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THE PHILIPPINE BITING MIDGES
OF THE GENUS CULICOIDES
(DIPTERA: CERATOPOGONIDAE)

MERCEDES D. DELFINADO
Philippine Zoological Expedition
1946-1947

THE PHILIPPINE BITING MIDGES
OF THE GENUS CULICOIDES
(DIPTERA: CERATOPOGONIDAE)

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8-10. Wings of *Culicoides*.

11. Palps of *Culicoides*.

12. Eyes of female *Culicoides*.

13. Spermathecae of *Culicoides*.

14. Male genitalia of *Culicoides*. 
The Philippine Expedition: Culicoides (Diptera)

INTRODUCTION

The blood-sucking flies of the genus Culicoides affect man by their severe and irritating bites (Arean and Fox, 1955; Hase, 1953), and by transmitting human and animal diseases (Hopkins and Nicholas, 1952; Henrard and Peel, 1949; Romana and Wygodzinsky, 1950; Price and Hardy, 1954; and others).

The first record of the genus Culicoides in the Philippines was published by Bezzi (1917), who briefly described C. judicandus. This was followed by a paper by Kieffer (1921), who included the description of C. philippinensis. Edwards (1929) listed the occurrence of C. oxystoma Kieffer, C. gymnopterus Edwards, and C. pungens de Meijere, and considered C. judicandus the same as C. philippinensis. Both Bezzi’s and Kieffer’s species are now regarded as synonyms of Culicoides peregrinus Kieffer by Macfie (1937), and C. oxystoma is considered a synonym of C. schultzei (Enderlein) by Wirth (personal communication). Recently, Wirth and Hubert (1959) added seven species from this region. These are: C. albibasis Wirth and Hubert, C. baisasi Wirth and Hubert, C. barnetti Wirth and Hubert, C. flavescens Macfie, C. flaviscutatus Wirth and Hubert, C. palpifer das Gupta and Gosh, and C. sarawakensis Wirth and Hubert.

This study has revealed an additional 35 species in this area, bringing the total to 46 species known from the Philippines. Of the 46 species, 21 are described as new, 14 are new Philippine records, and 11 were previously reported.

As this paper is a synopsis for the identification of Philippine Culicoides, only descriptions and brief comparisons are made. Discussions of the interrelations among the species and species groups of the genus have been omitted. However, the species are divided into taxonomic groups, and the appropriate subgeneric names have been utilized. A brief definition is given for each subgenus.

1 A thesis presented to the Faculty of the Graduate School of Cornell University for the Degree of Master of Science, February, 1960.
It is hoped that this paper will form a basis for the accurate identification of Philippine Culicoides and will promote further study of the new forms that await discovery.

METHODS AND TERMINOLOGY

The specimens studied are based upon material obtained by the Chicago Natural History Museum Philippine Zoological Expedition (1946–47), and upon the collection of the Division of Malaria, Philippine Department of Health, all collected from carabao-baited traps and light traps designed for mosquito collection.

The types of the new species are deposited either in the collections of Chicago Natural History Museum or in the Division of Malaria, Philippine Department of Health, Manila, as indicated below.

Paratypes are deposited in the collections of Chicago Natural History Museum (CNHM); Division of Malaria, Philippine Department of Health (PDH); Bernice P. Bishop Museum, Honolulu (BPBM); British Museum (Natural History) (BMNH); and the United States National Museum (USNM).

Specimens of previously described species have also been distributed among these collections, but the depositories for these are not indicated. The italicized abbreviation CNHM followed by a number, e.g., CNHM–15, is the lot number of the specimens which it follows and does not indicate the depository.

To obtain measurements of the body, wing, and female spermathecae, to procure antennal and palpal proportions, and for purposes of illustrations, specimens were cleared and mounted on microscope slides. The phenol-balsam method of Wirth (1952) was used for most of the specimens. In some cases, mounted specimens have been prepared by this method: Dried specimens are relaxed in liquid phenol, the wings are removed, and the head and body are placed in 5 per cent KOH solution. If specimens are fresh or preserved in alcohol, the wings are removed and then transferred to phenol; the head and body are placed in KOH. The parts in the KOH solution are gently heated until clear, then washed in acidified distilled water and dehydrated through several grades of alcohol (50–70–80–90 per cent). The specimens are mounted in balsam or diaphane.

1 [The Ceratopogonidae collected by members of the Philippine Zoological Expedition included 26 species of the genus Culicoides, of which 17 were new. Of these 9 are known and described solely from the specimens collected by the expedition. In addition, a new genus has previously been described from this collection by Wirth and Hubert (1960).—EDITOR.]
The terminology adopted in this study is that of Wirth (1952) and Wirth and Blanton (1953, 1956a). All measurements are made from slide-mounted specimens. The measurements are made with an ocular micrometer disc and are converted to microns or millimeter equivalents. Measurements for each species are usually based on a single specimen. When more than one specimen is involved, the measurements are presented as follows: “mean (minimum-maximum, \( n \) = number of measurements).” Body length is measured from the anterior edge of the mesonotum to the tip of the abdomen. Wing length is measured from the basal arculus to the wing tip. The female antennal ratio is obtained by dividing the combined lengths of the last five segments by the combined lengths of the preceding eight. The presence of antennal sensoria or distal sensory tufts is indicated by Roman numerals on specific antennal segments.

Tillyard’s (1926) modification of the Comstock-Needham (1898–99) system of wing venation and cell designation is used here. Thus, veins \( \text{Cu}_1 \) and \( \text{Cu}_2 \) of Comstock-Needham, Hoffman (1925), Foote and Pratt (1954), and Forattini (1957) become \( \text{M}_{3+4} \) and \( \text{Cu}_1 \), respectively, and cell \( \text{Cu}_1 \) becomes cell \( \text{M}_4 \).

In addition to the basic characters of wing pattern, of the male genitalia, and of the number of the female spermathecae used for the identification of species, certain quantitative characters of the females such as those discussed by Wirth and Blanton (1953, 1956a, 1956b) have also been utilized: the wing length; the costal length; the relative lengths of the flagellar segments of the antenna; the antennal ratio; the number of antennal segments bearing the distal sensoria; the number of teeth on the mandible; the number of spines in the comb at the apex of the hind tibia; and the relative size and proportions of each of the spermathecae.

It was found in this study that certain characters of the sucking apparatus, particularly the small spines or papillae on the epipharyngeal wall of the cibarial pump, and the ventral teeth at the mouth entrance, have taxonomic value. These characters are clearly seen in *Culicoides pampangensis*, new sp., *C. arakawai* (Arakawa) and *C. guttifer* de Meijere.

The descriptions of the species are based on slide-mounted specimens and do not include the mesonotal pattern. The illustrations have been made from slide preparations by using a microprojector.
SYSTEMATIC TREATMENT

Genus CULICOIDES Latreille


Type of the genus: Culicoides punctata Latreille, monobasic.

Wirth (1952) and Wirth and Blanton (1959) provide an extensive bibliography, synonymy and morphology of the genus. Diagnosis:

Small flies 1–2.5 mm. long, with moderately slender, lightly hairy body. Head with eyes usually bare, rarely hairy between facets, contiguous or separate; antennae 15-segmented with basal segment or scape ring-like, distal sensory tufts or sensoria present on most segments; female antennae with segments 3–10 rounded, oval or elongate but never shorter than individual segments 11–15; male antennae plumose, the last 3 segments elongate. Mesonotum with or without pattern, hairs and bristles short; humeral pits always large and distinct; scutellum with mid-scutellar and lateral bristles. Legs slender; femora sometimes slightly swollen, without spines; hind tibia with two transverse rows of spines and an anterior spur distally; claws small, usually simple, equal in both sexes; empodium shorter than claw length. Wing with pattern of pale and dark spots or bands, dense microtrichia, macrotrichia usually present, 1–2 anterior radial cells, usually 2, of sub-equal lengths; crossvein r-‐m slightly oblique; median fork distinctly petiolate. 1–3 well-developed spermathecae; rudimentary spermatheca and ring present or absent. Male terminalia with ninth sternite short, the posterior margin emarginate; ninth tergite with or without apicolateral processes; basistyle enlarged at base with developed or undeveloped dorsal and ventral roots; dististyle slightly swollen at base, slender distally with an incurved point; aedeagus usually an inverted Y-shape with sclerotized basal arms or arch and stem directed ventrocaudal; parameres sclerotized, with knobbed bases and ventrally directed distal points.

KEY TO FEMALES OF PHILIPPINE SPECIES OF CULICOIDES

1. Wing with the second radial cell included in a pale spot at apex..............2
   Wing with the second radial cell entirely dark, or tip may appear pale where end of vein R_{1+} is included in a pale spot..............................19
2. With two well-developed spermathecae.....................................3
   With three well-developed spermathecae (subgenus Trithecoides).........37
3. Base of cell M₄ dark bordering veins M₃+₄ and Cu₁..........................4
   Base of cell M₄ pale bordering veins M₃+₄ and Cu₁ at the base of fork, apices of veins M₁, M₂ and M₃+₄ usually pale (subgenus Hofmannia)...........16
4. Anterior radial cells not separated, the single radial cell long and narrow extending through pale spot to third dark costal spot; third palpal segment without sensory pit but with a few scattered sensoria (subgenus Culicoides, in part).................................................................5
   Anterior radial cells distinctly separate, the second usually ending in a pale spot a considerable distance from third dark spot; third palpal segment swollen and with common sensory pit.................................6
5. Cell R₁ with pale spot broadly meeting anterior margin of wing; prominent, narrow, transverse dark band across wing; legs unbanded. unicus, new sp., p. 665

¹ Females of C. gymnopterus, C. malayae, and C. sumatrae unknown.
Cell R_{4} with pale spot widely separated from margin of wing; diffuse dark band across wing, the first and second bands interrupted at middle of cell M_{1}; bases of all tibiae yellowish; wing 1.27 mm. long (pl. 10, fig. 3).

gemellus Macfie, p. 661

6. Pale spot anterior to mediocubital fork absent, cell M_{2} usually pale from base to apex; large distal pale spot broadly attaining margin of wing; third palpal segment small and not narrowed beyond pit; small to large species; wing 0.70-1.03 mm. long (subgenus Avaritia) ........................................ 7

Pale spot in cell M_{2} anterior to mediocubital fork always present; distal pale spot on cell R_{4} smaller, may or may not reach anterior margin of wing; third palpal segment usually elongate and narrowed distally; larger species; wing 0.91-1.03 mm. long (subgenus Culicoides) ................................. 14

7. Wing appearing brownish with pale markings indistinct; halter brown; antennal sensoria present on segments III, XI-XV; wing 0.82 mm. long (pl. 9, fig. 11) ........................................... pungens de Meijere, p. 656

Wing with pale areas extensive, more or less prominent.................. 8

8. Eyes hairy between facets; antennal sensoria present on segments III, XII-XV; radial cells short and small, only the tip included in pale spot; halter yellowish-white; wing 0.84 mm. long (pl. 9, fig. 5) .... actoni Smith, p. 654

Eyes bare; antennal sensoria present on segments III, XI-XV; radial cells longer, usually distal half of second radial cell pale .............. 9

9. Third palpal segment without sensory pit but with scattered, hyaline sensoria forming a rounded pitted spot; halter whitish nudipalpis, new sp., p. 655

Third palpal segment with distinct sensory pit .......................... 10

10. Anal cell with dark streak which may be interrupted before posterior margin of wing. .................................................. 11

Anal cell with two rounded dark spots, base broadly pale ............ 12

11. Front and middle knees of tibiae and femora pale, base of hind tibia yellowish; mediocubital fork pale-margined along veins M_{3+4} and Cu_{1}; wing 1.03 mm. long (pl. 9, fig. 7)........................................ boophagus Macfie, p. 655

Front and middle knees dark with adjacent pale band on tibiae and femora, base and apex of hind tibia pale .................................. 13

12. Base of vein M_{2} pale at medial fork, apex dark; legs unbanded, knees of femora and tibiae pale ...................................... brevipalpis, new sp., p. 654

Base of vein M_{5} dark at medial fork, apex pale; legs banded, knees dark with adjacent pale band on front and middle femora and tibiae. radicitus, new sp., p. 657

13. Dark streak on anal cell continuous, distal pale spot on cell R_{3} broadly meeting margin of wing; antennal sensoria present on segments III, XI-XV; wing 0.88 mm. long (pl. 9, fig. 10) ................................................... orientalis Macfie, p. 656

Dark streak interrupted, distal pale spot on cell R_{3} not reaching margin of wing; antennal sensoria present on segments III, XI-XIV; wing 0.70 mm. long (pl. 9, fig. 8) ........................................ jacobsoni Macfie, p. 655

14(6). Eyes contiguous; pale spot over crossein r-m may or may not be separated anteriorly from costal pale spot ........................ assimilis, new sp., p. 660

Eyes widely separated; pale spot over crossein r-m usually separated anteriorly from costal pale spot ................................... 15

15. Vein R_{1+2} dark into adjacent pale area up to where vein turns abruptly forward to meet costa .................................. recurvus, new sp., p. 663

Vein R_{4+5} not dark to where vein turns forward to meet costa. hirtipennis, new sp., p. 662

16(3). Pale wing markings extensive, almost all of second radial cell included in a large pale spot, limiting the transverse costal dark spots; third palpal segment without sensory pit but scattered sensoria ... effusus, new sp., p. 658

Pale markings less extensive, costal dark spots broad .................. 17

17. Crossein r-m entirely pale, costa ending in a pale spot a considerable distance from third dark area ................................. 18
Crossvein \( r-m \) dark, separating the pale spot before and after it, costa extending through pale spot with tip touching third dark area; wing 1.05 mm. long (pl. 9, fig. 15).………….. *insignipennis* Macfie, p. 659

18. Third dark costal spot broad, distal pale spot on cell \( R_b \) narrow and transverse, apices of veins \( M_1, M_2 \) and \( M_{1+2} \) pale; eyes just touching; third palpal segment with divided sensory pits; wing 1.10 mm. long (pl. 10, fig. 1).………….. *peregrinus* Kieffer, p. 660

Third dark costal spot narrowed by two large pale spots on cell \( R_s \); only tip of vein \( M_1 \) pale; eyes contiguous for the length of the diameter of 2.5 facets; third palpal segment with a moderately large sensory pit.

