

NEW SPECIES AND RECORDS OF PREDACEOUS MIDGES OF
THE GENUS *PROBEZZIA* FROM FLORIDA AND ALABAMA
(DIPTERA: CERATOPOGONIDAE)

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ABSTRACT

Three new species of *Probezzia* Kieffer are described from one locality, Florida Caverns State Park in Jackson County, Florida: *fairchildi* New Species, *meadi* New Species, and *weemsi* New Species. A fourth species, *glicki* New Species, is described from two localities in Alabama. Florida distribution records are presented for five additional previously described species. The midges from Blackshear, Georgia, previously reported as *Probezzia nigra* Wirth, were misidentified, and are now reported as *Macropeza blantoni* Wirth and Ratanaworabhan (New Georgia State Record). A new key is provided to the 23 known North American species of *Probezzia*, as well as diagrammatic illustrations of the color patterns of femora and tibiae of females.

Key Words: Predaceous midges, *Probezzia*, Ceratopogonidae.

RESUMEN

Se describen tres especies nuevas de *Probezzia* Keiffer de una localidad, el Parque Estatal Cavernas Floridananas en el condado de Jackson, Florida: *fairchildi* Especie Nueva, *meadi*, Expecie Nueva, y *weemsi* Especie Nueva. Una cuarta especie, *glicki* Especie Nueva, se describe de dos localidades en Alabama. Registros de distribución para la Florida se presentan para cinco especies previamente descritas. Las mosquitas de Blackshear, Georgia, previamente reportadas como *Probezzia nigra* Wirth, fueron el identificadas errroneamente, y ahora se reportan como *Macropeza blantoni* Wirth y Ratanaworabhan (Nuevo Registro para Georgia). Se presenta una nueva clave para las 23 especies norteamericanas conocidas de *Probezzia*, ademas unas ilustraciones de las configuraciones de colores de los femures y las tibias de las hembras.

The large, conspicuously marked, predaceous midges of the genus *Probezzia* Kieffer are common and characteristic inhabitants of the psammolittoral zone of the lakes and larger streams of the northern United States, southern Canada, and Eurasia. They have not been found south of northern Florida, Texas, and northern California. Williams (1955) and Wirth (1971) reported on the habits of the larvae and pupae. Mature larvae migrate from their shallow water habitat up the stems and leaves of cat-tails and other emergent plants where pupation occurs within a few inches of the water surface. Pupae secure themselves to the plants by means of secretory adhesive discs on some of the abdominal sternites. When disturbed, the pupae are able to move forward by wriggling movements and, using these discs, as well as the strong segmental spines on the abdomen, secure themselves.

Downes (1978) reported in detail the feeding habits of *Probezzia* females. The females are predaceous on small, soft-bodied insects (wing length 2-7 mm) such as mayflies and chironomid midges. Most remarkably, females of *Probezzia* will feed on the males of

their own species while mating is in progress, piercing the body wall and sucking the haemolymph. The shrivelled body of the male drops off later on, but the genitalia often remain attached to the female abdomen.

After two taxonomic revisions by Wirth (1951, 1971) the systematics of the North American *Probezzia* species is fairly satisfactory. An exception to this became apparent, however, when I made large collections of *Probezzia* adults at the Florida Caverns State Park in Jackson County, Florida, in 1970, 1973, and 1981. I collected two described species, *P. albitibia* Wirth and *P. smithii* (Coquillett), as well as three additional species which I am here describing as new. In addition I am describing a fourth species collected by Jayson Glick in Alabama, that may also occur in northern Florida. The midges from Blackshear, Georgia, reported by Wirth (1971) as *Probezzia nigra* Wirth, were misidentified, and are in fact *Macropheza blantonii* Wirth and Ratanaworabhan (1972a), previously known only from Florida (New Georgia State Record). See discussion under *Probezzia fairchildi* n. sp.

The genus *Probezzia* has been adequately diagnosed in the revision by Wirth (1971), to which the reader is referred for a full discussion of taxonomic characters and a summary of biological information. Downes & Wirth (1981) gave a more up-to-date discussion of taxonomic characters in the family Ceratopogonidae. In *Probezzia*, structural characters have not proved very useful except in a few exceptional species, and as previously, I rely heavily on features of coloration, especially of wings, halteres, legs, antennae, and abdominal tergites. Structure of the male genitalia is remarkably uniform among species and has not been used taxonomically, contrary to practice in the study of most other ceratopogonid genera.

