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A review of the Palaearctic biting midges of the subgenus *Brachypogon* (s. str.) (*Diptera, Ceratopogonidae*)

Przegląd palearktycznych kuczmanów z podrodzaju *Brachypogon* (s. str.) (*Diptera, Ceratopogonidae*)

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ABSTRACT. The Palaearctic species of *Brachypogon* (s. str.) are reviewed and illustrated. A key is presented for six Palaearctic species. Three new species from Korea and Pakistan (*B. krzeminskii*, *B. kremeri*, and *B. pakistanicus*) are described, and a neotype is designated for *Ceratopogon vitiosus*.

GROGAN (1982) presented a new concept of relationships between the taxa *Ceratopogon* MEIGEN, *Isohelea* KIEFFER and *Brachypogon* KIEFFER. He proposed that *Ceratopogon* and *Brachypogon* be recognized as distinct genera and that *Isohelea* be treated as a subgenus of *Brachypogon*. The Palaearctic species previously placed in the genus *Ceratopogon* by EDWARDS (1926), GOETGHEBUER and LENZ (1934), TOKUNAGA (1940), CLASTRIER (1961), REMM (1974), and HAVELKA (1976) are now divided between the following genera: *Ceratopogon*, *Ceratoculicoides* WIRTH et RATANAWORABHAN, 1971, *Brachypogon* and *Nannohelea* GROGAN et WIRTH, 1980.

This study reviews the Palaearctic species of *Brachypogon* sensu stricto. Two new species from Korea and one from Pakistan are described and

illustrated, a key is presented for the six Palaearctic species and a neotype is designated for *Ceratopogon vitiosus* WINNERTZ.

We wish to express our deepest thanks to Dr W.L. Grogan, Jr. (Salisbury State College, Salisbury, Maryland) for reading the manuscript and for many helpful suggestions; to Dr W. Krzemiński (Department of Systematic Zoology, Polish Academy of Sciences, Cracow) for specimens of *Brachypogon* from Korea; to Dr R. Lane (British Museum, Natural History, London) for help with English and some suggestions; and to Dr W.W. Wirth (Systematic Entomology Laboratory, U.S.D.A. c/o U.S. National Museum, Washington) for initiating the loan of Palaearctic *Brachypogon* from National Museum of Natural History, Smithsonian Institution.

The following special terms are used in the descriptions: Antennal ratio (AR) is the combined lengths of the distal five flagellomeres divided by the combined lengths of the remaining eight proximal flagellomeres of the female flagellum. Flagellomere ratio (FR) is the length of a flagellomere divided by its greatest breadth, FR(XIII) is a FR of flagellomere XIII, similarly FR(XII) is a FR of flagellomere XII of the female antenna. Palpal ratio (PR) is the length of a palpal segment divided by its greatest breadth, PR(III) and PR(IV) are PR of third and fourth palpal segments respectively. Wing length is measured from the basal arculus to the wing tip, the costal ratio (CR) is the length of costa measured from the basal arculus to the tip of the second radial cell, divided by the wing length. Tarsal ratio (TR) is the length of the basitarsus divided by the length of the second tarsomere; of fore leg—TR(I), middle leg—TR(II), hind leg—TR (III). The length of the spermatheca includes the neck.

Brachypogon (B.) Kieffer

Brachypogon KIEFFER, 1899: 69. Type species, *Ceratopogon vitiosus* WINNERTZ, by original designation.

Brachypogon: GROGAN, 1982: 521.

The known Palaearctic species of *Brachypogon* (*B.*) are easily separated from *B.* (*Isohelea*) by having both radial cells obliterated. Two small distinct radial cells are present in species of *B.* (*Isohelea*).

DESCRIPTION

This description is based on the Palaearctic species reviewed in the present paper.

Very small biting midges. Usually body blackish brown, tarsi and apices of tibiae usually paler. Eyes pubescent, contiguous. Antenna

with 13 flagellomeres. Distal five flagellomeres of female flagellum longer than proximal flagellomeres, occasionally some flagellomeres fused, AR 0.77–1.34; male flagellum with II–XI flagellomeres fused, only first and last two flagellomeres free. First flagellomere in both sexes with sensilla coeloconica. Palpus five-segmented; third palpal segment with sensory pit, fourth palpal segment with or without one or two long setae. Female mandible with 8–10 distinct teeth.

Scutellum with two submedian and two long lateral setae. Wing length 585–905 μm, CR 0.45–0.62 in female and 0.47–0.52 in male; both radial cells completely obliterated, vein M_2 absent or present distally; tip of costa and radial veins usually infuscated. Haltere knob usually pale. Hind basitarsus with a row of strong setae, with or without hooked setae on distal half. Female claws moderately long, equal or subequal, with basal inner teeth and rarely with basal outer teeth; male claws simple, each with a long basal seta curved at the tip. One or two spermathecae present. Eighth abdominal sternite of female divided longitudinally, sternite IX divided, each half with single arm, sternite X with two long setae. Male genitalia with simple aedeagus. Parameres fused at base, middle, or along whole length. *B. nieves* has additional dorsal caudomedian sclerotization arising from the transverse bridge joining the parameres.

