly chitinised, forming a semi-circular arch (Fig. 118).

16. *Culicoides dutoiti* De Meillon. Plate VIIIb.

A medium sized species with light grey wings.

Antennae.—Darkish brown. Last four segments slender and of medium size with relative lengths and widths of—

$$\frac{17.5}{6} \times \frac{18}{6} \times \frac{19.5}{6} \times \frac{29.5}{6} \text{ (Fig. 119).}$$

Palps.—Dark brown. Third segment moderately inflated, $45 \times 20\mu$ (Fig. 120).

Thorax.—Pleurae dark brown; scutellum greyish. The pattern of the ornamentations on the mesonotum shows a dark, more or less gothic arch, surrounded by a series of light patches (Fig. 121). Halteres with creamy crowns and whitish stalks.

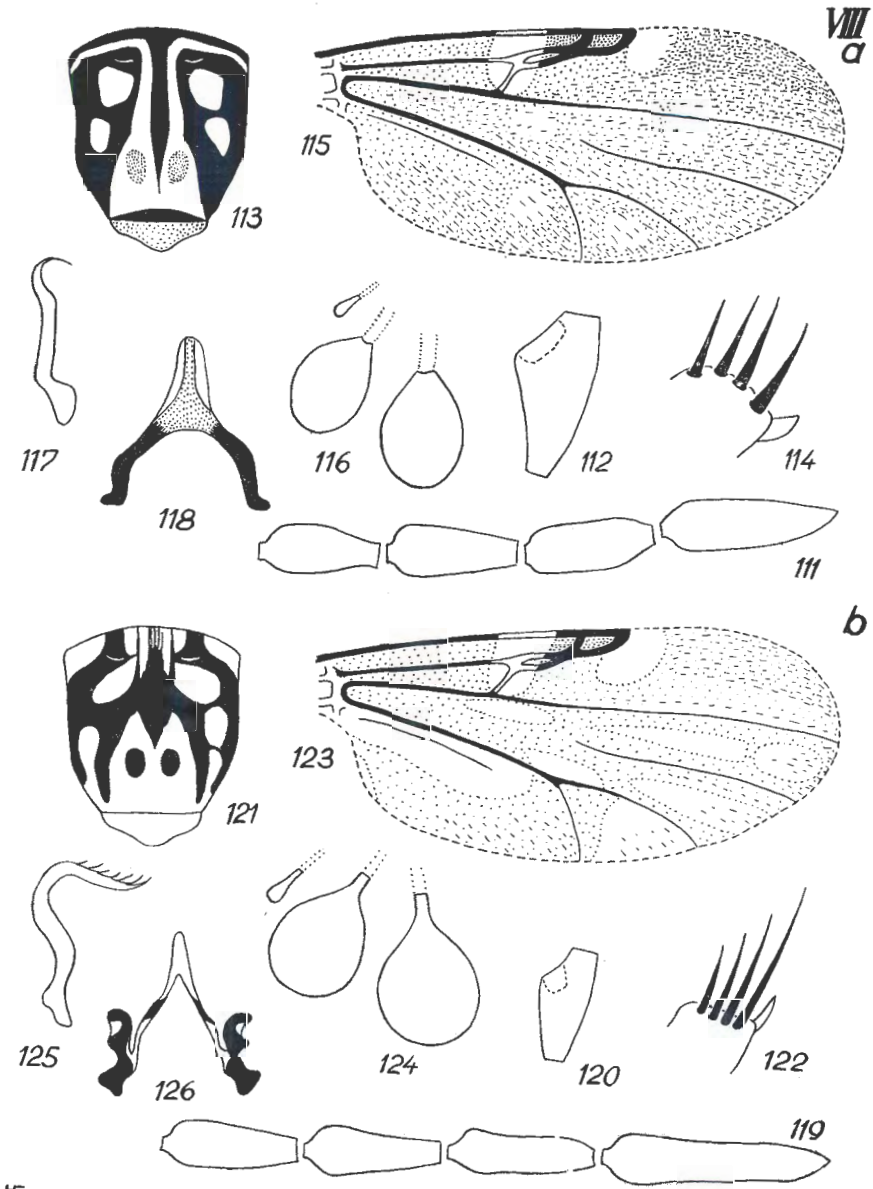
Legs.—Light brown. Apex of the hind tibiae with four long bristles, the first of which is the longest, 60μ (Fig. 122).

