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Predatory biting midges of the genus *Sphaeromias* (Diptera: Ceratopogonidae) in Europe

RYSZARD SZADZIEWSKI* , MARTA GWIZDALSKA-KENTZER,
ELŻBIETA SONTAG

Department of Invertebrate Zoology, University of Gdańsk,
Piłsudskiego 46, 81-378 Gdynia, * e-mail: szadz@ocean.univ.gda.pl

ABSTRACT. Recent examination of adult predatory biting midges of the genus Sphaeromias Curtis showed two species: *S. fasciatus* (MEIGEN, 1804) and *S. pictus* (MEIGEN, 1818) to occur in Europe. *Ceratopogon punctatus* MEIGEN, 1830, *Ceratopogon candidatus* LOEW, 1856, *Xylocrypta miricornis* KIEFFER, 1919 and *Sphaeromias sparus* BORKENT, 1997 are recognized as new junior synonyms of *S. pictus*. **New synonymy**.

KEY WORDS: Diptera, Ceratopogonidae, *Sphaeromias*, Europe, diagnosis, synonymy.

INTRODUCTION

Sphaeromias CURTIS, 1829 is a small genus of the tribe Sphaeromiini (subfamily Ceratopogoninae) which contains stout and large biting midges. Females are predators on other small insects, mostly dipterans of the family Chironomidae. Males do not take protein meal. Predatory larvae, good swimmers, are common inhabitants of lakes and ponds SZADZIEWSKI et al. 1997).

A total of 29 species are known world wide (BORKENT & WIRTH 1997), as few as four valid species being catalogued in Europe: *Sphaeromias fasciatus* (MEIGEN, 1804), *S. pictus* (MEIGEN,1818), *S. miricornis* (KIEFFER, 1919) and *S. sparus* Borkent 1997 (REMM 1988, BORKENT & WIRTH 1997).

Although EDWARDS (1926) suggested that *S. candidatus* (= *miricornis*) is a pale variety of *S. pictus*, usually three species were reported from various European countries as pro-

posed by GOETGHEBUER (1934): *S. fasciatus*, *S. pictus* and *S. miricornis* (= *candidatus*). *Sphaeromias sparus* BORKENT replacing homonymous *Ceratopogon punctatus* MEIGEN has never been identified in modern faunistic studies.

The purpose of the present paper is to demonstrate that the genus *Sphaeromias* is represented in Europe by only two species.

MATERIALS AND METHODS

Adult males and females of *Sphaeromias* from Poland, Czech Republic, France, Sweden, and Romania were examined. Many of them were mounted on microscope slides.