*bubalus*, new sp., p. 658

19(1). With two well-developed spermathecae (subgenus *Oecacta*).………….. 20
With only one large spermatheca (subgenus *Monoculicoides*).………….. 35

20. Extreme tip of second radial cell pale where end of vein \( R_{4+5} \) is included in a pale spot.………….. 21
Second radial cell entirely dark.………….. 24

21. Wing with anterior radial cells not separated.………….. *longipalpis*, new sp., p. 645
Wing with two anterior radial cells.………….. 22

22. Two distinct spots present, other pale areas absent.………….. *wenzeli*, new sp., p. 649
Wing not as above.………….. 23

23. With pale spots forming two broad transverse bands across wing, pale areas in apices of cells \( M_1, M_2 \) and \( R_s \) barely discernible.

*pampangensis*, new sp., p. 650

Pale markings extensive, not forming transverse bands across wing, apical cells with large pale spots………….. *ejercitoi*, new sp., p. 643

24. Cell \( R_k \) with pale spots immediately posterior to pale spot just beyond end of second radial cell, or anterior to medioceubital fork; antennal sensoria present on segments III, VII–X, never exceeding segment X.………….. 25
Pale spots anterior to vein \( M_1 \) and medioceubital fork absent; antennal sensoria variable on segments III, XIV, or III, XI–XIV.………….. 29

25. Crossvein \( r-m \) and first radial cell more or less dark, not included in a pale spot in front of crossvein; cell \( R_k \) with small pale spot at wing tip separate from margin of wing.………….. 26
Crossvein \( r-m \) with pale spot reaching anterior margin of wing; large distal pale spot on cell \( R_k \) broadly open anteriorly, various shapes.………….. 27

26. Antennal sensoria present on segments III, VII–X; front knee with adjacent pale band on tibia; wing 0.71 mm. long………….. *clavipalpis* Mukerji, p. 641
Antennal sensoria present on segments III, V, VII–X; knees dark with adjacent pale band on front and middle femora and all tibiae; wing 0.84 mm. long (pl. 8, fig. 8).………….. *huffi* Causey, p. 644

27. Cell \( R_k \) with two pale spots immediately posterior to pale spot just beyond end of second radial cell.………….. 28
Cell \( R_k \) with only one pale spot posterior to pale spot just beyond end of second radial cell, and a subtriangular spot at tip along margin of wing; antennal sensoria present on segments III, VII–X………….. *notatus*, new sp., p. 648

28. Distal pale spot on cell \( R_s \) hourglass-shaped; eyes widely separated; antennal sensoria present on segments III, VII–X; wing 0.82 mm. long (pl. 9, fig. 4).………….. *schultzei* (Enderlein), p. 653
Distal pale spot on cell \( R_s \) irregular in shape, nearly filling distal half of cell, more or less U-shaped and broadly emarginate anteriorly; eyes contiguous for the length of 3.5 facets.………….. *perornatus*, new sp., p. 651

29. Distal pale spot on cell \( R_s \) large, nearly filling half of cell and broadly meeting margin of wing; pale spot past tip of second radial cell diffuse; antennal sensoria usually present on segments III–XIV (except in *cordiger* Macfie, in which they are present on segments III–XV).………….. 30
Distal pale spot on cell R₄ small and well separated from margin of wing, or may be at wing tip; two pale spots past tip of second radial cell may or may not be connected; antennal sensoria variable, present from segments III–XIV, and III, XI–XIV. 31

30. Antennal sensoria present on segments III–XV; fourth tarsal segment coriaceous; wing 1.22 mm. long (pl. 8, fig. 5) 31  cordiger Macfie, p. 642
Antennal sensoria present on segments III–XIV; fourth tarsal segment elongate. 32

31. Small distal pale spot on cell R₄ at wing tip; macrotrichia long and abundant over most of wing surface; antennal sensoria present on segments III, XI–XIV. 32  marginatus, new sp., p. 646
Large distal pale spots on cell R₄ not reaching margin of wing; macrotrichia sparse, confined to distal half of wing or apices of wing. 33

32. Legs banded, with dark brown knees; antennal ratio 1.21; third palpal segment 2.06 times as long as broad. 33  medovelli, new sp., p. 647
Legs entirely brown, unbanded; antennal ratio 1.53; third palpal segment 2.34 times as long as its greatest breadth. 34  palawanensis, new sp., p. 648

33. Knees not dark, base of hind tibia pale; antennal sensoria variable on segments III–XIV and III–IX, XI–XIV. 34  damnosus, new sp., p. 642
Knees dark with adjacent pale band on tibiae. 35

34. Antennal sensoria present on segments III–XIV; antennal ratio 1.37; apices of cells R₄ and M₁ each with additional small pale spots along margin of wing. 35  praesignis, new sp., p. 652
Antennal sensoria present on segments III–X, XIII–XIV; antennal ratio 1.14; pale spots on apices of cells R₄ and M₁ absent. 36  infilatus, new sp., p. 644

35(19). Cell R₅ with one large pale spot past tip of second radial cell; macrotrichia sparse; spermatheca ovoid, thinly sclerotized; antennal sensoria present on segments III, XI–XIV; wing 0.89 mm. long (pl. 8, fig. 3). 37  hegeneri Causey, p. 641
Cell R₅ with two pale spots just beyond tip of second radial cell, the second partly underlying the cell; macrotrichia abundant. 38

36. With an additional rounded pale spot anterior to base of medial fork; spermatheca elongate oval; antennal sensoria present on segments III, IV, XI–XIV; wing 0.93 mm. long (pl. 8, fig. 2). 39  guttifer de Meijere, p. 640
Without such a spot; spermatheca pyriform with wide opening to duct; antennal sensoria present on segments III–XIV; wing 1.12 mm. long (pl. 8, fig. 1). 39  arakawai (Arakawa), p. 640

37(2). Spermathecae subequal and pyriform with short sclerotized necks, small openings to duct; wing largely pale with two prominent dark spots on anterior margin; hind femur narrowly dark at apex; mandible teeth 15–16; wing 1.03 mm. long (pl. 10, fig. 13). 40  flavescens Macfie, p. 667
Spermathecae unequal, rounded or elongate oval, sclerotized neck absent, openings to ducts large; mandible teeth 7–13. 40

38. Mandible teeth 7–8, the distal ones largest; halter knob pale; wing tip with pale narrow band; spermathecae rounded. 41
Mandible teeth 10–13, the distal ones scarcely larger than proximal series; spermathecae oval, the larger ones sometimes elongate. 40

39. Mandible with 7 curved teeth; hind femur dark, sometimes with narrow pale subapical band; wing with only distal half of second radial cell included in a pale spot; wing 0.98 mm. long (pl. 10, fig. 15). 42  palpifer das Gupta and Gosh, p. 668
Mandible with 8 triangular teeth; hind femur with distinct pale subapical band; nearly all of second radial cell in a pale spot; wing 0.82 mm. long (pl. 10, fig. 11). 43  baisasi Wirth and Hubert, p. 666

40. Wing tip with pale band; halter knob pale; mandible teeth 10–12. 44
Wing tip without pale band; halter knob dark; mandible teeth 10–13. 45
41. Hind femur dark, unbanded; wing appearing brownish with diffuse posterior pale spots; mandible teeth 10–13; wing 1.33 mm. long (pl. 10, fig. 14).

flaviscutatus Wirth and Hubert, p. 667

Hind femur with subapical pale band; pale wing markings prominent with broad pale apical band; mandible teeth 12; wing 1.05 mm. long (pl. 10, fig. 12).........................barnetti Wirth and Hubert, p. 667

42. Hind femur dark, unbanded; mandible teeth 13; wing brownish with diffuse posterior pale spots; wing 0.92 mm. long.

sarawakensis Wirth and Hubert, p. 668

Hind femur pale to knee; wing largely pale on basal half; mandible teeth 10-11; wing 0.89 mm. long.............albibasis Wirth and Hubert, p. 666

Subgenus Monoculicoides Khalaf


Type of the subgenus: Culicoides nubeculosus (Meigen), by original designation.

Species having only one large spermatheca; second radial cell entirely dark; wing with prominent pattern; male aedeagus massive; basistyle of ventral and dorsal roots developed; ninth tergum with apicolateral processes present.

Included species: arakawai, guttifer, hegneri.

Culicoides (Monoculicoides) arakawai (Arakawa)

Ceratopogon arakanae Arakawa, 1910, Konchu-Sekai, 14: 411 (arakanae is a misprint of arakawai); Matsumura, 1915, Konchu Bunrui Gaku Gekan, p. 56.

Culicoides arakawai (Arakawa), Arnaud, 1956, Microent., 21: 92 (redescr. female, male; Japan; eyes, antennae, palp, mouth-parts, scutum, legs, wings, male genitalia, and spermatheca illus.).


Diagnostic characters.—Wing with second radial cell entirely dark, cell R₄ with 3 subequal, rounded pale spots, the first just past tip of second radial cell, the second partly underlying cell, and the third at apex of cell along margin of wing (pl. 8, fig. 1); eyes widely separated; antenna with distal sensory tufts present on segments III–XIV; third palpal segment swollen, with large sensory pit; one spermatheca large, elongate pyriform, well sclerotized; male aedeagus massive, with broad truncated tip; ninth tergum with developed apicolateral processes; parameres stout, simple; dorsal and ventral roots of basistyle developed.

Distribution.—Luzon: Clark Air Base, Angeles, Pampanga, September 17, 1957, light trap, I. Balatbat; Tala, Rizal, May 21, 1958, light trap, M. D. Delfinado.

Culicoides (Monoculicoides) guttifer de Meijere

Culicoides guttifer de Meijere, 1907, Tijdschr. Ent., 50: 209 (female; Java; wing illus.).
Diagnostic characters.—Wing with dark spot over second radial cell and most of first radial cell; cell Rs with 4 pale spots, the first just past tip of second radial cell, the second partly underlying the cell, the third located anterior to base of medial fork, and the fourth at apex along margin of wing (pl. 8, fig. 2); eyes narrowly separated; antenna with distal sensory tufts present on segments III–IV, XI–XIV; third palpal segment swollen, with large sensory pit near apex; front and middle legs with subapical pale band on femur and sub-basal pale band on tibia; hind tibial comb with 4 spines; one spermatheca large, elongate-oval.

Distribution.—Luzon: Tala, Rizal, May 22, 1958, light trap, M. D. Delfinado.

Culicoides (Monoculicoides) hegneri Causey

Culicoides hegneri Causey, 1938, Amer. Jour. Hyg., 27 (2), p. 402 (male, female; Siam, at light; spermatheca, wing, and male hypopygium illus.).

Diagnostic characters.—Wing with second radial cell entirely dark, pale markings more or less extensive, cell Rs with two large pale spots, one past tip of second radial cell and the second at apex of cell Rs, radial cells large and broad (pl. 8, fig. 3); eyes widely separated; antenna with distal sensory tufts present on segments III, XI–XIV; third palpal segment moderately enlarged, with small sensory pit; one spermatheca large, ovoid and thinly sclerotized.


Subgenus Oecacta Poey


Type of the subgenus: Oecacta furens Poey, monobasic.

Species having two well-developed spermathecae; second radial cell usually dark; wing with prominent pattern; hind tibial comb with four spines; male genitalia with well-developed apicolateral processes; dorsal and ventral roots of balsam-style usually developed; parameres separated or joined at bases.

Included species: clavipalpis, cordiger, damnosus, ejercitoi, huffi, infolatus, longipalpis, marginatus, mcdowelli, notatus, palawanensis, wenzeli, pampangensis, perornatus, praesignis, schultzei.

Culicoides (Oecacta) clavipalpis Munkerji

Culicoides clavipalpis Munkerji, 1931, Indian Jour. Med. Res., 18: 1052 (female; India; antenna, head, wing, fore and hind legs, spermathecae, and eighth abdominal sternite illus.).

