

The subgenus *Atrichopogon* (*Lophomyidium*) with a revision of the Nearctic species (Diptera: Ceratopogonidae)

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Abstract

Atrichopogon Kieffer, subgenus *Rostropogon* Remm, is a junior synonym of the subgenus *Lophomyidium* Cordero (**NEW STATUS, NEW SYNONYMY**). *Monohelea ocumare* Ortiz from Venezuela is transferred to *Atrichopogon* (*Lophomyidium*) (**NEW COMBINATION**). The Holarctic species *Atrichopogon polydactylus* Nielsen is a junior synonym of *A. fuscus* (Coquillett), a widespread and common species previously reported from only the Western Hemisphere. Four Nearctic species are described as **NEW SPECIES**: *A. jamnbacki* from salt and brackish marshes along the Atlantic coast from Nova Scotia to North Carolina; the following freshwater species, *A. deyrupi* from southern Florida; *A. archboldi*, from southern Florida, Texas and California, and southward well into the Neotropical Region; and *A. borkenti*, from western Canada. The larvae of *A. (Lophomyidium)* are found on wet wood, soil, and stones in marshy habitats. Adults of *A. fuscus* have been observed feeding on insect carrion in spider webs.

Introduction

The Northern Hemisphere species of the genus *Atrichopogon* Kieffer with an elongate proboscis have long been a source of confusion. *Atrichopogon rostratus* (Winnertz 1852), a common and widespread European species, was for many years the only known species of this group, and was named the type-species of the subgenus *Rostropogon* Remm in 1979. In 1951, Nielsen described *Atrichopogon polydactylus*, the second Palaearctic species of this group, from Denmark. He compared it with *A. rostratus*, but did not give actual characters by which it could be distinguished; moreover he stated (p. 63) that "The larva perhaps cannot be distinguished from that of *A. rostratus* Winnertz, described by Lenz . . ."

In North America, Coquillett (1901) described *Atrichopogon fuscus* from four northeastern states, and Malloch (1915), Thomsen (1937), Wirth (1952, 1974), and Boesel (1973), among others, gave additional descriptions, including immature stages, figures, notes, and distribution indicating that this species was widespread over most of North America and ranged south to Costa Rica and Brazil. In 1958, Ewen and Saunders described all stages of *A. polydactylus* from Saskatchewan, but did not compare the species with *A. fuscus* or *A. rostratus*.

Thus a critical comparison of the three species *A. rostratus*, *A. polydactylus*, and *A. fuscus*, has never been published. J. A. Downes (in litt.) informed me in 1979 that he suspected that Ewen and Saunders' Saskatchewan rearings were not of the Palaearctic *A. polydactylus*, but of the Nearctic *A. fuscus*, but this opinion was never published.

In response to my request to borrow the types of *Atrichopogon polydactylus* from the Zoologisk Museum in Copenhagen, Leif Lyneborg referred me to Ryszard Szadziewski to whom Nielsen's types had been loaned. Dr. Szadziewski kindly let me study the types during his 1991 visit to Florida, and loaned me short series of the two Palaearctic species, *A. rostratus* and *A. polydactylus*. He pointed out that the two species were readily separable by comparison of the size and shape of the female spermathecae and the setation of the paratergites.

Published Neotropical records of *Atrichopogon fuscus* and the accumulation of a large number of Neotropical specimens of this and related, undetermined species in the collections of the U.S. National Museum of Natural History necessitated a search of the Neotropical literature for records of species of this group. In 1929, Cordero described the males of *Lophomyidium uruguayense*, new genus and species, from Uruguay. The excellent description and

figures indicate clearly that *L. uruguayense* is a member of the *rostratus* group of *Atrichopogon*. *Lophomyidium* Cordero 1929 thus has taxonomic priority over *Rostropogon* Remm 1979 (NEW SYNONYMY). Ortiz (1952, 1972) described *Monohalea ocumare* from a male from Venezuela. His description and figures indicate that *ocumare* is a species of *Atrichopogon* (*Lophomyidium*) (NEW COMBINATION), but lack sufficient details for a comparison with other species. A taxonomic revision of the Neotropical species of *Lophomyidium* will be necessary to establish the specific identities of *A. uruguayensis*, *A. ocumare*, and the other three described species of this subgenus in South America, *A. fuscus* (Coquillett 1901), *A. taeniatus* Macfie (1939), and *A. delpontei* Cavalieri and Chiossone (1973).

The purpose of this contribution is to compare the three nominate northern hemisphere species critically, and to re-examine all available North American specimens that would fall in the subgenus *A. (Lophomyidium)* in a taxonomic revision of the Nearctic species.

Explanation of the taxonomic characters used can be found in the general papers on Ceratopogonidae by Wirth (1952) and Downes and Wirth (1981). Terminology for the larvae and pupae follows that of Ewen and Saunders (1958). Measurements are given in microns unless otherwise specified.

Because of the enlargement of the clypeal region (Fig. 46) in this group of species, the measurement of length of proboscis and calculation of the proboscis/head ratio (P/H Ratio) is made differently from that traditionally used in ceratopogonid taxonomy. In this paper proboscis length is measured from the base of the clypeus to the tip of the labrum-epipharynx. A special P/H Ratio is derived by dividing the distance from the dorsal margin of the clypeus to the tip of the labrum-epipharynx by the distance from the clypeal margin to the upper head margin as seen in unflattened slide mounts in anterior view. This modification is made because it seems that the elongated proboscis is made up in large part by the unusual elongation of the clypeal region, rather than the portion from the tormae to the tip of the labrum-epipharynx as in some other Ceratopogonidae. Boesel (1973) also measured the proboscis length from the base of the clypeus to the tip of the proboscis.

Details of the structure of the male and female mouthparts of *Atrichopogon* were published by Goetghebuer (1923a) for *A. fuscus* (Meigen), by Gad

(1951) for *A. pollinivorus* Downes [misidentified as *A. pavidus* (Winnertz)] and by Glukhova (1981) for eight species of *Atrichopogon*, including *A. rostratus* (Winnertz). Glukhova divided the species she studied into four groups based on differences in structure of the female mouthparts. She placed *A. rostratus* in her Group III, giving the following comments:

"[Group III] also has only one species, *A. rostratus* (Winn.), typified by an unusually long proboscis in both female and male. Length of proboscis equal to head depth and not inferior in relative length to proboscis of blood-sucking *Culicoides*. All parts of proboscis elongated, slightly conical, with practically parallel margins. Mandibular teeth of unusual shape for the entire genus, very pointed and triangular. Pubescence of labrum resembling that in group I, but bristles shorter, and hypopharynx closer in shape to that of species in group II." According to Glukhova, in *Atrichopogon* the only piercing parts are the mandibles; the labrum and hypopharynx, devoid of armature, are not piercing parts. In some species the laciniae are somewhat elongated and provided with distal teeth, suggesting that they are more or less involved in biting.

McKeever et al. made comparative studies of four species of *Culicoides* (1988) and ten species in seven genera of the tribe Ceratopogonini (1991) by examination with light and scanning electron microscopy. Their studies portrayed minute details of mouthpart structure of ceratopogonid midges for the first time. They presented SEM photographs comparing the mandibles, laciniae, labrum, and hypopharynx of males and females. I am greatly indebted to Dr. McKeever for his cooperation in dissecting and photographing several species from the present study. With his generous permission I present his SEM photographs of the following species (Figs. 1-12): Female mandible of *Atrichopogon fuscus* (Fig. 2) and its tip enlarged (Fig. 1); same for *A. jamnbacki* (Figs. 3-4); and *A. deyrupei* (Figs. 5-6). For *A. jamnbacki*, female labrum (Fig. 7) and lacinia (Fig. 8); and male mandible (Fig. 9), labrum (Fig. 10), hypopharynx (Fig. 11), and lacinia (Fig. 12).

The morphology of the larvae and pupae is not treated here in detail because it was described and figured in excellent papers by Nielsen (1951) and Ewen and Saunders (1958) under the name *Atrichopogon polydactylus*. I will merely point out diagnostic characters and give supporting illustrations for the two species whose immature stages are

known, *A. fuscus* and *A. jamnbacki* (Figs. 21-27, 32-33).

Holotypes and allotypes of the new species herein described, unless otherwise specified, are deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D.C. (abbreviated USNM). Paratypes, when available, will be deposited in the Florida State Collection of Arthropods (FSCA), Gainesville; California Academy of Sciences (CASC), San Francisco; Canadian National Collection (CNCI), Ottawa; British Museum (Natural History) (BMNH), London; Museum National d'Histoire Naturelle (MNHN) in Paris; and Museum de La Plata (MLPA), Argentina.

Subgenus *Lophomyidium* Cordero

Lophomyidium Cordero, 1929: 94. Type-species, *Lophomyidium uruguayense* Cordero, by original designation.

Atrichopogon, subgenus *Rostropogon* Remm, 1979: 57. Type-species, *Ceratopogon rostratus* Winnertz, by original designation. NEW SYNONYMY.

Note on Synonymy. Ingram and Macfie (1931: 172) stated: "*Lophomyidium* is almost certainly *Atrichopogon*. Cordero's very detailed description and numerous illustrations of the only species, *L. uruguayense*, including a figure of the hypopygium in ventral view, leave little doubt of this, for if R2 is not clearly shown in the figure of the wing, its position is suggested, and the anomalous features, the palp with seven segments and the cushion-shaped empodium, may be explained as due to misinterpretation of appearances seen in a mounted specimen."

Diagnosis. Large species (wing length 1.58-1.80 mm) with long, usually downcurved proboscis. Eyes bare. Palpus (Fig. 14) 5-segmented, long and slender, third segment with deep sensory pit located well distad of midlength of segment. Proboscis (Fig. 46) elongate, exceeding height of head, slender, curving slightly backward apically. Female mandible (Figs. 1-6, 15, 28, 38) with distinct but small teeth; fulcrum located well proximad of midlength of mandible (Figs. 2, 6). Tip of fore tibia with a prominent projecting brush on anterior margin. Body frequently with whitish opaque subcutaneous fat bodies. Wing of males usually without macrotrichia on membrane, in females (Fig. 16) macrotrichia moderately numerous on distal fourth

to half of wing and usually extending into anal cell. Female abdomen without armature of stout spines on distal sternites; two spermathecae (Fig. 17). Male genitalia (Figs. 19-20) typical of the genus; sternite 9 without deep caudomedian excavation, with numerous scattered setae.

Note. I am indebted to Ryszard Szadziewski (in litt.) for calling to my attention a useful character on the thorax of adult *Atrichopogon*. This genus differs from *Forcipomyia*, the other genus of Forcipomyiinae, by its well-developed paratergite, which forms a distinct lens-shaped sclerite below the lateral margin of the scutum. In *Atrichopogon* the paratergite always bears midway near its ventral margin a long, bristle-like seta. In the group of species, mainly Nearctic, that I refer to as the *fuscus* Group, with 4 strong marginal bristles on the scutellum, the paratergite is otherwise completely bare of setae except in one Palaearctic species, *A. rostratus*, in which the paratergite also bears 1-6 additional small setae. A second group of species with 6 marginal scutellar bristles, that I refer to as the *archboldi* group, mainly Neotropical in distribution, is characterized by the presence of a vestiture of 5-20 scattered small setae on the paratergite in addition to the strong bristle.

Immature Stages. The larvae of *Lophomyidium* species are characterized by the absence of the transverse, elliptical, well-tracheated membranous areas on the dorsum of the mesothorax and abdominal segments I to VII, believed to be respiratory in function. Instead, larvae of this subgenus have the mediadorsal and laterodorsal processes elongated, thin-walled, and well provided with tracheae, thus likely functioning as tracheal gills (Figs. 21-14, 32-33).