RESULTS AND DISCUSSION

Genus *Sphaeromias* CURTIS, 1829

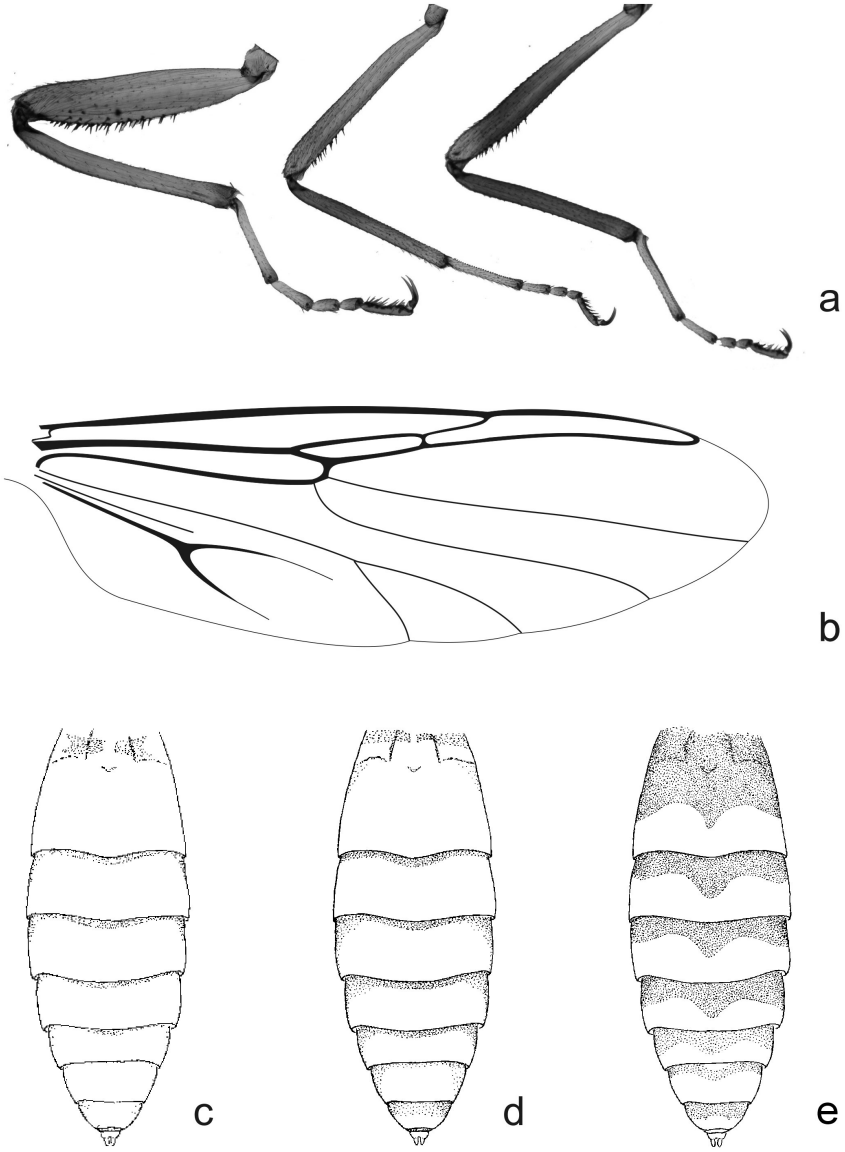
Sphaeromias CURTIS, 1829: 285, type-species *Sphaeromias albomarginatus* CURTIS, 1829 (= *fasciatus* MEIGEN, 1804), by monotypy. References: DEBENHAM (1974), WIRTH & GROGAN (1979), DE MEILLON & WIRTH (1991); SZADZIEWSKI et al. (1997).
Xylocrypta KIEFFER, 1899: 69, type-species *Ceratopogon fasciatus* MEIGEN, 1804, by monotypy.