Diagnostic characters.—Wing with radial cells and crossvein r–m dark, pale spot past tip of second radial cell angular, extending posteriorly to vein M1 (pl. 8, fig. 4); eyes contiguous; antenna with distal sensory tufts present on segments III,
VII-X; third palpal segment greatly swollen, with large deep sensory pit; hind tibial comb with four widely spaced spines; two well-sclerotized spermathecae with long neck; male aedeagus with spines at basal arch, serrated tip; parameres with strongly serrated tip, large thumblike projection; dorsal and ventral roots of basistyle well developed; ninth tergum with long, tapering, apicolateral processes.

Distribution.—Luzon: Clark Air Base, Angeles, Pampanga, September 17, 1957, light trap, I. Balatbat.

Culicoides (Oecacta) cordiger Macfie


Diagnostic characters.—Wing with second radial cell and distal half of first cell blackish, a small blackish rounded spot at middle of cell R₂ between two large pale spots, one just past tip of second radial cell and the other at apex of cell along margin of wing, basal half of cell M₁ largely pale (pl. 8, fig. 5); eyes very narrowly separated; antenna with distal sensory tufts present on segments III–XV; third palpal segment greatly enlarged, with a large, deep sensory pit; fourth tarsal segment of all legs cordiform; hind tibial comb with four spines; two moderately large spermathecae.


Culicoides (Oecacta) damnosus, new species

By wing pattern, *damnosus* appears to be related to *praesignis*, but its variable antennal sensorial pattern (segments III–XIV, and III–IX, XI–XIV) and pale knees do not resemble those of *praesignis*.

Female.—Length about 1.4 mm., wing 0.91 (0.86–0.98, n-10) mm. long. Eyes widely separated above, narrowing posteriorly (pl. 12, fig. 1). Antenna with flagellar segments in proportion of 40:27:27:27:27:27:27:27:54:51:61:61:81, antennal ratio 1.35 (1.29–1.40, n-6); antennal sensoria present on segments III–IX, XI–XIV, and III–XIV. Palpal segments in proportion of 20:47:54:23:27; third segment (pl. 11, fig. 1) distinctly swollen, 1.95 (1.87–2.00, n-6) times as long as broad with a large, deep, sensory pit on distal half. Mandible teeth 12 (11–14, n-9). Legs brown; knee spot absent; hind tibia with narrow, pale, 'basal band, four spines on comb. Wing (pl. 8, fig. 6) with costa extending 0.56 (0.53–0.60, n-10) of wing length; macrotrichia long and abundant on distal half of wing and arranged in rows on cells M₁ and M₂; very few on apex of anal cell. Wing predominantly brown with blackish spot over second radial cell and distal half of first, limited pale areas as shown in figure. Small, rounded, pale spots, one over cross-vein r–m, one past tip of second radial cell, and just below it a paler one which may or may not be connected; in paler specimens this spot is barely discernible; distal pale spot in cell R₄ broadly separated from margin of wing; cell M₁ with rounded basal and submarginal pale spots; diffuse lighter spots on cell M₂, one behind medial fork, and one at tip of cell along margin of wing; distinct rounded
pale spots at apex of cell M₄, and on anal cell just behind medioecubital fork. Halter brown. Spermathecae (pl. 13, fig. 1) two, subspherical, equal, each measuring 0.040 by 0.051 mm.; only rudimentary spermatheca present, ring absent.

Male.—Unknown.


Paratypes.—Six females, same data as holotype (2, USNM; 2, PDH; 2, CNHM); 7 females, Puerto Princesa, Palawan, August 24, 1925, "biting man," R. C. McGregor (1, PDH; 1, BMNH; 1, BPBM; 4, USNM).

Plesiotype.—A female, same data as holotype (CNHM).

Culicoides (Oecacta) ejercitoi, new species

Except for the difference in the extent of the pale spot at the tip of the second radial cell, and the structure of the sensory pit on the third palpal segment, this species seems to be identical with pelili-owensis Tokunaga.

Female.—Length about 1.16 mm., wing 1.02 (0.99–1.09, n-4) mm. long. Eyes narrowly separated (pl. 12, fig. 2). Antenna with flagellar segments in proportion of 37:27:27:27:27:27:27:27:47:51:51:64, antennal ratio 1.13 (1.10–1.16, n-4); antennal sensoria present on segments III–XIV. Palpal segments in proportion of 17:47:61:27:30; third segment (pl. 11, fig. 2) greatly swollen, 2.45 (2.25–2.65, n-4) times as long as its greatest breadth, with large, irregular, sensory pit and narrow apex. Mandible with 13 (13–15, n-4) teeth. Legs brown with narrow dark knees, slightly distinct pale sub-basal band on front and hind tibiae; mid-knee pale at femur and tibia; hind tibial comb with 4 spines. Wing (pl. 8, fig. 9) with costa extending 0.65 (0.61–0.70, n-4) of wing length; macrotrichia long and abundant over most of wing surface. Wing pattern as figured; pale markings extensive, second radial cell paler toward tip but not distinctly included in a large pale spot on cell R₄; a large pale spot on cell R₅ nearly filling distal half of cell and broadly meeting margin of wing, and a spot on apices of cells M₁ and M₂, the one on cell M₂ indistinctly separated from margin of wing the other meeting it; cell M₂ extensively pale from base of cell to level of large basal pale spot on cell M₁; a large distal pale spot filling half of cell M₄; anal cell pale at basal third and with a large double spot behind medioecubital fork to posterior margin of wing. Two narrow, transverse, dark bands across wing, each interrupted at middle of cell M₃ before medioecubital vein and continuing from this vein across middle of anal cell and from medioecubital fork to tip of vein Cu₁; a third dark band zigzag, from middle of cell R₃ anteriorly to tip of vein M₄+; a small, rounded dark spot straddling base of medioecubital vein just past arculus. Halter pale. Spermathecae (pl. 13, fig. 2) two, unequal, pyriform, measuring 0.040 by 0.051 and 0.037 by 0.061 mm.; rudimentary spermatheca and ring both present.

Male.—Unknown.
Holotype.—A female, CNHM-12, Siuk, Calamianes, Culion Island, Palawan, April 7, 1947, “Z. C.,” near sea level. In the collection of Chicago Natural History Museum.

Paratypes.—Two females, CNHM-12, Dimanianga, Busuanga Island, Palawan, March, 1947, near sea level, H. Hoogstraal (1, USNM; 1, PDH); 1 female, CNHM-16, Maco, Tagum, Davao, October, 1946, near sea level, H. Hoogstraal and D. Heyneman (CNHM).

Remarks.—This species is named in memory of Dr. Antonio Ejercito, of the Department of Health, Manila, Philippines, in recognition of his outstanding contribution to malaria control.

Culicoides (Oecacta) huffi Causey


Diagnostic characters.—Wing with second radial cell dark, crossvein r-m and first radial cell more or less dark, not included in a pale spot in front of crossvein; two separate, round, pale spots past tip of second radial cell, the second spot lying anterior to vein M1, small distal pale spots on cells R5 and M1 widely separated from margin of wing (pl. 8, fig. 8); eyes narrowly separated; antenna with distal sensory tufts present on segments III, V, VII-X; third palpal segment normal; two spermathecae with long neck; male aedeagus with high basal arch, spines poorly developed; ventral and dorsal roots of basistyle well developed; parameres with serrated tip, short thumblike projection; ninth tergum with long, tapering, apicolateral processes.

Distribution.—Luzon: Clark Air Base, Angeles, Pampanga, September 17, 1957, light trap, M. D. Delfinado.—Mindanao: Pikit, Cotabato, December 16, 1946, at light, F. G. Werner.

Culicoides (Oecacta) infalutus, new species

The presence of antennal sensoria on segments III–X, XIII–XIV, the absence of pale spots on apices of cells R5 and M1 along margin of wing, and the strongly swollen third palpal segment separate infalutus from its closely related species, praesignis.

Female.—Length about 1.5 mm., wing 0.90 (0.84–0.93, n-6) mm. long. Eyes closely approximated (pl. 12, fig. 3), bare. Antenna with flagellar segments in proportion of 40:27:30:30:30:30:30:30:47:51:54:54:74, antennal ratio 1.14 (1.10–1.19, n-4); antennal sensoria present on segments III–X, XIII–XIV. Palpal segments in proportion of 17:54:57:27:30; third segment strongly swollen (pl. 11, fig. 3), 2.18 (2.12–2.42, n-5) times as long as its greatest breadth, a small sensory pit present distally. Mandible teeth 15 (14–17, n-5). Legs brown with dark brown knees, adjacent pale band on tibiae yellowish; hind tibial comb with four spines, the first spine longest. Wing (pl. 8, fig. 7) with costa extending 0.56 (0.53–0.60, n-6) of wing length; macrotrichia very sparse, confined to apices of cells R4.
and M₁. Wing appearing brownish, with second radial cell and distal half of first in a darker spot; pale areas as figured. Transverse dark bands across wing, one before crossvein r-m to middle of anal cell, another at level of radial cells to tip of vein Cu₁, and a narrow one at middle of cell R₅ anteriorly to tip of vein M₃+4; a pale spot past tip of second radial cell appearing as two connected light spots; a distal pale spot on cell R₅ well removed from margin of wing, distal spots on cells M₁, M₂ and M₃ broadly meeting wing margin; a large pale spot nearly filling base of cell M₁, and, below this, a spot on cell M₂ posterior to vein M₃; also another spot on cell M₃ just behind medial fork; a distal pale spot on anal cell extending along margin of wing to anal angle of cell. Spermathecae (pl. 13, fig. 3) two, subspherical, equal, each measuring 0.054 by 0.071 mm.; rudimentary spermatheca present, sderotized ring absent.

Male.—Unknown.

Holotype.—A female, CNHM–16, Maco, Tagum, Davao, October, 1946, near sea level, H. Hoogstraal and D. Heyneman. In the collection of Chicago Natural History Museum.

Paratypes.—Three females, same data as holotype (2, USNM; 1, PDH); 1 female, CNHM–15, Camp Meran, east slope of Mount Apo, Davao, November 9, 1946, “beating tree ferns,” H. Hoogstraal (CNHM).

Plesiotype.—A female, same data as holotype (CNHM).

Culicoides (Oecacta) longipalpis, new species

The long, single radial cell, the much elongate third palpal segment with scattered sensoria, and the pale spot straddling distal third of vein M₁ will serve to distinguish this species readily.

Female.—Length about 1.3 mm., wing 0.99 (0.93–1.05, n-5) mm. long. Eyes narrowly separated (pl. 12, fig. 4). Antenna with flagellar segments in proportion of 37:23:23:27:27:27:30:30:54:57:64:68:88, antennal ratio 1.36 (1.27–1.44, n-4); antennal sensoria present on segments III, XI–XV. Palpal segments in proportion of 17:94:128:23:27; third segment long and slender (pl. 11, fig. 4), 4.2 times as long as broad, sensory pit absent but with few, scattered sensoria on distal half. Mandible teeth 12 (10–14, n-4). Legs brown; front and hind knees darker brown with adjacent pale band on tibiae, middle knee pale on each side of joint; hind tibial comb with four spines. Wing (pl. 8, fig. 10) with costa extending 0.65 (0.63–0.70, n-5) of wing length; macrotrichia long and dense, covering most of wing surface. Anterior radial cells separated, the single radial cell broad at distal half, and tip included in a pale spot. Wing color brown with two darker brown areas on anterior margin of wing; small, rounded, pale spots at wing base covering arculus, over crossvein r-m, on tip of anterior radial cell, and on apices of cells R₅ and M₁ broadly separated from margin of wing; a pale spot straddling distal third of vein M₁ posterior to pale spot on tip of radial; cell M₅ with double pale spots behind base of medial fork and in front of M₃+4 mediaocubital fork, a third one on margin of wing; anal cell with a basal pale spot and apical ones, the
basal one less distinct. Halter pale. Spermathecae (pl. 13, fig. 4) two, suboval, equal, each measuring 0.030 by 0.040 mm.; both rudimentary spermatheca and ring absent.

**Male.**—Unknown.

**Holotype.**—A female (CNHM–4), eastern slope of Mount McKinley, 3300 feet alt., Davao, September 25, 1946, at light, F. G. Werner. In the collection of Chicago Natural History Museum.

**Paratypes.**—Four females, same data as holotype (1, CNHM; 1, PDH; 2, USNM).

**Culicoides (Oecacta) marginatus,** new species

The general wing pattern relates this species to *damnosus*, from which it can be distinguished by the small distal pale spot on cell R₅ and the presence of antennal sensoria on segments III, XI–XIV.