Wings.—♀ 1.2×0.5 mm. Shiny with relatively few macrotrichia (Fig. 123).

Spermatheca.—Three, well pigmented. Two big ones are oval ($48 \times 42\mu$ and $42 \times 36\mu$) with about $6-8\mu$ of the duct being chitinised. Third one small (18μ) and tubular (Fig. 124).

Male terminalia.—Claspers rather thin and beak-like. Parameres of an even width throughout, ventrally bent at the middle, distal end with about seven filiform processes (Fig. 125). Aedeagus triangular; narrow basal arms with a heavily pigmented process (Fig. 126).

PLATE VIII.



FF.

17. *Culicoides babrius* De Meillon. Plate IXa.

A small, darkish species.

Antennae.—Light brown. Last four segments rather short with relative lengths and widths of
 $\frac{13}{6} \times \frac{13.5}{6} \times \frac{14}{6} \times \frac{23}{6}$ (Fig. 127).

Palps.—Brown. Third slightly swollen, up to $60 \times 27 \mu$ (Fig. 128).

Thorax.—Pleurae brown; scutellum grey with a dark, rounded area in the middle. Mesonotum with ornamentations as in Fig. 129. The lateral, admedian dark bars do not reach the mesonotal pits. Halteres white, stalks slightly grey.

Legs.—Brown. Apex of the hind tibiae with four bristles, of which the first one (58μ) reaches beyond the others for about one third of its length (Fig. 130).

Wings.—♀ 1.0×0.45 mm. No macrotrichia present proximally to the anterior cross-vein. The small pale spot underneath the big one at the tip of the costa reaches and sometimes surpasses the upper branch of the fourth vein (Fig. 131).

Spermatheca.—Three, well pigmented. The two larger ones pyriform ($52 \times 36 \mu$ and $48 \times 32 \mu$) with the conical commencement of the duct pigmented for about $4-6 \mu$. Third one small (20μ) and narrow (Fig. 132).

Male terminalia.—Claspers with a somewhat blunt tip. Parameres branched, of the type seen in *accraensis* (Fig. 133). Aedeagus consisting of a feebly pigmented, transparent plate and a heavily pigmented, crescentic piece at each side (Fig. 134).

18. *Culicoides similis* Carter, Ingram and Macfie. Plate IXb.

A small, darkish species.

Antennae.—Brownish. The last segment rather long and wide. The relative lengths and widths of the last four segments are—

$\frac{14}{6} \times \frac{15}{6} \times \frac{18}{6} \times \frac{29}{6}$ (Fig. 135).

Palps.—Brown. Third segment swollen, up to $58 \times 28 \mu$ (Fig. 136).

Thorax.—Pleurae yellowish or greyish brown. Scutellum of the same colour with a dark median band and dark patches at each side. Pattern of the mesonotum as in Fig. 137, the admedian, dark bars, which are connected in the middle forming an H, always reach the mesonotal pits. Halteres creamy, stalks slightly grey.

