



**The taxonomic status of two species of predaceous midges
in the genera *Bezzia* and *Palpomyia* described by STÆGER (1839)
in the genus *Ceratopogon* (Diptera: Ceratopogonidae: Palpomyiini)**

**Status taksonomiczny dwóch gatunków kuczmanów z rodzajów
Bezzia i *Palpomyia* opisanych przez STÆGERA (1839)
w rodzaju *Ceratopogon* (Diptera: Ceratopogonidae: Palpomyiini)**

DOI: 10.5281/zenodo.2526980

<http://zoobank.org/0414C6F0-17EB-4EEB-BD3E-DC987944D835>

PATRYCJA DOMINIAK^{1*}, RYSZARD SZADZIEWSKI²

¹ Tromsø University Museum, UiT – The Arctic University of Norway,
NO-9037 Tromsø, Norway, e-mail: heliocopris@gmail.com

² Department of Invertebrate Zoology and Parasitology, Faculty of Biology, University of Gdańsk,
Wita Stwosza 59, 80-308 Gdańsk, Poland, e-mail: biorys@biol.ug.edu.pl

* Corresponding author e-mail: heliocopris@gmail.com

ABSTRACT. Lectotypes are designated for the predaceous midges, *Ceratopogon circumdatus* STÆGER, 1839, and *Ceratopogon binotatus* STÆGER, 1839 housed in the Copenhagen Zoological Museum, Denmark, and both species are redescribed and photographed. *Ceratopogon circumdatus* is removed from synonymy with *Bezzia solstitialis* (WINNERTZ, 1852) and recognized as a new synonym of *Bezzia annulipes* (MEIGEN, 1830). *Ceratopogon binotatus* STÆGER, 1839, is removed from synonymy with *Palpomyia lineata* (MEIGEN, 1804) and recognized as the distinct species, *Palpomyia binotata* (STÆGER, 1839).

KEY WORDS: Diptera, Ceratopogonidae, Palpomyiini, new synonym, redescription, Denmark

INTRODUCTION

The predaceous midge tribe Palpomyiini ENDERLEIN, 1936 of Ceratopogonidae includes six genera: *Amerohelea* GROGAN & WIRTH, 1981 (13 species; Neotropics and Nearctic), *Bezzia* KIEFFER, 1899 (321 spp.; nearly worldwide), *Clastrieromyia* SPINELLI & GROGAN, 1985 (4 spp.; Neotropics), *Pachyhelea* WIRTH, 1959 (2 spp.; Neotropics and Nearctic), *Palpomyia* MEIGEN, 1818 (281 spp.; nearly worldwide), and *Phaenobezzia* HAESELBARTH, 1965 (35 spp.; nearly worldwide) (BORKENT 2016). Members of the two most species-rich genera, *Bezzia* and *Palpomyia*, are represented in Europe by about 50 and 70 valid species respectively (SZADZIEWSKI *et al.* 2013). More than half of these were described by KIEFFER, MEIGEN, GOETGHEBUER, STROBL, EDWARDS, STÆGER, and ZETTERSTEDT. However, type material of most of these species have never been re-examined. Herein, we redescribe and provide photographs of key characters of two species of Palpomyiini described by STÆGER (1839) from Denmark.

MATERIAL AND METHODS

Specimens were borrowed from the Copenhagen Zoological Museum, University of Copenhagen, Denmark (ZMUC). Five of the nine pinned female specimens were cleared in a solution of potassium hydroxide-water, then dissected and mounted on microscope slides in a mixture of phenol-ethanol and Canada balsam. Wings were removed and soaked in phenol-ethanol and mounted on microscope slides. The rest of the bodies were cleared in 10% KOH for 24h (at room temperature), then washed in water, soaked in 75% ethanol and phenol-ethanol, dissected and slide-mounted. Morphological terms in the descriptions and method of taking the measurements follow GROGAN & WIRTH (1975 & 1979) and SZADZIEWSKI (1988). Photographs and measurements were made with LAS Montage multifocus with a Leica M205A stereomicroscope and an attached Leica DFC 495 camera, and, a Leica DM6000 B microscope with a DFC 450 C camera.

SYSTEMATICS

Bezzia annulipes (MEIGEN, 1830)

Figures 1–4

Ceratopogon annulipes MEIGEN, 1830: 264 (female; Europe).

Bezzia annulipes: KIEFFER 1925: 130 (combination).

Ceratopogon circumdatus STÆGER, 1839: 596 (female; Denmark). **Syn. nov.**

Bezzia bidentata KIEFFER, 1901: 162 (female; France).

Bezzia fossicola KIEFFER, 1912: 102 (male, female; Germany).

Bezzia ploenensis KIEFFER, 1921: 62 (male, female; Germany).

Bezzia media KIEFFER, 1925a: 126 (male, female, larva, pupa; Belgium).

Bezzia phragmitis KIEFFER, 1925b: 428 (male; Germany).

Bezzia digramma KIEFFER, 1925b: 428 (female; Poland).

Bezzia kyotoensis TOKUNAGA, 1939: 282 (female; Japan).

Bezzia sicarti CLASTRIER, 1962: 83 (male, female; France).