The pupae (Fig. 25) of *Lophomyidium* differ from other *Atrichopogon* pupae in the rather tubular shape of the respiratory horn and the presence of many (40-90) spiracular openings in a much convoluted, U-shaped row looping around the distal end and reaching to near base of the tube on the posterior side (Figs. 26, 27). Abdominal segments II to VIII have thin-walled, slender, fingerlike, posteriorly-bent tracheal gills arising just anterior and dorsal to the well-developed, spinulose, lateral processes.

Distribution. Holarctic, Neotropical.

Included Species.

archboldi Wirth, new species. U.S.A. (Florida).
borkenti Wirth, new species. Canada (British Columbia).
delpontei Cavalieri & Chiossone, 1973: 121. Argentina.
deyrupi Wirth, new species. U.S.A. (Florida)
fuscus (Coquillett), 1901: 603 (*Ceratopogon*). U.S.A. (New Jersey).
jamnbacki Wirth, new species. U.S.A. (New York).
polydactylus Nielsen, 1951: 27. Denmark. Synonym of *fuscus* (Coquillett).
putredinus Kieffer, 1922: 233. Germany. Synonym of *rostratus* (Winnertz).
rostratus (Winnertz), 1852: 31 (*Ceratopogon*). Germany.
taeniatus Macfie, 1939: 186. Brazil.
uruguayensis (Cordero), 1929: 95 (*Lophomyidium*). Uruguay.

Key to the Nearctic Species of *Atrichopogon* subgenus *Lophomyidium*

1. Scutellum with 4 strong marginal bristles; female mandibular teeth perpendicular to axis of mandible (Figs. 1, 15) 2
- Scutellum with 6-8 moderate to strong marginal bristles; female mandibular teeth slanted (oblique to mandibular axis, figs. 5, 38) or perpendicular 3
2. Proximal antennal segments of female moniliform; spermathecae (Fig. 34) subequal, elongate oval to ovoid with short slender necks; male genitalia (Fig. 31) short and broad, gonocoxite greatly swollen, 1.5 times longer than broad *jamnbacki* n. sp.
- Proximal antennal segments of female 0.7 as long as broad (Fig. 13); spermathecae (Fig. 17) unequal, short, oval, with short, stouter necks; male genitalia (Fig. 20) more elongate, gonocoxite 3 times longer than broad *fuscus* (Coquillett)
3. Distal antennal segments (Fig. 37) short, segment 11 about 3 times length of 10 in female, antennal ratio 2.20; mandibular teeth perpendicular to slightly oblique; spermathecae (Fig. 40) subequal, elongate-ovoid with long tapering necks *borkenti* n. sp.
- Distal antennal segments elongate, 11 about 3.5 times length of 10 in female (Figs. 13, 30) antennal ratio 2.35; mandibular teeth markedly oblique (Fig. 38); spermathecae without long tapering necks 4

- 4(1). Palpal segments 1-3 yellow, 4-5 brown (Fig. 35); tibiae with pale long extensor bristles; female wing less hairy, macrotrichia smaller, 10-15 in anal cell, membrane whitish; spermathecae (Fig. 41) equal, oval, large, 150 by 108 microns *deyrupi* n. sp.
- Palpus entirely brown; tibiae with strong brown extensor bristles; female wing hairier, macrotrichia larger, 20-30 in anal cell, membrane grayish; spermathecae (Fig. 45) unequal, small, the larger 100 by 62 microns, ovoid tapering to short neck *archboldi* n. sp.

Note: The Palearctic species, *A. rostratus* (Winnertz), keys out with *A. fuscus* and *A. jamnbacki* but differs from both in its larger spermathecae (lengths 185 and 150 microns) and shorter proboscis (P/H Ratio 1.71).

Atrichopogon fuscus (Coquillett) (Figs. 1-2, 13-23, 25-26, 33)

Ceratopogon fuscus Coquillett, 1901: 605 (male, female; D.C., N.J., N.H., Me.); Kieffer, 1906: 53 (catalog reference); Malloch, 1915: 305 (all stages; Ill.; figs.).

Atrichopogon fuscus (Coquillett); Ingram & Macfie, 1922: 244 (combination); Thomsen, 1937: 65 (notes on immature stages); Johannsen, 1943: 777 (in list; N. Amer. distr.); Wirth, 1952: 118 (male, female; Calif.; distr.; figs.); Wirth, 1956: 242 (Brazil, Costa Rica; in flowers of *Hevea*); Wirth & Stone, 1956: 429 (Calif.; in key to species); Snow, et al., 1957: 18; Lewis, 1959: 18 (Conn.; seasonal distr.); Cole, 1969: 91 (notes and distr.); Boesel, 1973: 209 (male, female redescr.; distr.; fig. male, female wings); Wilkening et al., 1985: 514 (Fla. records).

Atrichopogon polydactylus Nielsen, 1951: 27 (all stages; Denmark; figs.); Ewen & Saunders, 1958: 715 (all stages; figs.; Canada (Sask.); Remm, 1988: 87 (in Palearctic catalog; Palearctic distr.). **NEW SYNONYMY.**

Atrichopogon rostratus (Winnertz) of authors, misident., in part; Goetghebuer, 1920: 31 (Belgium); Kieffer, 1925: 55 (France, northern Europe); Edwards, 1926: 400 (Great Britain); Goetghebuer & Lenz, 1934: 22 (northern European records); Tokunaga, 1940: 266 (Japan); Remm, 1961: 926 (USSR; fig. head).

Kempia fusca (Winnertz), misident. in part; Goetghebuer, 1923b: 176 (larva only; fig.; see note in Nielsen 1951: 63); Goetghebuer & Lenz, 1934: 110 (larva).

Description: Female (from Alexandria, Va.). Wing length 1.68 mm; breadth 0.72 mm; costal ratio 0.79.

Head: Uniformly brownish. Antenna (Fig. 13) with proximal flagellar segments 0.7 as long as broad; flagellar segments lengths 54-36-32-32-32-32-34-36-115-108-122-118-165 microns; antennal ratio 2.20. Palpus (Fig. 14) segments lengths 54-63-80-54-69 microns; third segment slightly swollen on distal half, sensory pit relatively shallow; palpal ratio 2.45. Proboscis relatively short, length 575 microns; P/H Ratio 2.03. Mandible (Figs. 1, 15) with 20 perpendicular teeth, the proximal teeth only slightly smaller.

Thorax: Dull to subshining dark brown, humeral areas often paler; scutum with uniform short, semi-appressed, pale, hairlike setae; paratergite with 1 long bristle-like seta. Scutellum dull yellowish, with four long brown marginal bristles and many short, fine, hairlike setae. Legs yellowish, including coxae, with short, fine yellowish setae; tibiae with longer, pale extensor setae. Hind leg with lengths from femur to T5, 780-720-420-158-108-72-72 microns; tarsal ratio 2.64. Wing (Fig. 16) with pale grayish membrane with coarse microtrichia; macrotrichia numerous on distal fourth of wing, 24 in anal cell; anterior veins yellowish to pale brownish, second radial cell 3.0 times length of first. Halter pale.

Abdomen: Pale brown, darker on sides; terga with sparse, short, fine, hairlike setae. Genital sclerotization inconspicuous, as in Fig. 18. Spermathecae (Fig. 17) short oval to ovoid with short slender necks; unequal, 101 by 72 and 87 by 58 microns.

Male. Wing length 1.10 mm; breadth 0.52 mm; costal ratio 0.71.

Similar to female with usual sexual differences; darker than female, legs and scutellum often brownish; wing without macrotrichia. Antenna with brownish plume; segments 11-15 with lengths 54-83-191-158-172 microns. Hind leg with lengths from femur to T5, 740-700-475-144-108-72-72 microns.

Genitalia (Fig. 20): Ninth tergite 1.5 times longer than broad, posterior margin evenly rounded, with long, pale-brown bristles; ninth sternite with numerous, inconspicuous, fine, pale setae, caudomedian excavation scarcely evident. Gonocoxite moderately slender, 2.6 times longer than broad, arcuate, bowed laterad, basal apodeme small, rounded; gonostylus 0.77 as long as gonocoxite, stout and nearly straight proximad, tapering to slightly bent, slender tip. Aedeagus (Fig. 19) 0.77 as long as basal breadth, basal arms

short, stout, reflexed laterad; basal arch to 0.44 length of aedeagus, posterolateral shoulders rounded, well developed; posterior margin of main body with a narrow sclerotization, transverse medially, bent laterocephalad in a distinct angle (this sclerotization sometimes concave in midportion of median and lateral sections, the main body appearing bilobed); distomedian process short, in ventral view with caplike flaring tip, a pair of sclerotized lines extending obliquely laterocephalad from lateral margins to basal arch.

Immature Stages. Larva (Fig. 21, from Downes & Wirth 1981): Description from Ewen & Saunders (1958). "Length about 4.9 mm. Color orange-brown, head dark. Head: Eye [Fig. 22] set high, raised above surface; all setae simple, seta 7 short, seta 10 represented by two close-set, slender bristles; antennal socle shorter than width at base. Body segments: Seta *a* and *b* on prothorax [Fig. 23] to eighth abdominal; seta *c* on mesothorax to seventh abdominal; setae *d*, *e*, and *f* on prothorax and abdominal segments I to VII, about two-thirds as long as segment, one of the three lacking on meso- and meta-thorax and eighth abdominal; mediodorsal and laterodorsal processes extended into long, slender, finger-like gills on mesothorax to eighth abdominal, small on prothorax; dorsoanal process very small on prothorax, lacking on remaining segments; lateral process well developed on meta-thorax to eighth abdominal, smaller on mesothorax; paired pigmented sclerites on laterodorsal surface of prothorax. Prothoracic pseudopod deeply cleft, each lobe with a posterior row of eight hooklets and an anterior row of four; anal pseudopod with an anterior row of six pairs of hooklets and a posterior row of five pairs."

To the above diagnosis the following notes may be added: Integument of head lacking nodules or ridges of irregular sculpture found in most *Atrichopogon* larvae. A pair of short, stout, blunt, brownish spurs present laterally near hind margin of head. Body with irregular patches of dark brown integumental pigment, more extensive on anterior segments; integument with dense vestiture of short, stout, sharp-pointed spinules, these longer and denser on sides of body and at bases of laterodorsal processes. Laterodorsal process on prothorax a low spiculose mound bearing a short stout seta (*b*). Last abdominal segment (Fig. 33) with a rectangular pigmented plate bearing two pairs of long setae, posterolateral pair strong.

Pupa (Fig. 25, from Nielsen 1951): Description from Ewen & Saunders (1958). "Length about 2.2 mm. Exuvia pale yellowish. Frontal and epicranial processes small, setae simple. Thoracic process 3 reduced to an inconspicuous node, others styliform, covered with small spinules. Lateral processes of abdominal segments I to V slender, unbranched, and covered distally with small spinules; mediodorsal processes short; mediodorsal and lateral setae short, slender, on abdominal segments I to V. On the lateral surfaces, abdominal segments II to VIII have thin-walled, fingerlike processes which probably have a respiratory function. Respiratory horn [Fig. 26] cylindrical, with a U-shaped row of spiracular papillae, the anterior part of which eventually bends across the dorsal side of the tube to continue proximally on the posterior surface."

Variation. Samples from California and some other western states are markedly darker in color and the male aedeagus usually has the posterior sclerotization of the main body more distinctly bilobed. However, no significant differences in measurements could be found in these samples.

Types. *Ceratopogon fuscus* Coquillett: "Three males and four females, Washington, District of Columbia (May 12, F. C. Pratt); Riverton, New Jersey (April 30, C. W. Johnson); Mount Washington, New Hampshire (Mrs. A. T. Slosson); and Waldboro, Maine (J. H. Lovell). Cat. No. 5476, U.S.N.M." Lectotype male (pinned), Riverton, N.J., designated by Wirth (1952: 119) as: type locality, Riverton, N.J. (type male in USNM). Also District of Columbia, New Hampshire, and Maine." Examined May 1991 by courtesy of B. V. Peterson, U.S. Department of Agriculture.