Discussion

Species of *Brachypogon* (*B.*) are distributed worldwide, and the subgenus presently includes 28 species in particular regions: Afrotropical —11 species, Australian —6, Palaearctic — 6, Neotropical — 3, Nearctic — 1, Oriental — 1.

If *Brachypogon* (*B.*) is really a monophyletic group as Grogan suggests then it probably originated in warm climate. Amongst the Palaearctic species only *B. vitiosus* occurs in the cooler parts of Europe and Asia. The other five species of this subgenus are found on the southern borders of the Palaearctic Region: *B. kokocinskii* in North Africa, *B. krzeminskii* sp. n. and *B. kremeri* sp. n. in Korea and Japan, *B. pakistanicus* sp. n. in Pakistan, and *B. nieves* in Western and Southern Europe.

Brachypogon (*B.*) *krzeminskii* sp. n., *B.* (*B.*) *pakistanicus* sp. n. and *B.* (*B.*) *kokocinskii* are perhaps most plesiomorphic of the Palaearctic species. The females of the former two species have two spermathecae, the male of *B. kokocinskii* has parameres weakly fused at the bases only; both sexes of *B. kokocinskii* and female of *B. krzeminskii* sp. n. have the fourth palpal segment with 1–2 long setae. It seems that *B. nieves* and Nearctic *B. canadensis* Downes, 1976, are the most apomorphic species in the subgenus

as a whole. They have a dorsal caudomedian sclerotization arising from the transverse bridge joining the parameres, which is not found in the other species of the subgenus.

It is interesting to note that in the species of the subgenus *Isohelea*, the fourth palpal segment always has two long setae (20 Palaearctic species examined). This contrasts with species of the subgenus *Brachypogon* which have one or rarely two long setae in some plesiomorphic species; the setae are completely lacking in the more apomorphic species.

Key to the Palaearctic species of the *Brachypogon* (*B.*)

1. Females 2
—. Males 7
2. Two spermathecae 3
—. One spermatheca 4
3. Fourth palpal segment with two long setae. Spermathecae asymmetrical. CR 0.45 (Korea, Japan) . . . . . *B. krzeminskii* sp. n.
—. Fourth palpal segment without long setae. Spermathecae symmerical. CR 0.55 (Pakistan) . . . . . *B. pakistanicus* sp. n.
4. Fourth palpal segment with one or two long setae. Hind basitarsus with hooked setae on distal half (Algeria) . . . . . *B. kokocinskii* SZADZIEWSKI
—. Fourth palpal segment without long setae. Hind basitarsus without hooked setae 5
5. Claws with basal inner and outer teeth (Palaearctic) . . . . . *B. vitiosus* (WINNERTZ)
—. Claws with basal inner teeth only 6
6. Spermatheca large (106×66μm). FR(XIII) 4.00, FR(XII) 3.1 (Korea) . . . . . *B. kremeri* sp.n.
—. Spermatheca small (68–86×38–60 μm). FR(XIII) 2.5, FR(XII) 2.2 (Europe) . . . . . *B. nieves* (HAVELKA)
7. Fourth palpal segment with one long seta. Hind basitarsus with hooked setae on distal half. Haltere knob dark. Parameres S-shaped, fused basally . . . . . *B. kokocinskii*
—. Fourth palpal segment without long seta. Hind basitarsus without hooked setae. Haltere knob pale. Parameres not S-shaped 8
8. Parameres with additional caudomedian sclerotization, at apices forked . . . . . *B. nieves*
—. Parameres without additional caudomedian sclerotization, totally fused . . . . . *B. vitiosus*

Brachypogon (*B.*) *krzeminskii* sp. n.

(Figs 1–4)

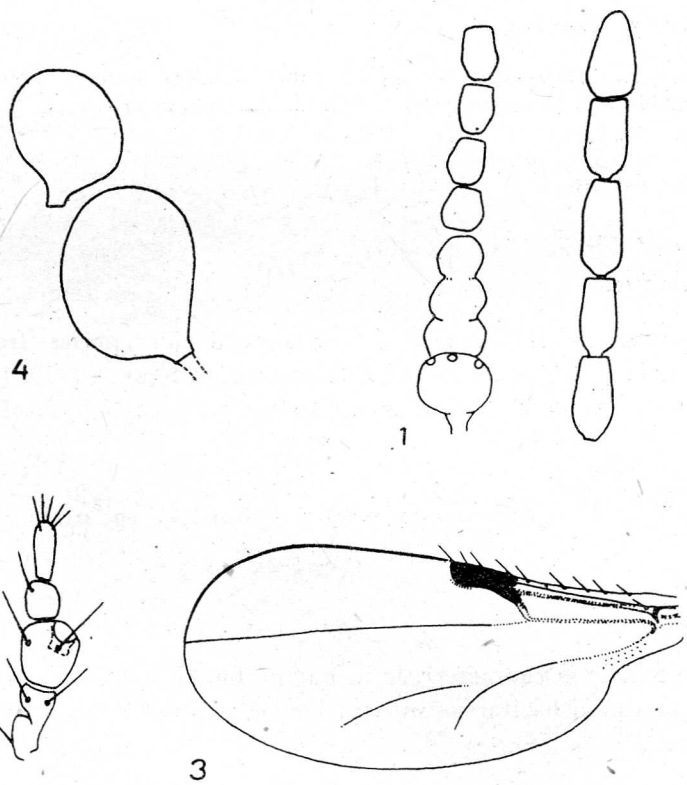
Ceratopogon (*Isohelea*) *minimus*: TOKUNAGA, 1940: 260 (♀, Japan), nec KIEFFER, 1924: 402.