MATERIAL EXAMINED. Seven females from the ZMUC collection, on pins in a drawer labelled “*Circumdatius* STOG.” (one label for all specimens); four of them were dissected and slide mounted in a phenol-Canada balsam mixture. **Lectotype** female (present designation), labelled “*B. annulipes*, ♀ varb., Lersó St.”. **Paralectotypes**, 6 females: 2 females without labels; 1 female labelled “*B. annulipes*”; 1 female labelled “*B. annulipes*, ♀ varb, Lersó St”; 1 female on microslide, labelled “*B. circumdatius* STAEG* Copenh. STAEGER SYNTYPE, 5/6 55” is *Bezzia annulipes*; 1 female labelled “*B. leucogaster*”.

STÆGER (1839) did not indicate how many specimens he examined. In the ZMUC collection seven female specimens were found under the label “*Circumdatius* STOG.”, and we presume they belong to the type series and therefore we consider them syntypes. The type series includes two species: *Bezzia annulipes* (MEIGEN, 1830) (6 females) and *B. leucogaster* (ZETTERSTEDT, 1850) (1 female). To enhance the stability of nomenclature, one of them we determined as *B. annulipes*, is designated the lectotype of *Ceratopogon circumdatius* STÆGER.

DIAGNOSIS Female. Legs yellow, with brown coxae, femoro-tibial joints, and tarsomeres 4–5, femora with preapical brown ring, tibiae with wide brown sub-basal band and dark brown apices. Fore femur with 2–3 small, stout spines on small tubercles. Spermathecae with very long slender necks. (REMM 1974, WIRTH *et al.* 1984).

DESCRIPTION (the paralectotype determined as *B. leucogaster* not included)

FEMALE. BODY COLORATION (FIG. 1). Head brown; antennal pedicel dark yellow, flagellum brownish, only proximal portions of all flagellomeres paler; palpus brownish. Thorax brown, scutellum slightly paler. Wing membrane pale, anterior veins slightly infuscated. Halter knob brown, stem brownish. Coxae brown; trochanters brownish; femora, tibiae yellow with darker femoro-tibial joints, with brown markings as follows: femora with narrow preapical band (sometimes barely visible on fore and mid femur), tibiae with wide band on proximal 1/2 and dark apices; tarsomeres 1–3 pale, 4–5 brown. Abdomen brown. **HEAD (FIG. 2a).** Antennal flagellum (**FIG. 2b**) length 1.0–1.1 mm (n=3); antennal ratio AR 1.3–1.4 (n=3). Palpal segment 3 slender (**FIGS. 2a, c**), length 86–95 µm (n=4), width 30–33 µm (n=3); palpal ratio PR 2.9–3.1 (n=3). Mandible with roughly 11–12 teeth increasing in size toward apex (**FIG. 2c**). **THORAX.** Thorax, coxae and femora with small simple unmodified setae. Scutellum with 4–6 long setae. Wing (**FIG. 3b**) 2.6–2.8 mm long (n=5); costal ratio CR 0.76–0.79 (n=5). Legs (**FIGS. 3a-c**); fore femur with 2–4 ventral spines (n=4); mid and hind femora unarmed; hind tibial comb with 8 spine-like setae; tarsomeres 1–2 of hind leg with 2 rows of palisade setae; tarsal ratio TR(I) 1.7 (n=4), TR(II) 1.9–2.0 (n=4), TR(III) 2.0–2.4 (n=4); claws similar on all legs, small, equal-sized, each talon with basal inner tooth (**FIG. 3a**). **ABDOMEN (FIGS. 4a-b).** With small simple unmodified setae. Two pairs of dorsal internal apodemes (**FIG. 4b**). Genitalia as in **FIG. 4a**. Sternite 8 with pair of posterior hyaline extensions; sternite 9 divided. Two spherical, slightly sub-equal spermathecae with very long slender necks (**FIGS. 4c-d**); dimensions 91–96x49–58 µm and 77–88x47–50 µm (n=3); and a 3rd rudimentary spermatheca (**FIG. 4d**) 43x7 µm (n=1).

COMMENTS. REMM (1974: 439) considered *Bezzia circumdata* a synonym of *B. solstitialis* (WINNERTZ, 1852), but in the Catalogue of Palaearctic Diptera (REMM 1988) this name was mentioned as a *nomen dubium* within Palpomyiini. Subsequently, BORKENT & WIRTH (1997) and BORKENT (2016) treated both names as synonyms. Although adults of *B. annulipes* and *B.*

solstitialis are very similar, females of the latter species differ in having more slender spines on the fore femur, the distal 1/2 of the hind femur is dark, and most importantly, their spermathecae have very short necks (WIRTH *et al.* 1984). Our examination of the lectotype of *C. circumdatus* revealed that all morphological features fit *B. annulipes* and that these two names are synonymous. Therefore, we consider *Bezzia solstitialis* is not synonymous with *B. circumdata*.

***Palpomyia binotata* (STÆGER, 1839)**

Figures 5–8

Ceratopogon binotatus STÆGER, 1839: 596 (female; Denmark).

Palpomyia binotata: KIEFFER 1906: 63 (combination); REMM 1976: 176 [as synonym of *Palpomyia lineata* (MEIGEN)]; BORKENT & WIRTH 1997: 132 (in world catalog; as synonym of *P. lineata*).

MATERIAL EXAMINED. **Lectotype** female (present designation); originally on pin in drawer labelled “*Binotatus* STOG.” (one label for two specimens from the type series), labelled: ♀ St.; it is now slide mounted in phenol-Canada balsam. ZMUC. **Paralectotype** female without original label, with present day label “*P. lineata*”. ZMUC.