The types of the new species here described are deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D. C.

KEY TO NORTH AMERICAN SPECIES OF *PROBEZZIA*

(See Figs. 1, 2)

1. Wing entirely pale, veins and membrane whitish 2
- Wing entirely infuscated or whitish with broad dark band, veins in infuscated portion darkened (if faint, infuscation may be seen more clearly by viewing the wing from the base or apex at a slight angle) 12
2. Scutum entirely yellow or pale brown, or yellow on anterior half 3
- Scutum entirely shining black or dark brown 4
3. Scutum entirely yellow or pale brown; legs entirely yellow to pale brown (northeastern N. Amer.) *pallida* Malloch (female)
- Scutum yellow on anterior half, shining black posteriorly; legs with distal halves of all femora and broad median ring and narrow apex of hind tibia brown (New York) *unica* (Johannsen)
- 4(2). Halter knob dark; tibiae and at least distal halves of femora black 5
- Halter knob pale; usually not more than distal third of all femora black; abdomen entirely yellowish white 6
5. Abdomen entirely dark; trochanters and bases of femora dark; scutum and scutellum dark brown with very fine short setae (Michigan) *atriventris* Wirth
- Abdomen pale, segments 8-9 dark; trochanters pale, femora usually pale on proximal fourth to half; scutum black with long, stouter setae (eastern N. Amer.) *albiventris* (Loew)
- 6(4). Legs entirely pale except for black 5th tarsomeres (northeastern N. Amer.) *pallida* Malloch (males)
- Legs with black markings on femora and tibiae 7
7. Hind tibia extensively dark-banded; fore tibia various 8

- Hind tibia yellow except extreme narrow base and apex black; fore femur usually dark on distal third to half (northeastern N. Amer.) . *xanthogaster* (Kieffer)
- 8. Hind tibia with broad sub-basal band and narrow apex black; fore tibia various 9
- Hind tibia black on distal 2/3; fore tibia pale except narrow base and apex black (Florida) *weemsi* new species
- 9. Fore femur dark on distal third to half 10
- Fore femur dark only on extreme apex 11
- 10. Fore and mid tibiae without dark sub-basal bands (northeastern N. Amer.) *sabroskyi* Wirth
- Fore and mid tibiae with bases extensively infuscated (northeastern N. Amer.) *jamnbacki* Wirth
- 11(9). Fore and mid tibiae with sub-basal dark bands (northeastern N. Amer.) *williamsi* Wirth
- Fore and mid tibiae dark only on extreme bases and apices (Europe, northwestern N. Amer.) *seminigra* (Panzer)
- 12(1). Wing entirely dark, or pale only at extreme base 13
- Wing with at least proximal fourth pale 17
- 13. Femora and tibiae entirely dark (southeastern U.S.) 14
- Femora dark at most only on distal third; tibiae dark with broad subapical pale band (northeastern N. Amer.; USSR) *fuscipennis* Wirth
- 14. Large species, wing length 2.66 mm; wing lightly infuscated; abdomen pale, segments 8-9 dark brown; antenna extremely elongated, antennal ratio 0.52; segment 11, 216 microns long; claws short, stout, and evenly curved (Florida) *fairchildi* new species
- Smaller species, wing length 1.7-2.3 mm; wing deeply infuscated; abdominal coloration various; antenna shorter, antennal ratio 1.4-1.5; segment 11, 125-147 microns long; claws slender, straighter 15
- 15. Antenna short, antennal ratio 1.55; segment 11, 125 microns long, segments 3-15 brownish; abdomen entirely brownish; wing length 1.7 mm (Florida) *meadi* new species
- Antenna long and slender, antennal ratio 1.36; segment 11, 147 microns long, segments 3-10 pale, 11-15 dark; wing length 2.3 mm; abdominal coloration various 16
- 16. Wing slightly infuscated; halter dark; abdominal tergites 4-5, 8-9 dark (Louisiana) *ludoviciana* Wirth
- Wing deeply infuscated; halter pale; abdominal tergites all dark (southeastern U.S.) *nigra* Wirth
- 17(12). Wing with dark band covering middle third of wing and centered just distad of r-m crossvein, distal portion of wing pale; broad apices of femora and broad sub-basal band on hind tibia dark; halter knob pale 18
- Wing with at least distal two-thirds dark; leg markings and halter color various 19
- 18. Fore and mid tibiae pale except bases and apices in female, entirely dark in male (northeastern N. Amer.) *albitibia* Wirth
- Fore and mid tibiae with basal third to half dark in female (male unknown) (Louisiana) *rosewalli* Wirth
- 19(17). Halter knob dark; tibiae and distal third to half of femora black (northeastern N. Amer.) *infuscata* Malloch
- Halter knob pale 20
- 20. Tibiae entirely and femora except extreme bases black (eastern N. Amer.) *smithii* (Coquillett)