**Female.**—Length about 1.5 mm., wing 0.93 (0.89–1.09, n-13) mm. long. Eyes narrowly separated, bare. Antenna with flagellar segments in proportion of 37:27:27:30:30:30:34:54:57:64:81, antennal ratio 1.29 (1.24–1.36, n-12); antennal sensoria present on segments III, XI–XIV. Palpal segments in proportion of 17:44:54:30:34; third segment greatly swollen, 2.20 (1.77–2.50, n-10) times as long as greatest width (pl. 11, fig. 5), with large, deep, sensory pit and narrow apex. Mandible teeth 10 (9–13, n-10). Legs brown with narrow dark knees, pale sub-basal rings on tibiae, four spines on hind tibial comb. Wing (pl. 8, fig. 11) with costa extending 0.56 (0.50–0.68, n-13) of wing length; macrotrichia densely scattered over wing surface. Wing brownish with pale markings as figured; a transverse pale spot on costal margin over crossvein r-m, and one past tip of second radial cell; in some specimens this appears as a connected double light spot; cells R₅, M₁, M₂, M₃, and Cu₁ each with a small rounded pale spot attaining wing margin; a very distinct pale spot just behind medial fork; anal cell with a large basal pale spot, an apical pale spot transverse from behind vein M₃+₄ and Cu₁ to wing margin; a pale spot past arculus on medial vein occupying basal cells above and below this vein. Halter knob brownish, stem pale. Spermathecae (pl. 13, fig. 5) two, ovoid, equal, each measuring 0.037 by 0.047 mm.; rudimentary spermatheca present, ring absent.

**Male genitalia** (pl. 14, fig. 1).—Ninth sternum narrow with a broad, deep, median excavation, the ventral membrane bare; ninth tergum long and tapering, the apex broad and truncated with a very shallow, median notch, and large, triangular apicolateral processes. Basistyle stout, mesal hairs absent, the ventral and dorsal roots well-developed; dististyle long, thick at base, narrowing toward tip. Aedeagus massive, the basal arms heavily sclerotized, with the anterior membrane forming a high rounded arch on its basal half, the apex long and truncated, thinly sclerotized. Parameres separate, each with bent, large, knobbed base, nearly straight and slender stem, bare, pointed, curved tip.

**Holotype.**—A female, Tala, Rizal, May 21, 1958, light trap, M. D. Delfinado. In the collection of the Division of Malaria, Philippine Department of Health.
Allotype.—A male, same data as the holotype.

Paratypes.—Three males, 10 females, same data as the holotype, except May 20, 1958 (4, CNHM; 4, PDH; 3, USNM; 1, BMNH; 1, BPBM); a female, CNHM–5, Pikit, Cotabato, December 16, 1946, near sea level, F. G. Werner (CNHM); a female, CNHM–16, Maco, Tagum, Davao, October, 1946, near sea level, H. Hoogstraal and D. Heyneman (USNM).


Culicoides (Oecacta) mcdowellii, new species

The large distal pale spot on cell R₅, and the presence of antennal sensoria on segments III–XIV relate this species to palawanensis, from which it can be distinguished by the pale banded legs with dark brown knees, the pyriform spermathecae with wide opening to ducts, and the large sensory pit with an extremely wide opening near apex of segment.

Female.—Length about 1.5 mm., wing 0.99 (0.89–1.03, n-18) mm. long. Eyes separated (pl. 12, fig. 5), bare. Antenna with flagellar segments in proportion of 44:27:34:34:34:34:34:57:57:68:68:81, antennal ratio 1.21 (1.14–1.30, n-15); antennal sensoria present on segments III–XIV. Palpal segments in proportion of 20:54:64:20:23; third segment (pl. 11, fig. 6) greatly swollen, 2.06 (1.88–2.25, n-8) times as long as its greatest breadth, a large, deep sensory pit with an extremely broad opening near apex of segment. Mandible teeth 13 (12–16, n-13). Legs banded, with darker brown knees; four spines on hind tibial comb, the first spine nearest the spur longest. Wing (pl. 8, fig. 12) with costa extending 0.64 (0.57–0.67, n-18) of wing length; macrotrichia long and densely distributed over most of wing surface. Wing markings practically the same as those of ejercitoi, but pale markings of wing not as distinct as those found in ejercitoi; second radial cell and nearly all of first blackish; diffuse dark spots at wing base, and anal cell with a broad dark streak from base to near apex. Halter brownish. Spermathecae (pl. 13, fig. 6) two, subequal, slightly pyriform, measuring 0.044 by 0.054 and 0.047 by 0.054 mm., with wide opening to duct; rudimentary spermatheca present, ring absent.

Male.—Unknown.

Holotype.—A female, CNHM–12, Siuk, Calamianes, Culion Island, Palawan, April 7, 1947, near sea level, “Z. C.” In the collection of Chicago Natural History Museum.

Paratypes.—Seven females, same data as the holotype (2, CNHM; 1, PDH; 2, USNM; 1, BPBM; 1, BMNH); 6 females, CNHM–10, San Pedro, Culion Island, Palawan, March 26, 1947, near sea level, H. Hoogstraal (1, CNHM; 1, USNM; 4, PDH); 1 female, CNHM–11,
Dimanianga, Busuanga Island, Palawan, March, 1947, near sea level, H. Hoogstraal (CNHM); 2 females, CNHM-13, Bacungan, Palawan, March 20, 1947, F. G. Werner (1, CNHM; 1, PDH).

*Plesiotype.*—A female, same data as the holotype (CNHM).

*Remarks.*—This species is dedicated to Dr. John McDowell, who served as Technical Adviser to the International Cooperation Administration and Malaria Consultant in the Department of Health, Manila, Philippines.

**Culicoides (Oecacta) notatus,** new species

This species is readily distinguished from its closely related species, *schultzei* and *perornatus*, by the presence of only one pale spot posterior to pale spot beyond end of second radial cell, and by the slender and longer second palpal segment.

*Female.*—Length about 1.3 mm., wing 0.88 mm. long. Eyes closely approximated (pl. 12, fig. 6), bare. Antenna with flagellar segments in proportion of 37:27:27:27:27:27:27:47:54:61:68:88, antennal ratio 1.40; antennal sensoria present on segments III, VII-X. Palpal segments in proportion of 17:68:61:23:30; third segment strongly swollen (pl. 11, fig. 7), 2.65 times as long as its greatest breadth, greatly narrowed beyond large, shallow, sensory pit. Mandible with 12 teeth. Legs brownish with narrow dark knees, broad adjacent pale band on femora and tibiae yellowish; apex of hind tibia pale; hind tibial comb with four spines, the spine nearest the spur longest. Wing (pl. 8, fig. 13) with costa extending 0.56 of wing length; sparse macrotrichia on apices of cells R4 and M4. Wing with marked pale and dark areas, second radial cell and tip of first blackish. Base broadly pale, a large pale area over crossvein *r–m* from anterior wing margin extending posteriorly to level of anterior mediocubital fork; two pale spots past tip of second radial cell, one light spot on each of the apices of cells R4, M4, M3, and M1, broadly meeting margin of wing, cell M1 also with a linear light spot extending from base to pale rounded spot at middle of cell, the pale spot on apex of cell R4 subtriangular; a large pale spot in anal cell connected posteriorly along wing margin to large basal pale area; vein M1 pale-margined at distal half. Halter brownish. Spermathecae (pl. 13, fig. 7) two, subequal, suboval, measuring 0.037 by 0.051 and 0.034 by 0.047 mm.; rudimentary spermatheca and a large, chitinized ring present.

*Male.*—Unknown.

*Holotype.*—Female, CNHM-16, Maco, Tagum, Davao, October, 1946, near sea level, H. Hoogstraal and D. Heyneman. In the collection of Chicago Natural History Museum.

*Paratype.*—A female, same data as holotype (USNM).

**Culicoides (Oecacta) palawanensis,** new species

The pale wing markings follow those of *cordiger*, but this species differs from *cordiger* in the absence of black, stigmatic spots on
the second radial cell, the distal half of the first, and the middle of cell Rs. The unbanded legs and remarkably large third palpal segment readily separate *palawanensis* from *mcdowelli*.

**Female.**—Length about 1.5 mm., wing 1.03 (0.95–1.13, n-10) mm. long. Eyes widely separated above, greatly narrowing posteriorly (pl. 12, fig. 7), bare. Antenna with flagellar segments in proportion of 40:23:27:27:27:27:27:27:27:27:27:27:27:27:27:27:68:64:68:71:98, antennal ratio 1.53 (1.48–1.62, n-4); antennal sensoria present on segments III–XIV. Palpal segments in proportion of 20:51:74:27:34; third segment greatly swollen (pl. 8, fig. 1), 2.34 (2.00–2.40, n-10) times as long as broad, with a large, deep, sensory pit on distal half. Mandible teeth 13 (12–16, n-13). Legs entirely brown, unbanded; hind tibial comb with four spines, the one nearest the spur longest. Wing (pl. 8, fig. 14) with costa extending 0.68 (0.65–0.75, n-10) of wing length; macrotrichia sparsely distributed on basal half of wing and anal cell. Wing brownish with second radial cell and distal half of first darker brown. The pale markings follow those of *cordiger* Macfie, but lack the black, stigmatic spots on second radial cell and distal half of first, and middle of cell Rs of *cordiger*; the marginal pale spots on cells Rs, M1, M2, and M4 barely discernible from the surrounding area. Halter brown. Spermathecae (pl. 13, fig. 8) two, subequal, subspherical, measuring 0.051 by 0.068 and 0.051 by 0.061 mm., with wide openings to duct; rudimentary spermatheca present, ring absent.

**Male genitalia** (pl. 14, fig. 2).—Ninth sternum broad, with a shallow mesal excavation, the ventral membrane hairy; ninth tergum long and tapering, with large, triangular apicolateral processes, the apical margin between them deeply cleft and bilobed. Basistyle simple, the ventral roots not developed, the dorsal ones long and slender; dististyle short and stout with notched apex. Aedeagus narrow and massive, with broadly truncated, thinly sclerotized apex, the anterior membrane forming a low basal arch. Parameres with main bodies narrowly fused at base; stern broad at base, widely divergent, with pointed, bare tip.


**Allotype.**—A male, same data as the holotype. In the collection of Chicago Natural History Museum.

**Paratypes.**—One male (USNM), 7 females (2, CNHM; 3, PDH; 2, USNM), same data as holotype; 1 female, CNHM-11, Diman- anga, Busuanga Island, Palawan, March, 1947, near sea level, H. Hoogstraal (CNHM).

**Plesiotype.**—A female, same data as holotype (CNHM).

**Culicoides (Oecacta) wenzeli**, new species

This species is readily distinguished by having in the wing pattern only two distinct pale spots, long and abundant macrotrichia covering most of wing surface, and a large, deep sensory pit on the third palpal segment.
**Female.**—Wing 0.84 mm. long. Eyes contiguous for the length of the diameter of 1.5 facets. Antennae missing. Palpal segments in proportion of 17:44:64:23:30; third segment distinctly swollen (pl. 11, fig. 9), 1.90 times as long as broad, with a large, deep sensory opening at distal half. Mandible teeth small and numerous. Legs brownish; knees yellowish on each side of femora and tibiae; hind tibial comb with four spines, the one nearest the spur longest. Wing (pl. 8, fig. 15) with costa extending 0.53 of wing length; brownish macrotrichia long and abundant, evenly distributed on wing surface. Wing appearing pale, the pattern and venation as figured; the second radial cell in a dark spot but tip of vein R_{1+2} included in a pale spot; two distinct pale spots over crossvein r-m, not reaching costal margin of wing, and a small one in cell R_5 at extreme tip of vein R_{1+2}; other pale areas in apices of cells R_4, M_1, and M_2 barely discernible. Halter knob yellowish, stem brown. Spermathecae (pl. 13, fig. 9) two, unequal, pyriform; rudimentary spermatheca and sderotized ring both present.

**Male genitalia** (pl. 14, fig. 3).—Ninth sternum narrow, with a broad, deep, median excavation, the ventral membrane hairy; ninth tergum tapering, with long, pointed apicolateral processes, a median notch in the apical margin between them. Basistyle slender and bare, ventral roots poorly developed, the dorsal ones long and slender; dististyle short, thick at basal half, narrowing toward pointed tip. Aedeagus with rounded basal arch extending to three-fourths of total length, the basal arms widely divergent, heavily sclerotized, the distal fourth broad, narrowing to a rounded apex. Parameres separate, each with abruptly bent base, broad stem and very slender, bent, bare, pointed tip.

**Holotype.**—A female, Tala, Rizal, May 22, 1958, light trap, M. D. Delfinado. In the collection of the Division of Malaria, Philippine Department of Health.

**Allotype.**—A male, same data as holotype (PDH).

**Paratype.**—A male, same data as holotype (PDH).

**Remarks.**—The species is dedicated to Mr. Rupert L. Wenzel, Curator of Insects, Chicago Natural History Museum.

**Culicoides (Oecacta) pampangensis**, new species

The structure of the epipharyngeal wall of the cibarial pump, the wing pattern, and the much enlarged third palpal segment with deep, large, sensory pit are distinctive features of this species. *Culicoides ejercitoi* resembles *pampangensis* but has extensive pale wing markings with large, pale, apical spots.