STÆGER (1839) did not include the number of specimens of *P. binotata* he examined. The collection of ZMUC included two females of *Palpomyia* pinned in a drawer below the label “*Binotatus* STOG.”, and we believe that they are the type series (syntypes) of *Ceratopogon binotatus*. In order to enhance the stability of nomenclature, we designate the originally labelled female as lectotype of *Ceratopogon binotatus*. The second female (paralectotype) is a specimen of *Palpomyia lineata* (MEIGEN, 1804).

DIAGNOSIS. Female body dark brown, antennal flagellum and legs yellowish; fore femora with 6 ventral spines, mid- and hind femora without ventral spines; hind tarsomere 5 of with two rows of 5 ventrolateral curved setae; anterior margin of sternite 8 with pair of hyaline pocket-like structures with heavily sclerotized anterior margins.

DESCRIPTION OF FEMALE LECTOTYPE. BODY COLORATION (FIG. 5). Head brown. Antennal pedicel dark yellow, flagellum yellowish-brown, proximal portions of flagellomeres paler; palpus brownish. Thorax including scutellum, brown. Wing membrane slightly infuscated, anterior veins dark brown. Halter knob brown, stem yellowish. Coxae brown; trochanters brownish; legs yellow, femoro-tibial joints black, proximal and distal portions of tibiae light brown; tarsomeres 4–5 brown. Abdomen brown. **HEAD (FIG. 6a).** Head slightly flattened dorso-ventrally. Antennal flagellum (**FIG. 6b**) length 1.62 mm; antennal ratio AR 1.6. Palpal segment 3 slender (**FIG. 6a**), length 100 µm, width 35 µm; palpal ratio PR 2.9. Mandible with 7 teeth, smaller on proximal and distal sections, larger on mid-section (**FIG. 6a**). **THORAX.** Thorax, coxae and femora with small simple unmodified setae. Scutum with anterior tubercle. Scutellum with about 6 marginal stout setae. Wing (**FIG. 6c**); length 3.4 mm; costal ratio CR 0.82. Legs (**FIGS. 7a-c**); fore femur with 6 ventral spines (**FIG. 7b**), mid and hind femora unarmed; hind tibial comb with 9 setae; tarsomeres 1–2 of hind leg with 2 rows of palisade seta; tarsal ratio TR(I) 1.7, TR(II) 2.1, TR(III) 2.3; hind tarsomere 5 with two

rows of 5 ventrolateral curved bristle-like setae (**FIG. 7c**); claws small, equal size, with basal inner tooth. **ABDOMEN.** With small simple unmodified setae. Two pairs of dorsal internal apodemes (**FIGS. 8a-b**). Genitalia as in **FIG. 8a**. Sternite 8 with a pair of hyaline, anteriorly directed pocket-like sclerites, with more heavily sclerotized anterior margins; posterior margin with medial ovoid excavation. Sternite 9 divided, anteromedial section of each half slender, tapered distally, sharply pointed. Two spherical, slightly unequal-sized spermathecae with short necks (**FIG. 8c**), dimensions 92x63 μm and 86x65 μm ; small elongate rudimentary 3rd spermatheca, dimensions 42x8 μm .

COMMENTS. STÆGER (1839) was not convinced that the females he examined represented a new species, and he suggested that they may belong to *Palpomyia cinerea* (MACQUART, 1826), described from France which is currently (BORKENT & WIRTH 1997) regarded as a junior synonym of *P. lineata* (MEIGEN, 1804). Over 100 years later, *Palpomyia binotata* (STÆGER, 1839) was subsequently synonymized with *P. lineata* by REMM (1976: 176). However, it is now apparent that these two species differ by several aspects of female morphology. For example, the legs of females of *P. lineata* are yellowish with distinct dark brown or black bands (mid and hind femora with apical bands, mid and hind tibiae with broad basal and narrower apical bands) and all femora usually have ventral spines (fore femur with 3–18, mid with 0–5, hind with 0–6 femoral spines) (GROGAN & WIRTH 1975, 1979). In addition, the mid and hind claws are larger than the fore claws, and all are much longer than in *P. binotata*. Coloration of the specimen designated here as lectotype differs slightly from the original description in that the ash-grey thorax pollinose and two chestnut brown longitudinal stripes that extend towards the front of thorax are barely visible. And, the palpi, antennae, legs and abdomen are also paler than described by STÆGER.

ACKNOWLEDGEMENTS

We are grateful to THOMAS PAPE of ZMUC for the loan of specimens, and to CARSTEN KIRKEBY (Technical University of Denmark) for providing a translation of the original article by STÆGER. We thank the referees, especially WILLIAM L. GROGAN JR., for the careful and insightful review of our manuscript.

STRESZCZENIE

Zbadanie okazów typowych dwóch gatunków drapieżnych kuczmanów opisanych przez STÆGERA (1839) z Danii pozwoliło na zaproponowanie kilku istotnych zmian taksonomicznych: 1. *Ceratopogon circumdatus* STÆGER, 1839 został uznany za młodszy synonim *Bezzia annulipes* (MEIGEN, 1830); 2. *Bezzia solstitialis* (WINNERTZ, 1852) to osobny gatunek, samice którego posiadają spermateki z krótkimi szyjkami – nazwa ta nie powinna być synonimizowana z *B. circumdata*; 3. *Palpomyia binotata* (STÆGER, 1839) to ważny gatunek bardzo podobny do *Palpomyia lineata* (MEIGEN, 1804). Nazwa ta powinna zostać wyłączona z synonimów *P. lineata*.



FIG. 1. *Ceratopogon circumdatus* STÆGER, 1839, female: habitus, lateral view.