DIAGNOSIS

The female is characteristic in having one long seta on the fourth palpal segment, hind basitarsus with hooked setae on distal half, CR 0.45 and two spermathecae.

DESCRIPTION

♀. Flagellum 280 μm long, AR 1.07; flagellomeres II–IV fused, last flagellomere cone-shaped (fig. 1); FR(XIII) 1.76, FR(XII) 1.75. Third palpal segment short (20 μm) and wide, PR(III) 1.11; fourth palpal segment (12.5 μm) with one long seta, PR(IV) 1.04 (fig. 2).



1–4. *Brachypogon* (*B.*) *krzeminski* sp. n., female: 1 — flagellum, 2 — palpus, 3 — wing, 4 — spermathecae

Wing length 585 μm; CR 0.45; anterior wing margin thickened from tip of costa to vein M_1, M_2 barely visible on distal half (fig. 3). Hind basitarsus with five hooked setae on distal half; claws with basal inner teeth only; TR(I) 1.58, TR(II) 2.00, TR(III) 2.33.

Abdomen extensively yellowish, tergites brown, small; proximal sternites markedly reduced to two small dark sclerites; cerci pale. Two asymmetrical spermathecae present (fig. 4), measuring 62×44 and 46×34 μm.

Male unknown.

ETYMOLOGY

This species is named in honour of Dr Wiesław Krzemiński of the Department of Systematic Zoology, Polish Academy of Sciences, Cracow, the collector of the species.

MATERIAL EXAMINED

Holotype, ♀, Democratic People's Republic of Korea, Kesông, 16 July 1981, leg. W. Krzemiński. The holotype is deposited in the Institute of Zoology, Polish Acad. Sci., Warsaw.

DISTRIBUTION

Korea, Japan.

DISCUSSION

TOKUNAGA (1940) described and figured this species from Japan, but identified it as *Ceratopogon minimus* which KIEFFER (1924) described from the north of France. *C. minimus* is a junior synonym of *C. vitiosus* WINN.

Brachypogon (*B.*) *pakistanicus* sp. n.

(Figs 5–8)

DIAGNOSIS

The female is characteristic in having fourth palpal segment without long setae, hind basitarsus without hooked setae, CR 0.55, and two spermathecae.

DESCRIPTION

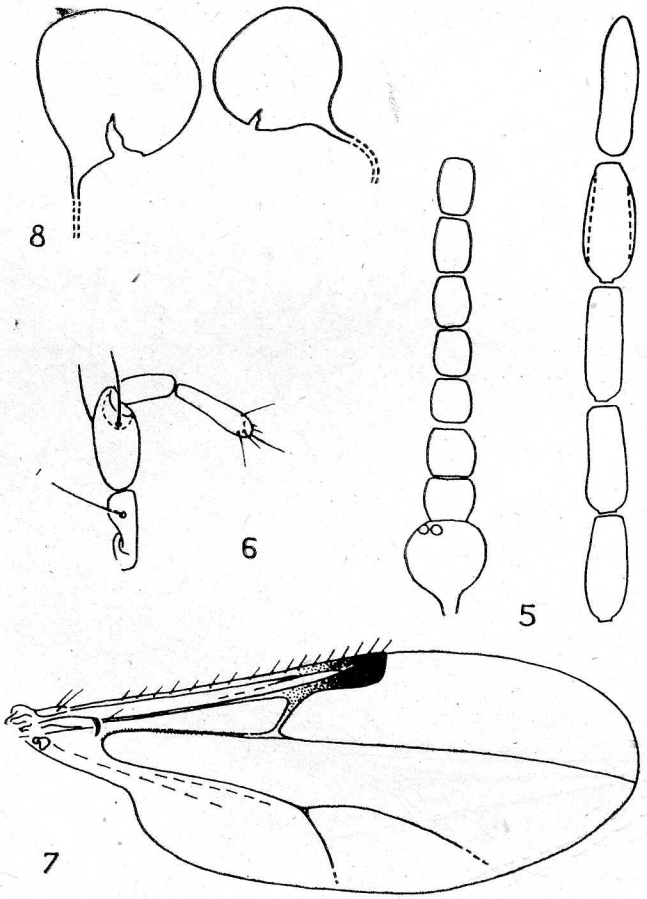
♀. Flagellum 356 μm long, AR 1.28, last flagellomere cylindrical (fig. 5); FR(XIII) 3.54, FR(XII) about 3.5. Third palpal segment 36 μm long, PR(III) 2.00; fourth palpal segment without long setae (fig. 6), PR(IV) 2.20.

Wing length 679 μm, CR 0.55, vein M_2 absent (fig. 7). Hind basitarsus

without hooked setae; claws equal, with basal inner teeth only; TR(I) 1.57, TR(II) 2.00, TR(III) 2.00.

Two symmetrical spermathecae present (fig. 8), measuring 64×58 and 52×40 μm; necks rather long and narrow, spermathecal ducts well sclerotized.

Male unknown.



