THE NORTH AMERICAN CULICOIDES OF THE GUTTIPENNIS GROUP (DIPTERA: CERATOPOGNIDAE) \(^1\)

WILLIS W. WIRTH AND FRANKLIN S. BLANTON
Entomology Research Division, ARS, USDA, Washington, D.C., and
Department of Entomology, University of Florida, Gainesville

The North American species of Culicoides related to guttipennis (Coquillett) comprise a very distinctive natural group with good adult characters in common, and with distinctive larval habitat. A critical review of the group is desirable at this time because recent work by Hair and Turner (1966) indicates that the commonest species, guttipennis, can be reared easily in laboratory colony. It is thus available for large scale experimental studies on biology and disease transmission, heretofore possible for very few species of blood sucking Ceratopogonidae. In this paper we will summarize the diagnostic characters for the group, offer a key to species, summarize the available distribution records, and briefly describe, and illustrate the ten known species, of which three are here described as new.

Because of its abundance and annoyance to humans in the eastern United States, guttipennis was one of the first Nearctic Culicoides species to be collected and described. It is the only species of the group known to bite man, and has been taken many times while sucking human blood. Malloch (1915) recorded it feeding on a horse in Illinois. Although it has not been recorded as feeding on birds, it has been taken by Messersmith (1965) in large numbers in light traps operated in poultry houses in Virginia. Only 11% of 308 guttipennis trapped in poultry houses were engorged, while at the same time 53% of 342 arborecola Root and Hoffman females contained blood. Records of Robinson (in litt.) from Minnesota, and Snow, Pickard, and Moore (1957) in Tennessee also indicate that arborecola is a bird feeder. Feeding habits of other members of this group are still unknown. Jammback (1965) has postulated that ornithophilic feeding habits are largely correlated with abundance of antennal sensory pits. Members of the Guttipennis group could all thus be expected to feed on birds except fluctuei Jones, whose mouthparts are reduced and therefore probably does not suck blood.

Vargas (1960) placed the species of this group in his subgenus Glaphiromyia, whose type-species is scopus Root and Hoffman. In our opinion the similarity in wing pattern and male genitalia structure between scopus and the Guttipennis group is not nearly sufficient to group them together subgenerically. The hairy tips and Oecacta-like basal knobs of the male parameres, the presence of only 4 tibial spines, the sensorial pattern 3, 8, 10-15, and the dark apices of veins M1, M2, M3+4, and Cu1, are all important characters clearly separating scopus subgenerically from the Guttipennis group.

Fox (1955) placed the species of the Guttipennis group in the subgenus Beltraumia, but this position is less tenable than in Glaphiromyia. Beltran-, as presently restricted, contains only species with one functional spermatoeca, wing never with pale spots straddling veins M1 and M2, and male parameres with distinct anterior process on the basal knob.

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Wirth (1965) assigned the known species of the Guttipennis group to the subgenus Oecacta Poey without group distinction. Atchley (1967) gave a short diagnosis of the Guttipennis group for the New Mexico species, and also placed them in the subgenus Oecacta.

We now prefer to follow the lead of Jamnback (1965), who first named and diagnosed the Guttipennis group in all stages. Jamnback left a number of groups unclassified as to subgeneric position, a conservative approach which has much to commend it. Formal subgeneric assignments should be made only when enough is known about the limits and diagnostic characters of the group concerned and those closely related to make a definitive classification.

The larval habitat is known for all species of this group except pecosensis Wirth. Seven species have been reared from wet or moist tree or stump holes, while the eighth, cochisensis n. sp., was reared from water in a pocket of a "Saguaro" cactus. In addition, there is one rearing of flukei Jones from a Sarracenia pitcher plant (Jamnback 1965). Hair, Turner, and Messersmith (1960) discussed and figured breeding habitats of arboricola Root and Hoffman, guttipennis (Coquillett) and villosipennis Root and Hoffman, all from tree and stump holes except one instance in which guttipennis was found in an accumulation of wet leaves at the margin of a small pond.

The following special terms are used in our descriptions of the female and in our summary of quantitative characters in Table 1. Proboscis/Head Ratio (P/II) is the length of the proboscis measured from the distal end of the labrum-epipharynx to the anterior margin of the tormae, divided by the length measured from the anterior margin of the tormae to the median hair socket between the inner eye margins. Palpal Ratio (PR) is the length of the third palpal segment divided by its greatest breadth. Antennal Ratio is the combined length of the five elongated distal antennomeres (for convenience hereafter in this paper referred to as "segments") divided by the combined length of the eight shorter proceeding "segments". Wing length is measured from the basal arculus to the wing tip; the Costal Ratio is the wing length divided by the length of the costa measured from the basal arculus to the tip of the second radial cell.

Measurements were made on specimens cleared in phenol and mounted on slides in phenol-balsam; when possible they were made on series and are given as mean (minimum—maximum, n = number of measurements).

Diagnosis. Wing with very distinctive pattern of markings: second radial cell dark to apex; pale spots present straddling mid-portions of veins M1 and M2; apices of veins M1, M2, M3+4 and sometimes Cu1 pale margined; cell R5 with double, transverse pale spot at midlength; anal cell usually with three separate pale spots arranged in a triangle distal of the proximal pale area (flukei is an exception to this wing pattern). Costa short to moderately long, extending from 0.52 to 0.61 of distance to wing tip; surface of wing with abundant, long macrotrichia, extending to base of wing in cell M2 and anal cell. Legs usually dark brown with blackish knee spots, narrow pale bands subapically on femora and subbasally on tibiae, sometimes faint or absent on hind femur; hind tibia with broad apex pale, tibial comb with 5 spines (6 in californiensis). Fourth tarsomere not cordiform or bilobed. Thorax usually with distinct pattern of large pruinose gray patches on
scutum, in two species with pruinose pattern absent except in prescutellar area. Female with eyes narrowly to broadly separated, without interfacetal hairs; antenna with distal five segments rather elongated, antennal ratio 1.00-1.64, antennal sensoria always present on segments 3, 11-15, variably present on 4-10, often forming pattern of 3, 5, 7, 9, 11-13; third palpal segment usually moderately swollen, with definite pit, variously deep to shallow, narrow to broad; proboscis length and number of mandibular teeth variable. Female with two large functional spermathecae, a rudimentary one and a sclerotized ring present, the large spermathecae ovoid with short, slender necks. Male genitalia with well-developed apicolateral processes on ninth tergum; ninth sternum narrow with shallow caudomedian excavation, the ventral membrane usually without fine spicules; bacistyles with dorsal and ventral roots simple, usually short to moderately long and slender with pointed tips; dististyles slender and tapering to bent distal point except in guttipennis which has a sharp bend in mid portion and straight blunted-tipped, slender distal portion; aedeagus with basal arch usually extending to half of total length, basal arms usually slender and curved, distal portion variously modified, with blunt or sharp pointed tip and subapical hyaline filaments present in two species; parameres very distinctive, with short, rather broad basal knob, a sharp basal constriction on stem, the latter usually sinuate, swollen in proximal portion and tapering to simple distal point bent or curved ventrad, the tip without fringing spines or hairs and the main body without ventral lobe.