FIG. 2. *Ceratopogon circumdatus* STÄGER, 1839, female: a – head, b – antenna, c – mouth parts.

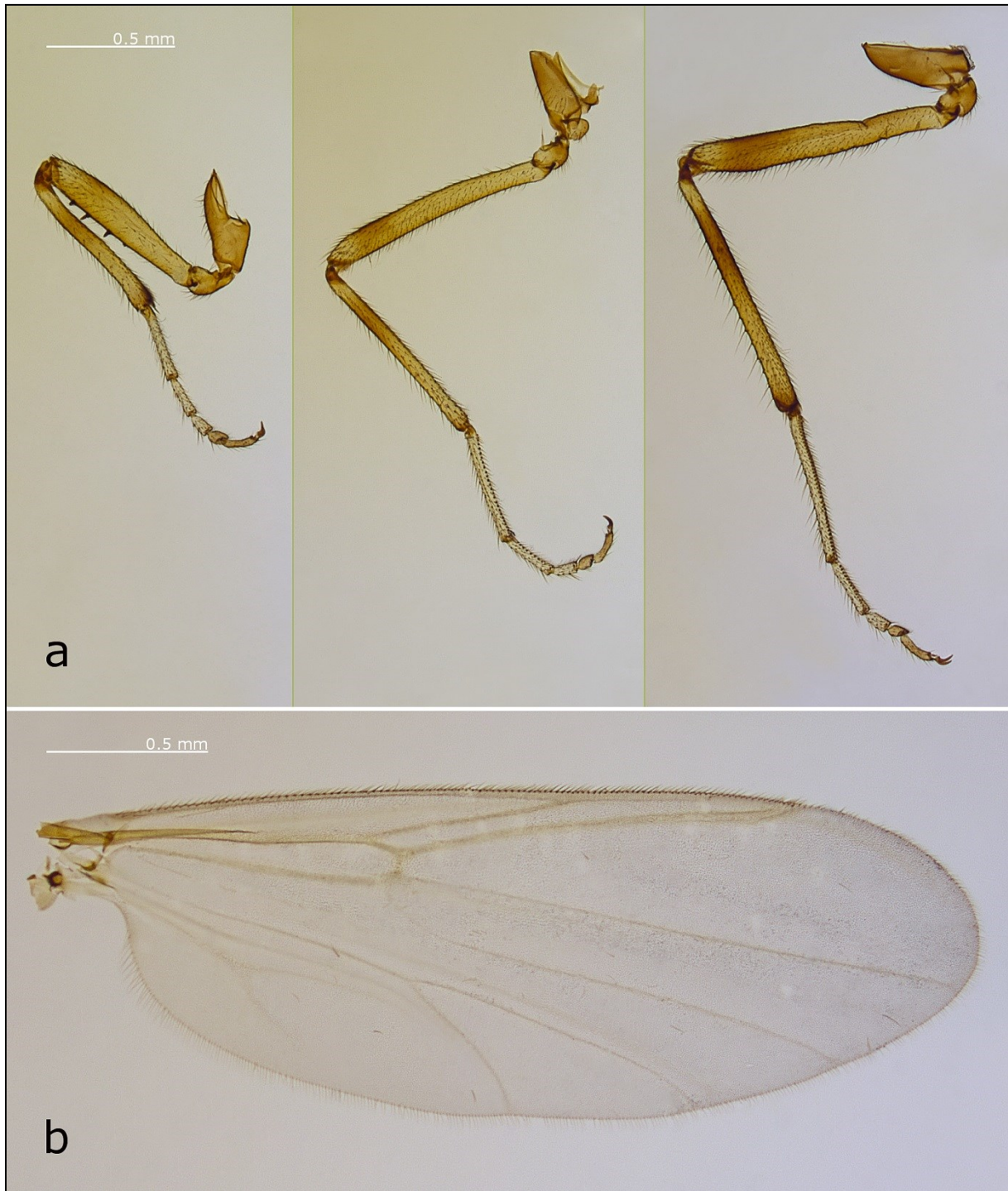


FIG. 3. *Ceratopogon circumdatus* STÆGER, 1839, female: a – legs (fore-, mid-, hindleg), b – wing.