- Fore and mid tibiae with only extreme apices dark; femora with extensive pale markings 21
21. Hind tibia pale except at extreme apex (Florida, Alabama) . *glicki* new species
- Hind tibia with broad sub-basal dark band 22
22. Femora extensively black, at least on mid and hind legs 23
- Femora almost entirely pale, only narrow knee spots dark (western N. Amer.)
..... *flavonigra* (Coquillett)
23. Femora black nearly to base of fore leg and on distal half to third on mid and hind legs (Texas) *bottimeri* Wirth
- Femora black on narrow apex of fore leg and on distal fourth on mid and hind legs (Europe; western N. Amer.) *concinna* (Meigen)

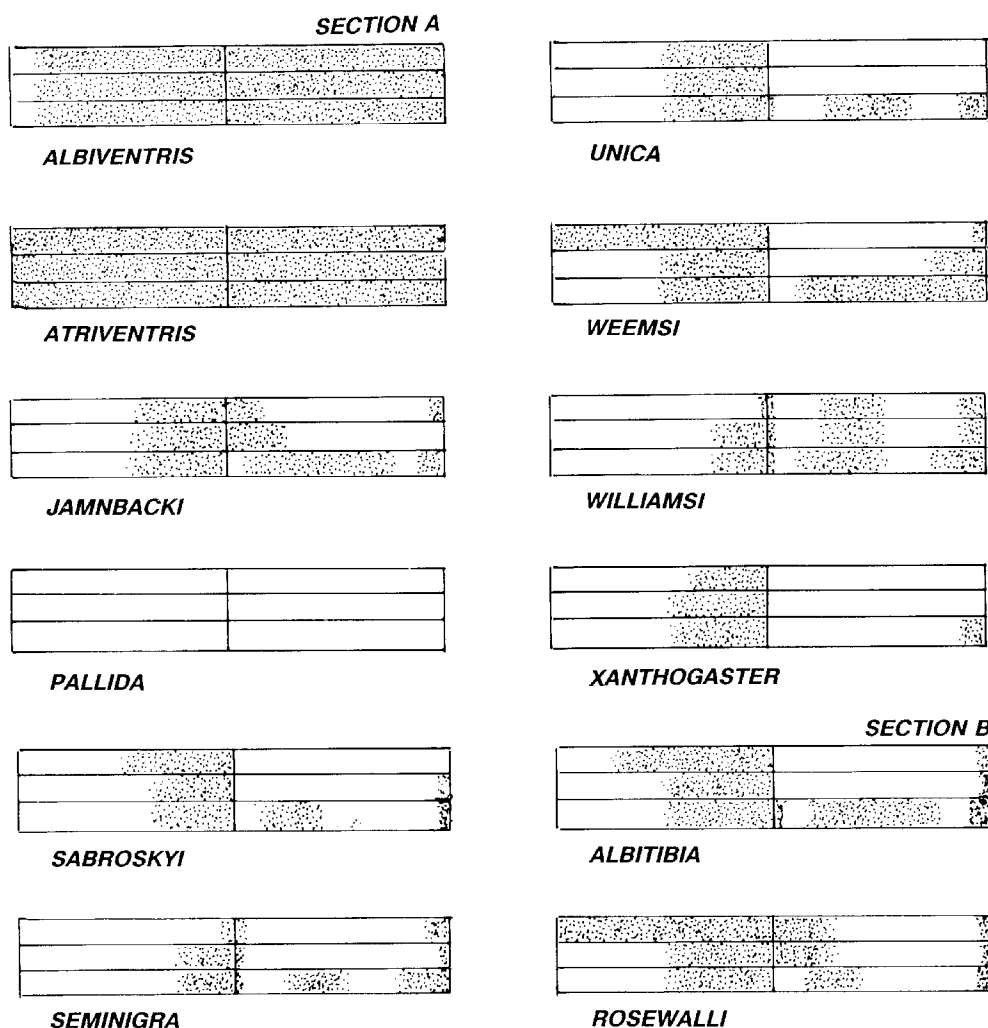


Fig. 1. Diagram of pale and dark markings of femora (left) and tibiae (right) of (top to bottom) fore, mid, and hind legs of species of *Probezzia* (Section A, species with wing entirely whitish; Section B, species with dark band over midportion of wing).