5–8. *Brachypogon* (*B.*) *pakistanicus* sp. n., female: 5 — flagellum, 6 — palpus, 7 — wing, 8 — spermathecae

MATERIAL EXAMINED

Holotype, ♀, Pakistan, Ayub. Natl. Park, Rawalpindi, June 1959, light trap, H. Barnett. The holotype is deposited in National Museum of Natural History, Smithsonian Institution, Washington.

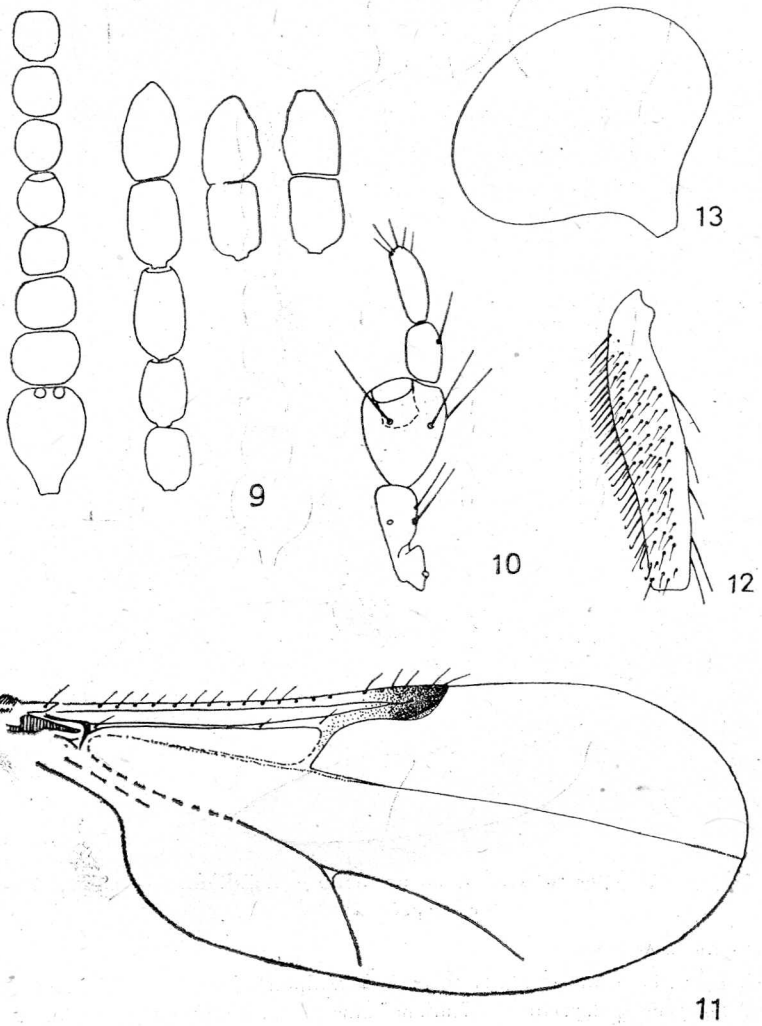
Brachypogon (*B.*) *kokocinskii* Szadziewski

(Figs 9–16)

Brachypogon kokocinskii SZADZIEWSKI, 1983: 393 (♀, ♂, Algeria).

DIAGNOSIS

The species is characteristic in having the fourth palpal segment with one or two long setae; hind basitarsus with hooked setae on dista



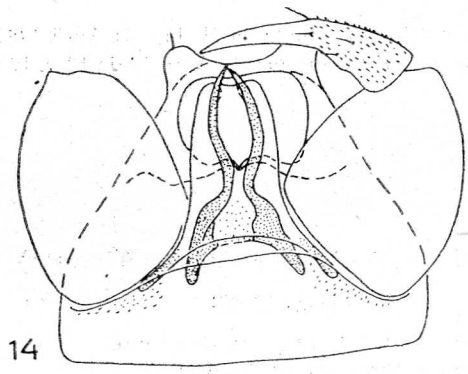
9–13. *Brachypogon* (*B.*) *kokocinskii* SZADZIEWSKI, female: 9 — flagellum, 10 — palpus, 11 — wing, 12 — hind basitarsus, 13 — spermatheca

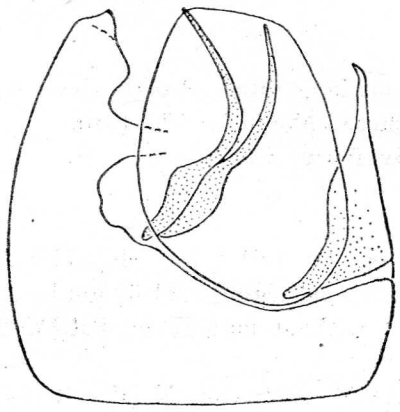
half. Female with one asymmetrical spermatheca; male genitalia with strongly sclerotized S-shaped parameres fused at the bases.

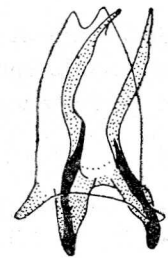
DESCRIPTION

♀. Flagellum 266–302 μm long, AR 0.77–0.84; last flagellomere subconical (fig. 9), FR(XIII) 1.27–1.78, FR(XII) 1.32–1.88. Third palpal segment long (32–40 μm) and wide, PR(III) 1.23–1.64; fourth palpal segment with 1–2 long setae, PR(IV) 1.29–1.83 (fig. 10). Mandible with 9–10 teeth.