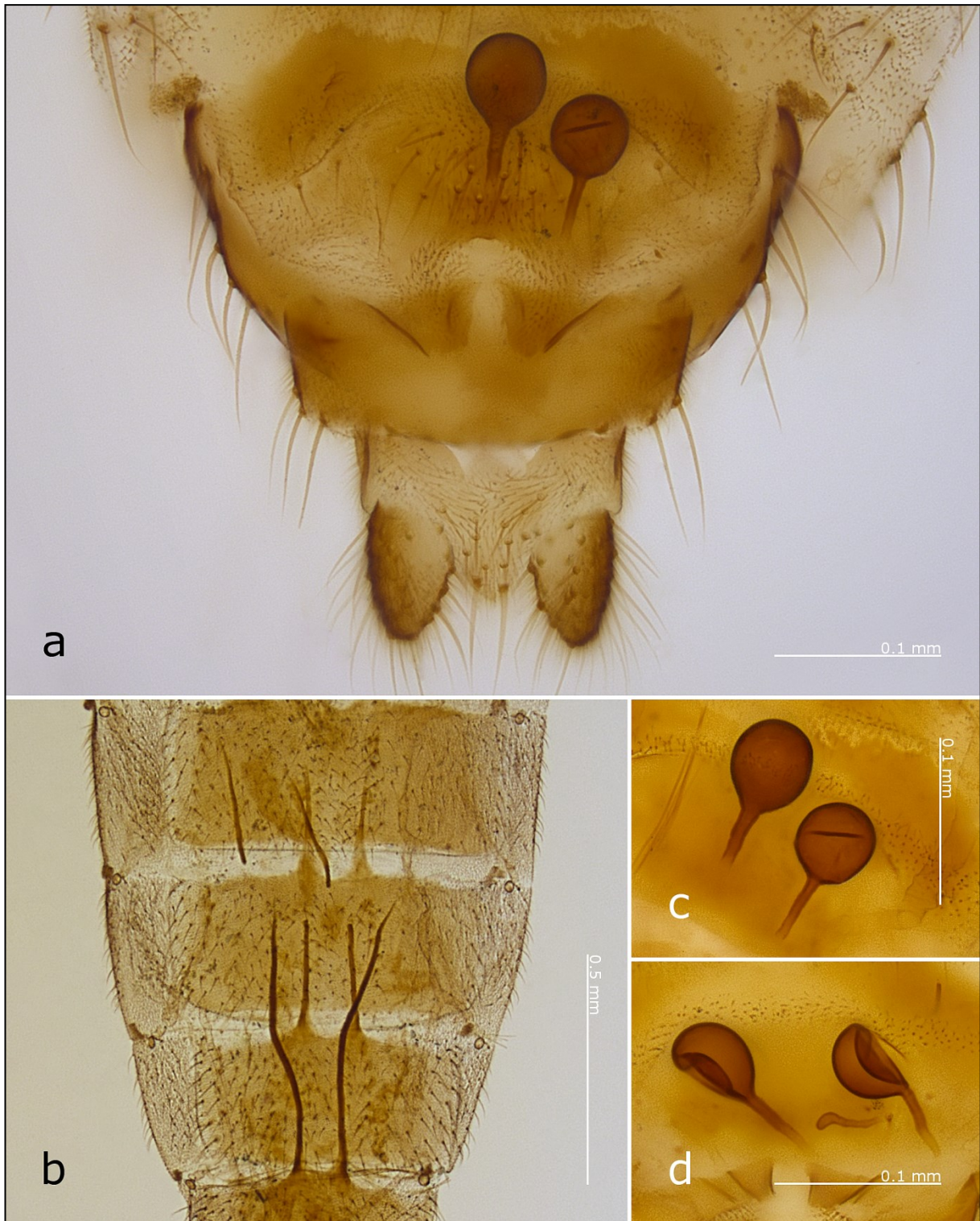


FIG. 4. *Ceratopogon circumdatus* STÆGER, 1839, female: a – genitalia, b – gland rods, c, d – spermathecae.



FIG. 5. *Palpomyia binotata* (STÄGER, 1839), female: habitus, lateral view.