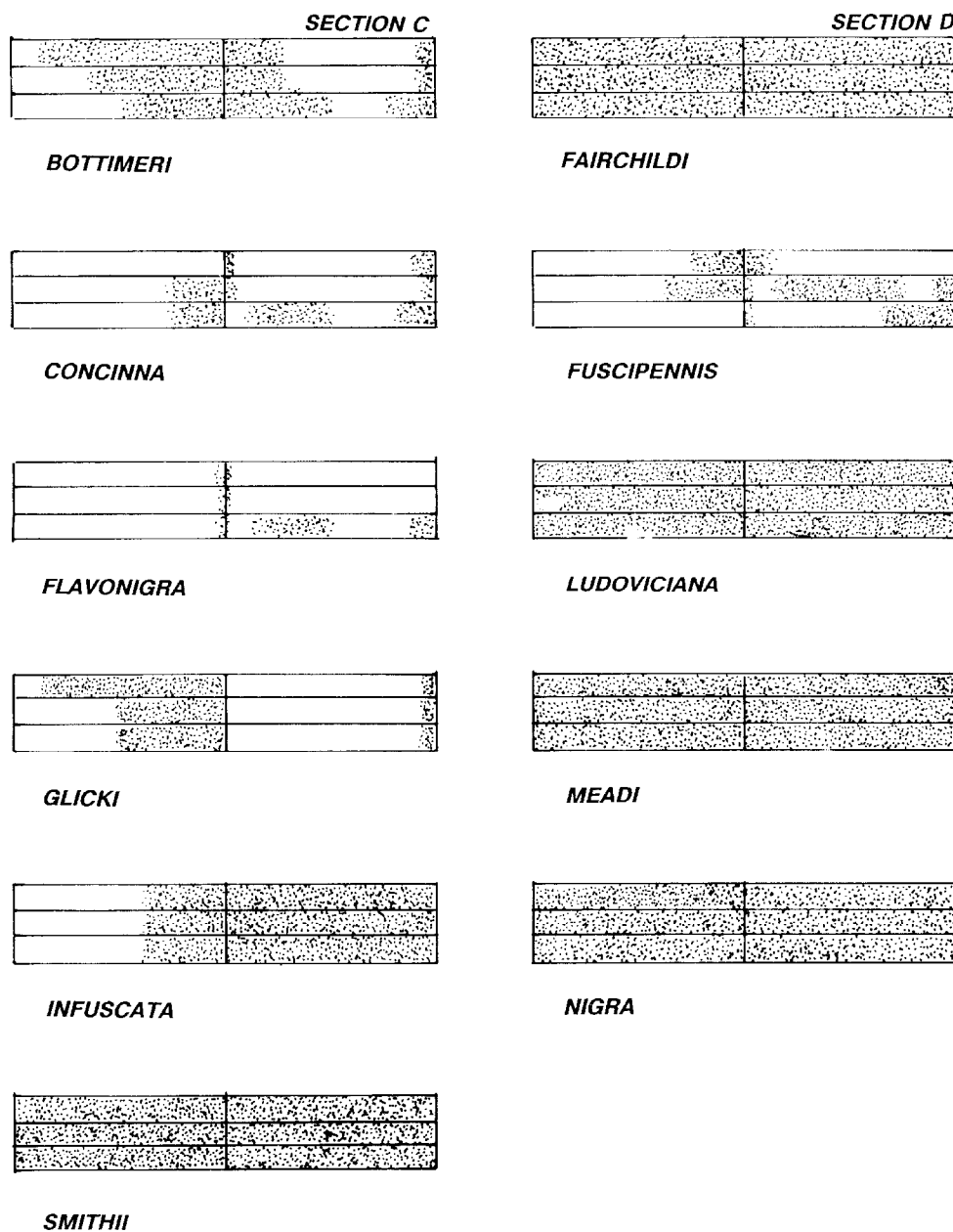


Fig. 2. Diagram of pale and dark markings of femora (left) and tibiae (right) of (top to bottom) fore, mid, and hind legs of species of *Probezzia* (Section C, species with wing infuscated on distal one-half to three-fourths; Section D, species with wing entirely infuscated).

Probezzia albitibia Wirth

Probezzia albitibia Wirth, 1971: 732 (male, female; Virginia, Wisconsin to Quebec, south to Virginia); Wirth & Grogan, 1979: 884 (male, female, pupa; Potomac River Valley records).

DIAGNOSTIC CHARACTERS OF FEMALE. Wing length about 2.7 mm. Antenna with segments 3-10 whitish, 11-15 dark brown. Thorax dark brown. Legs yellowish; fore

femur dark brown except at extreme base; distal 1/2 of mid femur and distal 1/3 of hind femur dark brown; fore and mid tibiae with faint basal and apical brown bands; hind tibia dark brown with pale brown sub-basal and subapical bands (these often entirely absent). Wing whitish including veins; a prominent transverse band across mid portion of wing, 1/4 as wide as wing is long, the veins in this area dark brown. Halter pale. Abdomen pale, tergites 3-5 dark brown.

DISTRIBUTION. Eastern North America, Wisconsin to Quebec, south to Alabama and Florida.

FLORIDA RECORDS. **Florida**, Jackson Co., Florida Caverns State Park, 4.v.1970, W. W. Wirth, light trap, 6 females; same, 26.v.1973, 7 females.

NOTES. The type series of *Probezzia albitibia* was mixed. Females from Maryland, Michigan, New York, and West Virginia resemble the holotype from Dead Run, Fairfax Co., Virginia, in having two pale bands on the hind tibia. Females from Falls Church, and Scott Run, Potomac River, Fairfax Co., Virginia, and the series recorded above from Jackson Co., Florida, differ in having the hind tibia entirely dark. No other differences could be