Atrichopogon polydactylus Nielsen: Holotype female (rearing no. LV); allotype male (rearing LIV); head, right wing, middle and hind tarsi, as well as abdomen mounted as slide preparations. Paratypes: 1 female. Type locality: Denmark, Jutland, Himmerland Prov., Rold Skov Forest, 1947-48. A. Nielsen. Through the courtesy of Leif Lyneborg of the Zoologisk Museum in Copenhagen and Ryszard Szadziewski of the University of Gdansk, I was able to examine the holotype, mounted on two slides: Slide 1, female; and slide 2, larval and pupal exuviae of the holotype female.

Distribution. Widespread in northern Eurasia, North America, and south in West Indies, Central and South America to Brazil and Bolivia.

Specimens Examined. Eurasia. BELGIUM: St. Jean in Eremo, 14.viii.1938, M. Goetghebuer, 1 male (det. *rostratus* by Goetghebuer) (USNM). ESTONIA: Lelle, 11.vi.1960, H. Remm, 1 male, 1 female (USNM). ENGLAND: Cheshire, Skirwith, vi.1927, H. Britten, female (USNM). JAPAN: Honshu, Kyoto Pref., Midoro Pond, vi.1955, P. H. Arnaud, Jr., light trap, 3 males, 1 female (USNM); Kyoto, 8.v.1953, P. W. Oman, 2 females (USNM). POLAND: Babia Gora, Zawoja-Czatoia, 3.vii.1989, R. Szadziewski, 1 female. Bryzno at Zarnowiec Lake, 8.vii.1980, RS, 1 female. Kunicha near Sztabin, 5-24.viii.1985, J. Krzywinski, at Apiaceae flower, 1 male, 1 female. Silec, dist. Ketrzyn, 7.viii.1979, at lake, 2 females, RS; Silec, at pond, 15.vii.1981, R.S., 1 female. Sztabin, 5.viii.1985, JK, 1 female. SCOTLAND: Dunoon, vi.1912, J. R. Malloch, 1 female (USNMN); Luss, 21.vi.1960, J. A. Downes, 1 female (CNCI). TURKEY: Celik Golu, Adiyaman, 900 m, 21.vi.1985, H. Schacht, 1 male, 2 females (Borkent coll. CD1273).

Canada (all from CNCI Collection except as noted). ALBERTA: Brooks, 3.vii.1955, J. A. Downes, 1 female. Kananaskis Envir. Sci. Ctr., 24.vii.1973, JAD, 6 males, 14 females. Waterton Lakes Nat. Park, 7-12.vii.1980, H. J. Teskey, 11 females. BRITISH COLUMBIA: Anahim Lake, 10 km SW, 3-5.vii.1992, A. Borkent, sweeping flowers of *Cecula*, 1 female; 47 km W, 14.vii.1992, AB, 2 females (Borkent coll.). Atlin, 660 m, vi.1955, H. Huckel, 3 males, 3 females. Lac Le Jeune, 27.vi.1973, HJT, 1 female. McQueen Lake, 10 km N Kamloops, 18.vi.1973, HJT, 1 female. Salmon Arm, 3 km E, 4.v.1992, AB, sweeping flowers of *Acer*, 2 females (Borkent coll.). MANITOBA: Churchill, 26.vii.1951, JAD, 4 males, 3 females; 15.vii-7.viii.1953, JAD, 3 males, 2 females; 13.viii.1981, 31.vii, 3.viii.1983, JAD, 3 males, 1 female; 19.vii.1947, T. N. Freeman, 1 female; 10.vii.1947, B. Hocking, 1 female; 17-26.vi.1948, G. E. Shewell, 3 females. Churchill, Warkworth Creek, 3-13.viii.1953, JAD, 2 males, 3 females; Whiteshell Prov. Park, Brereton Lake, 24.ix.1967, S. Smith, about spider web, 2 females. NEW BRUNSWICK: Chamcook, 30.vi.1966, GES, 4 females; Birch Cove, Chamcook, 14.vii.1957, ex flowers of *Eupatorium perfoliatum*, GES, 4 females. Kouchibouguac Nat. Park, 2.vii.1977, J. R. Vockeroth, 2 males, 2 females; vii.1977, 26.vii.1978, I. M. Smith, 6 males, 3 females; 8-14.vii.1978, JAD, 13 males, 4 females. St. Andrews, 9.viii.1957, GES, 1 female. NEWFOUNDLAND: St. Johns Agr. Exp. Sta., 9.viii.1967, J. F. McAlpine, 3 females. NOVA SCOTIA: Cape Breton Highlands Nat. Park, South Harbour, 19.vi.1983, JRV, 2 females. Cheticamp, 6.vi.1984, B. E. Cooper, 2 males, 16 females. Kentville, 6.viii.1958, JRV, 1 female. Lawrencetown, Halifax Co., 19-20.vii.1967, D. M. Wood, 1 male, 4 females. Smiths Cove, 6.viii.1925, A. Gibson, 2 females. ONTARIO: Algonquin Park, 25.vi.1966, S. Smith, 3 females. Almonte vic., 9, 21.v.1954, JAD, 3 males, 3 females. Bells Corner, Ottawa, 4.vi.1952, JFM, 1 female. Black Lake, N. Burgess Twp., 29.vii.1972, JAD, on spider web, 2 females; 10.vii.1977, JAD, 1 male, 10 females. Carleton Place, 27.vii.1959, C. H. Mann, 1

female. Constance Bay, Carleton Co., 9.vi.1977, JAD, 1 male, 4 females. Ericau, 5 km E, 1-25.viii.1984, AB, 1 male (CNC coll.). Kemptville, 5.vi.1960, W. W. Wirth, light trap, 1 female (USNM). Marmora, 30.v.1952, JRV, 1 female; 27.viii.1952, JFM, ex *Polyporus* sp., 3 females. Maynooth, 13.viii.1965, McAlpine & Martin, ex red pine, 1 female. Mer Bleu, Ottawa, 7.vi.1923, C. H. Curran, 1 female; 15.vi.1966, D. D. Munroe, 2 females. Orilla, 18.vii.1923, C. H. Curran, 1 male. Ottawa, 12-29.vi.1954, JAD, 1 female; 28.vii.1954, E. C. Becker, ex goldenrod leaf mines, 1 female; 12.vii.1966, S. Smith, 1 female. Ottawa, Mer Bleue, 23.vi.1975, W. L. Grogan, 1 male (USNM). Ottawa, Rideau River, 29.v.1960, WWW, light trap, 1 female (USNM). Pt. Pelee Nat. Park, 22.vii.1925, G. S. Walley, 1 female; 27.vi-11.vii.1984, AB, 1 male, 1 female. Sandbank, Prince Edward Co., 8.vii.1977, JAD, 2 males, 5 females. Simcoe, 13.vi.1938, GES, 1 female. QUEBEC: Abbotsford, 11.vi.1937, GES, 1 female. Buckingham, 21.x.1953, JFM, 1 female. Dunbar Lake, St. Maurice Prov. Park, 7-8.viii.1984, AB, 9 males, 6 females. Gatineau Park, 22.vi.1966, JAD, on spider web, 1 female. Hull, 10.viii.1968, ? collector, malaise trap, 2 females. Knowlton, 25.vii.1929, L. J. Milne, 1 female. Lac LaBelle, Riviere, Laurentide Prov. Park, 8.viii.1984, AB, 33 males, 68 females. Lac LaPêche, 18.vii.1954, JAD, 1 male. Lac Phillippe, 5.viii.1955, JRV, 1 female. New Richmond, 6.viii.1938, J. E. H. Martin, 3 females. Norway Bay, 19.viii.1938, GES, 2 females. Old Chelsea, 20-26.ix, 9.x.1955, JRV, 2 males, 2 females; 20.ix.1956, JFM, 1 female. Rowanton Depot, 28-30.vii.1954, JAD, 1 male, 2 females. Rupert House, 31.vii.1940, D. P. Gray, 2 females; E. J. LeRoux, 4 females. Summit King Mtn., 350 m, viii.1965, ? collector, malaise trap, 1 female. SASKATCHEWAN: Saskatoon, Beaver Creek, 28.viii.1955, WWW, 1 female (USNM). YUKON TERR.: Alaska Hwy km 1688, Christmas Creek, 11.vi.1979, JAD, 1 male.

U.S.A. (all in collection of USNM unless otherwise noted). ALASKA: Glacier Bay, Muir Inlet, 14.vi.1965, D. M. DeLong, 1 female. Palmer, 5.ix.1963, K. M. Sommerman, jeep trap, 2 females. Summer Shades Campground, George Parks Hwy, 12.vii.1978, P. H. Arnaud, Jr., 1 male, 3 females (CASC). ALABAMA: DeKalb Co., Collinsville, Lookout Mtn., 1.vii.1968, Blanton & Jones, light trap, 4 females (FSCA). Lauderdale Co., Florence, 16.viii.1968, G. E. Smith, 2 females. Mobile Co., Dog River, vi.1968, Blanton & Cannon, light trap, 5 males, 14 females (FSCA); Theodore, Alligator Creek, 7.vi.1968, Blanton & Cannon, 1 female (FSCA). ARKANSAS: Drew Co., Monticello A. & M., 22.v.1969, P. E. Grissom, UV light trap, 1 female. CALIFORNIA: Humboldt Co., Mad River Beach, 19.viii.1948, W. W. Wirth, swampy pond, 1 male, 2 females. Monterey Co., Paraiso Hot Springs, 13 km S Soledad, 31.viii.1975, P. H. Arnaud, Jr., 6 females (CASC). San Luis Obispo Co., Alamos Creek, 22.vi.1948, WWW, 1 male; Black Lake Canyon, 22.viii.1948, WWW, swept from trees at lake margin, 11 males, 3 females. Siskiyou Co., S. Fork Sacramento River, 19.vii.1948, WWW, swept from *Dar-*