Pupa (after Jamnback 1965) with operculum densely covered with short stout spines; anterodorsal setae very unequal; all abdominal segments densely covered with scale-like confluent spines, giving a unique reticulated appearance; respiratory organ with surface at least in part with appressed broad scaly spines.

Larva (after Jamnback 1965) with head long and narrow; thorax unpigmented dorsally, with faint lateral pigmented spots on meso and metathorax present or absent; last abdominal segment with unique (for Culicoides) long setae, longer than maximum width of segment.

**KEY TO SPECIES OF THE GUTTIPENNIS GROUP**

1. Wing with distal pale spot in cell R5 elongate, filling distal portion of cell, apices of veins M1, M2, and M3+4 dark; proboscis very short, P/H ratio only 0.42; mandible with 6-7 teeth .................. *flukei* Jones
   — Wing with distal pale spot in cell R5 double, transverse, lying well proximad of cell apex; apices of veins M1, M2, and M3+4 pale margined; proboscis moderately long, P/H ratio 0.77-1.00; mandible with 11-21 teeth ........................................... 2

2. Wing with apex of vein Cu1 pale at wing margin .................. 3
   — Wing with apex of vein Cu1 dark ........................................ 4

3. Hind femur with prominent subapical pale band; palpal pit moderately broad; 14-18 mandibular teeth; male aedeagus without apical filaments (e USA) ........................................... *arboricola* Root and Hoffman
   — Hind femur dark to tip; palpal pit very broad; 11-16 mandibular teeth; male aedeagus with 2 subapical filaments (sw USA) ........................................... *oklahomensis* Khalaf
4. Pale spot over r-m crossvein larger, extending caudad well past base of media ................................................................. 5
   — Pale spot over r-m crossvein smaller, not extending caudad past base of media ................................................................. 6
5. Third palpal segment slender (PR 2.9) with shallow pit; spermathecae large, pyriform; male genitalia massive, dististyles bent (e USA). guttipennis (Coquillett)
   — Third palpal segment moderately swollen (PR 2.0) with moderately deep pit; spermathecae smaller, ovoid, with short slender neck; male genitalia normal, dististyles not bent (Texas) .................. pecosensis Wirth
6. Distal antennal segments each at least 2.5 times as long as proximal ones; palpal pit shallow; scutum with pruinose gray pattern (e USA) .................................................. villosipennis Root and Hoffman
   — Distal antennal segments less than twice as long as proximal ones; palpal pit very deep to moderately deep; scutum with or without pruinose gray pattern ................................................................. 7
7. Halter knob dark (scutum with gray pruinose pattern, sensoria present on segments 3-15, one per segment on 4-8, eyes narrowly separated, palpal pit shallow) .................. beckae n. sp.
   — Halter knob pale ................................................................................................................................. 8
8. Legs dark, hind femur dark to tip; scutum black without pale pruinose pattern ................................................................. 9
   — Legs pale, hind femur with broad distal pale band; scutum brownish with pale pruinose pattern (sensoria present on segments 3-9, 11-15; male apicolateral processes slender) (Calif.) california n. sp.
9. Sensoria present on antennal segments 3-15, several per segment on 4-9; eyes broadly separated; palpal pit very deep; opening by a smaller pore; male apicolateral processes slender (e USA) ........ ouwaiani Khalaf
   — Sensoria present on antennal segments 3-9, 11-15, one per segment on 4-9; eyes narrowly separated; palpal pit moderately deep; male apicolateral processes stouter (sw USA) .............. coxisensis n. sp.

Culicoides arboricola Root & Hoffman

(Fig. 1-8)


Female.—Length of wing 1.19 (1.02-1.40, n = 9) mm.

Head: Eyes (Fig. 4) bare; narrowly separated. Antenna (Fig. 1) with lengths of flagellar segments in proportion of 22-17-17-18-18-18-18-39-39-39-41-87, antennal ratio 1.48 (1.38-1.64, n = 9); distal sensory tufts present on segments 3, 5, 7, 9, 11-15. Palpal segments (Fig. 3) with lengths in proportion of 12-41-39-13-11; palpal ratio 2.84 (2.5-3.2, n = 1)
third segment moderately swollen, with a broad shallow sensory pit. Proboscis moderately long, P/H ratio 1.00; mandible with 15(14-17, n = 10) teeth.

Thorax: Dark brown; scutum with pattern of pruinose gray patches. Legs (Fig. 5) brown, knee spots blackish; all femora with subapical and all tibiae with subbasal, prominent pale rings; hind tibia with distal fourth pale; hind tibial comb with 5 spines, the two nearest the spur longer, subequal.

Wing (Fig. 2): Pattern as usual in the group, pale spots extensive; distal portions of veins M1, M2, M3+4 and Cu1 pale to wing margin; pale spot over r-m crossvein extending broadly into cell M2. Macrotrichia long and numerous; costal ratio 0.60 (0.58-0.62, n = 10). Halter pale.

Abdomen: Dark brown. Spermathecae (Fig. 6) slightly unequal, measuring 0.052 mm by 0.045 mm and 0.048 mm by 0.040 mm; slightly ovoid with short slender necks.

Male.—Genitalia as in Fig. 7-8. Ninth tergum with moderately long, angular apicolateral processes; ninth sternum with very shallow caudo-median excavation, the ventral membrane not spiculate. Basistyle moderately long and slender, dorsal and ventral roots simple, subequal in length; dististyle nearly straight, tapering distally to slender, slightly hooked distal point. Aedeagus with basal arch high, extending to slightly more than half of total length, the basal arms very slender; distal portion tapering to very slender, pointed tip. Parameres (Fig. 7) each with large basal knob, base of stem constricted, straight mid portion somewhat swollen proximad, tapering distally to slender, pointed tip abruptly bent anterolaterally.

Distribution.—Eastern United States from Minnesota and Texas to Connecticut and Florida.

Type.—Holotype male, Gwynns Falls Park, Baltimore, Maryland, July 1931, tree hole, Root and Hoffman (Type no. 53305, USNM; pinned, wing and genitalia on slides).

Specimens Examined.—300 slides, 181 pinned.

ALABAMA: Atmore (Blanton); Florence (Snow); Wilson Dam (Snow).

CONNECTICUT: Storrs (Lewis).