Diagnosis

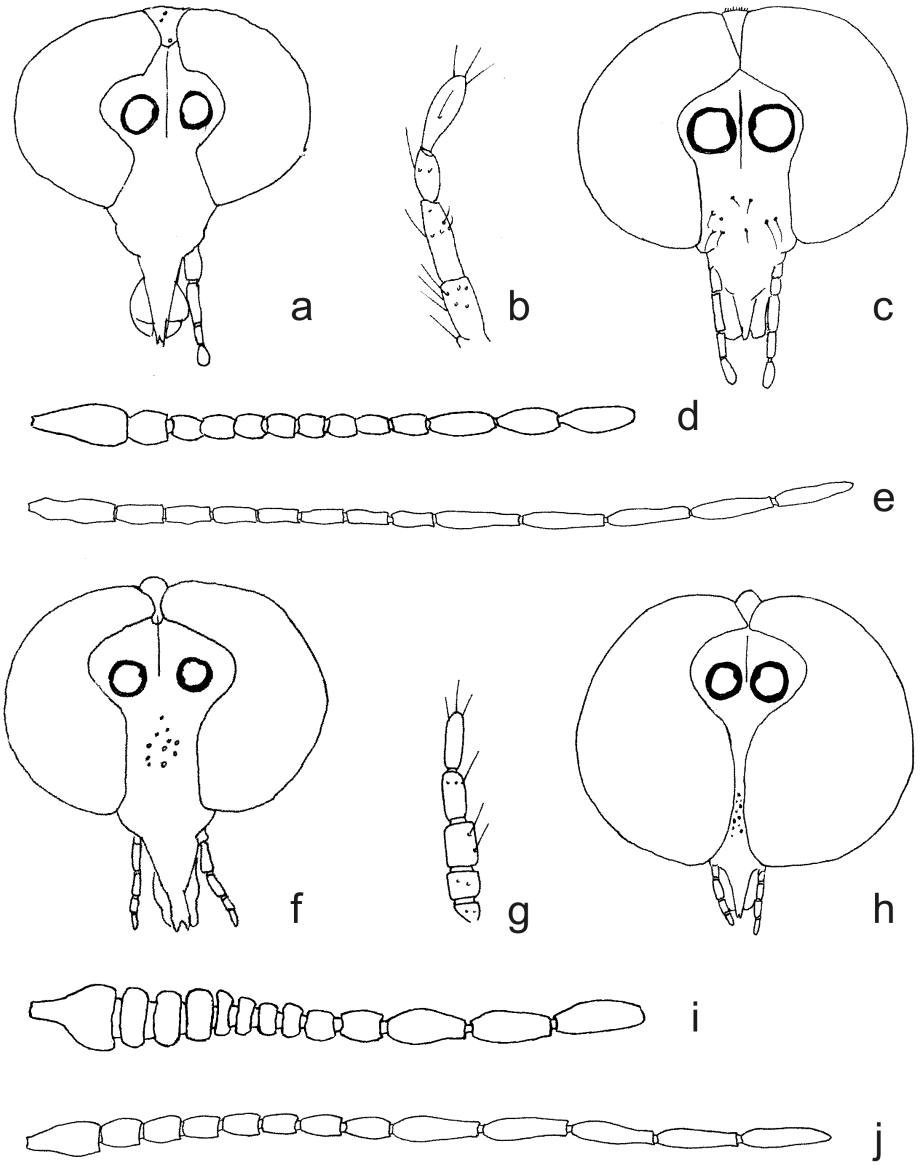
The only genus in the tribe Sphaeromiini in which females have fifth tarsomeres armed with three or more pairs of batonnets along entire length of segment, tarsal claws gently curved and equal on all legs, all femora armed with ventral spines. Males are distinct in having antennal plume totally reduced, all femora armed with ventral spines and parameres fused, tongue-like.

Stout and large, grayish pollinose, biting midges with wing length 2.2-4.6 mm. Eyes bare, contiguous or narrowly separated (Figs 1a,c,f,h). Mandible with 20-28 teeth including 6-7 large ones (Table 1). Mesonotum with anterior tubercle. Legs moderately slender, fore femur slightly swollen (Fig. 1a); all femora armed with ventral spines in both sexes (Fig.1a, Table 1). Fourth tarsomeres cylindrical. Fifth tarsomeres armed ventrally with 3-8 pairs of batonnets along entire length of segment in female; claws large, equal, gently curved, with or without sharp-pointed inner basal tooth. Fifth tarsomeres of males armed with 0-6 batonnets. Wing with two radial cells, media broadly sessile, mebrane bare (Fig. 1b); costa long extending nearly to wing tip, CR 0.90-0.95 in female, and 0.78-0.88 in male (Table 1). Female abdomen without special armature; two functional seminal capsules present. Male genitalia with long gonocoxites and gonostyli (Figs 3a,d); aedeagus with high basal arch