lingtonia bog, 2100 m, 1 female. Tulare Co., California Hot Springs, Deer Creek Bridge, 6.viii.1947, WWW, 1 male, 3 females; Kaweah River, 8 km E Lemon Cove, 4.vii.1947, WWW, 1 male, 1 female; Poso Creek, 6.viii.1947, WWW, under bridge, 1 male, 2 females; Springville, Middle Fork Tule River, 10.vii.1947, WWW, 2 males, 3 females. FLORIDA: Alachua Co., Gainesville, Lake Alice, vi.1969, F. S. Blanton, 1 male, 2 pupae; Gainesville, Chantilly Acres, v-viii.1967, FSB, light trap, 4 males, 8 females (FSCA); Gainesville, Oak Crest, iv-v.1985, WWW, UV light trap, 1 male, 3 females. Gilchrist Co., 15.1960, G. R. Hicks, light trap, 1 female (FSCA). Liberty Co., Torreya St. Park, iv.1952, O. Peck, 3 females (CNC); 20.v.1966, H. V. Weems, 1 male (FSCA). Orange Co., Maitland, Lake Hope, 27.iv.1985, WWW, UV light trap, 4 females. Pasco Co., Elfers, 19.iv.1952, J. R. Vockeroth, 1 female (CNCI). Pinellas Co., Tarpon Springs, 18.iv.1952, JRV, 1 female (CNCI). ILLINOIS: Dubois, 23.v.1917, J. R. Malloch, 2 females (Illinois Natural History Survey, Urbana). Mason Co., Havana, Chautauqua Park, 29.iv.1914, JRM, 1 female (INHS). Piatt Co., Monticello, Sangamon River, 28.vi.1914, JRM, 3 females (INHS). St. Clair Co., Centreville, 10.viii.1914, JRM, 1 female (INHS). KANSAS: Douglas Co., Univ. Kansas Biol. Sta., 26.vii.1966, W. R. Atchley, at light, 2 males. LOUISIANA: E. Baton Rouge Parish, Amite River, 16.v.1947, WWW, 1 female; Baton Rouge, 15.v.1947, WWW, at lights, 1 male, 5 females. MAINE: Penobscot Co., Old Town, Lake Pushaw, 1.viii.1966, WWW, light trap, 2 females. MARYLAND: Garrett Co., Cranesville Swamp, 6.v.1960, WWW, reared ex sphagnum, 1 female. Montgomery Co., Colesville, 15.vi.1977, WWW, light trap, 1 female; Forest Glen, 20.viii.1966, viii.1972, WWW, light trap, 1 male, 4 females; Plummers Id., 2.vii.1915, R. C. Shannon, 2 males. Prince Georges Co., Patuxent Nat. Wildlife Res. Ctr., 17-23.vii.1979, 1.viii.1979, WWW, malaise trap, 1 male, 2 females. Wicomico Co., Wango Beach Island, 18-24.v.1982, W. L. Grogan, Jr., malaise trap, 1 female (Grogan). MASSACHUSETTS: Middlesex Co., Bedford, 21.vii.1961, WWW, swept in swamp, 4 males, 10 females. MICHIGAN: Cheboygan Co., Douglas Lake, 8-18.viii.1959, R. W. Williams, emergence trap, Reese's Bog, 1 male. MISSISSIPPI: Jackson Co., Horn Island, 20.iv.1965, E. A. Richmond, 1 female, 5 males. MONTANA: Big Timber, 14.vii.1917, H. G. Dyar, 1 male, 1 female. NEVADA: Reno, 31.viii.1915, HGD, 1 male. Steamboat, 13.v.1915, HGD, 3 males, 3 females. NEW JERSEY: Middlesex Co., New Brunswick, 12.vii.1958, WWW, lake margin, 2 females. NEW MEXICO: Tucumcari, 15.vi.1964, W. R. Atchley, 1 male, 12 female. NEW YORK: Monroe Co., Braddock Bay, 12.vi.1963, WWW, near marsh, 2 males, 2 females. NORTH CAROLINA: Macon Co., Highlands, vii.1965, P. M. Marsh, malaise trap, 1 female. Transylvania Co., Lake Toxaway, 9-20.vii.1989, WWW, UV light trap, 1 male, 2 females. TEXAS: Aransas Co., Aransas Nat. Wildlife Refuge, 20.v.1972, WWW, 1 female. UTAH: Cache Co., Hyrum, 28.vi.1974, W. L. Grogan, Jr., 3 males, 3 females. Emery Co., Huntington, Huntington

River, 9.vi.1974, WLG, 1 female. Wasatch Co., Kamas, Beaver Creek, 22.vii.1958, B. V. Peterson, 3 females (CNCI). VIRGINIA: Alexandria, Dyke Marsh, 11.vi.1952, WWW, 2 males, 8 females. Fairfax Co., Falls Church, 8.vi.1952, WWW, stream margin, 1 female; 18.viii.1958, WWW, light trap, 1 male, 1 female. WEST VIRGINIA: Morgan Co., Largent, 3.vii.1977, WWW, malaise trap, 1 female. WISCONSIN: Shawano Co., N shore Shawano Lake, vi.1968, Blanton & Habeck, light trap, 1 female (FSCA). WYOMING: Old Faithful, Yellowstone National Park, 123.viii.1927, J. M. Aldrich, 2 males, 2 females. Teton Co., Grand Teton Nat. Park, Two Oceans Lake, 19.vii.1980, J. H. Epler, 1 female.

Discussion. In the northern Palaearctic Region *Atrichopogon fuscus* has often been misidentified as *A. rostratus* (Winnertz) (see Specimens Examined). According to Ryszard Szadziewski (in litt.) *A. rostratus* occurs in southern Europe and North Africa, while *A. fuscus* has a more northern distribution. I have examined the following specimens of *A. rostratus*: MACEDONIA: Lake Ochrid, 4-7.vi.1955, R. L. Coe, swept from vegetation by lake, 1 male, 1 female (in USNM by exchange with BMNH). POLAND: Kunicha near Sztabin, 5-24.viii.1985, Krzywinski leg., 1 female. TURKEY: Pass W. Oltu, 2209 m, Erzurum, 6.vii.1985, H. Schacht, 1 male (Borkent coll.). W. Sarikamis, 2100 m, Bahnstat, Soganli, 5.vii.1985, H. Schacht, 2 males, 5 females (Borkent coll.).

In southern South America *Atrichopogon fuscus* can be confused with *A. delpontei* Cavalieri & Chiossone which also has four scutellar bristles, but the latter differs in its larger size (wing length 1.77 mm), longer proboscis (P/H Ratio 2.80) and hairier wing (about 40 macrotrichia in anal cell). Malloch (1915a) recorded *Atrichopogon fuscus* from Illinois and described the immature stages. His figures of the male antenna, palpus, and genitalia, and female wing agree with *A. fuscus* as described here, but his figures of the female antenna and larva do not, and agree more with *A. websteri* (Coquillett) as described by Thomsen (1937).

Atrichopogon jamnbacki Wirth, new species
(Figs. 3-4, 7-12, 24, 27-32, 34)

Description: Female Holotype. Wing length 1.59 mm; breadth 0.58 mm; costal ratio 0.77.

Head: Uniformly pale brown including antenna and palpus. Antenna (Fig. 30) flagellar segments lengths 54-40-40-40-40-40-36-36-108-108-

111-122-180 microns; antennal ratio 1.95; proximal flagellar segments moniliform, as broad as long. Palpus (Fig. 29) segments lengths 3-62-118-54-62 microns; third segment slightly swollen on distal half, palpal ratio 3.30. Proboscis relatively short, length 565 microns; P/H Ratio 2.61. Mandible (Fig. 28) with 26 perpendicular teeth, teeth progressively smaller proximad.

Thorax: Pale brown, scutum darker; scutellum paler, with four long brown marginal bristles plus numerous fine hairlike setae; paratergite with one unusually strong bristle-like seta. Legs stramineous, with fine pale setae, a few long brownish extensor bristles on hind tibia. Hind leg with lengths from femur to T5, 700-695-360-144-129-79-86 microns; tarsal ratio 2.50. Wing membrane pale grayish, anterior veins pale yellowish; with coarse macrotrichia moderately numerous on distal fourth of wing, 10-15 in anal cell. Halter pale.

Abdomen: Pale brown, with irregular segmental brownish bands distally on tergites; subcutaneous pigmented bodies prominent; with moderately long, fine, pale brown setae, more numerous on pleura. Spermathecae (Fig. 34) brownish, slightly ovoid with short taper to short slender necks; subequal, each 144 by 93 microns.

Male Allotype. Wing length 1.52 mm; breadth 0.47 mm; costal ratio 0.68.

Similar to female with usual sexual differences. Body darker brown; legs pale brownish. Wing nearly bare, only a few macrotrichia near wing tip. Antenna with dark brown plume; segments 11-15 lengths 54-72-180-144-191. Hind leg with lengths from femur to T5, 720-630-318-144-122-86-86 microns; tarsal ratio 2.20.

Genitalia (Fig. 31): Globose, slightly broader than long; ninth tergum 252 microns long by 273 microns wide, nearly circular in profile with truncated base. Gonocoxite much swollen, 151 microns long by 97 microns wide, inner margin with relatively dense fine hairlike setae; gonostylus relatively slender, slightly curved to slender tip, 162 microns long. Aedeagus diagnostic, relatively longer and narrower than in related species, caudolateral shoulders prominent, posteriorly produced in a horn-shaped distomedian process with slender tip turned ventrally.

Immature Stages. Larva (Figs. 24, 32): Length about 5 mm. Color pale grayish white, head brown; grayish cast of body due to dense vestiture of small, sharp spinules uniformly distributed over body;

dorsum of body segments with irregular patches of dark brown pigment, more or less with pebble-grain texture, more extensive on anterior segments, forming irregular transverse segmented bands. Setae of head, body as in *A. fuscus*; laterodorsal seta *b* of prothorax replaced by a short, stout, convexly conical papilla (Fig. 24). Mediodorsal processes of body segments small, displaced laterally near laterodorsal processes, the latter shorter, stouter, curved, more closely appressed to body than in *A. fuscus*, with much reduced spinulose vestiture. Last abdominal segment with dorsal plate replaced by small inconspicuous pair of pigmented bars; setae corresponding to posterolateral setae of dorsal plate replaced by pair of black conical papillae, similar to those on prothorax but more elongate.

Pupa: One pharate male pupa available; chaetotaxy poorly visible in the slide mount, but similar to that of *A. fuscus*. Length about 3 mm. Respiratory horn (Fig. 27) much shorter, broader than in *A. fuscus*, 2.7 times longer than maximum breadth, convoluted in shape with about 90 spiracular openings arranged in irregular serpentine line around margin and on both upper and lower surfaces.

Distribution. Atlantic Coast salt marshes from Nova Scotia to North Carolina.

Types. Holotype male, allotype female, North Sea, Long Island, Suffolk Co., New York, vi.1956, H. A. Jamnback, reared from salt marsh. Paratypes, 48 males, 39 females, 3 larvae, 1 pupa (from USNM except as noted): U.S.A. DELAWARE: Sussex Co., Dewey Beach, 30.viii.1972, W. W. Wirth, light trap, 6 males, 4 females; Lewes, vi-viii.1963, ? collector, light trap, 1 female; Rehoboth, 1.ix.1977, WWW, malaise trap, 1 male, 1 female. MARYLAND: Calvert Co., Chesapeake Beach, 19.ix.1915, W. L. McAtee, 2 males, 2 females; 19.vii.1932, F. C. Bishop, mosquito trap, 1 male. Somerset Co., Irish Grove Wildlife Sanctuary, 11.vi.1973, P. G. Bystrak, light trap in fallow field near brackish marsh, 20 males, 19 females (Grogan coll.). Talbot Co., Wittman, 16.viii.1974, W. E. Steiner, at light, 5 males, 3 females (Grogan). NEW JERSEY: Atlantic Co., Motts Creek, 21.v.1974, C. W. Sabrosky, 1 male. NEW YORK: Same data as types, 2 males, 1 female, 3 larvae, 1 pupa. Suffolk Co., Orient Beach, Long Island, 25.v.1963, WWW, salt marsh, 1 male. NORTH CAROLINA: Carteret Co., Bogue Island, 17.x.1974, G. Steyskal, 1 male.

Canada. NOVA SCOTIA: Baddeck, Victoria, viii.1971, G. B. Fairchild, UV light trap, 9 males, 7 females.

Etymology. This species is named for Hugo Jamnback of the New York State Museum and Science Service in Albany in recognition of his outstanding contributions to our knowledge of the biology and taxonomy of North American biting midges.

Discussion. *Atrichopogon jamnbacki* can readily be distinguished by the globose male genitalia with horn-like distomedian process on the aedeagus. The female resembles *A. fuscus* in having four scutellar bristles and perpendicular mandibular teeth, but the proximal antennal segments are not so compressed and the spermathecae are larger and tapering to slender necks.

Present records indicate that this species is confined to salt and brackish marshes along the Atlantic coast of the United States and Canada.

Atrichopogon borkenti Wirth, new species (Figs. 36-37, 39-40)

Description: Female Holotype. Wing length 1.80 mm, breadth 0.76 mm; costal ratio 0.72.

Head: Uniformly dark brown including antenna and palpus. Antenna (Fig. 37) flagellar segments lengths 43-29-29-29-29-29-29-86-94-103-110-155 microns; antennal ratio 2.20; proximal segments markedly transverse, with prominent, short, stout, sensilla chaetica. Palpus (Fig. 36) segments lengths 43-90-147-65-79 microns; third segment slightly swollen on distal half, palpal ratio 4.0. Proboscis elongated, length 617 microns; P/H ratio 2.56. Mandible with 25 slightly oblique teeth, teeth progressively smaller and more perpendicular proximad.