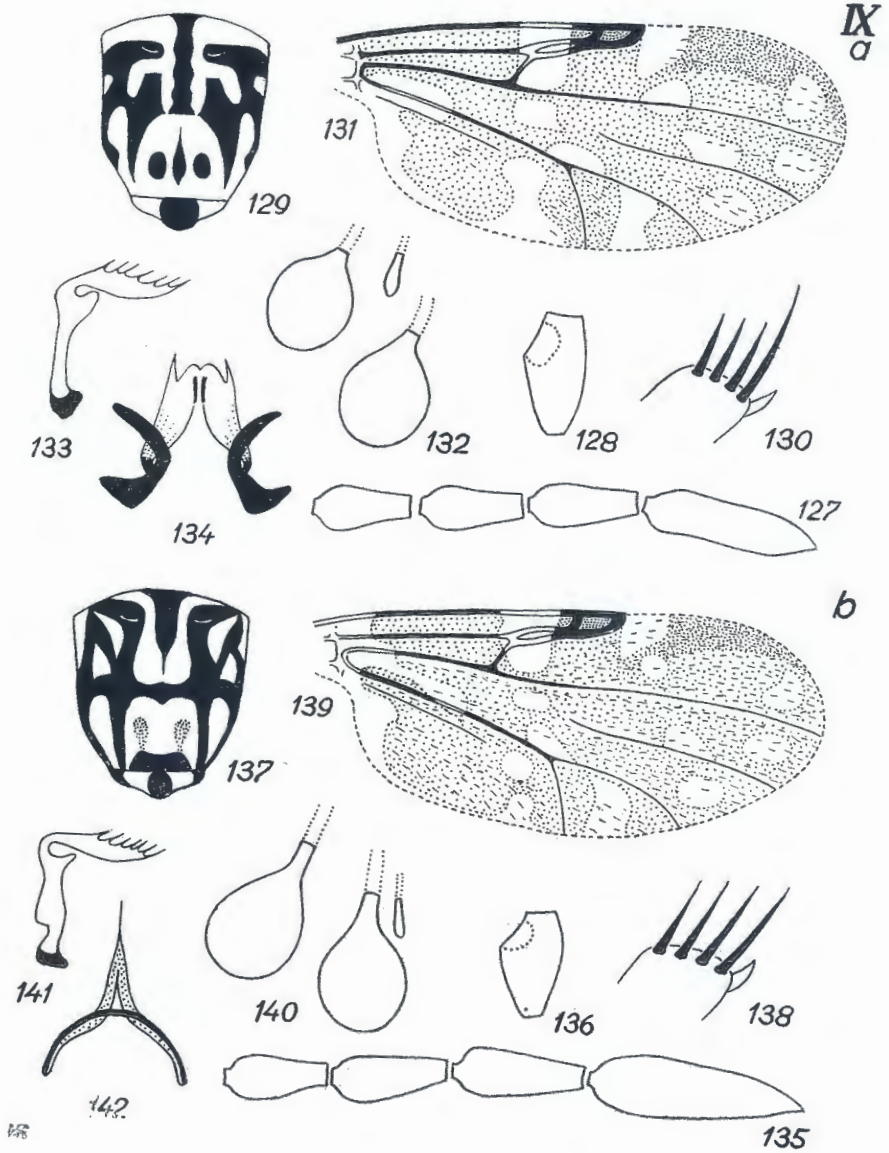
Legs.—Brown. Apex of hind tibiae with four bristles of approximately the same lengths of about 48μ (Fig. 138).

Wings.—♀ 1.1×0.4 mm. Macrotrichia extend to the base of the wing. The small, pale spot underneath the big one at the tip of the costa does not reach the upper branch of the fourth vein (Fig. 139).

Spermatheca.—Three, more pigmented than in *babrius*. The two big ones are ovoid to pyriform, $48 \times 36 \mu$ and $46 \times 34 \mu$, the duct is chitinised for about $14-16 \mu$. Third one very small (15μ) and tubelike (Fig. 140).

Male terminalia.—Claspers normal. Parameres branched as in *accraensis*, the shorter branch being the narrower (Fig. 141). Stem of the aedeagus not highly chitinised, very long, distal and ventrally bent and filiform. The narrow, well pigmented limbs form a low, broad arch (Fig. 142).

PLATE IX.



19. *Culicoides milnei* Austen. Plate Xa.

A large brown species with brownish wings.

Antennae.—Brown. Last four segments very long and narrow with relative lengths and widths of—

$$\frac{22.5}{6} \times \frac{26}{5.5} \times \frac{29.5}{5.5} \times \frac{44}{6} \text{ (Fig. 143).}$$

Palps.—Dark brown. Third segment very long and only slightly swollen, $104 \times 26\mu$ (Fig. 144).

Thorax.—Pleurae and scutellum dark brown. Anterior part of the mesonotum dark brown with two admedian, dark stripes extending backwards (Fig. 145). Halteres infuscated with white crowns.

Legs.—Dark brown. Apex of hind tibiae with five very long bristles, the second of which is the longest, about 80μ (Fig. 146).

Wings.—♀ 1.6×0.5 mm. Macrotrichia sparse. Pigmentation varying, sometimes pale and iridescent, the pale spots at the base more or less confluent. Second radial cell often incomplete (Fig. 147).

Spermatheca.—Three, highly pigmented. The two big ones ($55 \times 49\mu$ and $48 \times 40\mu$) globular in shape, duct chitinised for about $4-6\mu$. Third one rudimentary, $20 \times 14\mu$ (Fig. 148).