**Female.**—Length about 1.3 mm., wing 1.0 (0.86–1.09, n=10) mm. long. Eyes approximated (pl. 12, fig. 8). Antenna with flagellar segments in proportion of 47:30:30:30:30:30:61:61:74:74:102, antennal ratio 1.52; antennal sensoria present on segments III–XIV. Palpal segments in proportion of 23:61:31:34:34; third segment strongly swollen (pl. 11, fig. 10), 2.19 (2.00–2.40, n=8) times as long as its greatest breadth, sensory pit large with a wide opening. Mandible teeth 14 (13–16, n=10). Epipharyngeal wall of the cibarial pump with rows of small, blunt spines or papillae. Legs brownish, knee spot indistinct, femora pale at extreme...
base, tibiae with narrow basal band; hind tibial comb with four spines, the one nearest the spur longest. Wing (pl. 9, fig. 1) with costa extending 0.63 (0.54-0.70, n-10) of wing length; macrotrichia long and dense on distal half of cell Rs, sparse on cells M1 and M2. Wing pattern as figured; extreme tip of second radial cell included in a pale spot; narrow pale spot at wing base; two prominent, broad, transverse pale bands across wing, the first at level of crossvein r-m to tip of anal cell, and narrowly interrupted by dark stem of mediocubital fork, the second beginning on and including tip of second radial cell and extending to tip of cell M3; lighter pale spot at margin of wing on cell M2, absent on cells Rs and M1. Halter brownish. Spermathecae (pl. 13, fig. 10) two, equal, pyriform, each measuring 0.040 by 0.054 mm.; only rudimentary spermatheca present, ring absent.

Male genitalia (pl. 14, fig. 4).—Ninth sternum broad, with deep mesal excavation, the ventral membrane hairy; ninth tergum short and tapering, with long apicolateral processes, the apical margin between them with a deep, median notch. Basistyle short, mesal margin simple, only the dorsal roots developed; dististyle nearly straight, slender. Aedeagus with heavily sclerotized basal arch, width at base 0.7 times total length, anterior membrane covering about distal half of arch; distal stem short, the apex broadly rounded, unsclerotized. Parameres with main bodies joined at bases by a thin loop; knobbed base straight, with stout, short, divergent stem and pointed, bare tip.

Holotype.—A female, Clark Air Base, Angeles, Pampanga, September 17, 1957, light trap, I. Balatbat. In the collection of the Division of Malaria, Philippine Department of Health.

Allotype.—A male, same data as holotype (PDH).

Paratypes.—Seven females, same data as holotype (3, PDH; 3, USNM; 1, BPBM); 1 female, Tala, Rizal, May 22, 1958, light trap, M. D. Delfinado (BMNH).

Plesiotype.—One female, same data as holotype (PDH); 1 female, CNHM-11, Dimanianga, Busuanga Island, Palawan, near sea level, H. Hoogstraal (CNHM).

Culicoides (Oecacta) perornatus, new species

The characteristic distal pale spot on cell Rs, the remarkably swollen third palpal segment with large, deep sensory pit, and the elongate-oval spermathecae with long, chitinized neck are the distinctive features of this species.

Female.—Length about 1.6 mm., wing 1.0 mm. long. Eyes contiguous for the length of the diameter of 3.5 facets (pl. 12, fig. 9). Antennae missing. Palpal segments in proportion of 20:37:61:23:37; third segment greatly swollen (pl. 11, fig. 11), 2.0 times as long as broad with a large, deep sensory pit at middle. Mandible teeth 10. Legs brown; knees with a narrow darker brown band, with adjacent yellowish band on front and middle tibiae; fore and mid femora banded; base and apex of hind tibia pale, tibial comb with four spines. Wing (pl. 9, fig. 2) with costa extending 0.63 of wing length; macrotrichia fairly abundant over distal half of
wing surface, few in anal cell. Wing pattern very characteristic, as shown in figure; second radial cell and distal end of first in a dark spot; diffuse pale areas over wing base past arculus and across basal half of anal cell; a large pale spot over cross-vein r-m extending posteriorly from costa to medial vein; cell R₄ with a pale spot immediately posterior to another pale spot situated just beyond end of second radial cell, and a third elongate spot on anterior side of vein M₁ posterior to the second rounded spot; distal pale spot irregular in shape, occupying most of distal half of cell, more or less U-shaped and broadly emarginate anteriorly; cells M₁ and M₂ each with marginal pale spots, the spot on cell M₁ apparently reaching margin of wing, the spot on cell M₂ widely separated from wing margin; cell M₃ with a transverse pale spot across middle of cell extending proximally to base of medio-cubital fork and posteriorly along basal fourth of vein Cu₁; anal cell with a large, oblique double spot broadly meeting posterior margin of wing. Halter knob brown. Spermathecae (pl. 13, fig. 11) two, elongate oval with long, chitinized neck, subequal, measuring 0.034 by 0.061 and 0.034 by 0.051 mm.; a club-shaped rudimentary spermatheca and ring present.

*Male.*—Unknown.


**Culicoides (Oecacta) praesignis**, new species

*C. praesignis* is readily distinguished from its closely related species, *infalatus*, by the presence of an additional small pale spot on apices of cells R₅ and M₁, and antennal sensoria on segments III–XIV.

*Female.*—Length about 1.6 mm., wing 1.03 mm. long. Eyes very narrowly separated (pl. 12, fig. 10), bare. Antenna with flagellar segments in proportion of 44:30:30:30:30:30:30:47:51:57:85, antennal ratio 1.31; antennal sensoria present on segments III–XIV. Palpal segments in proportion of 17:40:61:23:27; third segment distinctly swollen (pl. 11, fig. 12), 2.0 times as long as its greatest breadth, sensory pit large and deep, with opening near apex. Mandible teeth 13. Legs brown with darker brown knees, narrow sub-basal band on tibiae yellowish, four spines on hind tibial comb. Wing (pl. 9, fig. 3) with costa extending 0.64 of wing length; macrotrichia sparse on apices of cells M₁, M₂, M₃, and anal cell. Wing appearing dark with second radial cell and distal half of first on a blackish spot; three well-defined, rounded pale spots, one extending from anterior margin over crossvein r–m, another situated past tip of second radial cell and broadly connected to a posterior one below cell, and another on cell R₆ midway between this pale spot and wing tip, and well separated from margin of wing; also on cell R₅ a small pale spot at extreme tip of wing just above vein M₁; two rounded pale spots on cell M₁, and an additional small spot at tip along margin of wing; cell M₂ with a large pale spot behind medial fork, another between this one and the distal pale spot on margin of wing, and another at base of cell connected anteriorly to a pale spot straddling base of medial vein; anal cell with a distinct pale spot just behind mediocubital fork and a smaller one below it along margin of wing. Vein M₁ appearing pale-
margined. Halter knob brown, stem pale. Spermathecae two, subequal, pyriform, measuring 0.037 by 0.057 and 0.033 by 0.057 mm.; rudimentary spermatheca and ring both present.

Male.—Unknown.

Holotype.—A female, CNHM–16, Maco, Tagum, Davao, October, 1946, near sea level, H. Hoogstraal and D. Heyneman. In the collection of Chicago Natural History Museum.

Culicoides (Oecacta) schultzei (Enderlein)

*Ceratopogon schultzei* Enderlein, 1908, Denkschr. med. naturw. Ges. Jena, 13: 459 (male, female; Süwwestafrika; wing and male genitalia illus.).


Diagnostic characters.—Wing with pale and dark markings well defined, pale spots on cell R₉ rather variable, the distal one usually hourglass-shaped (pl. 9, fig. 4); eyes widely separated; third palpal segment enlarged, with large sensory pit; knees dark, with adjacent pale band on tibiae, fore and mid femora; hind tibial comb with four spines; two well-developed spermathecae and a rudimentary spermatheca which is variable in size; male aedeagus with simple, wide basal arch, large, stout distal half; parameres slender, with pointed tips; basistyle with dorsal and ventral roots long, pointed, well developed; ninth tergum with apicolateral processes long, tapering.


Subgenus Avaritia Fox


Type of the subgenus: *Ceratopogon obsoletus* Meigen, by original designation.

Species having two well-developed spermathecae; wing with faint markings, scanty macrotrichia, second radial cell usually in a pale spot; antenna with distal sensory tufts present on segments III, XI or XII–XV; male genitalia with apicolateral processes absent; dorsal and ventral roots of basistyle well developed; aedeagus various; parameres simple, tapering to a pointed tip.

Included species: *actoni, brevipalpis, boophagus, jacobsoni, nudipalpis, orientalis, pungens, radicus*. 
Culicoides (Avaritia) actoni Smith

*Culicoides actoni* Smith, 1929, Indian Jour. Med. Res., 17: 255 (female; India; palp, wing, and spermathecae illus.).

**Diagnostic characters.**—Wing brownish with two distinct large pale spots on cell Rs, one at tip of second radial cell, the second at apex, broadly meeting margin of wing; other pale areas more or less faint (pl. 9, fig. 5); eyes just touching, hairy between facets; antenna with distal sensory tufts present on segments III, XII–XV; third palpal segment slightly swollen, with small sensory pit; front and middle knees yellowish on femora and tibiae, base of hind tibia yellowish; hind tibial comb with five spines; two well-developed spermathecae; male aedeagus narrow with high basal arch, thin anterior membrane near base of arch; parameres with simple pointed tips; dorsal and ventral roots of basistyle well developed; anterior margin of ninth tergum bilobed, apicolateral processes absent.

**Distribution.**—Luzon: Clark Air Base, Angeles, Pampanga, September 17, 1957, light trap, I. Balatbat.—Mindanao: Eastern slope of Mount McKinley, Davao, August 28, 1946, F. G. Werner.

**Culicoides (Avaritia) brevipalpis**, new species

This species is closely related to *radicus*, but differs in having pale base and dark apex of vein M₂; brownish halter; unbanded legs; and scarcely swollen, unmodified third palpal segment.

**Female.**—Length about 1.2 mm., wing 0.93 mm. long. Eyes contiguous for the length of the diameter of two facets (pl. 12, fig. 11), bare. Antennal segments in proportion of 37:27:27:27:27:27:30:40:44:47:51:81, antennal ratio 1.47; antennal sensoria present on segments III, XI–XV. Palpal segments in proportion of 10:30:34:27:23; third segment not modified (pl. 11, fig. 13), scarcely swollen, twice as long as broad, with a broad, shallow sensory pit on apical half. Mandible teeth 12. Legs unbanded, with knees slightly pale on femora and tibiae; five spines on hind tibial comb. Wing (pl. 9, fig. 6) with costa extending 0.56 of wing length; macrotrichia absent. Wing predominantly pale, pattern as figured, distal half of second radial cell included in a pale spot. Dark spots covering distal half of first radial cell and the proximal half of second cell to anterior vein M₁, across middle of distal half of cell Rs, and continued along fold of vein M₁ to wing tip, forming a large pale apical spot at margin of wing; diffuse dark area on base of wing just proximad of broad pale spot from costa to media; a large dark spot on tip of vein M₁ narrowly separated posteriorly from dark spot on apex of vein M₂ and continued proximad along this vein to near base; entire vein Cu₁ and tip of vein M₃₊₊ dark; anal cell with two small, rounded dark spots, one below mediocubital vein midway between base and fork, the second on mid-margin of cell. Halter brownish. Spermathecae (pl. 13, fig. 12) two, subequal, subspherical; a bulbous rudimentary spermatheca and ring both present.

**Male.**—Unknown.

**Holotype.**—A female, Clark Air Base, Angeles, Pampanga, September 17, 1957, light trap, I. Balatbat. In the collection of Division of Malaria, Philippine Department of Health.
Culicoides (Avaritia) boophagus Macfie


**Diagnostic characters.**—Wing with extensive pale areas, two prominent dark spots on anterior margin, the first over vein R₁ covering apical third of first and proximal half of second radial cells, the second at middle of cell R₄, stopping before dark linear line running anteriorly along vein M₁; mediocubital fork pale-margined along veins M₂₊, and Cu₁, apices of these veins dark; dark streak on anal cell broad, interrupted before posterior margin of wing (pl. 9, fig. 7); third palpal segment with distinct sensory pit; front and middle knees pale on tibiae and femora, hind leg with brown femur, tibia with yellowish base, five spines on tibial comb; two well-developed spermathecae.

**Distribution.**—Luzon: Clark Air Base, Angeles, Pampanga, September 17, 1957, I. Balatbat.

Culicoides (Avaritia) jacobsoni Macfie

*Culicoides jacobsoni* Macfie, 1934, *Tijdschr. Ent.*, 77: 215 (male; Sumatra; genitalia illus.).

**Diagnostic characters.**—Pale markings on wing less extensive, distal pale spots on cells R₄ and M₁ not reaching margin of wing, dark streak on anal cell interrupted at distal third (pl. 9, fig. 8); eyes contiguous; third palpal segment swollen, with distinct sensory pit; knees dark, front and middle knees with adjacent pale band on tibiae and femora; hind tibial comb with five spines; halter yellowish; two well-developed spermathecae.

**Distribution.**—Mindanao: Maco, Tagum, Davao, October, 1946, H. Hoogstraal and D. Heyneman.

Culicoides (Avaritia) nudipalpis, new species

The scattered, hyaline sensoria, which form a rounded, pitted spot on the third palpal segment, the whitish halter, and the extensive pale spots of wing readily separate this species.