Thorax: Shining dark brown including scutellum. Scutellum with six strong black marginal bristles plus numerous fine setae; paratergite with one strong bristle-like seta plus scattered small setae. Legs brown, with fine brown setae, hind tibia with small extensor bristles. Hind leg with lengths from femur to T5, 755-720-430-165-122-72-87 microns; tarsal ratio 2.60. Wing membrane whitish, anterior veins pale brown; short, fine-pointed macrotrichia moderately numerous on distal fourth of wing, 10-20 in anal cell. Halter pale.

Abdomen: Brown; pleura microscopically spiculate, with sparse fine setae arising from small pigmented tubercles. Spermathecae (Fig. 40) deeply pigmented dark brown, elongate ovoid with tapering necks; subequal, each measuring 143 by 79 microns including necks.

Male Allotype. Wing length 1.76 mm, breadth 0.55 mm; costal ratio 0.66.

Similar to female with usual sexual differences. Head, body and legs dark brown, almost black. Wing pale, nearly whitish; bare of macrotrichia. Antenna with dark brown plume; segments 11-15 lengths 50-75-150-118-158 microns. Hind leg with lengths from femur to T5, 575-540-346-115-94-65-72 microns; tarsal ratio 3.00.

Genitalia (Fig. 39): Ninth tergite about as broad as long, posterior margin evenly curved, with long brown bristles; ninth sternite with numerous fine setae, caudomedian excavation very shallow. Gonocoxite moderately slender, 2.5 times longer than broad, slightly arcuate; gonostylus 0.8 as long as gonocoxite, slightly curved, moderately stout proximally, tapering distally to slender, strongly curved tip. Aedeagus 0.75 as long as basal breadth, basal arch to half of total length; lateral margins expanded, winglike, but with shoulders evenly rounded to convex main body; distomedian process short, broad, with blunt, caplike, flaring tip.

Distribution. Alberta, British Columbia.

Types. Holotype female, allotype male, British Columbia, 20 km E Pemberton, 14.viii.1991, A. Borkent, sweeping flowers of *Salix* (CD1374) (deposited in CNCI). Paratypes, 24 males, 47 females, as follows: ALBERTA: Banff Nat. Park, 7.viii.1950, G. E. Shewell, 5 females (CNCI). BRITISH COLUMBIA: Same data as types, 2 males, 5 females (slides). Anahim Lake, 37 km W, 6.vii.1992, AB (CD1423), 14 females (Borkent coll.); 47 km NW, 14.vii.1992, AB, sweeping flowers of *Habenaria*, *Mimulus*, *Toefeldia*, 4 males, 8 females (Borkent coll.). Courtney, 24 km W, 17.vii.1991, AB, 1 male (Borkent coll.). Hope, 42 km NE, 2.viii.1991, AB (CD1370), 6 females (Borkent coll.). Salmon Arm, 3 km E, 4.v.1992, AB, sweeping flowers of *Acer*, 1 female (Borkent coll.). Sicamous, 8 km E, 8.vi.1992, AB, sweeping flowers of *Salix* (CD1419), 17 males, 13 females (Borkent coll.). Squamish, 20 km N, 29.vii.1990, AB, 2 males (Borkent coll.).

Etymology. This species is named in honor of its collector, Art Borkent of Salmon Arm, British Columbia, in recognition of his important additions to our knowledge of North American Ceratopogonidae and also for his contributions on the phylogeny of nematoceros Diptera.

Discussion. *Atrichopogon borkenti* is most closely related to the group of species with six scutellar bristles and oblique mandibular teeth. All other known species of this group are Neotropical in distribution. *Atrichopogon borkenti* differs from *A. deyrupi* and *A. archboldi*, species of this group occurring in the southern United States, by its shining blackish thorax and dark brown legs, and by its short antenna and spermathecae with long tapering necks.

Atrichopogon deyrupi Wirth, new species (Figs. 56, 35, 38, 41-42)

Description: Female Holotype. Wing length 1.68 mm; breadth 0.65 mm; costal ratio 0.73.

Head: Brown; antenna dark brown; palpus yellow, fifth segment and distal portion of fourth brown. Antenna elongate, flagellar segments lengths 54-36-36-36-36-36-36-125-125-136-144-180 microns; proximal segments slightly broader than long; antennal ratio 2.34. Palpus (Fig. 35) segments lengths 57-116-160-72-79 microns; third segment slightly swollen on distal portion, with deep sensory pit near tip; palpal ratio 4.20. Proboscis relatively short, length 576 microns; P/H Ratio 2.66. Mandible (Figs. 5, 38) with 23 slanting teeth, teeth progressively smaller proximally.

Thorax: Brown; scutum with three faint, broad, brownish vittae. Scutellum yellowish, with small yellowish marginal bristles and numerous fine, short, hairlike setae; paratergite with one strong bristle-like seta plus scattered small setae. Legs yellowish; hind tibia brownish, with long yellowish extensor bristles, these about twice as long as thickness of tibia. Hind leg with lengths from femur to T5 900-862-434-186-151-100-115 microns; tarsal ratio 2.20. Wing grayish hyaline, anterior veins yellowish brown; second radial cell three times length of first; macrotrichia moderately numerous on distal fourth of wing, 10-15 in anal cell. Halter pale.

Abdomen: Pale brownish with dark brownish segmental bands laterally; sparse vestiture of short,

fine, hairlike setae. Spermathecae (Fig. 41) dark brown pigmented; oval without distinct necks; subequal, each 150 by 108 microns.

Male Allotype. Wing length 1.52 mm, breadth 0.47 mm; costal ratio 0.68.

Similar to female with usual sexual differences. Antenna with sparse plume of brown verticils; palpus yellowish, segment 5 and apex of 4 brownish. Antennal segments 11-15 lengths 50-72-216-153-162 microns. Palpus short, lengths of segments 43-72-93-43-54 microns. Thorax dark brown; scutellum yellow, with six yellowish bristles. Legs yellowish; tibiae brownish, especially hind pair; lengths of hind leg from femur to T5, 775-680-324-159-130-87-87; tarsal ratio 2.04; hind tibia with pale extensor bristles twice as long as thickness of tibia.

Genitalia (Fig. 42): Prominent, yellowish, somewhat enlarged. Ninth tergite oval in profile with truncated base, 360 microns long by 280 wide; ninth sternite 108 microns long with shallow caudo-medial excavation. Gonocoxite moderately stout, 216 by 93 microns; gonostylus markedly short, stout, 155 microns long by 43 basal thickness, curved hooklike, tapering to pointed apex. Aedeagus not as broad as typical in genus, 160 microns wide by 144 long; basal arch reduced to a low concavity between basal arms; posterolateral shoulders broadly rounded; distomedian process sessile, broad and caplike, arising from an M-shaped linear sclerotization.

Immature Stages. Unknown.

Distribution. Florida, Mississippi.

Types. Holotype female, allotype male, Florida, Highlands Co., Lake Placid, Archbold Biological Station, 13-19.iv.1970, W. W. Wirth, light trap. Paratypes, 21 males, 37 females (in USNM except as noted): FLORIDA: Alachua Co., Gainesville, iv.1960, S. Gabler, bird nest, 1 female (CNCI). Charlotte Co., Placida, 11.iv.1952, J. R. Vockeroth, 20 males, 1 female (CNCI). Highlands Co., same data as types, 1 male, 7 females; same data except 1-7.v.1964, R. W. Hodges, at light, 4 females; 1.iv.1990, WWW, UV light trap, 1 female; Buck Island Ranch, ix.1990, WWW, UV light trap, 1 female. Pasco Co., Elfers, 19.iv.1952, J. R. Vockeroth, 21 females (CNCI). MISSISSIPPI: Harrison Co., Gulfport, 1.viii.1968, R. E. Woodruff, UV light trap, 1 female (FSCA).

Etymology. This species is named for Mark A. Deyrup of the Archbold Biological Station at Lake Placid, Florida, in appreciation of his keen interest in the ecological adaptations of the invertebrates of the south Florida sand scrub to their xeric habitats. Mark has been of unfailing and generous assistance to me in my project to study the Archbold ceratopogonids.

Discussion. *Atrichopogon deyrupei* and *A. archboldi* are closely related, differing from the other North American *A. (Lophomyidium)* except *A. borkenti* in possession of 6-8 scutellar bristles and slanting female mandibular teeth. *A. deyrupei* is immediately distinguished by the contrasting yellow color of the proximal palpal segments, and also differs from *A. archboldi* in having fewer macrotrichia on the female wing (10-15 in anal cell), and larger, equal-sized spermathecae. The male of *A. deyrupei* can be distinguished from the male of *A. archboldi* by the reduced antennal plume and short, broad, yellowish genitalia with short, stout, hook-like gonostylus. *Atrichopogon archboldi* has a broader distribution in the southernmost United States and the Neotropics, while *A. deyrupei* is apparently confined to a limited area in Florida and southern Mississippi.

Atrichopogon archboldi Wirth, new species (Figs. 43-47)

Description: Female Holotype. Wing length 1.58 mm; breadth 0.64 mm; costal ratio 0.73.

Head: Dark brown including antenna and palpus. Antenna (Fig. 43) flagellar segments lengths 54-40-36-36-36-36-36-133-133-144-144-168 microns; proximal segments slightly broader than long; antennal ratio 2.36. Palpus (Fig. 44) segments lengths 54-118-155-72-72 microns; third segment slightly swollen on distal portion, small deep sensory pit at distal fourth; palpal ratio 5.40. Proboscis (Fig. 46) long, length 685 microns; P/H Ratio 2.32. Mandible with 28 slanting teeth, teeth progressively smaller proximally.

Thorax: Dark brown; scutellum yellowish, with 6-8 moderately long yellowish bristles and numerous small, hair-like setae; paratergite with one strong bristle-like seta plus scattered small setae. Legs yellowish, femora slightly darkened except at bases; tibiae broadly brownish in midportion; vestiture of numerous strong brownish setae, much

stronger than in allied species; hind tibia with long, dark brown, extensor bristles about three times as long as thickness of tibia. Hind leg with lengths from femur to T5 700-695-432-158-122-87-79 microns; tarsal ratio 2.72. Wing grayish hyaline, anterior veins pale brownish; second radial cell three times length of first; macrotrichia more numerous and stronger than in allied species, numerous on distal half of wing, 20-30 in anal cell. Halter pale.

Abdomen: Pale brownish with dark brownish segmental bands laterally; moderately dense vestiture of moderately long, curved setae. Conspicuous subcutaneous mottling of small opaque bodies. Spermathecae (Fig. 45) deeply dark brown pigmented; slightly ovoid without apparent necks, small and unequal, 100 by 62 and 81 by 59 microns.

Male Allotype. Wing length 1.72 mm; breadth 0.50 mm; costal ratio 0.71.

Similar to female with usual sexual differences; head dark brown including antenna, plume and palpus; thorax dark brown including scutellum. Legs brownish, hind femur paler; tibiae dark brown. Antenna segments 11-15 lengths 54-72-180-136-180 microns. Palpus with lengths of segments 54-72-144-58-72 microns. Hind leg with lengths from femur to T5 790-765-520-180-144-83-93 microns; tarsal ratio 2.88.

Genitalia (Fig. 47): Short and broad; ninth tergite 1.1 longer than broad, caudal margin rounded but appearing slightly elongated longitudinally; ninth sternite with fewer and stronger scattered setae than in allied species. Distal abdominal segments and ninth tergite with exceptionally long, dark brown, bristles. Gonocoxite relatively stout, not bowed laterad, 2.5 times longer than broad; gonostylus nearly straight proximally, tapering to slender bent tip. Aedeagus about as broad as long, basal arch to half of total length, basal arms short; caudal margin evenly rounded, caudomedian process inconspicuous, appearing as a small transverse concave thickening near caudal margin of aedeagus.

Immature Stages. Unknown.

Distribution. Southern Florida, Texas and California, south to West Indies and Central and South America to Argentina.