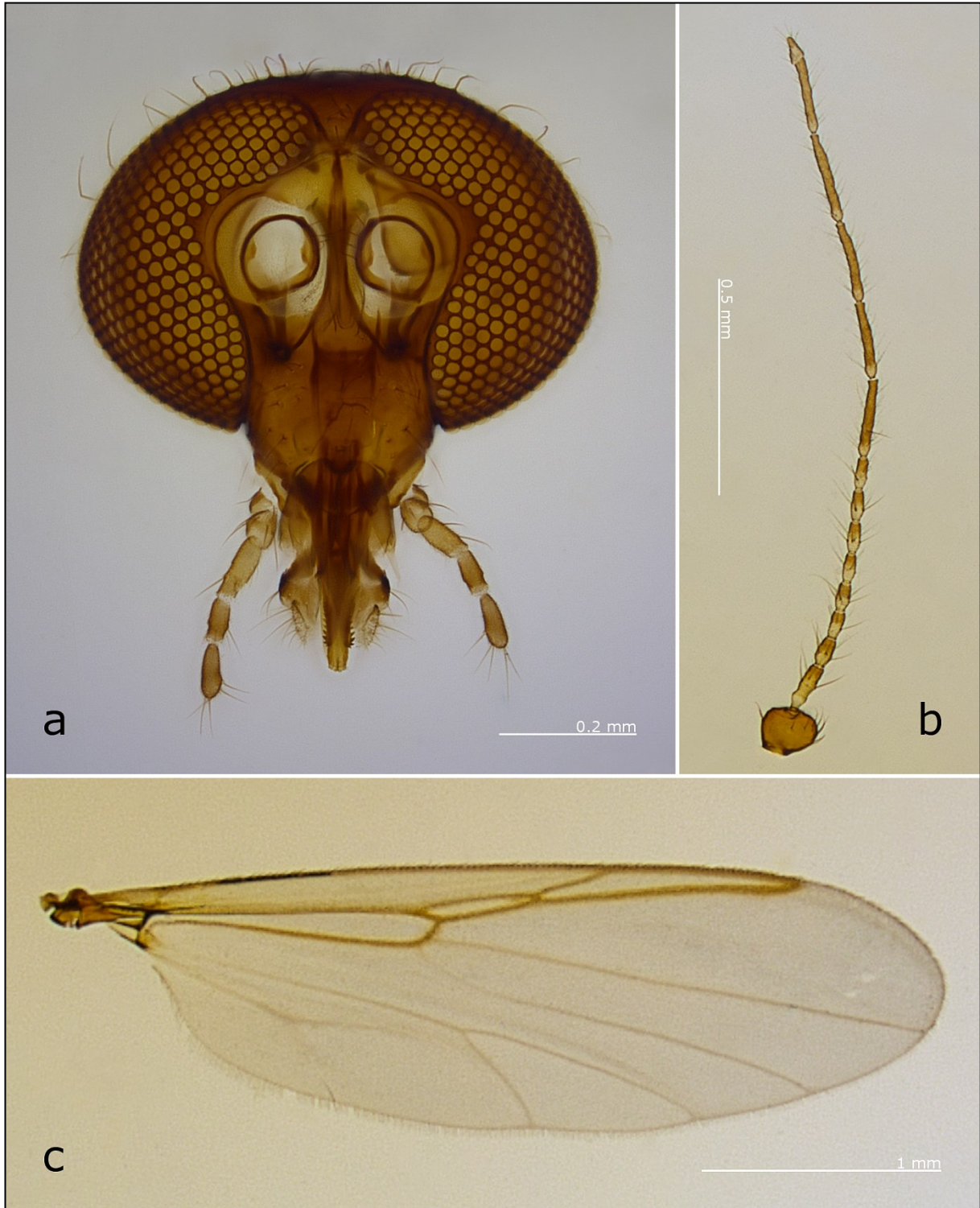


FIG. 6. *Palpomyia binotata* (STÆGER, 1839), female: a – head, b – antenna, c – wing.

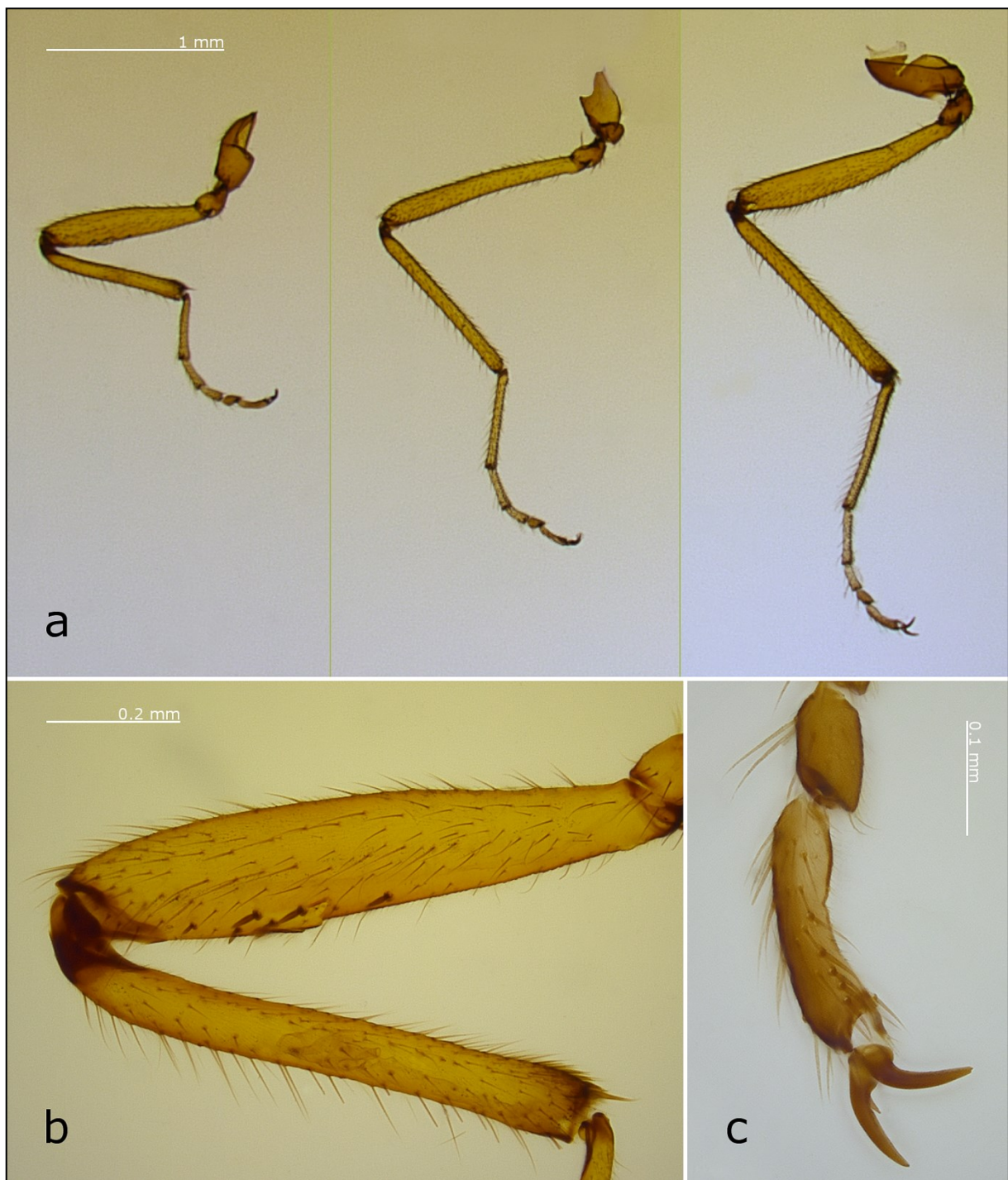


FIG. 7. *Palpomyia binotata* (Stæger, 1839), female: a – legs (fore-, mid-, hindleg), b – fore femur and tibia, c – hind leg tarsomeres 4 and 5, and claws.