found and it is unknown whether this difference represents variation in one species or whether a second species is involved. The males are sexually dimorphic in having all the tibiae dark; in all other *Probezzia* leg color is virtually the same in males and females (Wirth & Grogan 1979: 886).

Probezzia albiventris (Loew)

Ceratopogon albiventris Loew, 1861: 311 (Cent. I, no. 7) (female; Georgia).

Probezzia albiventris (Loew); Malloch, 1914: 138 (combination); Wirth, 1951: 28 (diagnosis; distribution); Wirth, 1971: 733 (taxonomic notes; distribution); Wilkening et al., 1985: 528 (Santa Rosa, Florida record).

DIAGNOSTIC CHARACTERS OF FEMALE. A large black and pale yellow species, wing length 2.7 mm. Antenna brown, segments 3-10 pale, 11-15 brown. Palpus brown. Legs dark brown; trochanters, bases of femora variably, and tarsomeres 1-3 pale; tarsomeres 4-5 black; female claws short and curved, 110 microns long. Wing entirely whitish hyaline including veins. Halter dark. Abdomen pale, segments 8 and 9 dark brown.

DISTRIBUTION. Eastern North America, Wisconsin to New Brunswick, south to Texas and Florida.

FLORIDA RECORDS. **Florida**: Santa Rosa Co., Jay v.1962, T. W. Boyd, light trap, 3 females.

Probezzia sabroskyi Wirth

Probezzia sabroskyi Wirth, 1951: 31 (male, female; Michigan; fig. male genitalia); Wirth, 1971: 736 (Distribution; correction of Wirth 1951 misdeterminations); Wilkening et al., 1985 (Santa Rosa Co., Florida record).

DIAGNOSTIC CHARACTERS OF FEMALE. Wing length about 2.7 mm. Antenna brown, segments 3-10 whitish. Thorax dark brown. Legs pale yellow; distal 1/3 of all femora, a sub-basal band at 1/3 length of hind tibia, and narrow apex of hind tibia dark brown. Wing milky white including veins. Halter pale. Abdomen yellowish white (tergites 3-5 dark in Florida specimens).