**Female.**—Length about 1.3 mm., wing 0.85 (0.77–1.02, n-9) mm. long. Eyes contiguous for the length of the diameter of two facets (pl. 12, fig. 12), bare. Antenna with flagellar segments in proportion of 34:23:23:27:27:30:30:44:47:51:51: 74, antennal ratio 1.14 (1.09–1.18, n-4); antennal sensoria present on segments III, XI–XV. Palpal segments in proportion of 17:40:44:27:30; third segment scarcely swollen (pl. 11, fig. 14), 2.42 (2.16–2.60, n-4) times as long as broad, without sensory pit but with scattered, hyaline sensoria forming a rounded, pitted spot. Mandible teeth 13–15. Legs brownish; knees dark with adjacent pale band on front and middle femora and tibiae, and hind tibia; hind femur dark from base to apex; tibial comb with five spines, the one nearest the spur longest. Wing with costa extending 0.47 (0.42–0.51, n-9) of wing length; nearly bare, only a few macrotrichia present at wing tip. Pattern as follows: pale spots extensive; distal end of second radial cell and almost all of first cell pale; dark spot over tip of first radial cell and proximal third of second, narrowly extending posteriorly as diffuse patches over
medial fork, and continuing along vein $M_2$ to wing tip, forming a dark spot on middle of cell $M_1$, continuing across cell $M_2$ to apex of vein $M_{3+4}$, and over middle of medioubital fork and vein $Cu_1$; vein $M_{3+4}$ dark-margined; transverse dark spot across middle of cell $R_4$ from anterior wing margin to fold of vein $M_3$, interrupted before dark spot on tip of vein $M_1$; anal cell with two dark spots (pl. 9, fig. 9). Halter yellowish-white. Spermathecae (pl. 13, fig. 13) two, unequal, slightly pyriform, measuring 0.034 by 0.051 and 0.030 by 0.040 mm.; rudimentary spermatheca and ring both present.

**Male.**—Unknown.

**Holotype.**—A female, Kidapawan, Cotabato, March 5, 1957, carabao-baited trap, F. Kalaw. In the collection of the Division of Malaria, Philippine Department of Health.

**Paratypes.**—Three females, same data as the type except June and August, 1956 (1, CNHM; 1, USNM; 1, PDH); 2 females, Clark Air Base, Angeles, Pampanga, September 17, 1957, light trap, I. Balatbat (1, BMNH; 1, BPBM); a female, Tala, Rizal, May 21, 1958, light trap, M. D. Delfinado (USNM).

**Plesiotype.**—A female, same data as the holotype except July 13, 1957 (USNM).

**Culicoides (Avaritia) orientalis** Macfie

*Culicoides orientalis* Macfie, 1932, Ann. Mag. Nat. Hist., ser. 10, 9: 490 (male, female; Malay orientalis, India, Java; wing and male genitalia illus.).

**Diagnostic characters.**—Wing with prominent pattern; distal half of second radial cell in a pale spot; apical third of vein $M_1$, distal half of vein $M_2$, and all of the veins $M_{3+4}$ and $Cu_1$ dark; a large distal pale spot on cell $R_4$ nearly filling half of cell; a continuous dark streak on anal cell (pl. 9, fig. 10); eyes contiguous; third palpal segment slightly swollen, with small sensory pit; hind tibial comb with five spines; two well-developed spermathecae; male aedeagus narrow with high basal arch, a lightly sclerotized anterior membrane near base of arch; parameres with simple pointed tips; dorsal and ventral roots of basistyle well developed; anterior margin of ninth tergum with a median notch, apicolateral processes absent.

**Distribution.**—Luzon: Clark Air Base, Angeles, Pampanga, September 17, 1957, light trap, I. Balatbat.—Mindanao: Kidapawan, Cotabato, August, 1956, carabao-baited trap, F. Kalaw; Maco, Tagum, Davao, October, 1946, H. Hoogstraal and D. Heyneman.

**Culicoides (Avaritia) pungens** de Meijere

*Culicoides pungens* de Meijere, 1909, Tijdschr. Ent., 52: 200 (female; Sumatra; antenna and wing illus.).

**Diagnostic characters.**—Wing appearing brownish with less extensive pale markings, nearly all of one cell and proximal two thirds of second radial cell dark, apical pale spots on cells $R_4$ and $M_1$ widely separated from margin of wing (pl. 9, fig. 11); eyes contiguous; third palpal segment slightly swollen, with shallow sen-
sory pit; legs brown, front and middle knees narrowly dark; hind tibial comb with five spines; halters brown; two well-developed spermathecae.

**Distribution.**—Palawan: San Pedro, Culion Island, March 26, 1947, H. Hoogstraal; Balbalasan, March, 1913.

**Culicoides (Avaritia) radicitus,** new species

The wing pattern of this species is very similar to that of *brevipalpis,* but it is distinguished by the dark base and pale apex of vein M₂, and by the dark knees adjacent to the pale band on the front and middle femora and tibiae.

**Female.**—Wing length 0.78 mm. Eyes contiguous for the length of the diameter of two facets, bare. Antenna with flagellar segments in proportion of 30:20:23:23:23:27:37:40:40:40:57, antennal ratio 1.10; antennal sensoria present on segments III, XI–XV. Palpal segments incomplete. Third palpal segment small, scarcely swollen, sensory pit broad and shallow. Mandible teeth small, numerous. Legs brownish with dark knees, pale adjacent bands on front and middle femora and tibiae, hind femur dark from base to apex; hind tibial comb with five spines, the one nearest the spur longest. Wing (pl. 9, fig. 12) with costa extending 0.49 of wing length; macrotrichia entirely absent. Wing pattern as shown in figure. Three transverse, dark spots on anterior margin of wing, one well before cross vein r–m extending posteriorly to base of media, the second covering distal end of first radial cell and proximal half of second and continued posteriorly to base of medial fork and along vein M₂ before margin of wing, the third across cell R₃ and continued slightly toward wing tip; dark spots at apices of veins M₁ and M₃₊₄, over vein Cu₄, across cubitoanal veins, and along margin of anal cell. Halter pale. Spermathecae two; both rudimentary spermatheca and ring present.

**Male genitalia** (pl. 14, fig. 6).—Ninth sternum very narrow, with a broad, median excavation, the ventral membrane bare; ninth tergum parallel-sided, the apical margin with a wide, median notch, divergent lateral lobes, and a pair of submedian, large, triangular, hyaline projections; the apicolateral processes absent. Basistyle slender, simple, the ventral and dorsal roots very well developed, each elongate, slender and curved; dististyle slender and gently curved. Aedeagus twice as long as basal width, the basal arms divergent, sclerotized, the anterior membrane forming a low basal arch, the apex with a large internal sclerotized peg and a slender, blunt tip. Parameres each with bent, thick base; slender stem tapered to pointed, recurved apex.

**Holotype.**—A male, Tala, Rizal, May 21, 1958, light trap, M. D. Delfinado. In the collection of the Division of Malaria, Philippine Department of Health.

**Allotype.**—A female, Clark Air Base, Angeles, Pampanga, September 17, 1957, light trap, I. Balatbat. In the collection of the Division of Malaria.

**Paratype.**—One male, same data as holotype, except May 22, 1958 (USNM).
Subgenus **Hoffmania** Fox


Type of the subgenus: *Culicoides inamollae* Fox and Hoffman, by original designation.

Species with two well-developed spermathecae; second radial cell ending in a pale spot; base of cell $M_1$ pale where it borders the veins at the base of the medio-cubital fork, or apices of veins $M_1$, $M_2$, $M_{3+4}$ pale; crossvein $r-m$ more or less darkened; antenna with distal sensoria on segments III, XI–XV; hind tibial comb with five spines; male genitalia with the apicolateral processes small or absent; ventral roots of basistyle undeveloped; aedeagus with proximal barlike sclerotization or marginal band.

Included species: *bubalus, effusus, insignipennis, peregrinus*.

**Culicoides (Hoffmania) bubalus**, new species

This species is closely related to *peregrinus* Kieffer but can be distinguished from it by the large distal pale spot on cell $R_5$ and the pale tip of vein $M_1$, as well as by the structural characters mentioned in the key.

**Female.**—Length 1.9 mm., wing 1.3 mm. long. Head dark brown, antennae lighter brown. Eyes contiguous for the length of the diameter of 2.5 facets (pl. 12, fig. 13), bare. Antenna with flagellar segments in proportion of 44:40:47:51:51:51:51:51:74:74:85:85:119, antennal ratio 1.03; antennal sensoria present on segments III, XI–XV. Palpal segments in proportion of 17:64:71:37:37; third segment distinctly swollen (pl. 11, fig. 15), 2.6 times as long as broad, greatly narrowed distally past the moderately large, deep sensory pit. Mandible teeth 18. Legs dark brown; mid-knee narrowly yellowish on each side of joint; front tibia with sub-basal and hind tibia with basal and apical narrow yellowish band; hind tibial comb with six spines, the second spine from the spur longest. Wing (pl. 9, fig. 13) with costa extending 0.88 of wing length; macrotrichia confined to wing margin in apices of cells $R_3$, $M_1$ and $M_3$. Wing pattern as figured, the distal half of second radial cell included in a pale spot which extends posteriorly to vein $M_1$ and outwardly along vein $M_1$ to pale tip of vein; pale spots on cells $M_1$ and $M_3$ straddling middle of vein $M_1$ and separated from margin of wing; pale spot on cell $M_1$ continued proximad along vein $M_{3+4}$ to base of medio-cubital fork, and bordering vein $Cu_1$ posteriorly. Halter brown. Abdomen dark brown, cerci yellowish. Spermathecae (pl. 13, fig. 14) two; rudimentary spermatheca present, ring absent.

**Male.**—Unknown.

**Holotype.**—A female, Kidapawan, Cotabato, August, 1956, carabao-baited trap, F. Kalaw. In the collection of the Division of Malaria, Philippine Department of Health.

**Culicoides (Hoffmania) effusus**, new species

The extensive pale wing markings, the narrow transverse costal dark spots, and the absence of a common sensory pit on the third palpal segment serve to distinguish this species readily.
Female.—Length about 1.7 mm., wing 1.17 (1.06-1.31, n-14) mm. long. Head brown, including palpi and antennae. Eyes contiguous for the length of the diameter of 3.5 facets (pl. 12, fig. 14). Antenna with flagellar segments in proportion of 47:40:17:47:47:47:51:64:64:71:81:115, antennal ratio 1.06 (1.01-1.09, n-11); antennal sensoria present on segments III, XI-XV. Palpal segments in proportion of 23:61:68:34:34; third segment swollen at middle (pl. 11, fig. 16), 2.4 times as long as its greatest breadth, common sensory pit absent but with scattered sensoria. Mandible teeth 14 (11-15, n-10). Legs brown; knees yellowish on each side of joints; hind tibia with pale, narrow, apical band; five spines on comb, the second from the spur longest. Wing (pl. 9, fig. 14) with costa extending 0.80 (0.71-92, n-14) of wing length; macrotrichia confined to apices of cells M₁, R₅, and M₃ and arranged in rows between veins M₁, M₂, and M₃₊₄. Yellowish pale wing markings extensive, limiting the costal dark spots to narrow, transverse band as shown in figure. Almost all of second radial cell included in a large pale spot. Tips of veins M₁ and M₂ appearing pale. Pale spot on cell M₁ distad to pale spot straddling vein M₂ but well separated from wing margin, on cell M₂ the distal pale spot broadly meeting margin of wing; two pale spots on cell M₄ at base of mediocubital fork, completely isolated from the distal pale spot. Halter brownish. Abdomen brown, cerci yellowish. Spermathecae (pl. 13, fig. 15) two, pyriform, subequal, measuring 0.037 by 0.057 and 0.040 by 0.051 mm.; rudimentary spermatheca and sclerotized ring both present.

Male.—Unknown.

Holotype.—A female, CNHM—4, from eastern slope of Mount McKinley, 3300 feet alt., at light, September 25, 1946, F. G. Werner. In the collection of Chicago Natural History Museum.

Paratypes.—Three females, CNHM—16, Maco, Tagum, Davao, near sea level, October, 1946, H. Hoogstraal and D. Heyneman (2, CNHM; 1, USNM); 4 females, CNHM—4, Todaya, east slope of Mount Apo, 2800 feet alt., November, 1946, H. Hoogstraal (1, CNHM; 3, USNM); 3 females, Tagum, Davao, July, 1957, I. Puhawan (1, PDH; 2, USNM); 1 female, Kidapawan, Cotabato, March 5, 1956, F. Kalaw (PDH); 1 female, Taft, Samar, May 3, 1956, I. Balatbat (PDH); 1 female, Clark Air Base, Angeles, Pampanga, September 7, 1957, from carabao-baited trap, I. Balatbat (USNM); 7 females, Kidapawan, Cotabato, July and August, 1956, carabao-baited trap, F. Kalaw (2, BMNH; 1, BPBM; 4, PDH).

Culicoides (Hoffmania) insignipennis Macfie

_Culicoides insignipennis_ Macfie, 1937, _Ann. Trop. Med. Parasit._, 31: 469 (female; Malaya; wing illus.).

Diagnostic characters.—Wing with second radial cell in a pale spot, crossvein r-m dark, costa extending through pale spot with tip touching third dark spot, apices of veins M₁, M₂ and M₃₊₄ more or less pale, two pale spots on cell M₄, one at base of cell and the second at apex of cell along margin of wing (pl. 9, fig. 15); eyes contiguous; third palpal segment moderately swollen, with small, shallow
sensory pit; legs dark brown, knees yellowish, hind tibia narrowly yellowish at base and apex; two spermathecae suboval, well sclerotized.