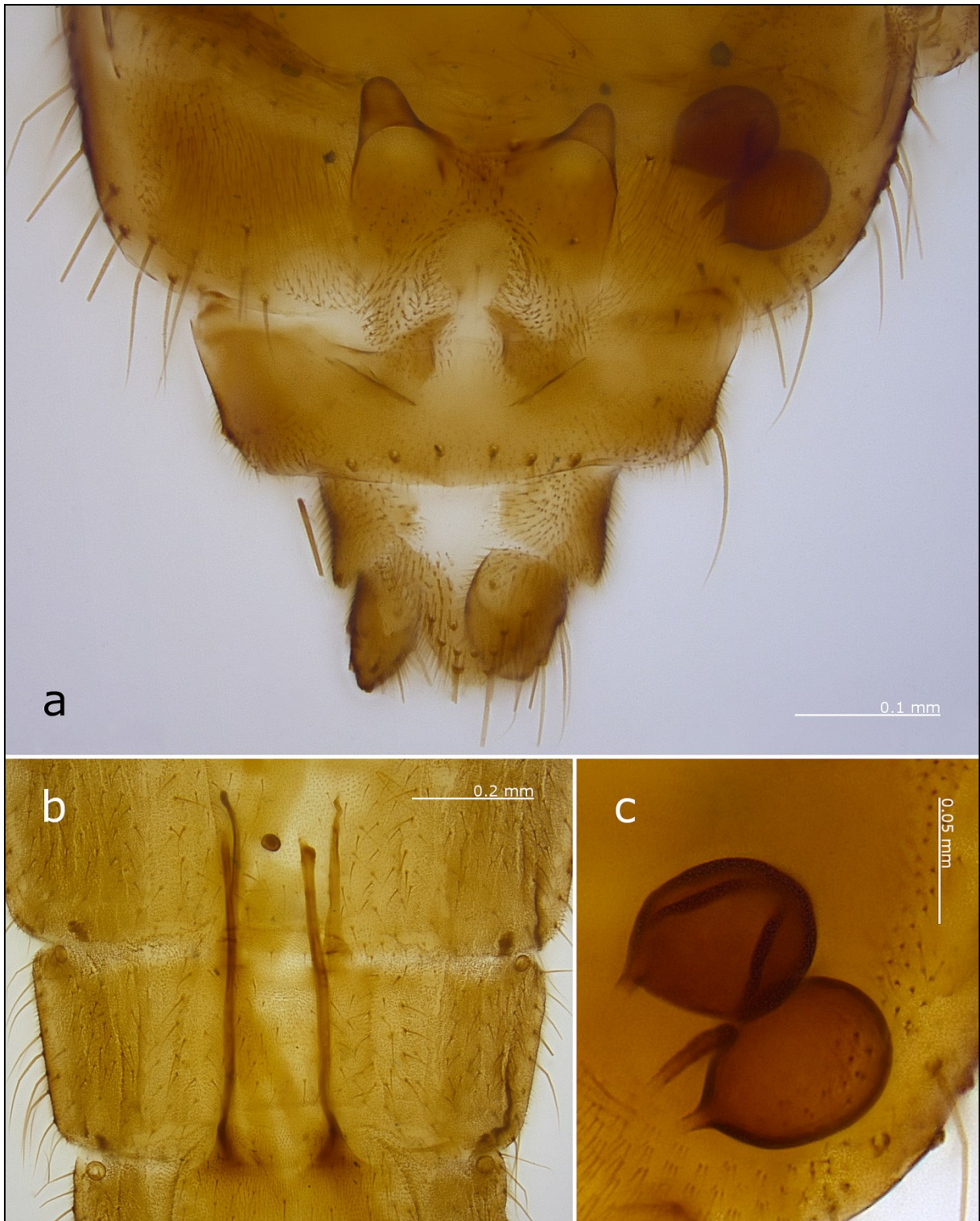


FIG. 8. *Palpomyia binotata* (STÄGER, 1839), female: a – genitalia, b – gland rods, c – spermathecae.