Types. Holotype female, Maitland, Lake Hope, Orange Co., Florida, 5.viii.1988, W., W. Wirth, UV light trap. Allotype male, same data but date

27.iv.1985. Paratypes, 4 males, 37 females as follows (in USNM except as noted): FLORIDA: Alachua Co., Gainesville, Oak Crest, 28.vii.1986, 1.viii.1986, 14.xi.1986, WWW, UV light trap, 5 females. Dade Co., Kendall, 6.viii.1979, WWW, light trap, 2 females. Highlands Co., Lake Placid, Archbold Biological Station, 10.iv.1970, 8.ix.1989, 20.ix.1990, WWW, UV light trap, 10 females; 28.iv.1967, B. V. Peterson, 3 females (CNCI). Lee Co., Sanibel Island, 11.v.1973, WWW, malaise trap, 1 female. Orange Co., same data as types but dates 29.iv.1984, 15.iii.1985, 27.iv.1985, 21.vi.1987, WWW, 4 males, 14 females. Putnam Co., Welaka, 17-18.i.1947, Bellamy, light trap, 2 females.

Other Nearctic Specimens Examined. The following are believed to members of this species but are not designated as paratypes: CALIFORNIA: Inyo Co., Resting Springs, 29.v.1955, J. N. Belkin, 2 males, 2 females. Riverside Co., Thousand Palms, 23.iv.1955, W. R. Richards, 3 males, 3 females (CNCI). TEXAS: Brewster Co., Park 8 km s Marathon, 19.vii.1963, A. B. Gurney, 2 males, 4 females. Cameron Co., 16.ix.1963, R. B. Eads, light trap, 1 male, 2 females.

Etymology. This species is named in honor of Richard Archbold, founder of the Archbold Biological Station. The station has been my host for several periods of productive ceratopogonid research.

Discussion. *Atrichopogon archboldi* is a widespread Neotropical species that reaches its northern geographical limit in southern Florida, Texas, and California. Its taxonomic relations with a number of related Neotropical species and its distribution in Central and South America and the West Indies remain to be studied. Distinguishing characters to separate it from other North American *A. (Lophomyidium)* are given in the key and in the discussion under *Atrichopogon deyrupei*.

Atrichopogon uruguayensis (Cordero) from Uruguay appears to be very similar to *A. archboldi*, but is a much larger species (wing length 1.90 mm) and the legs are entirely brown. I have examined the following material of *A. uruguayensis* from Argentina and Paraguay (NEW RECORDS): ARGENTINA: Buenos Aires, As. Vitel, N of Chascomus, 27.xi.1979, C. M. & O. S. Flint, 1 male, 1 female; Las Talas (Barisso), 25.iii.1980, G. R. Spinelli, 1 female. Corrientes, Bella Vista, 20.i.1981, GRS, 1 male. Misiones, Iguazu, 4-10.x.1927, R. C. & E. M. Shannon, 1 female. PARAGUAY: Dept. Cordillera, 2 km

W Valenzuela, 17.v.1986, R. E. Woodruff, UV light trap, 1 male, 29 females (FSCA).

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Literature Cited

- Boesel, M. W.** 1973. The genus *Atrichopogon* (Diptera, Ceratopogonidae) in Ohio and neighboring states. *Ohio Journal of Science* 73: 202-215.
- Cavalieri, F., & Chiossone, I. P., and Chiossone, I. P.** 1973. Notas sobre el genero *Atrichopogon* Kieffer, 1906, de la Argentina (Diptera, Ceratopogonidae). I. Consideraciones generales y descripcion de *Atrichopogon delpontei* sp. nov. *Revista de la Sociedad Entomologica Argentina* 34: 119-129.
- Cole, F. R.** 1969. The Flies of Western North America. University of California Press, Berkeley and Los Angeles, 693 pp.
- Coquillett, D. W.** 1901. New Diptera in the U. S. National Museum. *Proceedings of the United States National Museum* 23: 593-618.
- Cordero, E. H.** 1929. Contribucion al estudio de los Dipteros del Uruguay. I. *Lophomyidium uruguayense* n. gen., n. sp. Nueva Ceratopogonina hematofaga. *Anales del Museo de Historia Natural de Montevideo* 3: 93-108.
- Downes, J. A., and Wirth, W. W.** 1981. Ceratopogonidae, pp. 393-421, *In*: J. F. McAlpine, et al., eds. *Manual of Nearctic Diptera*. Vol. 1. Agriculture Canada Monograph No. 27, 674 pp.
- Edwards, F. W.** 1926. On the British biting midges (Diptera, Ceratopogonidae). *Transactions of the Entomological Society of London* 74: 389-462.
- Ewen, A. G., and Saunders, L. G.** 1958. Contributions toward a revision of the genus *Atrichopogon* based on characters of all stages (Diptera, Heleidae). *Canadian Journal of Zoology* 36: 671-724.
- Glukhova, V. M.** 1981. [A comparative morphological review of the mouthparts of females and males in the subfamilies Dasyheleinae and Forcipomyiinae (Diptera, Ceratopogonidae)]. *Entomologicheskoe Obozrenie* 60: 62-76 (in Russian, translation in *Entomological Review* 60: 59-72, 1981).

- Goetghebuer, M.** 1920. Ceratopogoninae de Belgique. Memoires du Musee Royal d'Histoire Naturelle de Belgique 8: 1-116.
- Goetghebuer, M.** 1923a. Ceratopogonines de Belgique. Parasites accidentels de l'homme. Bulletin de la Societe Entomologique de Belgique 5: 34-37.
- Goetghebuer, M.** 1923b. Larves et nymphes de Ceratopogonines. Annales de Biologie Lacustre 11: 173-186.
- Goetghebuer, M., and Lenz, F.** 1933-1934. Heleidae ((Ceratopogonidae). In: Lindner, E., ed. Die Fliegen der Palaearktischen Region Fam. 13. 77: 1-48 (1933), 78: 49-133 (1934), 12 plates.
- Ingram, A., and Macfie, J. W. S.** 1922. West African Ceratopogoninae Part II. Annals of Tropical Medicine and Parasitology 16: 243-282.
- Ingram, A., and Macfie, J. W. S.** 1931. Ceratopogonidae. Diptera of Patagonia and South Chile, part II, fasc. 4, pp. 155-232. London.
- Johannsen, O. A.** 1943. A generic synopsis of the Ceratopogonidae (Heleidae) of the Americas, a bibliography, and a list of the North American species. Annals of the Entomological Society of America 36: 763-791, 3 plates.
- Kieffer, J. J.** 1906. Diptera. Fam. Chironomidae. Fasc. 42, 78 pp., 4 plates. In: Wytzman, P., ed. Genera Insectorum. Bruxelles.
- Kieffer, J. J.** 1925. Dipteres (Nematoceres piqueurs): Chironomidae Ceratopogoninae. Faune de France 11: 1-139.
- Lewis, F. B.** 1959. Abundance and seasonal distribution of the common species of Ceratopogonidae (Diptera) occurring in the state of Connecticut. Canadian Entomologist 91: 15-28.
- Macfie, J. W. S.** 1939. A report on a collection of Brazilian Ceratopogonidae (Dipt.). Revista de Entomologia 10: 137-219.
- Malloch, J. R.** 1915. The Chironomidae, or midges, of Illinois, with particular reference to the species occurring in the Illinois River. Bulletin of the Illinois State Laboratory of Natural History 10: 275-543, 24 plates.
- McKeever, S., Hagan, D. V., and Grogan, W. L., Jr.** 1991. Comparative study of mouthparts of ten species of predaceous midges of the tribe Ceratopogonini (Diptera: Ceratopogonidae). Annals of the Entomological Society of America 84: 93-106.
- McKeever, S., Wright, M. D., and Hagan, D. V.** 1988. Mouthparts of females of four *Culicoides* species (Diptera: Ceratopogonidae). Annals of the Entomological Society of America 81: 332-341.
- Nielsen, A.** 1951. Contributions to the metamorphosis and biology of the genus *Atrichopogon* Kieffer, with remarks on the evolution and taxonomy of the genus. Det Kongelige Danske Videnskabernes Selskab, Biologiske Skrifter 6: 1-95.
- Ortiz, I.** 1952. Apuntes en Ceratopogonidae (Diptera, Nematocera) III. Sobre una nueva especie de *Monohelea* Kieffer, 1917i (*Monohelea ocumare* n. sp.). Revista Sanidad y Asistencia Social (Caracas) 17: 253-256.
- Ortiz, I.** 1972. Sobre una omision en la descripcion de *Monohelea ocumare* Ortiz, 1952 (Diptera: Ceratopogonidae). Revista de Instituto Nacional de Higiene (Caracas) 5: 149-151.
- Remm, H.** 1961. Estonian species of the genus *Atrichopogon* Kieffer (Diptera, Heleidae). II. Description of three new species and key for the identification of Estonian species of the subgenus *Atrichopogon* s. str. (In Russian, English summary. Entomologicheskoe Obozrenie 40: 920-928 (English translation in Entomological Revue 450: 527-532).
- Remm, H.** 1979. Eesti nsv habesaasklaste (Diptera, Ceratopogonidae) fauna kataloog. Dipteroloogilisi Uurimusi, Tartu. pp. 40-60.
- Remm, H.** 1988. Family Ceratopogonidae, pp. 11-114. In: A. Soos & L. Papp, eds. Catalogue of Palaearctic Diptera Vol. 3. Ceratopogonidae-

Mycetophilidae. 448 pp. Akademiai Kiado Budapest.

Snow, W. E., Pickard, E., and Moore, J. B. 1957. The Heleidae of the Tennessee River Basin. *Journal of the Tennessee Academy of Science* 32: 18-36.

Thomsen, L. 1937. Aquatic Diptera. Part V. Ceratopogonidae. Cornell University Agricultural Experiment Station Memoir 210: 57-80.

Tokunaga, M. 1940. Chironomoidea from Japan (Diptera), XII. New or little-known Ceratopogonidae and Chironomidae. *Philippine Journal of Science* 72: 255-311, 4 plates..

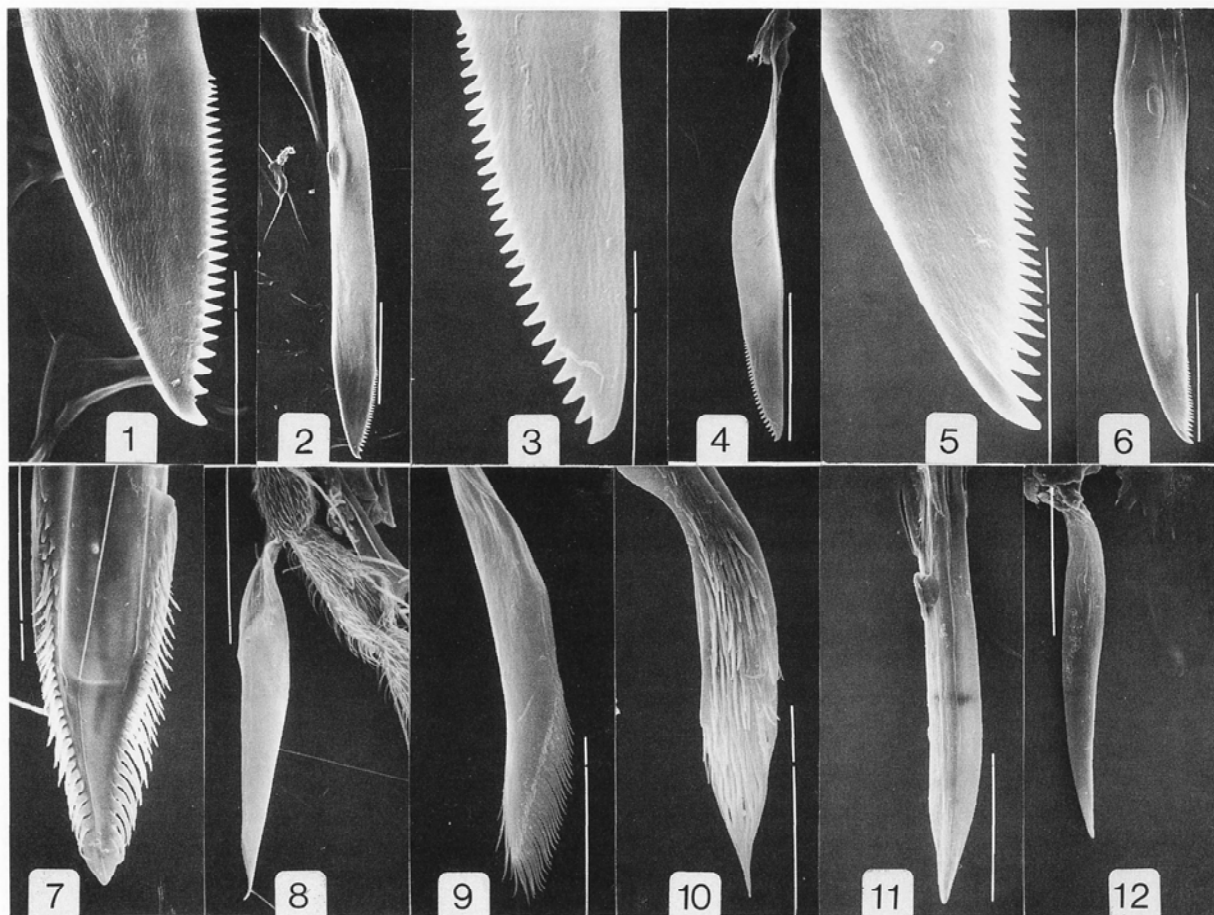
Wilkening, A. J., Kline, D. L., and Wirth, W. W. 1985. An annotated checklist of the Ceratopogonidae (Diptera) of Florida with a new synonymy. *Florida Entomologist* 68: 511-537.