Wing length 680–780 μm; CR 0.53–0.57; vein M_2 absent (fig. 11). Hind basitarsus with 5–10 hooked setae on distal half (fig. 12), claws with basal inner teeth only; TR(I) 1.35–1.64, TR(II) 1.76–1.94, TR(III) 1.89–2.06. Haltere knob pale.







14–16. *Brachypogon* (*B.*) *kokocinskii* SZADZIEWSKI, male genitalia: 14 — ventral view, 15 — lateral view, 16 — aedeagus and parameres

One asymmetrical spermatheca with well defined neck (fig. 13), measuring 58–64×50–62 μm.

♂. Similar to female with the usual sexual differences, but haltere knob dark.

Flagellum length 368–416 μm. Third palpal segment 38–40 μm long, PR(III) 1.72–1.90; fourth palpal segment with one long seta. Wing length 686–905 μm; CR 0.48–0.52. Haltere knob dark. TR(I) 1.53–1.60, TR(II) 1.72–1.89, TR(III) 1.63–2.00.

Genitalia (figs 14–16); aedeagus long, almost rectangular, tip excavated; parameres strongly sclerotized, S-shaped, fused at the bases, free distally.

MATERIAL EXAMINED

Algeria: Ras Isly near Sala Bey, Monts du Hodna, 24 April 1981; Les Falaises at Jijel, 15 April 1981; Grarem near Constantine, 19 April 1981; 10 ♂, 10♀; leg. R. Szadziewski. Paratypes.

DISTRIBUTION

Algeria.

Brachypogon (*B.*) *vitiosus* (Winnertz)

(Figs 17–27)

Ceratopogon vitiosus WINNERTZ, 1852: 49 (♂, ♀, Germany).
Anakempia minima KIEFFER, 1924: 402 (♀, France).
Trishelea nigra MAYER, 1934: 291 (♀, Germany).
Ceratopogon (*Brachypogon*) *vitiosus*: REMM, 1974: 57 (♂, ♀, = *Anakempia minima* = *Trishelea nigra*); HAVELKA, 1976: 217 (♂, ♀).

DIAGNOSIS

Fourth palpal segment without long setae. Female claws with basal inner and outer teeth, spermatheca spherical with distinct neck. Male genitalia with parameres totally fused, plate-shaped.

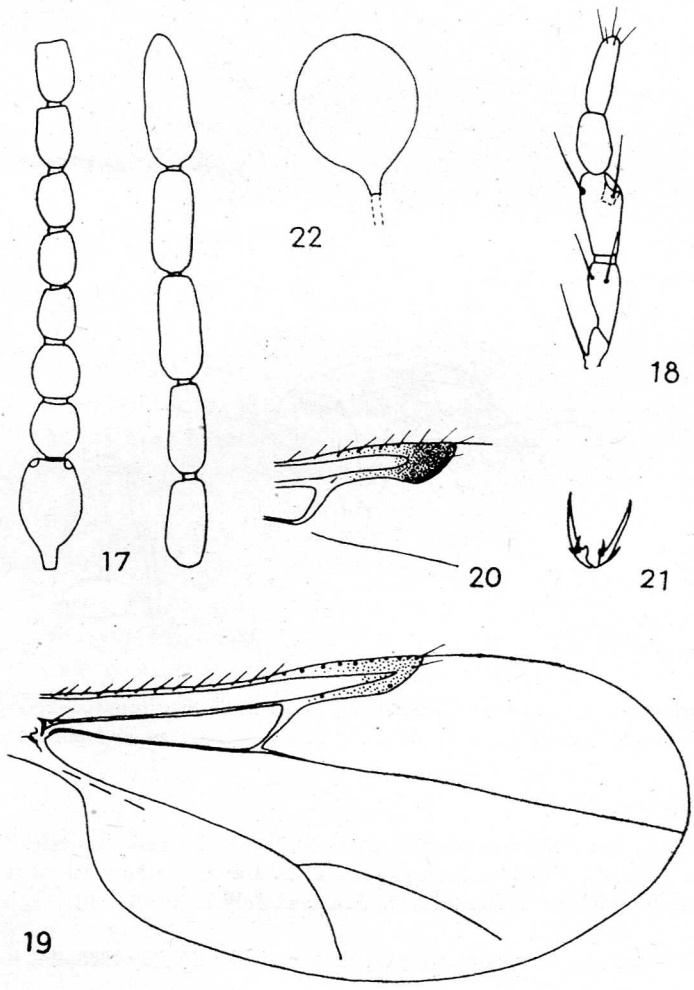
DESCRIPTION

♀. Flagellum 356–362 μm long, AR 1.01–1.23; FR(XIII) 2.75–3.00, FR(XII) 2.25–2.62 (fig. 17). Third palpal segment 28–30 μm long, PR(III) 1.87–2.00; fourth palpal segment without long setae, PR(IV) 1.70–2.00 (fig. 18). Mandible with 8–9 teeth.

Wing length 660–796 μm, CR 0.56–0.62; vein M_2 absent (figs 19–20). Hind basitarsus without hooked setae; claws with basal inner and outer teeth (fig. 21); TR(I) 1.37–1.47, TR(II) 2.16–2.40, TR(III) 1.71–1.94.