FLORIDA: Lee Woodlot, Alachua Co., Smith, reared tree hole); Island Grove, Alachua Co. (St. Bd. Health); Gainesville, Alachua Co., (Blanton, Walker); Punta Gorda, Charlotte Co. (St. Bd. Health); Princeton, Dade Co. (St. Bd. Health); Cross City, Dixie Co. (St. Bd. Health); Steinhatchee, Dixie Co. (St. Bd. Health); Innerarity Point, Escambia Co. (Bett); Bratt, Escambia Co. (Blanton, Broce); N. Flagler Beach, Flagler Co. (St. Bd. Health); Appalachicola, Franklin Co. (St. Bd. Health); Chattahoochee, Gadsden Co. (St. Bd. Health); Suwanee River, Gilchrist Co. (Hicks); Wekiva Island, Gulf Co. (St. Bd. Health); Jasper, Hamilton Co. (St. Bd. Health); Plant City, Hillsborough Co. (St. Bd. Health); Bonifay, Holmes Co. (St. Bd. Health); Monticello, Jefferson Co. (St. Bd. Health); Mayo, Lafayette Co. (St. Bd. Health); Tallahassee, Leon Co. (Kohn); Cedar Key, Levy Co. (St. Bd. Health); Teeloggia, Liberty Co. (St. Bd. Health); Salerno, Martin Co. (St. Bd. Health); Rock Harbor, Monroe Co. (St. Bd. Health); Lake Worth, Palm Beach Co. (Wirth); Port Richey, Pasco Co. (St. Bd. Health); Myakka St. Park, Sarasota Co. (St. Bd. Health); N. Ponte Vedra,
St. Johns Co. (St. Bd. Health); Dranford, Suwanee Co. (Hicks); Ormond Beach, Volusia Co. (St. Bd. Health); Wachulla, Volusia Co. (Jernigan); Santa Rosa, Walton Co. (St. Bd. Health); Greenhead, Washington Co. (St. Bd. Health).

GEORGIA: Dekalb Co. (Donaldson); Savannah, Isle of Hope.

ILLINOIS: Grafton (Snow).

KANSAS: Lawrence (Barr); Manhattan (Young).

LOUISIANA: Arabi (Khalaf); Carlisle (Khalaf); Covington Khalaf; Kilbourne (Wirth); Lafitte (Khalaf); New Orleans (Eads, Hinman); Weeks Island (Khalaf).

MARYLAND: Fairland (Hubert); Snow Hill (Anderson).

MINNESOTA: Burnside (Robinson), biting birds 21 ft high in cottonwood tree.

MISSISSIPPI: Greenwood (Komp); Washington Co. (Roberts).

NEBRASKA: Dunbar, Otoe Co. (Wirth).

OKLAHOMA: McIntosh Co. (Khalaf); Stillwater (Rozeboom), reared, tree hole; Westville (Kaiser and Nailon); Wichita Nat. Forest (Khalaf).

PENNSYLVANIA: York (Spangler).

TENNESSEE: Chestee Creek (Snow).

TEXAS: Aransas Refuge, Aransas Co. (Wirth and Jones).

VIRGINIA: Alexandria (Wirth), reared, tree hole; Blacksburg (Messersmith); Elkton (Messersmith, Raffensperger); Falls Church (Wirth), reared, tree hole; Mt. Crawford (Messersmith), reared, stump hole; Newport (Hair), reared, tree hole; Poplar Camp (Messersmith); Vesuvius (Messersmith); Vienna (Bridwell).

WISCONSIN: Dane Co. (Jones), reared, tree hole.

Culicoides beckae Wirth and Blanton, new species

(Fig. 9-16)

Female.—Length of wing 1.15 mm.

Head: Eyes (Fig. 12) bare; narrowly separated. Antenna (Fig. 9) with lengths of flagellar segments in proportion of 36-30-30-30-30-30-33-35-50-70-75-75-96, antennal ratio 1.53; distal sensory tufts present on segments 3-15, one per segment on 4-10. Palpal segments (Fig. 11) with lengths in proportion of 5-20-25-10-7; palpal ratio 2.5, third segment moderately swollen on mid portion, with a broad, shallow sensory pit. Proboscis moderately short, P/H ratio 0.83; mandible with 15 teeth.

Thorax. Dark brown, scutum with pattern of large pruinose gray patches. Legs (Fig. 13) dark brown, knee spots blackish; all femora with subapical and tibiae with sub-basal, narrow pale rings; hind tibia with broad apical pale band; hind tibial comb with 5 spines, the two nearest the spur longer, subequal.

Wing (Fig. 10): Pattern as usual in the group; pale spots very much restricted, the one over r-m crossvein not extending into costal cell or cell M2; apex of vein Cu1 not pale at wing margin. Macrotrichia numerous and coarse; costal ratio 0.61. Halter knob dark.

Abdomen: Dark brown. Spermathecae (Fig. 14) subequal, each measuring 0.051 mm by 0.035 mm; ovoid with very short necks.

Male.—Genitalia as in Fig. 15-16. Ninth tergum moderately elongate with stout, angular apicolateral processes; ninth sternum with shallow, broad,
Fig. 9-16, *Culicoides beckae*: 9, female antenna; 10, female wing; 11, female palpus; 12, female eye separation; 13, female hind leg; 14, female spermathecae; 15, male parameres; 16, male genitalia, parameres removed.

caudomedian excavation, the ventral membrane not spiculate. Basistyle slender, dorsal and ventral roots slender, subequal; dististyle nearly straight, tapering to slender, pointed, slightly bent tip. Aedeagus with basal arch extending to about half of total length, the basal arms moderately stout, curved; distal portion very slender, with sharp pointed tip. Parameres (Fig. 15) each with small basal knob, base of stem constricted a short distance; main portion moderately swollen proximally, very slender distally, tapering to very slender distal filament.

*Distribution.*—Alabama: Florida, Virginia.


Wirth: Culicoides of the Guttipennis Group


Discussion.—This species resembles villosipennis Root and Hoffman and ousairani Khalaf in its restricted pale wing spots, but differs from both in its dark halteres and pale banded hind femora, differs from villosipennis moreover in its shorter distal antennal segments and sensorial pattern, and from ousairani in its scutal pattern and shallow palpal pit. The male genitalia of beckiae are most similar to those of arboricola Root and Hoffman, but the parameres are much more slender distally.

We are very pleased to dedicate this species to Mrs. Elisabeth C. Beck of the Florida State Board of Health in recognition of her long interest and important contributions to our knowledge of Florida biting midges.

Culicoides californiensis Wirth & Blanton, new species

(Fig. 17-23)

Female.—Length of wing 1.28 (1.13 - 1.50, n = 14) mm.