FLORIDA RECORDS. **Florida**: Santa Rosa Co., Blackwater River, Florida A. & M. Biological Station, 23.v.1973, W. W. Wirth, light trap, 1 female.

Probezzia smithii (Coquillett)

Ceratopogon smithii Coquillett, 1901: 600 (female; New Jersey).

Probezzia smithii (Coquillett); Malloch, 1914: 138 (combination); Wirth, 1951: 29 (diag-

nosis; distribution); Wirth, 1971: 737 (distribution; taxonomic notes); Wirth & Grogan, 1979: 888 (male, female, pupa; Potomac River Valley records); Wilkening et al., 1985: 529 (records from Jackson, Leon, Santa Rosa Counties, Florida).

DIAGNOSTIC CHARACTERS OF FEMALE. A small blackish species; wing length 2.0 mm. Antenna pale, segments 11-15 brownish. Legs with femora and tibiae blackish, extreme bases of femora paler. Wing dark, whitish on proximal 1/4. Halter pale. Abdomen with variable dark markings, usually dark on tergites 2-8.

DISTRIBUTION. Eastern United States, Kansas and Wisconsin to New Jersey, south to Louisiana and Florida.

FLORIDA RECORDS. **Florida:** Jackson Co., Florida Caverns State Park, 4.v.1970, 26-29.v.1973, 24.iv.1981, W. W. Wirth, light trap, 47 females. Leon Co., 5 mi N Tallahassee, v.1970, WWW, light trap, 1 female. Santa Rosa Co., Blackwater River State Park, 25.v.1973, WWW, light trap, 1 female.

Probezzia fairchildi Wirth, New Species

DESCRIPTION. Female Holotype. Wing length 2.66 mm; breadth 0.98 mm. Antenna much elongated, segments 4-10 each as long as those in 11-14 series; segments 4-10 yellowish white, 11-12 dark except at base, 13-15 entirely dark brown; lengths of flagellar segments 262-180-216-310-210-180-195-180-216-198-114-186-238 microns; antennal ratio (11-15/3-10) 0.52. Palpus pale brown, lengths of segments 36-54-118-58-72 microns. Thorax black. Legs with femora and tibiae entirely blackish; claws relatively stout, curved. Wing uniformly infuscated, veins pale brown. Halter dark. Abdomen pale yellow, segments 8-9 entirely dark brown. Spermathecae slightly ovoid, slightly unequal, 144 x 115 microns and 129 x 97 microns; tapering slightly to slender necks.

Male Allotype. Wing length 1.55 mm; breadth 0.50 mm; costal ratio 0.81. Color markings as in female, but abdomen entirely brown. Antenna brown, segments 12-15 darker, plume pale; lengths of flagellar segments 115-57-57-57-57-57-57-57-57-100-129-186-226 microns. Genitalia typical of the genus.

DISTRIBUTION. Florida.

TYPES. Holotype female, allotype male, Jackson Co., Florida, 26.v.1973, W. W. Wirth, light trap. Paratypes, 21 males, 21 females, as follows:

Florida: Jackson Co., same data as types, 21 males, 15 females; same but 4.v.1970, 1 female; same but 24.iv.1981, 3 females. Baker Co., Glen St. Mary, v.1971, F. S. Blanton, light trap, 1 female. Leon Co., Tall Timbers Res. Station, iv.1978, F. W. Mead, light trap, 1 female.

ETYMOLOGY. This species is dedicated to G. B. Fairchild in recognition of his important contributions to Diptera taxonomy, especially of the families Psychodidae and Tabanidae, and in appreciation of his friendship and good will as a retired colleague at the Florida State Collection of Arthropods, Gainesville, Florida.

DISCUSSION. *Probezzia fairchildi* is unique in the genus in the unusual length and stoutness of the proximal antennal segments, readily distinguishing it from all other *Probezzia* species. In size and color markings this species greatly resembles the North American species of *Macropeza*, a closely related Sphaeromiine genus (Wirth & Ratanaworabhan 1972a, Knausenberger & Wirth 1980). In *Macropeza*, however, the female fifth tarsomeres have fewer ventral batonnets; the female claws are short and curved, stout at the base and pointed apically; the r-m crossvein is elongate; and the hind tarsi are often greatly elongated.