Male terminalia.—Tip of claspers rounded. Parameres with a boot-shaped base, gradually narrowing apically, with minute hairs at the end (Fig. 149). Aedeagus triangular with a long and narrow stem, slightly bent at the top (Fig. 150).

20. *Culicoides pallidipennis* Carter, Ingram and Macfie. Plate Xb.

A small, light brown species with light wings.

Antennae.—Brown. Last four segments medium in size with relative lengths and widths of—

$$\frac{16.5}{6.5} \times \frac{17}{6.5} \times \frac{16.5}{6.5} \times \frac{28.5}{6.5} \text{ (Fig. 151).}$$

Palps.—Brown, third segment hardly inflated, $50 \times 18\mu$ (Fig. 152).

Thorax.—Pleurae and scutellum greyish brown. Mesonotum yellowish brown with two admedian, dark brown stripes, often connected in the prescutellar area forming the letter W (Fig. 153). Halteres cream-coloured with slightly infuscated stems.

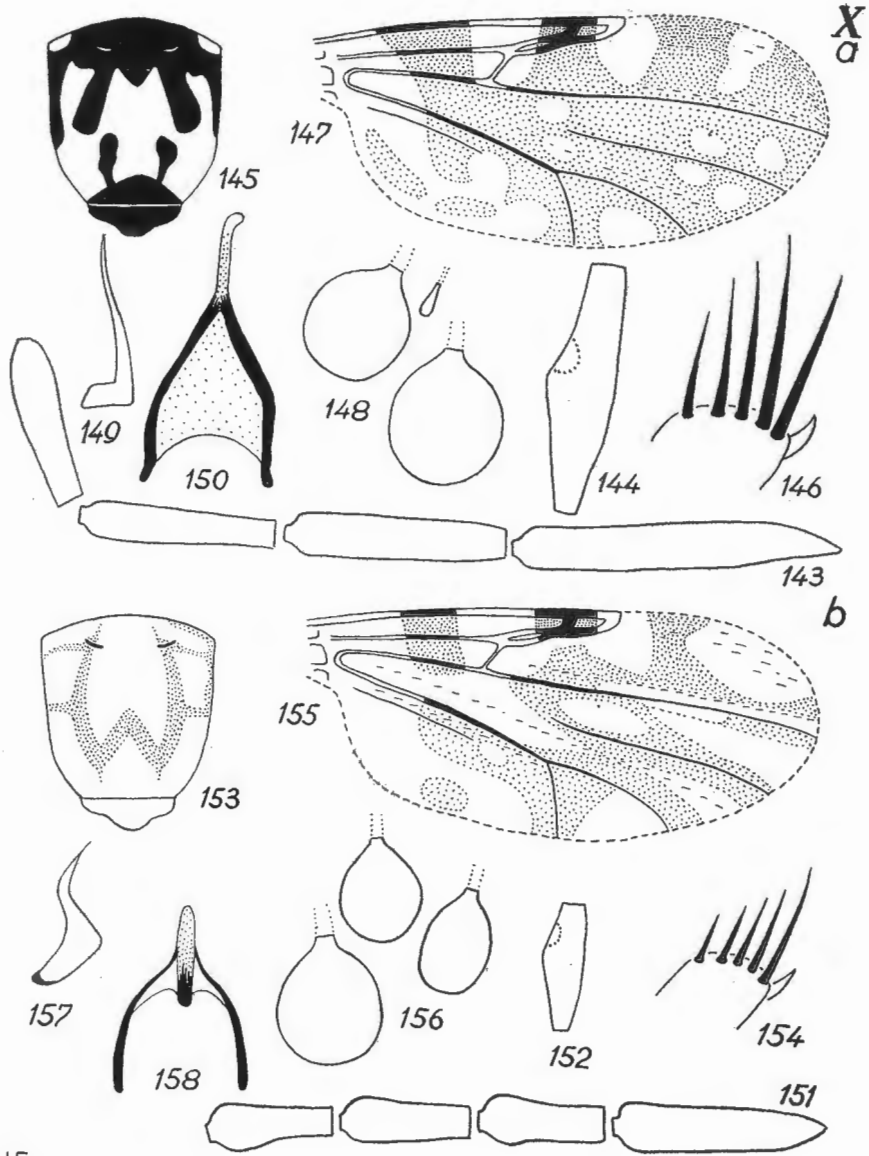
Legs.—Brownish. Apex of hind tibiae with four bristles, the first of which is the longest, about 45μ (Fig. 154).