Head: Eyes (Fig. 21) separated by a distance equal to diameter of 1.5 facets, bare. Antenna (Fig. 18) with lengths of flagellar segments in proportion of 30-40-40-40-41-41-41-41-57-62-72-82-100, antennal ratio 1.12 (1.02-1.20, n = 10); distal sensory tufts present on segments 3-9, 11-15. Palpal segments (Fig. 19) with lengths in proportion of 35-77-102-36-39; palpal ratio 2.60 (2.4-2.9, n = 10), third segment moderately swollen, with a moderately large, deep, sensory pit. Proboscis moderately long, P/H ratio 1.00; mandible with 13 (12-14, n = 14) teeth.

Thorax: Coppery brown, scutum with pattern of pruinose patches. Legs (Fig. 23) pale brown, knee spots dark; all femora with subapical and all tibiae with subbasal, narrow pale rings; hind tibia broadly pale at base and at apex; hind tibial comb with 6 spines, the one nearest the spur longest.

Wing (Fig. 17): With pattern typical of the group, pale spot lacking on distal portion of vein Cu1; pale spots moderately large and distinct. Macrotrichia long and numerous; costa quite short, costal ratio 0.52 (0.51-0.59, n = 13). Halter pale.

Abdomen: Dark brown. Spermathecae (Fig. 22) slightly unequal, measuring 0.055 mm by 0.044 mm and 0.052 mm by 0.044 mm, slightly ovoid with short slender necks.

Male.—Genitalia as in Fig. 24-25. Ninth tergum long with long slender, pointed apicomedial processes; ninth sternum with very low caudomedian excavation, the ventral membrane not spiculate. Basistyle slender, dorsal and ventral roots slender; dististyle very slightly curved, tapering to pointed, slightly bent tip. Aedeagus with basal arch extending to half of total length, basal arms slender, slightly curved; distal portion gradually tapering to very slender, attenuated tip. Parameres each with short basal knob, constricted base of stem, moderately stout, sinuate mid portion gradually tapering to rather stout, curved, pointed tip.

Pupa.—Thoracic respiratory horn as in Fig. 20.

Distribution.—California.
Fig. 17-25, Culicoides californiensis: 17, female wing; 18, female antenna; 19, female palpus; 20, pupal respiratory organ; 21, female cyc separation; 22, female spermathecae; 23, female hind leg; 24, male parameres; 25, male genitalia, parameres removed.

*Type*. Holotype female, allotype male, Bakersfield, Kern Co., California, 2 May 1954, W. A. McDonald, reared from cottonwood tree hole (Type no. 69492 USNM). Paratypes: CALIFORNIA: same data as types, 20 males, 80 females, 10 larvae, 10 pupae. Kern County Park, June 1946, B. Brookman, light trap, 1 female. Victorville, San Bernardino Co., 4 Feb. 1955, W. A. McDonald, reared from cottonwood tree hole, 1 male, 1 female.

*Discussion*.—This species resembles *ousairani* in the lack of scutal pattern, but differs in the presence of subapical pale band on the hind femur, and the scutum is much paler brownish.

Culicoides cochisensis Wirth and Blanton, new species

(Fig. 26-33)

*Female*.—Length of wing 1.14 (1.04—1.26, n = 13) mm.

Head: Eyes (Fig. 28) narrowly separated, bare. Antenna (Fig. 26) with lengths of flagellar segments in proportion of 43-34-35-36-36-36-36-
Wirth: Culicoides of the Guttipennis Group

56-59-65-65-83, antennal ratio 1.13 (1.05 - 1.19, n = 12); distal sensory tufts present on segments 3-9, 11-15, one per segment on 4-9. Palpal segments (Fig. 31) with lengths in proportion of 22-60-90-27-25; palpal ratio 2.47 (2.29 - 2.62, n = 13), third segment moderately swollen on mid portion, with a broad, deep sensory pit. Proboscis moderately short, P/H ratio 0.86; mandible with 12 (11 - 13, n = 13) teeth.

Thorax: Dark chocolate brown, acutum without pattern of gray pruinose patches. Legs (Fig. 30) dark brown; knee spots blackish; fore and mid femora with subapical and fore and mid tibiae with subbasal, narrow pale rings; hind femur dark to tip, hind tibia with broad basal and apical pale bands; hind tibial comb with 5 spines, the two nearest the spur longer, subequal.

Wing (Fig. 27): Pattern as usual in the group; pale spots not extensive, the one over r-m crossvien not meeting costal margin nor passing into cell M2; apex of vein Cu1 not pale at wing margin. Macrotrichia numerous and coarse; costa short, costal ratio 0.52 (0.51 - 0.54, n = 13). Halter pale.

Abdomen: Dark brown. Spermathecae (Fig. 29) unequal, measuring 0.051 mm by 0.039 mm and 0.046 mm by 0.033 mm; ovoid with short, rather stout necks.

Male.—Genitalia as in Fig. 32-33. Ninth tergum fairly broad distally with moderately long, rather stout, pointed apicolateral processes; ninth sternum with shallow, broad, caudomedian excavation, the ventral membrane not spiculate. Basistyle slender, dorsal and ventral roots slender, subequal; dististyle nearly straight, tapering to slender, pointed, slightly curved tip. Aedeagus with basal arch extending to about half of total length, the basal arms moderately stout, curved; distal portion very slender, with sharp pointed tip. Parameres (Fig. 32) each with small basal knob, base of stem constricted a considerable distance; main portion moderately stout, sinuate, tapering gradually to rather stout distal point.

Distribution.—Arizona; Mexico, Utah.

Types.—Holotype female, allotype male, Sycamore Canyon, Ruby, Santa Cruz Co., Arizona, 22 May 1954, G. D. Butler, light trap (Type no. 69493, USNM). Paratypes, 34 males, 27 females.


Mexico: 10 mi s Canipele, Baja Calif., 28 Aug. 1959, Radford and Werner, light trap, 2 males.

Utah: Salt Lake City, 14 Sept. 1952, H. Bullock, ex window, 1 female.
Discussion.—This species resembles *ousairani* Khalaf in its lack of pruinose scutal pattern, dark hind femora and reduced wing spots, but *ousairani* differs in its antennal sensorial pattern, deep palpal pit opening by a small pore, and by the slender apicolateral processes, stouter tip of the aedeagus, and more slender tips of parameres in the male genitalia.

Fig. 26–33. *Culicoides coxisensis*; 26, female antenna; 27, female wing; 28, female eye separation; 29, female spermatheca; 30, female hind leg; 31, female palpus; 32, male parameres; 33, male genitalia, parameres removed.

*Culicoides flukei* Jones

(Fig. 34-42)

*Culicoides flukei* Jones, 1956, Proc. Entomol. Soc. Wash. 58: 30 (male, female; Wis.; Fig. wing, palpus, spermatheca, male genitalia).—Jammback, 1965, N. Y. St. Mus. Bull. 399: 61 (redescribed, Fig.; larva and pupa; N.Y.).