Winnertz, J. 1852. Beitrage zur Kenntnis der Gattung *Ceratopogon*. *Linnaea Entomologica*. Berlin. 6: 1-80.

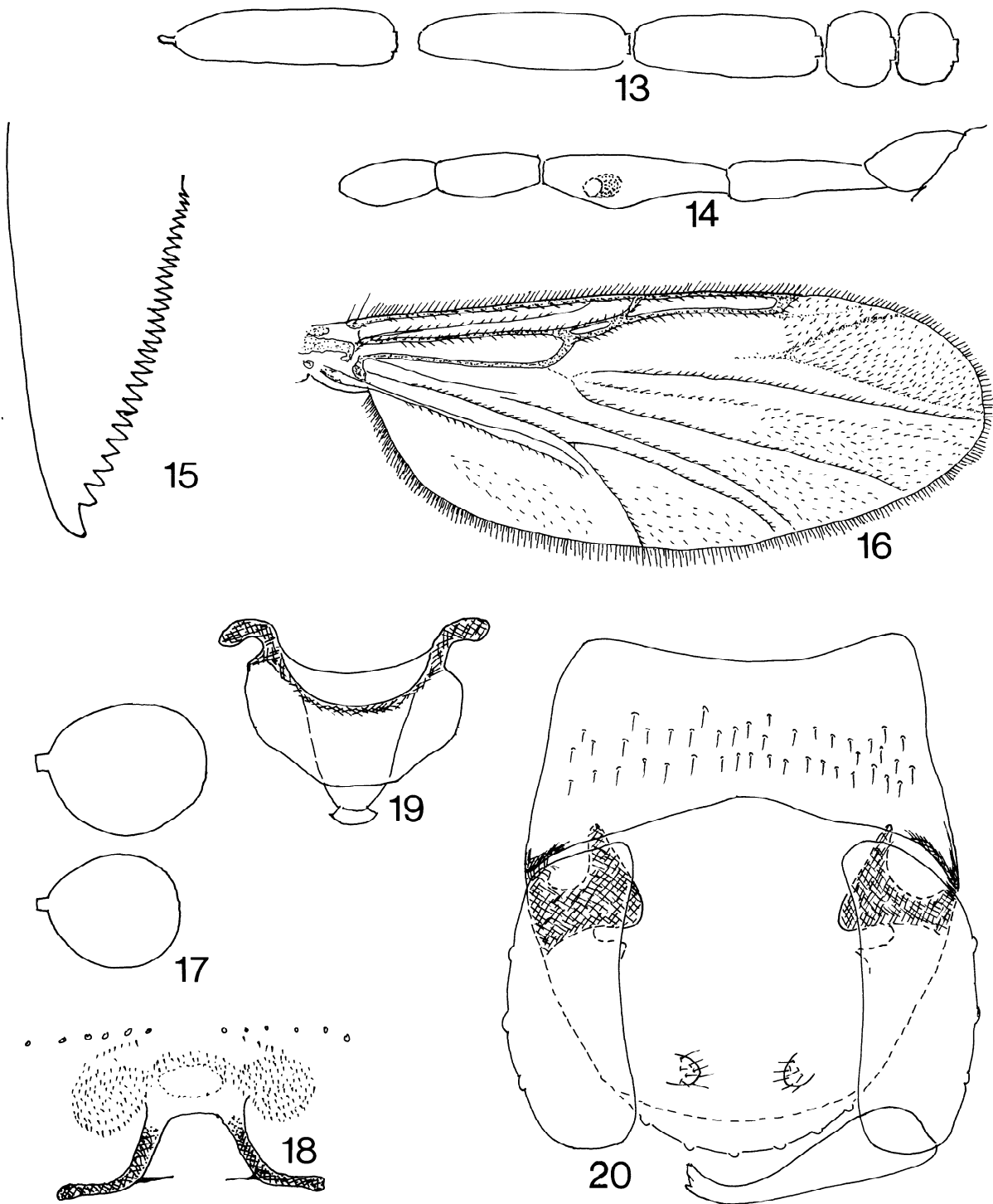
Wirth, W. W. 1952. The Heleidae of California. *University of California Publications in Entomology* 9: 95-206.

Wirth, W. W. 1956. The heleid midges involved in the pollination of rubber trees in America (Diptera, Heleidae). *Proceedings of the Entomological Society of Washington* 58: 241-250.

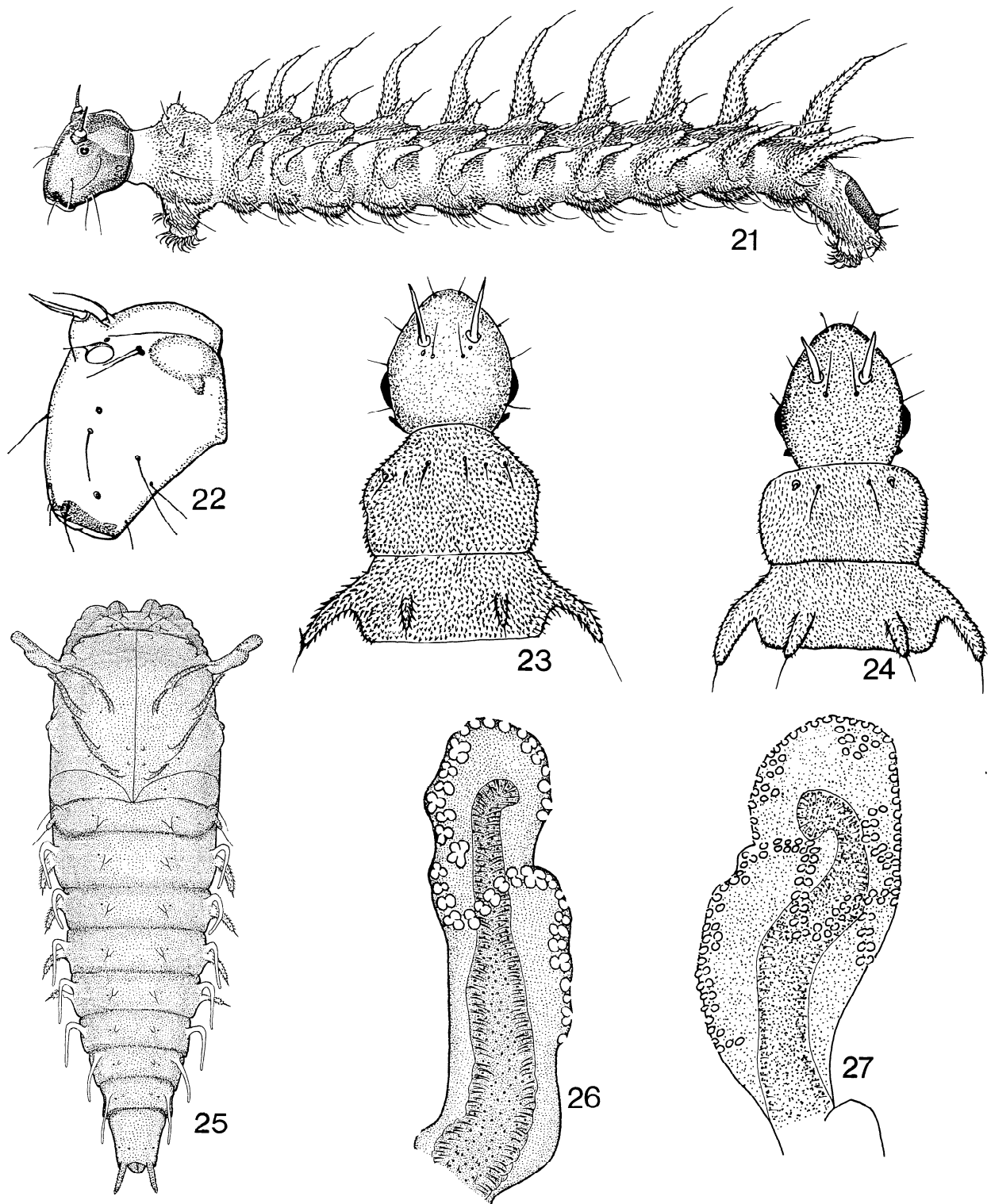
Wirth, W. W., and A. Stone. 1956. Chapter 14. Aquatic Diptera. In: R. L. Usinger, ed. *Aquatic Insects of California, with Keys to North American Genera and California Species*. Univ. California Press, Berkeley, pp. 372- 482.