One spherical spermatheca with distinct short neck (fig. 22), measuring 54–62×40–46 μm.

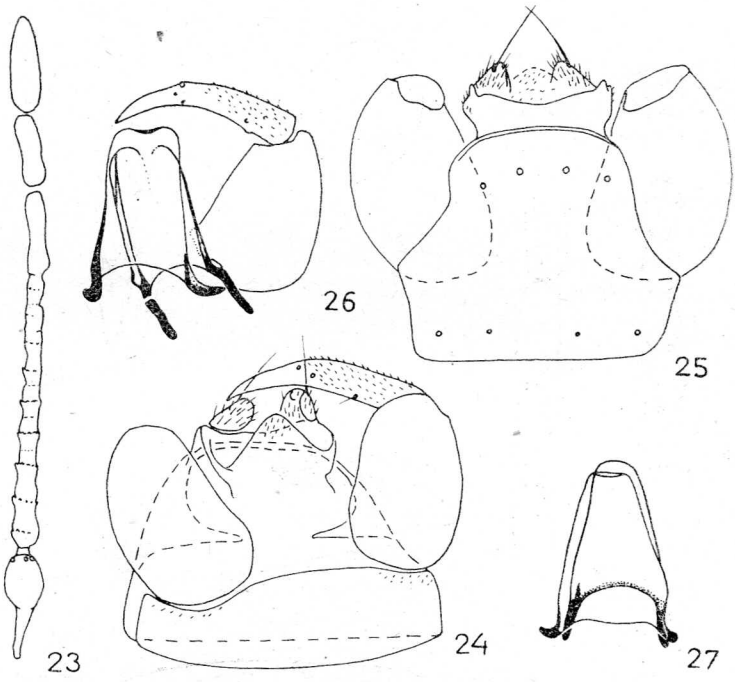
♂. Similar to female with the usual sexual differences.



17–22. *Brachypogon* (*B.*) *vitiosus* (WINNERTZ), female: 17 — flagellum, 18 — palpus, 19–20 — wing, 21 — claws, 22 — spermatheca

Flagellum length 420–472 μm (fig. 23). Third palpal segment 28–30 μm long, PR(III) 2.00–2.28; fourth palpal segment without long setae. Wing length 641–746 μm, CR 0.47–0.52. TR(I) 1.22–1.57, TR(II) 1.67–2.05, TR(III) 1.41–1.76.

Genitalia (figs 24–27); aedeagus long, almost rectangular, tip straight; parameres completely fused, plate-shaped, with evenly rounded tip (fig. 23).



23–27. *Brachypogon* (*B.*) *vitiosus* (WINNERTZ), male: 23 — flagellum, 24–27 — genitalia, 24 — ventral view, 25 — dorsal view, 26–27 — aedeagus and parameres

MATERIAL EXAMINED

West Germany: *Trishelea nigra* MAYER, Liebenau/Neumark, Gastsee, Juli 1933, holotype ♀. This holotype is in the collection of P. Havelka, who received it from the late Prof. Dr Joachim Illies. Breitenbach, June and July 1971–1972, 4♂, 3 ♀, leg. P. Havelka.

Poland: Krzewsk near Elbląg, sweeping at Drużno lake, 10 July 1983, 3 ♀, leg. R. Szadziewski.

France: Provence, Mont du Loube, 9 May 1966, 1 ♂, leg. M. Kremer.

Spain: Monasterio de Piedra, 4 June 1975, 1 ♂, leg. P. Havelka.

Algeria: Ras Isly near Sala Bey, Monts du Hodna, 24–26 April 1981, 5 ♂, leg. R. Szadziewski.

Afghanistan: Kundy Prov., Bolla, Quchi, black light, 10 Sept. 1968, 4 ♀, leg. D. P. Wojcik (National Museum of Natural History, Smithsonian Institution, Washington).

Japan: Honshu, Kyoto Prefect., Midoro Pond, June 1955, light trap, 9 ♂, 2 ♀, leg. P.H. Arnaud (National Museum of Natural History, Smithsonian Institution, Washington).

The types (3 ♂ and 3 ♀) of *Ceratopogon vitiosus* are believed to have been destroyed in Bonn in 1945 (see CAMPBELL et PELHAM-CLINTON, 1960). In order to stabilise the nomenclature of this rather common species, we have designated a neotype collected in West Germany: slide mounted female, No. 168, Breitenbach, 16 July 1971, leg. P. Havelka. The neotype is deposited in Landessammlungen für Naturkunde, Karlsruhe.

DISTRIBUTION

Brachypogon vitiosus is a widespread Palaearctic species recorded from Germany (WINNERTZ, 1852; MAYER, 1934; HAVELKA, 1976), Austria (GOETGHEBUER, LENZ, 1934), France (KIEFER, 1924), Spain (HAVELKA, 1979), Estonian SSR (REMM, 1979), Caucasus (REMM, 1967), Lithuanian SSR, Middle Asia, Siberia (GLUCHOVA, 1979), South Primorye (REMM, 1971; GLUCHOVA, 1979). This is the first record from Poland, Algeria, Afghanistan and Japan. Adults are found between April and September in semiarid, steppean and forest zones of the Palaearctic Region. Larvae have been found in springs (HAVELKA, 1976) and in forest soil at stream edge (GLUCHOVA, 1979).