Female.—Length of wing 0.99 (0.81 - 1.10, n = 5) mm.

Head: Eyes (Fig. 34) bare; contiguous or narrowly separated. Antenna (Fig. 35) with lengths of flagellar segments in proportion of 26-20-20-20-22-20-20-22-28-28-28-28-38-48, antennal ratio 1.02 (1.02 - 1.03, n = 3); distal sensory tufts present on segments 3, 11-15. Palpal segments (Fig. 36) with lengths in proportion of 12-20-32-14-15; palpal ratio 1.53; third segment very short, slightly swollen, with a small, shallow sensory pit. Proboscis very short, P/H ratio 0.42; mandible with 7 teeth.
Fig. 34-42, Culicoides fluket: 34, female eye separation; 35, female antenna; 36, female palpus; 37, female wing; 38, female spermathecae; 39, female hind leg; 40, pupal respiratory organ; 41, male parameres; 42, male genitalia, parameres removed.

Thorax: Brown; scutum with extensive pattern of pruinose gray patches. Legs (Fig. 39) brown, knee spots blackish; all femora with subapical and all tibiae with subbasal, narrow pale rings, hind tibia with apex broadly pale; hind tibial comb with 5 spines, the two nearest the spur longer, subequal.

Wing (Fig. 37): Pattern not typical of the Guttipennis group in that distal pale spot in cell R5 is elongate longitudinally, practically filling distal third of cell; apices of veins M1, M2, M3+4 and Cu1 not pale margined, and anal cell with only one pale spot in distal portion; pale spot present straddling mid portion of vein M2, but pale spot on mid portion of vein M1 lying mostly on anterior side of vein. Macrotrichia sparser than usual in the group, forming longitudinal rows on mid portion of wing, becoming very sparse at base of anal cell and extending to base of cell M2 in only a double row; costal ratio 0.57. Halter pale.

Abdomen: Dark brown. Spermathecae (Fig 38) subequal, each measuring 0.037 mm by 0.033 mm; slightly ovoid with nearly imperceptible necks.

Male.—Genitalia as in Fig. 41-42. Ninth tergum rather short and broad, apicolateral processes very short and blunt; ninth sternum with very shallow caudomedian excavation, the ventral membrane not spiculate. Basistyle short, ventral root not developed, dorsal root slender; dististyle slender, curves...
ing distally, with bent pointed tip. Aedeagus with basal arch broad, extending to 0.6 of total length, basal arms slender, curving; distal portion short and broad, tapering to very blunt tip. Parameres (Fig. 41) each with rather small basal knob, deep constriction at base of stem, main portion markedly sinuate, swollen proximad, tapering distally to very slender point bent ventrocephalad.

**Pupa.**—Respiratory organ as in Fig. 40.

**Distribution.**—Wisconsin; New York; Virginia.

**Types.**—Holotype female, pinned with pupal skin, Dane Co., Wisconsin, 30 May 1954, R. H. Jones, reared from sugar maple tree hole (Type no. 69494, USNM). Paratypes: 19 males and 24 females, some with larval and pupal skins.

**Specimens Examined.**—9 males, 7 females.

**New York.**—Freeville, 29 June 1955, reared from pitcher plant, 1 male and pupa; Newcomb, Essex Co., 10 July 1954, H. A. Jamback, reared from tree hole, 2 males, 2 females, pupae.

**Virginia.**—Mount Solon, 16-20 Aug. 1951, W. S. Murray, reared from tree hole, 1 male.

**Wisconsin.**—Dane Co., 30 May 1954, R. H. Jones, reared from tree hole, 5 males, 5 females, pupae, larvae (type series).

**Culicoides guttipennis** (Coquillett)

(Fig. 43-51)


Fig. 43-51, *Culicoides guttipennis*: 43, female eye separation; 44, female antenna; 45, female palpus; 46, female wing; 47, female spermathecae; 48, female hind leg; 49, pupal respiratory organ; 50, male parameres; 51, male genitalia, parameres removed.


*Culicoides* (*Beltranomyia*) *guttipennis* (Coquillett); Fox, 1955, J. Agr. Puerto Rico 39: 223 (subg. pos.).

*Culicoides* (*Glaophiromyia*) *guttipennis* (Coquillett); Vargas, 1960, Rev. Biol. Trop. 8: 41 (subg. pos.).

**Female.**—Length of wing 1.32 (1.18 – 1.50, n = 13) mm.
Head: Eyes narrowly separated (Fig. 43), bare. Antenna (Fig. 44) with lengths of flagellar segments in proportion of 23-16-17-18-18-18-18-37-36-41-45-57, antennal ratio 1.54 (1.45 - 1.73, n = 13); distal sensory tufts present on segments, 3, 5, 7, 9, 11-15. Palpal segments (Fig. 45) with lengths in proportion of 8-31-36-13-15; palpal ratio 2.85 (2.70 - 3.50, n = 13); third segment slightly swollen, with a moderately small, shallow, sensory pit. Proboscis moderately long, P/H ratio 0.98; mandible with 21 (20 - 21, n = 13) teeth.

Thorax: Dark brown; scutum with pattern of pruinose gray patches. Legs (Fig. 48) brown, knee spots blackish; all femora with subapical and all tibiae with subbasal, narrow pale rings, hind tibia with broad apex pale; hind tibial comb with 5 spines, the two nearest the spur longer, subequal.

Wing (Fig. 46): Pattern as usual in the group, pale spots moderately extensive, pale spot over r-m crossvene broadly meeting costal margin and extending posteriorly well into cell M2; vein Cu1 not pale on distal portion. Macrotrichia moderately long and numerous; costa moderately long, costal ratio 0.60 (0.58 - 0.63, n = 13). Halter pale.

Abdomen: Dark brown. Spermathecae (Fig. 47) slightly unequal, measuring 0.054 mm by 0.048 mm and 0.049 mm by 0.045 mm; distinctly pyriform, tapering gradually to the slender neck.

Male.—Genitalia as in Fig. 50-51. Ninth tergum with very prominent, broad, apicolateral processes with acute-angled tips; ninth sternum with deep, broad, caudomedian excavation, the ventral membrane spiculate. Basistyle very stout, with broad basal swelling on mesal side, ventral root stout, dorsal root slender; dististyle nearly straight near base, abruptly bent at midlength, gradually tapered to slender, blunt, straight apex. Aedeagus with basal arch extending to half of total length, basal arms slender and curved; distal portion stout and parallel-sided, tapering very little to the truncated tip. Parameres (Fig. 50) massive; each with very large basal knob, short constriction at base of stem; the latter straight, distinctly swollen on basal portion, tapering distally; distal portion abruptly bent and curved ventrolateral and then mesal, with rather stout distal point.

Pupa.—Respiratory organ as in Fig. 49.

Distribution.—Eastern United States from Minnesota to New York and Oklahoma to Florida.