REFERENCES

- BORKENT A. 2016. World species of biting midges (Diptera: Ceratopogonidae). Available from <http://wwx.inhs.illinois.edu/files/1114/2384/5200/CeratopogonidaeCatalog.pdf> [last updated 16 May 2016]
- BORKENT A., WIRTH W.W. 1997. World species of biting midges (Diptera: Ceratopogonidae). *Bulletin of the American Museum of Natural History* **233**: 1-257.
- CLASTRIER J. 1962. Notes sur les Cératopogonidés. XVI. - Espèces du genre *Bezzia* KIEFFER ou apparentées de la région Paléarctique. *Archives de l'Institut Pasteur Algérie* **40**: 53-125.
- ENDERLEIN G. 1936. Ordnung: Zweiflügler, Diptera. Abt. 16, 259 pp. [In:] BROHMER P., EHRMANN P., ULMER G. (EDS), *Die Tierwelt Mitteleuropas 6: Insekten III Teil*. Leipzig.
- GROGAN W.L., Jr., WIRTH W.W. 1975. A revision of the genus *Palpomyia* MEIGEN of northeastern North America (Diptera: Ceratopogonidae). Agricultural Experiment Station, University of Maryland **875**: v + 49 pp.
- GROGAN W.L., Jr., WIRTH W.W. 1979. The North American predaceous midges of the genus *Palpomyia* MEIGEN (Diptera: Ceratopogonidae). *Memoirs of the Entomological Society of Washington* **8**: vi + 125 pp.
- GROGAN W.L., Jr., WIRTH W.W. 1981. A new American genus of predaceous midges related to *Palpomyia* and *Bezzia* (Diptera: Ceratopogonidae). *Proceedings of the Biological Society of Washington* **94**: 1279-1305.
- HAESSELBARTH E. 1965. *Phaenobezzia*, a new genus of biting midges (Diptera: Ceratopogonidae), with a review of the African species. *Zeitschrift für Angewandte Zoologie* **52**: 297-324.
- KIEFFER J.J. 1899. Description d'un nouveau genre et tableau des genres européens de la famille des Chironomides (Dipt.). *Bulletin de la Société Entomologique de France* **1899**: 66-70.
- KIEFFER J.J. 1901. Synopse des représentants européens du groupe *Ceratopogon* avec description de quelques espèces nouvelles. *Bulletin de la Société d'Histoire Naturelle de Metz* **9**: 143-165.
- KIEFFER J.J. 1906. Diptera. Fam. Chironomidae. [In:] WYTSMAN P. (ED.), *Genera Insectorum: Fasc. 42*, 78 p., 4 pls. Bruxelles.
- KIEFFER J.J. 1912. Quelques nouveaux tendipédides (Dipt.) obtenus d'éclosion (2e note). *Bulletin de la Société Entomologique de France* **1912**: 101-103.
- KIEFFER J.J. 1921. Chironomides nouveaux ou peu connus de la région paléarctique. *Bulletin de la Société d'Histoire Naturelle de la Moselle* **29**: 51-109.
- KIEFFER J.J. 1925a. Diptères (Nématocères piqueurs): Chironomidae Ceratopogoninae. *Faune de France* **11**: 1-139.
- KIEFFER J.J. 1925b. Nouveaux genres et nouvelles espèces de chironomides piqueurs. *Archives de l'Institut Pasteur Algérie* **3**: 405-430.
- MACQUART J. 1826. Insectes Diptères du nord de la France. Tipulaires. De la Société des Sciences, de l'Agriculture et des Arts, de Lille **1823-1824**: 59-224.

- MEIGEN J.W. 1804. Klassifikation und Beschreibung der europäischen zweiflügeligen Insekten. (Diptera LINN.). Erster Band. Abtheilung I, i-xxviii + 1-152 pp., pls. 1-8; Abtheilung II, i-vi + 153-314 pp., pls. 9-15. Braunschweig.
- MEIGEN J.W. 1818. Systematische Beschreibung der bekannten europäischen zweiflügeligen Insekten. Vol. 1, xxxvi + 333 pp., pls. 1-11. Aachen.
- MEIGEN J.W. 1830. Systematische Beschreibung der bekannten europäischen zweiflügeligen Insekten. Vol. 6, iv + 401 pp., pls. 55-66. Aachen.
- REMM H. 1974. A review of species of the genus *Bezzia* KIEFFER (Diptera, Ceratopogonidae) from the fauna of the USSR. I [in Russian, English summary]. Entomologicheskoe Obozrenie **53**: 429-442. Translation in Entomological Review **53**(1): 136-145.
- REMM H. 1976. A synopsis of the *Palpomyia* of the USSR (Diptera, Ceratopogonidae). Eesti NSV Teaduste Akadeemia Juures Asuva Eesti Looduseuurija Seltsi Aastaraamat **64**: 172-197.
- REMM H. 1988. Ceratopogonidae. [In:] SOOS Á., PAPP L. (EDS), Catalogue of Palaearctic Diptera. Vol. 3. Akadémiai Kiadó, Budapest, pp. 11-110.
- SPINELLI G., Grogan W.L., Jr. 1985. *Clastrieromyia*, a new Neotropical genus of predaceous midges related to *Palpomyia* and *Bezzia* (Diptera: Ceratopogonidae). Proceedings of the Entomological Society of Washington **87**: 329-334.
- STÆGER R.C. 1839. Systematisk fortegnelse over de i Danmark hidtil fundne Diptera. Naturhistorisk Tidsskrift **2**: 549-600.
- SZADZIEWSKI R. 1988. Biting midges (Diptera, Ceratopogonidae) from Baltic amber. Polskie Pismo Entomologiczne **58**: 3-283.
- SZADZIEWSKI R., BORKENT A., DOMINIAK P. 2013. Fauna Europaea: Ceratopogonidae. [In:] BEUK P., PAPE T. (EDS), Fauna Europaea: Diptera, Nematocera. Fauna Europaea version 2.6. Available online, <https://fauna-eu.org/>.
- TOKUNAGA M. 1939. Japanese biting midges of *Bezzia* and *Palpomyia* (Ceratopogonidae, Diptera). Tenthredo **2**: 273-313.
- WINNERTZ J. 1852. Beitrag zur Kenntniss der Gattung *Ceratopogon* MEIGEN. Linnaea Entomologica **6**: 1-80.
- WIRTH W.W. 1959. *Pachyhelea*, a new genus of American Ceratopogonidae related to *Palpomyia* (Diptera). Bulletin of the Brooklyn Entomological Society **54**: 50-52.
- WIRTH, W.W., PALCHICK S.M., FORSTER L. 1984. The North American predaceous midges of the *Bezzia annulipes* group (Diptera: Ceratopogonidae). Proceedings of the Entomological Society of Washington **86**: 155-175.
- ZETTERSTEDT J. W. 1850. Diptera Scandinaviae. Disposita et descripta **9**: 3367-3710. Lundae (=Lund).

* *Editorial remarks:*

* This paper is dedicated to the late BOGUSŁAW SOSZYŃSKI.