Culicoides (Hoffmania) peregrinus Kieffer

*Culicoides peregrinus* Kieffer, 1910, Mem. Indian Mus., 2: 191 (female; India; wing illus.).

Diagnostic characters.—Wing with second radial cell pale, apices of veins M₁, M₂ and M₃+₄ pale, distal pale spot on cell R₃ narrow and transverse (pl. 10, fig. 1); eyes just touching; antenna with distal sensory tufts present on segments III, XI–XV; third palpal segments with divided sensory pits; legs dark with a pale basal band on femora and tibiae, and a pale apical band on fore and mid femora; hind tibial comb with five–six spines; two well-developed spermathecae; male aedeagus elongate, slender, with anterior sclerotized marginal band and spherical tip; basistyle with hairy inner margin, short dorsal and ventral roots; parameres slender, tapering to curved, hairy tips; ninth tergum rounded apically with median notch, apicolateral processes absent.


Subgenus Culicoides Latreille


Type of the subgenus: *Culex pulicaris* Linn., as *Ceratopogon punctatus* Meigen, monobasic.

Species with two well-developed spermathecae; second radial cell ending in a pale spot; base of cell M₃ dark at base of mediocubital fork and only tip of vein M₁ pale; crossvein *r–m* always pale; pale spot in cell M₂ anterior to mediocubital fork always present; antenna with distal sensory tufts present on segments III, XI–XV; tibial comb with five–six spines; male genitalia with apicolateral processes absent or poorly developed; basistyle with ventral roots undeveloped; aedeagus usually with anterior marginal band, distal peg and spherical tip; parameres abruptly bent at base, tapering to curved pointed, hairy or bare tips.

Included species: *assimilis*, *gemellus*, *gymnopterus*, *hirtipennis*, *malayae*, *recurvus*, *sumatrae*, *unicus*.

Culicoides (Culicoides) assimilis, new species

This species is closely related to *recurvus* and *hirtipennis* in having the elongate third palpal segment and a pale spot in cell M₂ anterior
to the mediocubital fork, but it may be readily distinguished from them by the contiguous eyes.

**Female.**—Length about 1.5 mm., wing 1.02 (0.96–1.05, n-3) mm. long. Eyes contiguous for the length of 2.5 facets (pl. 12, fig. 15). Antenna with flagellar segments in proportion of 37:34:34:37:37:37:37:40:54:51:57:64:91, antennal ratio 1.09 (1.08–1.12, n-3); antennal sensoria present on segments III, XI–XV. Palpal segments in proportion of 17:24:47:30:27; third segment swollen (pl. 11, fig. 17), 2.55 (2.33–2.83, n-3) times as long as its greatest breadth, with a moderately large, deep sensory pit. Mandible teeth 18. Legs brown; front knee narrowly dark with adjacent pale ring on tibia; middle knee broadly pale on femur and tibia; front and hind femora dark from base to apex, base and apex of latter yellowish; comb with five spines, the second from the spur longest. Wing (pl. 10, fig. 2) with costa extending 0.68 (0.63–0.71, n-3) of wing length, with very few macrotrichia on apices of cells Rs and M1, along margin of wing. Wing with pale areas on the following: over distal half of second radial cell, at wing base, over crossvein r–m (may or may not be separated anteriorly from costal pale spot), on cell R3 before anterior wing margin, and on cell M3, narrowly separated from margin of wing; tip of vein M1 appearing pale. Halter yellowish. Spermathecae (pl. 13, fig. 16) two, subspherical, unequal, measuring 0.047 by 0.057 and 0.034 by 0.044 mm.; rudimentary spermatheca and ring both present.

**Male.**—Unknown.

**Holotype.**—A female from Kidapawan, Cotabato, July 13, 1957, carabao-baited trap, F. Kalaw. In the collection of the Division of Malaria, Philippine Department of Health, Manila.

**Paratypes.**—Three females, same data as the holotype, except June and August, 1956 (1, PDH; 2, USNM); 1 female, CNHM-16, Maco, Tagum, Davao, October, 1946, near sea level, H. Hoogstraal and D. Heyneman (CNHM); 1 female, Tala, Rizal, May 20, 1958, light trap, M. D. Delfinado (PDH); 1 female, Clark Air Base, Angeles, Pampanga, September 17, 1957, light trap, I. Balatbat (CNHM).

**Culicoides (Culicoides) gemellus** Macfie


**Diagnostic characters.**—Wing with the single radial cell extending through pale spot to distal dark area on cell R5, pale spots on cells R4 and M1 separated from margin of wing, base of cell M1 dark (pl. 10, fig. 3); eyes contiguous; antenna with distal sensory tufts present on segments III, XI–XV; third palpal segment elongate with small, scattered sensoria; legs dark brown with bases of all tibiae yellowish; hind tibial comb with six spines; two well-developed spermathecae.


Culicoides (Culicoides) gymnopterus Edwards

_Culicoides gymnopterus_ Edwards, 1926, Sarawak Mus. Jour., 3: 247 (female, male; Sarawak; wing and male genitalia illus.).

_Diagnostic characters._—Wing with the second radial cell short, ending in a pale spot a considerable distance from third dark spot; cell R₄ with pale spot broadly meeting anterior margin of wing; wing brownish with pale spots appearing yellowish, dark spots as follows: a broad one at base proximad to pale spot over crossvein _r–m_, two transverse, narrow ones over distal half of second and proximal third of first radial cells, and across middle of cell R₃ (pl. 10, fig. 4); legs largely brown; hind tibial comb with six spines; ninth tergum rounded apically with hyaline medial lobe, the apicolateral processes absent; basistyle with poorly developed ventral roots, short, pointed dorsal roots; dististyle slender, curved to a blunt apex; aedeagus narrow, with anterior marginal band near base of arch, a long, slender distal peg, and a ball-like tip; parameres separate, stem rather broad, abruptly tapering to recurved, pointed tip.


Culicoides (Culicoides) hirtipennis, new species

This species is related to _recurvus_, which has very similar wing pattern and male genitalia. In _C. hirtipennis_ vein R₄₋₅ is not dark to where vein turns forward to meet costa, front and middle knees are pale, and parameres have a hairy tip.

_Female._—Length about 1.14 mm., wing 0.91 mm. long. Eyes widely separated (pl. 12, fig. 16), bare. Antenna with flagellar segments in proportion of 37:30:34:34:34:34:44:44:44:15:54:81, antennal ratio 1.05 (1.02–1.08, _n_–2); distal sensoria present on segments III, XI–XV. Palpal segments in proportion of 13:37:47:23:20; third segment swollen at middle (pl. 11, fig. 18), 2.3 times as long as its greatest breadth, with two sensoria which appear fused into a large, single pit. Mandible teeth 16 (14–18, _n_–2). Legs brown; front and middle knees pale on femora and tibiae; hind femur dark from base to apex; base of hind tibia yellowish; comb with five spines, the second spine from the spur longest. Wing (pl. 10, fig. 5) with costa extending 0.50 of wing length; nearly bare, with few macrotrichia along apical margin of wing. Wing brownish with pale spots appearing yellowish, distal half of second radial cell pale. Pattern as figured, pale spot over crossvein _r–m_ narrowly separated anteriorly from costal white spot; spot on middle of cell R₃ may or may not reach anterior margin of wing; distal pale spots on cells M₂ and M₃ broadly meeting margin of wing; tip of wing in front of vein M₁ slightly pale.
Halter brownish. Spermathecae (pl. 13, fig. 17) two, ovoid, unequal, measuring 0.034 by 0.051 and 0.034 by 0.047 mm.; rudimentary spermatheca and ring both present.

**Male genitalia** (pl. 14, fig. 5).—Ninth sternum broad, with a deep median excavation, the ventral membrane bare; ninth tegrum rounded apically with a well-developed, thinly sclerotized median lobe, the apicolateral processes absent. Basistyle stout with setae on mesal margin, poorly developed ventral roots, short, pointed dorsal roots; dististyle slender, slightly curved to a blunt apex. Aedeagus long and narrow, width at base 0.4 times the total length, the basal arms well sclerotized and stout, a sclerotized anterior band (transverse bar) near base of arch, distal peg absent but with thinly sclerotized membrane forming a small distal arch; apex long and slender with a ball-like tip. Parameres separate, base abruptly bent and slender; stem nearly straight, tapering to recurved haired tip.

**Holotype.**—A female, *CNHM-6*, Burungkot, Upi, Cotabato, 1500 feet alt., January 1–6, 1947, net along forest floor, F. G. Werner. In the collection of Chicago Natural History Museum.

**Allotype.**—A male, same data and depository as holotype.

**Paratypes.**—A male and female, same data as holotype (USNM).

**Culicoides (Culicoides) malayae** Macfie


**Diagnostic characters.**—Wing with second radial cell in a pale spot, pale markings extensive, distal pale spots on cells R₅, M₁, and M₂ not touching margin of wing, cell M₁ dark at base, the distal pale spot broadly meeting margin of wing (pl. 10, fig. 6); eyes contiguous; third palpal segment moderately swollen, with small, shallow sensory pit; hind femur entirely brown, tibiae with narrow, yellowish band at base and apex; two spermathecae well sclerotized, suboval; male aedeagus with anterior marginal band, distal peg, truncated tip; parameres separate, tips bare; basistyle with ventral roots not developed; ninth tegrum with truncated apex, very small apicolateral processes.

**Distribution.**—Mindanao: Pikit, Cotabato, December 16, 1946, at light, F. G. Werner.

**Culicoides (Culicoides) recurvus**, new species

The male genitalia of *recurvus* are nearly identical with those of *hirtipennis* to which it is closely related, but *recurvus* may be distinguished by vein R₄₊₅, which is dark up to the point where it turns abruptly forward to meet the costa; also, the front knee is dark, with an adjacent pale band on tibia.

**Female.**—Length about 1.5 mm., wing 1.03 (0.99–1.06, n-8) mm. long. Eyes widely separated (pl. 12, fig. 17), bare. Antenna with flagellar segments in proportion of 44:30:34:34:34:34:34:37:51:54:61:64:102, antennal ratio 1.17 (1.14–1.20,
n-3); antennal sensoria present on segments III, VII, XI–XV and III, XI–XV. Palpal segments in proportion of 17:44:61:27:30; third segment (pl. 11, fig. 19) greatly swollen, 2.0 times as long as broad, with a large, shallow, sensory pit. Mandible teeth 15 (13–19, n-8). Legs brown; front knee dark with adjacent pale ring on tibia; femora dark; bases of middle and hind tibiae yellowish; hind tibial comb with five spines, the second from the spur longest. Wing (pl. 10, fig. 7) with costa extending 0.64 (0.61–0.67, n-8) of wing length; nearly bare with only a few macrotrichia at wing tip. Wing brown with limited rounded pale spots appearing yellowish; distal end of second radial cell pale; pale spot over crossvein r–m separated anteriorly from costal pale spot by the radial vein; cell R3 with distal pale spot before margin of wing; cells M2 and M1 each with submarginal pale spots, cell M2 also with a double pale spot from just below medial fork to anterior level of mediocubital fork; tip of vein M1 distinctly pale. Halter brown. Spermathecae (pl. 13, fig. 18) two, subspherical, subequal, measuring 0.037 by 0.051 and 0.040 by 0.051 mm.; rudimentary spermatheca and ring both present.

Male genitalia (pl. 14, fig. 7).—Ninth sternum broad, with a shallow median excavation, the ventral membrane bare; ninth tergum rounded apically with a thinly sclerotized median lobe, the apicolarateral processes absent. Basistyle slender, mesal margin hairy, only the dorsal roots developed; dististyle thick at base, narrowing toward apex. Aedeagus long and narrow with anterior sclerotized band (transverse bar) near extreme base of arch, very long and slender tip, distal peg absent. Parameres separate, with abruptly bent, small, knobbed base, slender and straight stem, and recurved, pointed, and bare tip.

Holotype.—A female, Clark Air Base, Angeles, Pampanga, September 17, 1957, light trap, I. Balatbat. In the collection of the Division of Malaria, Philippine Department of Health, Manila.

Allotype.—A male, same data and depository as the holotype.

Paratypes.—Two females, same data as the holotype (1, CNHM; 1, USNM); 1 female, Taft, Samar, May 3, 1956, carabao-baited trap, I. Balatbat (USNM); 1 female, Davao, May, 1956, carabao-baited trap, H. Crisostomo (PDH).

Culicoides (Culicoides) sumatrace Macfie


Diagnostic characters.—Wing with distal half of second radial cell in a pale spot, transverse pale spot at middle of cell R3 reaching anterior margin of wing, pale tip of vein M3, dark base of cell M4 (pl. 10, fig. 8); eyes contiguous; antenna with distal sensory tufts present on segments III, XI–XV; third palpal segment swollen, with small round sensory pit; two well-developed spermathecae; male aedeagus with anterior marginal band, distal peg, and spherical tip; parameres separate, tips bare; basistyle with ventral roots not developed; ninth tergum rounded apically, apicolateral processes absent.
Delfinado: Philippine Biting Midges

Distribution.—Luzon: Clark Air Base, Angeles, Pampanga, September 17, 1957, light trap, I. Balatbat.—Mindanao: Kidapawan, Cotabato, June and August, 1956, carabao-baited trap, F. Kalaw.