<table>
<thead>
<tr>
<th>TABLE 1.—COMPARISON OF MEAN VALUES OF CERTAIN STRUCTURAL CHARACTERS OF SPECIES OF THE GUTTIPENNIS GROUP.</th>
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<tbody>
<tr>
<td>Wing Length mm</td>
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<td>arboricola</td>
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<td>hookae</td>
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<td>pecosensis</td>
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<td>villosipennis</td>
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Types.—Six female syntypes, pinned, Medina, Ohio, 5 Aug. 1897, J. S. Ille (Type no 5460, USNM). The female bearing Coquillett's label is hereby selected as lectotype.

Specimens examined.—120 slides, 192 pinned.

Alabama: Greenbrier (Snow), biting man in tree.

Connecticut: Stoors (Lewis)

Florida: Citra, Marion Co. (St. Bd. Health).

Georgia: Fort Mountain (Fattig); Savannah (Hall), reared, tree hole.

Illinois: Grafton (Snow); White Heath (Malloch).

Iowa: Ames (Knight), reared, tree hole; (Laffoon, Millspeugh).

Kansas: Lawrence (Barr); Riley Co. (Marston); Sunflower Tract, Johnson Co. (Atchley), reared, tree hole.

Kentucky: Golden Pond (T.V.A.)

Louisiana: Arabi (Khalaf); Baton Rouge (Wirth); Covington (Khalaf); Kilbourne (Wirth); Weeks Island (Khalaf).

Maryland: College Park (Bishop); Fairland (Hubert); Forest Glen (Heide mann, Wirth); Green Spring Valley (Foote); Patuxent Wildlife Refuge (Scanlon); Plummer's Island (Barber, Schwarz, Malloch, Shannon); Roland Park (Root), reared, tree hole.

Massachusetts: Boxford (Aitken), reared, tree hole.

Michigan: Detroit (Steyshalk), Douglas Lake (William).

Minnesota: Nine Mile Creek, Hennepin Co. (Denning), reared, tree hole.

Mississippi: Pickwick Res. (Snow).

Missouri: Independence (Swain); Webster Grove (Swain).

Nebraska: Dunbar, Otoe Co. (Wirth); Norfolk (Reeves and Galindo).

New York: Allegheny St. Park (Wirth), reared, tree hole; Cranberry Lake, St. Lawrence Co. (Wirth).

Ohio: Clear Park, Ashland Co. (Thomas); Medina (Hine), type series.

Oklahoma: Page (Standish, Kaiser); Summerfield (Standish, Kaiser); West ville (Kaiser, Naini); Wichita Nat. Forest (Khalaf).

Pennsylvania: York (Hubert).

Tennessee: Reelfoot Lake (Snow).

Virginia: Alexandria (Wirth), reared, tree hole; Blacksburg (Messersmith); Broad Run; Dead Run (Shannon); Elkton (Raffensperger); Falls Church (Wirth), reared, tree hole; Ferrum (Messersmith); Harrisonburg, Camp Todd (Allard), biting man at dusk; Mount Solon (Wirth, Murray); Mount Vernon (Wirth), biting man at dusk; Ottobine (Messersmith), reared, stump hole; Paris (Bartech); Peaks of Otter (Messersmith); Poplar Camp (Messersmith); Skyland (Dyar), biting man; Vesuvius (Messersmith); Vienna (Dridwell), Warrensburg (Grave).

Wisconsin: Washburn Co. (Jones), reared, tree hole.

Culicoides oklahomensis Khalaf

(Fig. 52-59)

Culicoides villospennis oklahomensis Khalaf, 1952, Ann. Entomol. Soc. Amer. 45: 335 (male; Okla.).—

Fig. 52-59, Culicoides oklahomensis: 52, female antenna; 53, female wing; 54, female palpus; 55, female hind leg; 56, female eye separation; 57, male parameres; 58, male genitalia, parameres removed; 59, female spermathecae.

larval habitat).—Khalaf, 1966, Ann. Entomol. Soc. Amer. 59: 881 (La.).—
Culicoides (Oecacta) villosipennis var. oklahomensis Khalaf; Khalaf, 1954,
Ann. Entomol. Soc. Amer. 47: 57 (subg. pos., status).—
Culicoides (Oecacta) villosipennis oklahomensis Khalaf; Khalaf, 1957,
Amer. Midl. Nat. 58: 212 (Okla.; notes).
Culicoides (Oecacta) oklahomensis Khalaf; Wirth, 1965, In Stone, et al.,
Cat. N. Amer. Dip. p. 129 (Pos.; Ariz., Mexico, Okla., Tex.).
Culicoides (Beltramiyia) villosipennis var. oklahomensis Khalaf; Fox,
Culicoides arboricola Koot & Hoffman (misident.); Wirth & Bottimer, 1956,
Mosquito News 16: 263 (Tex.; habits.).
Female.—Length of wing 1.06 (1.02 - 1.18, n = 9) mm.

Head: Eyes (Fig. 56) bare; moderately separated, by a distance equal
to 1.5 times the diameter of an eye facet. Antenna (Fig. 52) with lengths of
flagellar segments in proportion of 40-28-30-30-30-30-30-30-55-55 62 66-86,
antennal ratio 1.35 (1.31 - 1.36, n = 7); distal sensory tufts present on seg-
ments 3, 5, 7, 9, 11-15. Palpal segments (Fig. 54) with lengths in proportion
of 22-65-65-24-24; palpal ratio 2.54 (2.33 - 2.83, n = 8); third segment slightly
swollen, with a broad, very shallow, sensory pit. Proboscis short, P/H ratio
0.77; mandible with 12 (11-14, n = 9) teeth.
Thorax: Dark brown; scutum with pattern of pruinose gray patches. Legs (Fig. 55) brown, knee spots blackish; fore and mid femora with subapical and fore and mid tibiae with subbasal, narrow pale rings; hind femur dark to tip, hind tibia with broad subbasal and apical pale bands; hind tibial comb with 5 spines, the one nearest the spur longest.

Wing (Fig. 55): Pattern as usual in the group, pale spots extensive; distal portions of veins M1, M2, M3+4, and Cu1 pale margined; pale spot over r-m crossovein extending from costal margin broadly into cell M2. Macrotrichia coarse and numerous; costa short, costal ratio 0.55 (0.53 - 0.64, n = 9). Halter pale.

Abdomen: Dark brown. Spermathecae (Fig. 59) subequal, each measuring 0.040 mm by 0.036 mm; ovoid in shape with short slender necks.