DISCUSSION

REMM (1974) was the first to redescribe *B. vitiosus*. He also synonymized *Trishelea nigra* and *Anakempia minima* with *Ceratopogon vitiosus* based on descriptions alone. Examination of the holotype of *T. nigra* supports REMM's synonymy even though the holotype lacks the spermatheca. The location of the type material of *A. minima* is unknown.

Brachypogon (*B.*) *kremeri* sp. n.

(Figs 28–32)

DIAGNOSIS

This new species is characteristic in having a very large spermatheca with a distinct neck; the fourth palpal segment without long setae, claws with basal inner teeth only and FR(XIII) 4.0.

DESCRIPTION

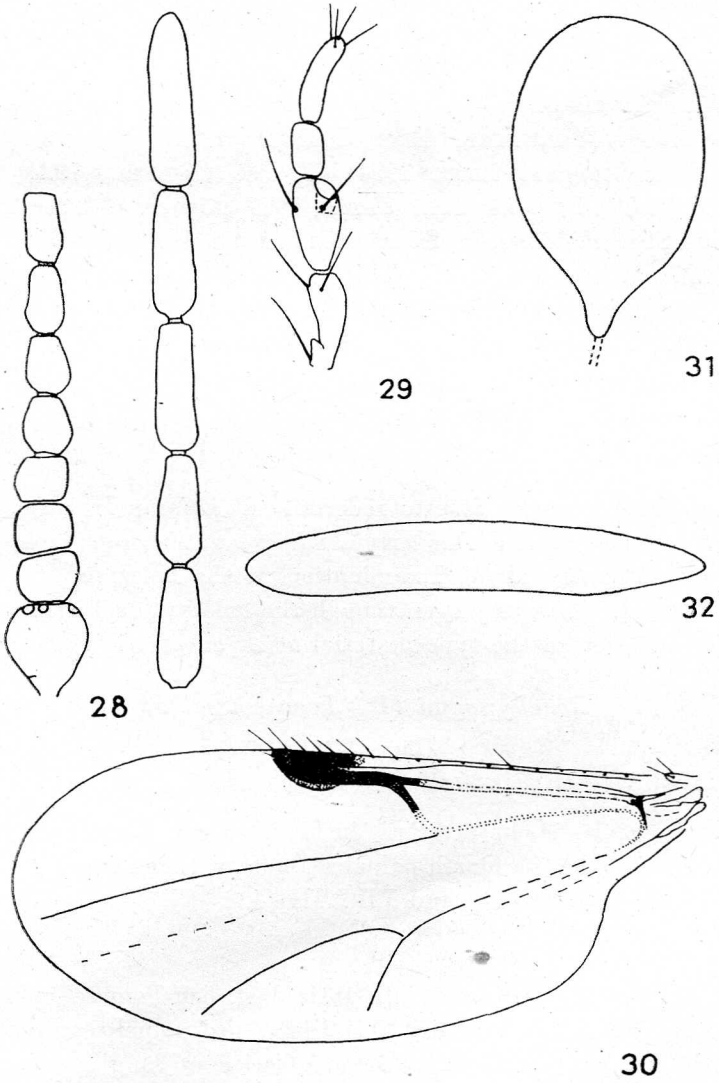
♀. Flagellum 402 μm long, AR 1.34; last flagellomere cylindrical, long (fig. 28), FR(XIII) 4.00, FR(XII) 3.14. Third palpal segment 32 μm long, PR(III) 2.00; fourth palpal segment without long setae, PR(IV) 1.59 (fig. 29). Mandible with 8 teeth.

Wing length 780 μm, CR 0.58; vein M_2 barely visible on distal half

(fig. 30). Hind basitarsus without hooked setae; claws with basal inner teeth only; TR(I) 1.47, TR(II) 2.10, TR(III) 2.00.

One large, ovoid spermatheca tapered to the neck (fig. 31), measuring 106×66 μm. In abdomen 36 cigar-shaped eggs were found (fig. 32), each measuring ca. 300 μm long.

Male unknown.



28–32. *Brachypogon* (*B.*) *kremeri* sp. n., female: 28 — flagellum, 29 — palpus, 30 — wing, 31 — spermatheca, 32 — egg

ETYMOLOGY

This species is named in honour of Professor Michel Kremer of the Institut de Parasitologie et Pathologie Tropicale, Faculté de Médecine, Strasbourg, in recognition of his contributions to the study of the Palaearctic *Culicoides* LATR.

MATERIAL EXAMINED

Holotype, ♀, Democratic People's Republic of Korea, Kymgangsan, 28 June 1981, leg. W. Krzemiński. The holotype is deposited in the Institute of Zoology, Polish Acad. Sci., Warsaw.

DISTRIBUTION

Korea.

Brachypogon (*B.*) *nieves* (Havelka), comb. n.

(Figs 33–39)

Ceratopogon nieves HAVELKA, 1976: 91 (♂, West Germany).
Ceratopogon nieves: HAVELKA, 1982: 61 (♂, ♀, Spain).

DIAGNOSIS

Female with one medium-sized spermatheca with distinct neck; FR(XIII) 2.5; claws with basal inner teeth only. Male genitalia with parameres forked at apices. Fourth palpal segment without long setae.