Probezzia glicki Wirth, New Species

DESCRIPTION. Female Holotype. Wing length 2.08 mm. Antenna slender, pale yellow, segments 11-15 infuscated; lengths of flagellar segments 107-90-90-90-98-90-90-107-

126-137-144-155-159 microns; antennal ratio 0.95. Palpus whitish, lengths of segments 28-43-72-44-43 microns. Thorax dark brown; coxae and trochanters yellowish white. Legs yellowish white, fore femur dark brown on distal 3/4, mid and hind femora dark on distal 1/2; tibiae with narrow bases and apices brown. Tarsal claws moderately long and slender. Wing pale on proximal 1/2, faintly infuscated on distal 1/2. Halter pale. Abdomen pale, segments 7-8 brown. Spermathecae greatly unequal, the larger elongate oval, tapering distally to stout neck; the smaller short oval, not tapering, with short slender neck; measurements 143 x 83 microns including neck, and 86 x 65 microns.

Male. Unknown.

DISTRIBUTION. Alabama.

TYPES. Holotype female, **Alabama**, Tallapoosa Co., 2.2 mi SW Camp Hill at Hwy. 34, 15.vi.1988, W. E. Garrett. Paratype, 1 female, **Alabama**, Dallas Co., Marion Junction, Black Belt Substation, 21-23.v.1978, J. I. Glick; 1 female, same data but 25-27.vi.1978.

ETYMOLOGY. This species is named for Jayson I. Glick in recognition of his superb but unpublished taxonomic study of the Ceratopogonidae of Alabama as a graduate student at Auburn University.

DISCUSSION. *Probezzia glicki* resembles *P. xanthogaster* in leg markings, pale abdomen, and pale halter, but *P. xanthogaster* differs in having the wing and abdomen entirely whitish.

Probezzia meadi Wirth, New Species

DESCRIPTION. Female Holotype. Wing length 1.65 mm; breadth 0.58 mm. Antenna relatively short, entirely brown; lengths of flagellar segments 90-51-51-47-47-47-62-125-125-136-136-169 microns; antennal ratio 1.55. Palpus brown; lengths of segments 14-32-57-47-47 microns. Thorax black. Legs with femora and tibiae dark brown; femora with bases slightly paler. Claws long and slender, slightly curved, the basal tooth unusually slender, nearly half as long as claw. Wing entirely infuscated, the veins dark brown. Halter pale. Abdomen pale brown, segments 8-9 dark brown. Spermathecae oval, unequal, measuring 108 x 80 microns and 87 x 67 microns.

Male. Unknown.

DISTRIBUTION. Alabama, Florida.

TYPES. Holotype female, **Florida**, Jackson Co., Florida Caverns State Park, 4.v.1970, W. W. Wirth, light trap. Paratypes, 25 females, as follows: **Alabama**: Tallapoosa Co., Sandy Creek, 3.5 km WSW of Camp Hill at Hwy 34, 15.vi.1988, W. E. Garrett, 1 female. **Florida**: Escambia Co., Walnut Hill, vi.1969, F. S. Blanton, light trap, 1 female. Jackson Co., same data as holotype, 9 females; same data but 26.v.1973, 12 females. Leon Co., 3 mi N Tallahassee, v.1970, FSB, light trap, 1 female. Santa Rosa Co., Jay, v.1962, T. W. Boyd, light trap, 1 female.

ETYMOLOGY. This species is dedicated to Frank W. Mead, Florida State Department of Agriculture and Consumer Services, in recognition of his many years of dedication to the collection and study of Florida Diptera, and in appreciation of his long and close friendship.

DISCUSSION. *Probezzia meadi* resembles the Neotropical species of the genus *Neobezzia* Wirth and Ratanaworabhan (1972b) in its long, slender claws of the female, but *Neobezzia* species lack the strong mesonotal spines, the costa does not reach the wing tip (costal ratio 0.87-0.95), and the male parameres are fused on the distal half. *Probezzia meadi* resembles *P. nigra* Wirth and *P. ludoviciana* Wirth, but the two related species are larger and the female antennal segments 3-10 are pale.