Male.—Genitalia as in Fig. 57-58. Ninth tergum tapering distad to moderately long, acutely angular, slightly flaring apicolateral processes; ninth sternum with very shallow caudomedian excavation, the ventral membrane not spicate. Basistyle slender, slightly tapering distad, ventral and dorsal roots slender, the dorsal root much longer; dististyle slightly curving, tapering gradually to slender, slightly bent distal point. Aedeagus with basal arch extending to slightly over half of total length, basal arms slender, curved; distal portion slender, tapering to sharp distal point, a pair of pointed slender hyaline filaments arising laterally near tip. Parameres (Fig. 57) slender; basal knob small with anterior corner slightly prolonged; stem constricted at base, slightly swollen on basal portion, slightly sinuate and gradually tapering to simple distal point.

Distribution.—Oklahoma; Arizona, Louisiana, Mexico, New Mexico, Texas.

Types.—Holotype male, Wichita Refuge, Oklahoma, 4 June 1947, deposited in University of Oklahoma Museum; 10 male paratypes.

Specimens Examined.—


LOUISIANA: Covington, 23 July 1965, K. T. Khalaf, light trap, 1 male.


Culicoides ousairani Khalaf

(Fig. 60-67)

Culicoides ousairani Khalaf, 1952, Ann. Entomol. Soc. Amer. 45: 354 (male, female; Wichita Refuge, Okla.; Fig. antenna, palpse, male genitalia).—Wirth & Bottimer, 1956, Mosquito News 16: 263 (Tex.; habits).—Beck, 1956,
Fig. 60–67, Culicoides ousairani: 60, female antenna; 61, female palpus; 62, female wing; 63, female eye separation; 64, male parameres; 65, male genitalia, parameres removed; 66, female spermathecae; 67, female hind leg.
Wirth: Culicoides of the Guttipennis Group

with lengths in proportion of 30-75-112-45-35; palpal ratio 2.48 (2.37 - 2.64, n = 15); third segment moderately swollen, with a deep sensory pit opening by a much smaller pore. Proboscis moderately long; P/H ratio 0.86; mandible with 14(12 - 16, n = 15) teeth.

Thorax: Dark brown; scutum without pattern of pruinose gray patches. Legs (Fig. 67) brown; hind leg stouter than usual; knee spots blackish; fore and mid femora with subapical and fore and mid tibiae with subbasal, narrow pale rings; hind femur dark to tip, hind tibia with subbasal and apical broad pale bands; hind tibial comb with 5 spines, the two nearest the spur longer, subequal.

Wing (Fig. 62): Pattern as usual in the group, pale spots much reduced, pale spot over r-m crossvein not attaining costal cell or cell M2; veni Cu1 dark along distal portion. Macrotrichia very coarse and numerous; costa moderately long, extending to 0.57 (0.49 - 0.60, n = 14) of distance to wing tip. Halter pale.

Abdomen: Dark brown. Spermathecae (Fig. 66) slightly unequal, measuring 0.051 mm by 0.042 mm and 0.046 mm by 0.036 mm; slightly ovoid with very short slender necks.

Male.—Genitalia as in Fig. 64-65. Ninth tergum short and broad, apicolateral processes long and slender, slightly flaring; ninth sternum with very shallow caudomedian excavation, the ventral membrane not spiculate. Basistyle moderately stout, not tapering, dorsal and ventral roots slender, subequal; dististyle nearly straight, very slender on distal half, with slightly bent, pointed tip. Aedeagus with basal arch extending to slightly more than half of total length; basal arms moderately stout, curving; caudomedian stem stout proximad, tapering on distal half to blunt distal point. Parameres (Fig. 64) each with large basal knob; stem greatly constricted at base, considerably swollen at base of midportion, sinuate, tapering gradually distad to slender point abruptly bent ventrad.

Distribution.—Southeastern United States from Oklahoma and Texas to Pennsylvania and Florida (Nuevo Leon).

Types.—Holotype male, Wichita Refuge, Oklahoma, 4 June 1947, K. Khalaf, deposited in the University of Oklahoma Museum. Paratypes, 10 males (1 in USNM).

Specimens examined.—170 slides, 138 pinned.

Alabama: Atmore (Blanton); Florence (Snow).

Florida: Cory Village, Alachua Co. (Smith); Edgewater, Volusia Co., (St. Bd. Health); Gainesville, Alachua Co. (Hicks); Innerarity Point, Escambia Co. (St. Bd. Health); Jasper, Hamilton Co. (St. Bd. Health); Newnans Lake, Alachua Co. (Blanton); Torreya State Park, Liberty Co., (Blanton & Weems).

Louisiana: Baton Rouge (Wirth); La Grande (Khalaf); Lake Charles (Khalaf); Verna River (Khalaf).

Maryland: Fairland Hubert.

Oklahoma: Cleveland (Howell); Wichita Nat. Forest (Khalaf), type series.

Pennsylvania: York (Spangler).

Texas: Brownsville (Joyce, Ross), reared, tree hole; Cameron Co. (Fads), reared from shrub tree hole; Del Rio (Brundrett, Fads); Fort Davis (Dollahite); Dryden (Schomberg); Hunt, Kerr Co. (Eoda); Kerrville (Bottimer, Wirth); Sheffield (Schomberg); Sonora (Price).
The Florida Entomologist  Vol. 50, No. 3

Virginia: Elkton, Rockingham Co. (Messersmith, Raffensperger); Falls Church (Wirth); Ferrum (Messersmith).
Mexico: Monterrey, Nuevo Leon (Blanton)

Culicoides pacosensis Wirth
(Fig. 68-75)


Culicoides (Glaephomyia) pacosensis Wirth; Vargas, 1960, Rev. Biol. Trop. 8: 41 (subg. pos.).

Culicoides (Oecacta) pacosensis Wirth; Wirth, 1965, In Stone et al., Cat. Dipt. N. Amer. p. 130 (subg. pos.).

Female.—Length of wing 1.20 (1.12 - 1.42, n = 7) mm.

Head: Eyes (Fig. 71) bare, moderately separated (by distance equal to diameter of 1.5 eye facets). Antenna (Fig. 68) with lengths of flagellar segments in proportion of 42-32-32-32-32-32-32-32-32-32-32-32-32-58-58-60-60-75; antennal ratio 1.15 (1.04 - 1.21, n = 5); distal sensory tufts present on segments 3, 5, 7, 9, 11-15. Palpal segments (Fig. 70) with lengths in proportion of 20-70-75-23-25; palpal ratio 2.36 (2.03 - 2.88, n = 5); third segment moderately swollen, with a broad shallow sensory pit. Proboscs moderately long, P/H ratio 0.98; mandible with 15 (14 - 18, n = 7) teeth.

Thorax: Dark brown; scutum with pattern of pruinose gray patches. legs (Fig. 75) brown, knee spots blackish; all femora with subapical and all tibiae with subbasal, narrow pale rings, hind tibia with broad apical pale band; hind tibial comb with 5 spines, the one nearest the spur longest.