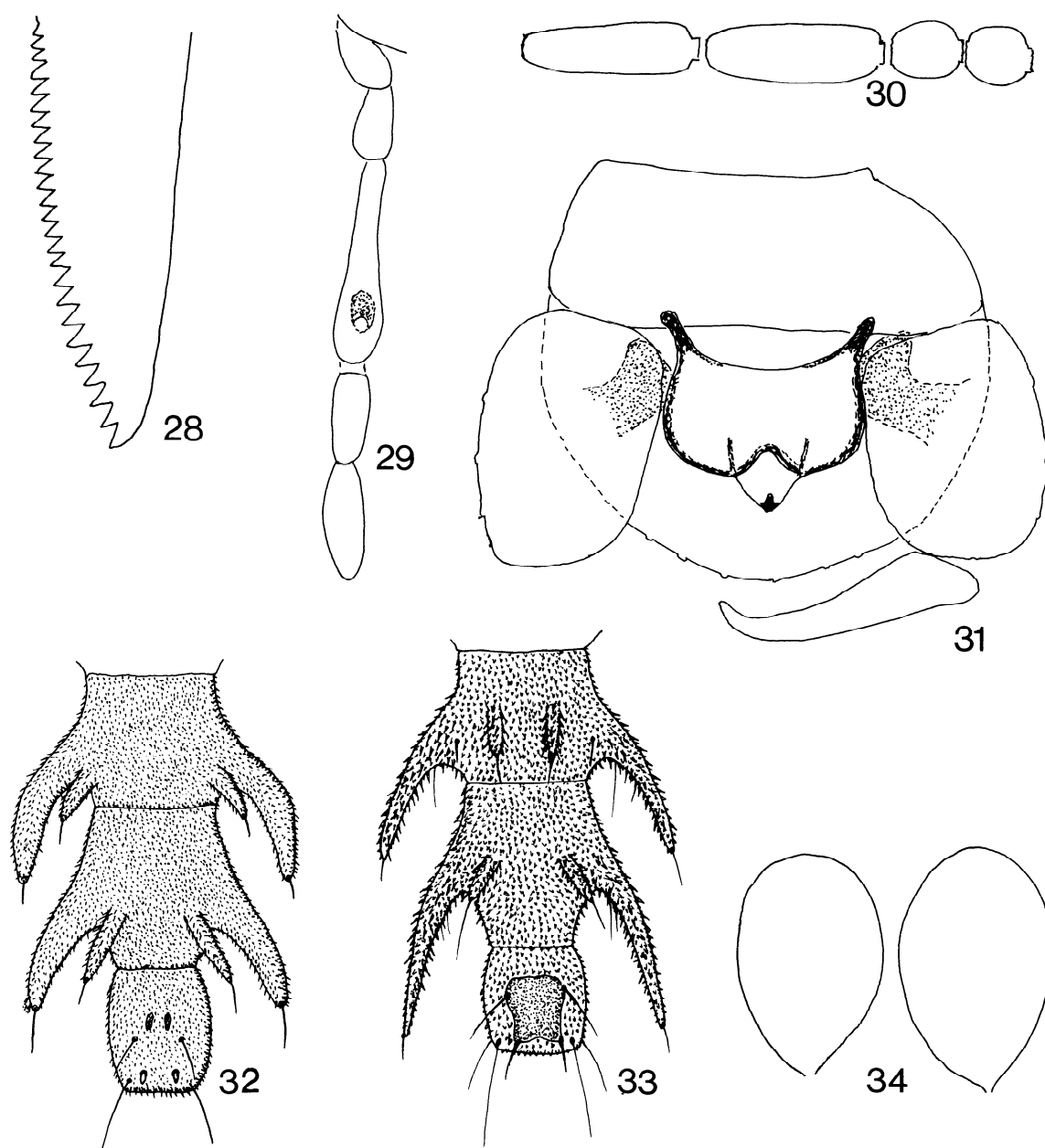
Figures 1 - 12. Mouthparts of *Atrichopogon*: 1-6, female mandibles of, 1-2, *A. fusculus*; 3-4, *A. jamnbacki*; 5-6, *A. deyrupei*. 7-12, *A. jamnbacki*; 7-8, female; 7, labrum; 8, lacinia; 9-12, male; 9, mandible; 10, labrum; 11, hypopharynx; 12, lacinia, of male (SEM photographs by Sturgis McKeever; 2, 4, 6, 8-12, low power; 1, 3, 5, 7, high power).



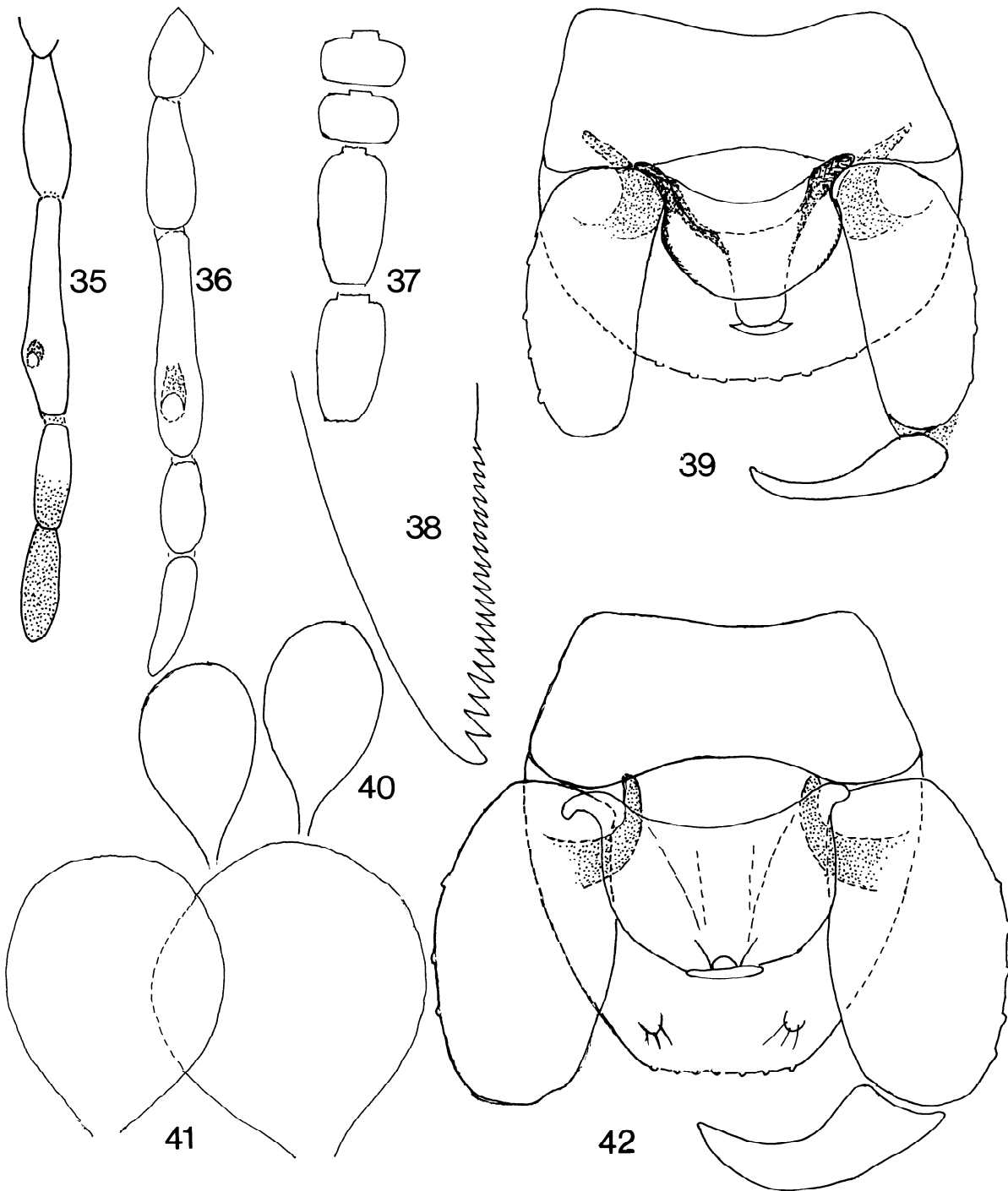
Figures 13 - 20. *Atrichopogon fusculus*; 13-18, female; 19-20, male: 13, antennal segments 9-12, 15; 14, palpus; 15, mandible; 16, wing; 17, spermathecae; 18, genital sclerotization; 19, aedeagus; 20, genitalia, aedeagus omitted.



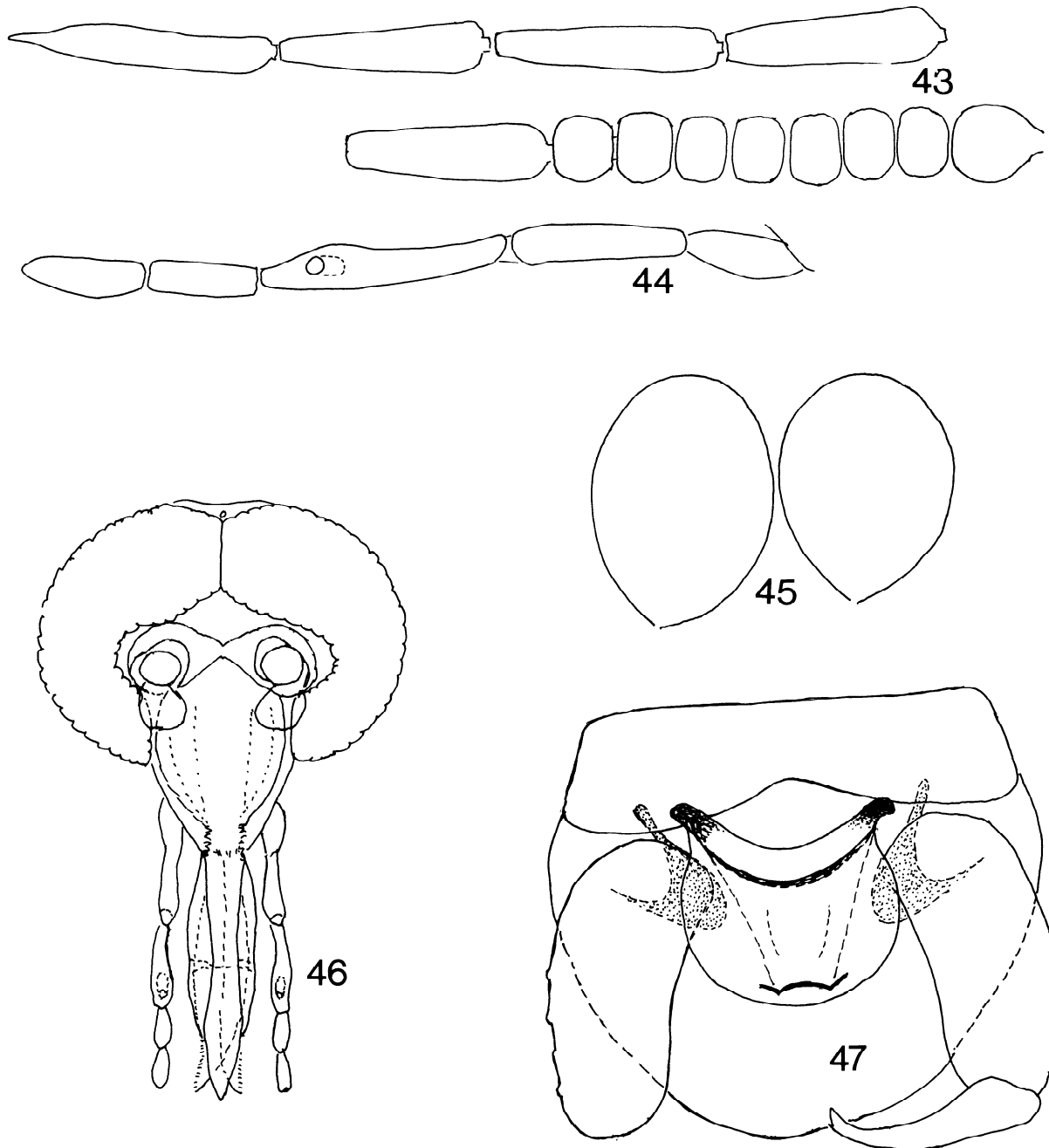
Figures 21 - 27. *Atrichopogon* immature stages; 21-23, 25-26, *A. fuscus*; 24, 27, *A. jamnbacki*: 21, larva, lateral view; 22, larval head; 23-24, larval head and thoracic segments 1-2; 25, pupa; 26-27, respiratory horn of pupa (Fig. 21 from Downes & Wirth 1981; 22 from Ewen & Saunders 1958; 25-26 from Nielsen 1951).



Figures 28 - 34. 28-32, 34, *A. jamnbacki*; 33, *A. fuscus*; 28-30, 34, female; 31, male; 32-33, last three abdominal segments of larva: 28, mandible; 29, palpus; 30, antennal segments 9-12; 31, genitalia; 34, spermathecae.



Figures 35 - 42. 35, 38, 41-42, *Atrichopogon deyrupei*; 36-37, 39-40, *A. borkenti*; 35-38, 40-41, female; 39, 42, male; 35-36, palpus; 37, antennal segments 9-12; 38, mandible; 39, 42, genitalia; 40-41, spermathecae.



Figures 43 - 47. *Atrichopogon archboldi*; 43-46, female; 47, male: 43, antenna; 44, palpus; 45, spermathecae; 46, anterior view of head, antennae omitted; 47, genitalia.