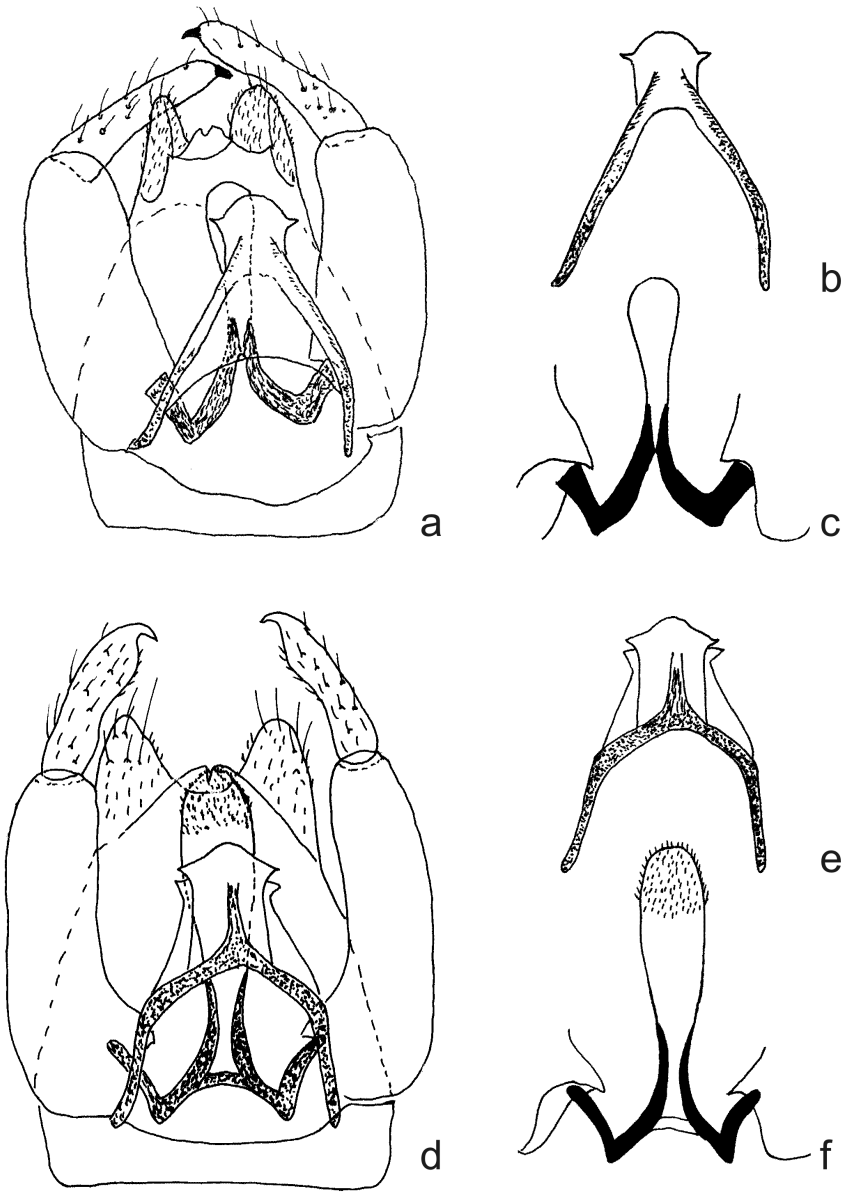
and broad cap-like tip (Figs 3b,e); parameres fused distally into a tongue-like lobe (Figs 3c,f).



1a-e. *Sphaeromias fasciatus* (MEIGEN), female: a - fore, mid and hind legs, b - wing, c-e - coloration of abdomen.



Figs 2a-j. Head of *Sphaeromias fasciatus* (MEIGEN) (a-e), and *S. pictus* (MEIGEN) (f-j): a,f - frontal aspect of female head, c,h - frontal aspect of male head, b,g - male palpus, d,i - male flagellum, e,j - female flagellum.



Figs 3a-f. Male genitalia of *Sphaeromias fasciatus* (MEIGEN) (a-c), and *S. pictus* (MEIGEN) (d-f): a,d - ventral aspect, b,e - aedeagus, c,f - parameres.

Table 1. Numerical characters of examined *Sphaeromias*.