Wing (Fig. 69): Pattern as usual in the group, pale spots extensive, pale spot over r-m crossvein extending broadly from costa into cell M2; distal portion of vein Cu1 dark. Macrotrichia moderately long and numerous; costal ratio 0.57 (0.55 - 0.60, n = 7). Halter pale.

Abdomen: Dark brown. Spermathecae (Fig. 72) unequal, measuring 0.059 mm by 0.044 mm and 0.049 mm by 0.039 mm; slightly ovoid, with very short, slender necks.

Male.—Genitalia as in Fig. 73-74. Ninth tergum moderately long, tapering distally, apicodateral processes long and slender, pointed, slightly flaring; ninth sternum with very shallow caudalmedian excavation, the ventral membrane not spicate. Basistyle moderately stout, dorsal and ventral roots short, moderately slender; dististyle slightly curved, gradually tapering to slender, slightly bent tip, Aedeagus with basal arch short, extending to only 0.4 of total length, basal arms stout and slightly curved; distal stem parallel sided, moderately stout, with truncate tip. Parameres each with small basal knob, stem with basal constriction, moderately swollen at base of mid portion, distally sinuate and tapering to sharp, ventrally twisted point.

Distribution.—Texas; New Mexico.

Types.—Holotype female (Type no 62365, USNM), Sanderson, Terrell Co., Texas, 29 Aug. 1853, H. Brundrett, light trap; 4 male and 20 female paratypes, same data.

Specimens examined.—81 pinned, 50 slides.
Fig. 68-75. *Culicoides pecosensis*: 68, female antenna; 69, female wing; 70, female palpus; 71, female eye separation; 72, female spermathecae; 73, male parameres; 74, male genitalia, parameres removed; 75, female hind leg.


*Culicoides villosipennis* Root and Hoffman

(Fig. 76-82)

Fig. 76-82. Culicoides villosipennis: 78, female palpus; 77, female antenna; 78, female wing; 79, female eye separation; 80, female spermathecae; 81, male parameres; 82, male genitalia, parameres removed.

Mosquito News 17: 77 (Va.).—Beck, 1958, Mosquito News 18: 8 (Fla.; notes).


Culicoides (Gluphiromyia) villosipennis Root & Hoffman; Vargas, 1960, Rev. Biol. Trop. 8: 41 (Subg. pos.).
Wirth: Culicoides of the Guttipennis Group 231

Female.—Length of wing 1.62 (1.30 - 1.72, n = 12) mm.

Head: Eyes (Fig. 79) bare; moderately separated, by a distance equal to
the diameter of 1.5 eye facets. Antenna (Fig. 77) with lengths of flagellar
tennal ratio 1.64 (1.51 - 1.85, n = 5), distal segments remarkably elongated;
distal sensory tufts present on 3, 5, 7, 9, 11-15. Palpal segments (Fig. 76)
with lengths in proportion of 34-80-85-27-25; palpal ratio 2.38 (2.17 - 2.65,
n = 10); third segment moderately swollen, with a broad shallow sensory
pit. Proboscis short, P/H ratio 0.82; mandible with 12 (11-14, n = 12) teeth.

Thorax: Dark brown; scutum with pattern of pruinose gray patches.
Legs dark brown, knee spots blackish; fore and mid femora with subapical
and fore and mid tibiae with subbasal, narrow pale rings; hind femur dark
to tip, hind tibia with broad subbasal and apical pale bands; hind tibia with
5 spines, the two nearest the spur longer, subequal.

Wing (Fig. 78): Pattern as usual in the group, pale spots much reduced,
pale spot over r-m cross vein not extending into cell M2; vein Cu1 dark on
distal portion. Macronervia very strong and numerous; costa long, costal
ratio 0.61 (0.60 - 0.64, n = 12). Halter pale.

Abdomen: Dark brown. Spermathecae (Fig. 80) subequal, each meas-
uring 0.058 mm by 0.043 mm; ovipositor with short slender necks.

Male.—Genitalia as in Fig. 81-82. Ninth tergum tapering, with short,
angularly pointed apicolateral processes; ninth sternum with shallow caudo-
median excavation, the ventral membrane not spicate. Basistyle moder-
ately stout, dorsal and ventral roots slender, the former longer; dististyle
nearly straight proximally, tapering to slender, pointed bent tip. Aedeagus
with basal arch extending to half of total length, basal arms moderately
stout, curving; distal stem tapering to moderately slender tip with two pairs
of short lateral hyaline processes subapically. Parameres (Fig. 81) slender,
each with small basal knob and extensive basal constriction of stem, main
portion slightly sinuate, slightly swollen proximally, distally tapering to sharp,
ventrally bent point.

Distribution.—Eastern North America from Wisconsin and Oklahoma to
Maine and Florida.

Types.—Holotype male, Sparrows Point, Baltimore, Maryland, 24 July
1931, Root and Hoffman, reared from tree hole (Type no. 53304, USNM). Allo-
type and 5 paratypes, same data.

Specimens examined.—101 slides, 77 pinned.

ALABAMA: Greenbrier (Snow), biting man, 20 ft. in tree.

CONNECTICUT: Storrs (Lewis).

FLORIDA: Alachua Co. (Lee, Smith), Gainesville (Blanton); Bratt, Escambia
Co. (Blanton and Bruce); Chattahoochee, Gadsden Co., (St. Bd. Health);

Tallahassee, Leon Co., (Kohn).

GEORGIA: DeKalb Co. (Donaldson)

IOWA: Ames (Laffoon).

KANSAS: Lawrence (Barr).

KENTUCKY: Golden Pond (T.V.A.).

LOUISIANA: Covington (Khalaf); Kilbourne (Wirth); Lake Charles (Khalaf);

Verm River (Khalaf); Weeks Island (Khalaf).

MAINE: Sebago Lake St. Park (Kuschke).

MARYLAND: Fairland (Hubert); Forest Glen (Wirth); Green Spring Valley,

Baltimore Co. (Foote); Patuxent Refuge (Scanlon); Plummer's Island
(Shannon); Sparrows Point (Root and Hoffman), type series.

Massachusetts: Centerville (Wall).

Michigan: Douglas Lake (Williams).

New Jersey: Pittsdown (Burbulis).

Oklahoma: Westville (Kaiser, Nailon).


Pennsylvania: York (Hubert, Spangler).

Tennessee: Chestuee Creek, Athens (Snow); Dover (Pickard).

Virginia: Alexandria (Wirth), reared, tree hole; Blacksburg (Messersmith);

Falls Church (Wirth); Ferrum (Messersmith); Mount Solon (Murray,
Wirth); Poplar Camp (Messersmith); Vesuvius (Messersmith).

Wisconsin: Washburn Co. (Jones), reared, tree hole.

LITERATURE CITED


The Florida Entomologist 50 (3) 1967