Wings.—♀ 1.1×0.4 mm. Macrotrichia scanty, almost confined to the distal part of the apical cell. (Fig. 155.)

Spermatheca.—Three, highly pigmented. The two big ones are oval ($49 \times 41\mu$ and $38 \times 32\mu$), the commencement of the duct chitinised for a short distance only ($4-5\mu$). Third one very variable in shape and size (from $20 \times 8\mu$ to $36 \times 27\mu$), either drop-like or oval (Fig. 156).

Male terminalia.—Tip of claspers rounded. Parameres slightly S-shaped and pointed, basal portion very broad (Fig. 157). Limbs of aedeagus very thin; the spine-like stem has a short anterior process between the limbs (Fig. 158).

PLATE X.



21. *Culicoides hirtius* De Meillon and Lavoipierre. Plate XIa.

A medium, dark brown species with brownish wings.

Antennae.—Brown. Last four segments cylindrical and slender with relative lengths and widths of—

$$\frac{17.5}{5.5} \times \frac{19.5}{6} \times \frac{20.5}{6} \times \frac{28}{6.5} \text{ (Fig. 159).}$$

Last segment in male inflated (Fig. 160).

Palps.—Brown. Third segment long and narrow, $76 \times 24 \mu$ (Fig. 161).

Thorax.—Pleurae and scutellum dark brown. The dark ornamentation of the mesonotum is mostly confined to the proximal half (Fig. 162). Halteres white throughout.

Legs.—Brown. Apex of hind tibiae with five rather long bristles, the second of which is the longest, about 66μ (Fig. 163).

Wings.—♀ 1.3×0.6 mm. Macrotrichia fairly dense. The pale spot in the cubital cell forming a ring, often incomplete proximally. Pale area at the cross-vein always extending across the median vein. The two pale spots at the distal portion of the anal cell are connected with a pale area at the base of the wing (Fig. 164).

Spermatheca.—Usually two (according to Colaco up to four), well pigmented, pyriform to globular ($44 \times 40 \mu$ and $42 \times 38 \mu$). The duct is chitinised for the short distance of about 6–8 μ (Fig. 165).

Male terminalia.—Tip of claspers rounded. Parameres rather long and bent, gradually narrowing to a fine point, bearing minute hairs, similar to those of *milnei* (Fig. 166). Aedeagus triangular, inner side forming a rather pointed arch; stem rather short and narrow (Fig. 167).

22. *Culicoides magnus* Colaco. Plate XIb.

A large, brown species with brownish wings.

Antennae.—Brown. Last four segments rather long and cylindrical with relative lengths and widths of—

$$\frac{20}{6.5} \times \frac{21.5}{6.5} \times \frac{23.5}{7.5} \times \frac{37}{7.5} \text{ (Fig. 168).}$$

Last segment in male also cylindrical and narrow (Fig. 169).

Palps.—Brown. Third segment moderately swollen, $86 \times 32 \mu$ (Fig. 170).

Thorax.—Pleurae and scutellum light brown. Mesonotum yellowish with faint, rather variable markings, often reduced to two admedian, darker brown stripes (Fig. 171). Halteres creamy with brownish stalks.

Legs.—Brown. Apex of hind tibiae with six rather long bristles, the second of which is the longest with about 75μ (Fig. 172).

Wings.—♀ 2.0×0.85 mm. Macrotrichia dense. Ornamentation varying considerably, very similar to *hirtius*. The pale, ring-like spot in the cubital cell often incomplete distally. The pale spot which covers the anterior cross-vein mostly stops at the upper branch of the fourth vein, and a small, pale spot is usually found underneath it. The two pale spots at the distal portion of the anal cell not connected with the pale area at the base of the wing. (Fig. 173).

Spermatheca.—Three, well pigmented, always pyriform, with a conical outlet. The two big ones measuring about $73 \times 53 \mu$ and $66 \times 48 \mu$, with ducts pigmented for a distance up to 14μ . The third one is always smaller, up to $21 \times 16 \mu$ (Fig. 174).

Male terminalia.—Tip of claspers rounded. Parameres similar to those of *hirtius*, but even narrower at the basal portion (Fig. 175). Aedeagus triangular, inner side forming a more rounded arch; stem slightly longer and more pointed than in *hirtius* (Fig. 176).

PLATE XI.