DESCRIPTION

♀. Flagellum 318–325 μm long, AR 1.03–1.12; last flagellomere cylindrical (fig. 33), FR(XIII) 2.50, FR(XII) 2.21. Third palpal segment short (26 μm), PR(III) 1.62; fourth palpal segment without long seta, PR(IV) 1.45–1.60 (fig. 34).

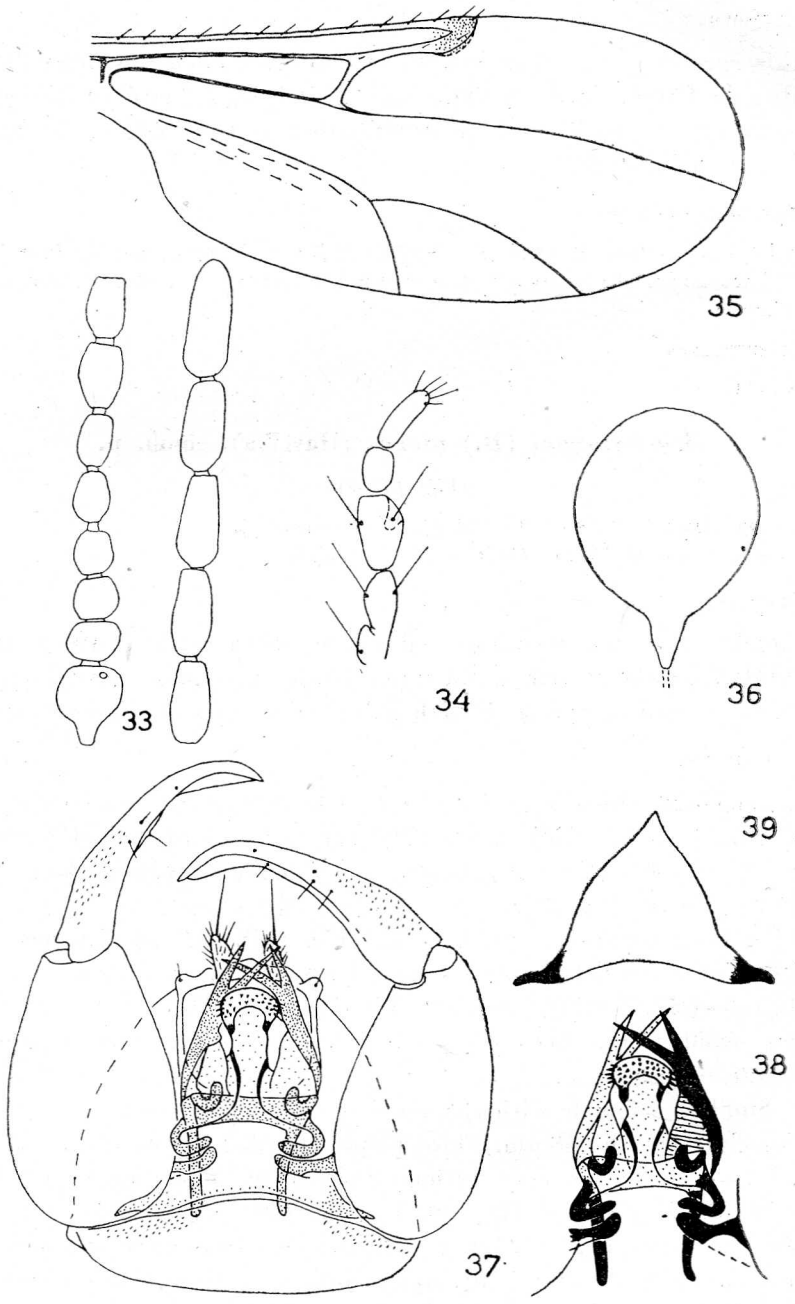
Wing length 635–770 μm, CR 0.50–0.58; vein M_2 absent (fig. 35). Hind basitarsus without hooked setae; claws with basal inner teeth only; TR(I) 1.40–1.53, TR(II) 2.00–2.22, TR(III) 1.61–1.76.

One ovoid spermatheca with well defined neck (fig. 36), measuring 68–86 × 38–60 μm.

♂. Similar to female with the usual sexual differences.

Flagellum length 448 μm. Third palpal segment 32 μm long, PR(III) 1.78; fourth palpal segment without long setae. Wing length 690 μm, CR 0.50. TR(I) 1.38, TR(II) 2.10, TR(III) 1.94.

Genitalia large (figs 37–39); aedeagus short, triangular with pointed tip; parameres fused at middle, apices forked at tip; additional dorsal caudomedian sclerotization with head-shaped tip covered with spines; gonostyle rather stout, distal portion wide.



33–39. *Brachypogon* (*B.*) *nieves* (HAVELKA): 33 — female flagellum, 34 — female palpus, 35 — female wing, 36 — spermatheca, 37 — male genitalia, 38 — parameres, 39 — aedeagus

MATERIAL EXAMINED

Spain: Rio Anduña near Huesca, 1♂, 1♀, leg. P. Havelka.
France: Provence, Mont du Loube, 9 May 1966, 1 ♀, leg. M. Kremer.

DISTRIBUTION

West Germany, Spain. This is the first record from France.

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