Culicoides (Culicoides) unicus, new species

The wing pattern and venation, and the sensorial pattern of this species ally it to gemellus Macfie, but it differs in having prominent, narrow, transverse, dark bands across wing and unbanded legs.

Female.—Length about 1.6 mm., wing 1.29 (1.19–1.42, n=5) mm. long. Eyes contiguous for the length of the diameter of four facets (pl. 12, fig. 18), bare. Antennal flagellar segments in proportion of 47:40:44:44:47:47:47:64:61:68:68:115, antennal ratio 1.02 (0.95–1.08, n=4); antennal sensilla present on segments III, XI–XV. Palpal segments in proportion of 17:57:68:37:40; third segment elongate, slightly swollen at middle (pl. 11, fig. 20), 3.46 (3.16–4.00, n=5) times as long as its greatest width, with a few scattered sensilla on proximal third. Mandible teeth 15 (13–17, n=5). Legs yellowish brown, unbanded; hind tibial comb with six spines, the second spine from the spur longest. Wing (pl. 10, fig. 9) with costa extending 0.89 (0.81–0.98, n=5) of wing length; almost bare, with only a few macrotrichia at wing tip on cells R₅ and M₁. Wing pattern and venation as shown in figure. Anterior radial cells separated, the single radial cell long and narrow, extending through pale spot to distal dark area on cell R₄. Wing predominantly pale, with brown, narrow, irregular, transverse bands across wing; the first dark band before crossvein r–m from costa extending across middle of anal cell to margin of wing; the second at proximal half of anterior radial cell to tip of vein Cu₁, occupying bases of cells M₁ and M₄; the third band across middle of cell R₄ extending from anterior wing margin to tip of vein M₃+₄, the dark area continued along veins M₁ and M₂ to wing tip, isolating the distal pale spots on cells R₅, M₁ and M₂; the distal pale spots on cells R₅ and M₂ broadly meeting margin of wing. Halter yellowish. Spermathecae (pl. 13, fig. 19) two, slightly subspherical, equal, each measuring 0.037 by 0.051 mm.; rudimentary spermatheca and ring both present.

Male genitalia (pl. 14, fig. 8).—Ninth sternum broad, with shallow median excavation, the ventral membrane bare; ninth tergum rounded apically with well-developed median lobe, the apicolateral processes absent. Basistyle simple, mesal hairs absent, the ventral roots poorly developed, the dorsal roots short, pointed; dististyle long and slender with gently curved apex. Aedeagus long, about twice as long as basal width, the basal arms stout, heavily sclerotized, transverse bar absent but with a thin anterior membrane near base of arch, distal peg present; apex very long and slender with ball-like tip. Parameres separate, each with bent base, thick stem tapering to pointed, bare tip.

Holotype.—A female, CNHM–4, eastern slope of Mount McKinley, Davao, 3300 feet alt., September 25, 1946, at light, F. G. Werner. In the collection of Chicago Natural History Museum.

Allotype.—A male, same data and depository as holotype.

Paratypes.—Four females, same data as holotype (1, CNHM; 1, PDH; 2, USNM).
Subgenus *Trithecoides* Wirth and Hubert


Type of the subgenus: *Culicoides flaviscutatus* Wirth and Hubert, by original designation.

Species having three well-developed spermathecae; long second radial cell in a pale spot; eyes broadly contiguous; antenna with distal sensory tufts present on segments III, XI-XV; third maxillary palpus usually slender with scattered sensoria on distal surface of segment; male genitalia with apicolateral processes; basi-style with ventral root greatly reduced, dorsal root slender; aedeagus with short basal arch, tapering sides and simple, blunt tip; parameres simple.

Included species: *albibasis, baisasi, barnetti, flavescens, flaviscutatus, palpifer, sarawakensis*.

*Culicoides (Trithecoides) albibasis* Wirth and Hubert

*Culicoides (Trithecoides) albibasis* Wirth and Hubert, 1959, *Pacific Insects*, 1 (1), p. 31 (female, male; Malaya, light trap; palp, mandible, spermathecae, wing, and male genitalia illus.).

Diagnostic characters.—Wing largely pale on basal half (pl. 10, fig. 10); halter dark; legs pale at knees with broad pale band on each side; scutum bright yellow; third palpal segment moderately slender, with sensoria borne on distal surface of segment; mandible with 10-12 small triangular teeth of subequal lengths; three spermathecae unequal, broader than long, with broad unsclerotized entrances to ducts.


*Culicoides (Trithecoides) baisasi* Wirth and Hubert

*Culicoides (Trithecoides) baisasi* Wirth and Hubert, 1959, *Pacific Insects*, 1 (1), p. 12 (female; Samar, carabao-baited trap; palp, mandible, spermathecae, and wing illus.).

Diagnostic characters.—Wing with large pale spot over crossvein *r*-m covering second radial cell nearly to its base, narrow pale apex (pl. 10, fig. 11); legs distinctly banded; third palpal segment short, stout, with sensoria grouped together on apical third of segment; mandible with eight large, recurved teeth; three spermathecae unequal, without sclerotized necks, with large openings to ducts; parasitic on mosquitoes.

Culicoides (Trithecoides) barnetti Wirth and Hubert

Culicoides (Trithecoides) barnetti Wirth and Hubert, 1959, Pacific Insects, 1 (1), p. 32 (female, male; Malaya, light trap; palp, mandible, spermathecae, wing, and male genitalia illus.).

Diagnostic characters.—Wing broadly pale at tip, with a very small dark anterior spot over vein R_{1} (pl. 10, fig. 12); halteres pale; hind femora prominently banded; third palpal segment slender, with sensoria borne on distal surface of segment; mandible with about 12 minute triangular teeth; three spermathecae joined a considerable distance before entering duct, the large spermatheca slightly longer than broad.


Culicoides (Trithecoides) flavescens Macfie


Culicoides (Trithecoides) flavescens Macfie, new status, Wirth and Hubert, 1959, Pacific Insects, 1 (1), p. 13.

Diagnostic characters.—Wing with extensive pale areas, prominent brown infuscation along veins, two small dark brown spots over vein R; and just past end of second radial cell (pl. 10, fig. 13); third palpal segment very slender, with sensoria scattered on surface; apical mandibular teeth very large and widely spaced; three spermathecae subequal, slightly pyriform, with very slender openings to ducts.


Culicoides (Trithecoides) flaviscutatus Wirth and Hubert

Culicoides (Trithecoides) flaviscutatus Wirth and Hubert, 1959, Pacific Insects, 1 (1), p. 34 (female, male; North Borneo, light trap; palp, mandible, spermathecae, wing, and male genitalia illus.).
Diagnostic characters.—Wing with dark brown anterior margin, two large pale spots over crossvein r–m and beyond end of second radial cell, narrowly and sometimes faintly pale tip (pl. 10, fig. 14); scutum entirely yellow; hind femora entirely dark; third palpal segment slender, with sensoria borne on distal surface of segment; mandible with about 12 small triangular teeth; three spermathecae unequal, with broad, unsclerotized entrances to ducts, the large one elongate.


Culicoides (Trithecoides) palpifer das Gupta and Gosh


Diagnostic characters.—Wing with markedly dark areas on costal margin, two very pale spots on middle of crossvein r–m and apex of second radial cell, broad pale tip (pl. 10, fig. 15); third palpal segment short, moderately slender, with sensoria borne distally in shallow, open, pit-like area; mandible with 6–8 curved teeth, the distal ones larger; three spermathecae unequal, with large entrances to ducts joined at one point just before the ring.


Culicoides (Trithecoides) sarawakensis Wirth and Hubert

_Culicoides (Trithecoides) sarawakensis_ Wirth and Hubert, 1959, Pacific Insects, 1 (1), p. 28 (female; Sarawak, “biting man;” palp, mandible, spermathecae, and wing illus.).

Diagnostic characters.—Wing pattern relatively dark and uniform except for only moderately contrasting pale spots over radial crossvein and distal half of second radial cell (pl. 10, fig. 16); halters dark; hind femora dark, unbanded; third palpal segment slender, with sensoria borne on distal surface; mandible with 12–13 fine teeth of subequal lengths; three spermathecae unequal, with broad unsclerotized openings to ducts, large spermathecae much longer than broad.

Distribution.—Mindanao: Pikit, Cotabato, December 16, 1946, at light, F. G. Werner.
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Fig. 11. *C. baisasi* Wirth and Hubert  
Fig. 13. *C. flavescens* Macfie

Fig. 12. *C. barnetti* Wirth and Hubert  
Fig. 14. *C. flavisculatus* Wirth and Hubert

Fig. 15. *C. palpifer* das Gupta and Gosh

Fig. 16. *C. sarawakensis* Wirth and Hubert
PALPS OF CULICOIDES

Subgenus Oecacta Poey

Fig. 1. *C. damnosus*, new sp.
Fig. 2. *C. ejercitoi*, new sp.
Fig. 3. *C. infulatus*, new sp.
Fig. 4. *C. longipalpis*, new sp.
Fig. 5. *C. marginatus*, new sp.
Fig. 6. *C. medowelli*, new sp.

Fig. 7. *C. notatus*, new sp.
Fig. 8. *C. palawanensis*, new sp.
Fig. 9. *C. wenzeli*, new sp.
Fig. 10. *C. pampangensis*, new sp.
Fig. 11. *C. perornatus*, new sp.
Fig. 12. *C. praesignis*, new sp.

Subgenus Avaritia Fox

Fig. 13. *C. brevipalpis*, new sp.

Fig. 14. *C. nudipalpis*, new sp.

Subgenus Hoffmania Fox

Fig. 15. *C. bubalus*, new sp.

Fig. 16. *C. effusus*, new sp.

Subgenus Culicoides Latr.

Fig. 17. *C. assimilis*, new sp.
Fig. 18. *C. hirtipennis*, new sp.

Fig. 19. *C. recurvus*, new sp.
Fig. 20. *C. unicus*, new sp.
EYES OF FEMALE *CULICOIDES*

Subgenus *Oecacta* Poey

Fig. 1. *C. damnosus*, new sp.  
Fig. 2. *C. ejercitoi*, new sp.  
Fig. 3. *C. infulatus*, new sp.  
Fig. 4. *C. longipalpis*, new sp.  
Fig. 5. *C. medowelli*, new sp.

Fig. 6. *C. notatus*, new sp.  
Fig. 7. *C. palawanensis*, new sp.  
Fig. 8. *C. pampangensis*, new sp.  
Fig. 9. *C. perornatus*, new sp.  
Fig. 10. *C. praesignis*, new sp.

Subgenus *Avaritia* Fox

Fig. 11. *C. brevipalpis*, new sp.  
Fig. 12. *C. nudipalpis*, new sp.

Subgenus *Hoffmania* Fox

Fig. 13. *C. bubalus*, new sp.  
Fig. 14. *C. effusus*, new sp.

Subgenus *Culicoides* Latr.

Fig. 15. *C. assimilis*, new sp.  
Fig. 16. *C. hirtipennis*, new sp.

Fig. 17. *C. recurvus*, new sp.  
Fig. 18. *C. unicus*, new sp.
SPERMATHECAE OF CULICOIDES

Subgenus Oecacta Poey

Fig. 1. *C. damnosus*, new sp.  
Fig. 2. *C. ejercitoi*, new sp.  
Fig. 3. *C. infulatus*, new sp.  
Fig. 4. *C. longipalpis*, new sp.  
Fig. 5. *C. marginatus*, new sp.  
Fig. 6. *C. mcdowelli*, new sp.  
Fig. 7. *C. notatus*, new sp.  
Fig. 8. *C. palawanensis*, new sp.  
Fig. 9. *C. wenzeli*, new sp.  
Fig. 10. *C. pampangensis*, new sp.  
Fig. 11. *C. perornatus*, new sp.

Subgenus Araritia Fox

Fig. 12. *C. brevipalpis*, new sp.  
Fig. 13. *C. nudipalpis*, new sp.

Subgenus Hoffmania Fox

Fig. 14. *C. bubalus*, new sp.  
Fig. 15. *C. effusus*, new sp.

Subgenus Culicoides Latr.

Fig. 16. *C. assimilis*, new sp.  
Fig. 17. *C. hirtipennis*, new sp.  
Fig. 18. *C. recurvus*, new sp.  
Fig. 19. *C. unicus*, new sp.
MALE GENITALIA OF CULICOIDES

Subgenus Oecacta Poey

Fig. 1. *C. marginatus*, new sp.  
Fig. 2. *C. palawanensis*, new sp.  
Fig. 3. *C. wenzeli*, new sp.  
Fig. 4. *C. pampangensis*, new sp.

Subgenus Avaritia Fox

Fig. 6. *C. radicitus*, new sp.

Subgenus Culicoides Latr.

Fig. 5. *C. hirtipennis*, new sp.  
Fig. 7. *C. recurvus*, new sp.  
Fig. 8. *C. unicus*, new sp.