Probezzia weemsi Wirth, New Species

DESCRIPTION. Holotype Female. Wing length 1.95 mm; breadth 0.57 mm. Antenna long and slender, segments 2-10 pale, 11-15 infuscated; lengths of flagellar segments

93-72-72-72-72-72-90-143-143-143-162-180 microns; antennal ratio 1.41. Palpus pale, lengths of segments 18-36-65-36-43 microns. Thorax dark brown; coxae and trochanters pale; femora dark brown distally, pale at extreme base on fore leg, on proximal 1/3 to 1/2 on mid and hind legs; tibiae dark at extreme base, fore tibia dark at extreme tip; distal 1/3 of mid tibia and distal 2/3 of hind tibia brownish. Wing entirely pale, appearing hyaline rather than whitish. Halter pale. Abdomen entirely yellowish white. Spermathecae slightly unequal, slightly ovoid, tapering slightly to short slender necks; measuring 102 x 78 microns and 80 x 62 microns.

Male Allotype. Wing length 1.18 mm; costal ratio 0.73. Coloration as in female, but hind tibia infuscated on distal 1/3. Antenna with plume and segments 3-12 pale, 13-15 brown; lengths of flagellar segments 72-43-43-43-43-43-43-43-57-80-90-126-143. Genitalia typical of the genus.

DISTRIBUTION. Northern Florida.

TYPES. Holotype female, allotype male, **Florida**, Jackson Co., Florida Caverns State Park, 26.v.1973, W. W. Wirth, light trap. Paratypes, 20 females, same data as types.

ETYMOLOGY. This species is dedicated to Howard V. Weems of the Florida Department of Agriculture and Consumer Services, in recognition of his many years of enthusiastic leadership in the development of the Florida State Collection of Arthropods, and in appreciation of his close and long lasting friendship.

DISCUSSION. *Probezzia weemsi* resembles the northeastern species, *P. xanthogaster* Kieffer, with its pale wing, halter, and abdomen, but differs in leg markings, the tibiae in *P. xanthogaster* being entirely pale except for the extreme tip of the hind pair.

NOTES ON GEOGRAPHIC DISTRIBUTION

The genus *Probezzia* presently is known only from 23 North American species, three of which also occur in Eurasia. The distribution of the genus is primarily in the northeastern United States and eastern Canada (12 species); while three species (*concinna*, *fuscipennis*, and *seminigra*) occur in Eurasia, western Canada, and northwestern United States; four species (*bottimeri*, *ludoviciana*, *nigra*, and *rosewalli*) occur only in the Gulf Coast states; and four species (*fairchildi*, *glicki*, *meadi*, and *weemsi*) occur only in Alabama and northern Florida.

The occurrence of three undescribed species of *Probezzia*, along with two known species, *P. albitibia* Wirth and *smithii* (Coquillett), in the same collections at Florida Caverns State Park, and a fourth new species in nearby parts of Alabama, points to this area as a probable center of endemism for this genus in the southeastern United States. Berner (1950) stated in his monograph on the Florida mayflies (Ephemeroptera): "The Apalachicola River drainage has without doubt been the main highway of ingress to Florida for the great majority of animals which require flowing water or hardwood forest." Rogers (1933) found that the ecological conditions existing in the Apalachicola drainage would admirably explain the distribution of many northern crane flies (Tipulidae) in Florida. Neill (1957) gave a valuable summary of plant and animal distribution illustrating "northern disjuncts" in the Florida panhandle. Carr (1940) reported that the most extensive invasion of Florida by the northern element is encountered in that portion of the panhandle which is drained by the Apalachicola River.

Hubbell (1936: 354) stated that "in this peculiar environment [the deep ravines of the Apalachicola region] a great many Northern plants occur, evidently the remnants of a Northern flora left as relicts from Pleistocene times in these deep, moist, cool ravines . . . It has also been noted that many Northern plants reach their southernmost limits in these ravines and that many typically Southern plants intermingle here with the Northern species. Not only is this true of plants, but such has proved to be the case in the crane flies, the Odonata, the Opilionids, the Orthoptera, the crayfish, the amphibians, and the reptiles. Many of the species of mayflies which have entered the state have spread out from the Apalachicola drainage and now occupy rather wide ranges in

Florida, but there are certain forms which seem to be more or less confined to this region."

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