	Sphaeromias fasciatus		***Sphaeromias pictus***	
	female	male	female	male
wing length (mm)	3.70 – 4.63	2.35 – 3.20	3.80 – 4.54	2.24 – 2.54
costal ratio CR	0.90 – 0.94	0.78 – 0.88	0.87 – 0.95	0.79 – 0.86
flagellum length (mm)	1.12 – 1.79	0.67 – 1.00	0.73 – 1.20	0.43 – 0.56
antennal ratio AR	0.93 – 1.26	0.75 – 0.96	0.90 – 1.20	0.79 – 1.20
PR III	3.00 – 3.75	3.00	2.00 – 2.75	1.00 – 1.50
teeth of mandible	20 - 26	-	26 - 28	-
tarsal ratio of fore leg TRI	1.6 – 1.9	1.4 – 1.8	1.5 – 2.0	1.5 – 1.9
tarsal ratio of mid leg TR II	2.6 – 3.2	1.8 – 2.6	2.1 – 2.8	2.1 – 2.4
tarsal ratio of hind leg TR III	2.3 – 2.5	2.0 – 3.0	2.0 – 2.2	1.8 – 2.2
length of larger seminal capsule (mm)	0.110 – 0.130	-	0.160 – 0.180	-
ventral spines on fore femur	22 – 30	12 - 22	5 – 14	3 – 4
ventral spines on mid femur	6 – 10	2 – 4	7 - 14	3 – 5
ventral spines on hind femur	7 - 12	2 – 5	8 - 11	4 – 6

Discussion

Morphological studies showed the genus *Sphaeromias* to be represented by two distinct species: *S. fasciatus* and *S. pictus*. They differ in the number of spines on femora, fifth tarsomeres, male genitalia, antennae, the head construction, etc. (see key and Table 1). Colouration of abdomen (Fig. 1c-e) and legs is greatly variable and has no diagnostic value. Specimens with dark tibiae and yellow subapical ring identified as *S. pictus* with the key of GOETGHEBUER (1934) and those totally pale with a dark apex, determined as *S. miricornis*, evidently represent the same species. We observed a similar variation of leg colouration in *S. fasciatus*.

Key to species

*. Scutellum in both sexes with strong short marginal setae; fifth palpal segment broadly ovoid (Fig. 2b). Female claws with inner tooth on all legs. Male flagellum relatively long (Fig. 2d). Apex of parameres bare (Fig. 3c) ……..……..... ***S. fasciatus* (MEIGEN)**

-. Scutellum in both sexes with long pale hairs. Fifth palpal segment slender, cylindrical (Fig. 2g). Female claws with inner tooth on fore legs, simple on mid and hind legs. Male flagellum very short (Fig. 2i). Apex of parameres covered with short setae (Fig.3f) ……..……. ***S. pictus* (MEIGEN)**

Sphaeromias fasciatus (MEIGEN, 1804)

Figs 1a-e, 2a-e, 3a-c

Ceratopogon fasciatus MEIGEN, 1804: 30 (female, Germany).
Sphaeromias fasciatus: GOETGHEBUER 1934: 59 (= *cingulatus*, *procerus*, *ocularis*); REMM 1988: 15, BORKENT & WIRTH 1997 : 123 (= *cingulatus*, *albomarginatus, procerus*, *ocularis, goetghebueri*, North and Central Europe).
Ceratopogon cingulatus MEIGEN, 1804: 30 (female, Germany).
Sphaeromias albomarginatus CURTIS, 1829: 285 (England).
Ceratopogon procerus ZETTERSTEDT, 1855: 4867 (female, Sweden).
Xylocrypta ocularis KIEFFER, 1924: 397 (male, Germany).
Sphaeromias goetghebueri DE MEIJERE, 1946: 9 (male, Netherlands).

Diagnosis

Wing length 3.7-4.6 mm in female and 2.4-3.2 mm in male (Table 1); median veins broadly sessile (Fig. 1b). Eyes narrowly separated in females (Fig. 2a) and narrowly fused in males (Fig. 2c); vertex flat. Fifth palpal segment broadly ovoid in both sexes (Fig. 2b). Male flagellum relatively long, plume reduced, distal three flagellomeres elongated (Fig. 2d). Female flagellum with cylindrical proximal flagellomers (Fig. 2e). Mesonotum dark brown with indistinct gray pollinose; longitudinal darker stripes weakly visible; scutum and scutellum covered with short sharp dark spine-like setae. Fifth tarsomeres with 6-8 pairs of batonnets in female, and 1-3 pairs in male. Legs brown; hind legs with darker tibia and femur, usually apex of hind femur and apex of tibia pale, hind femur stout and armed with 22-30 ventral spines (Fig. 1a, Table 1). Hind and mid femora slender and armed with 6 -12 ventral spines (Table 1). Male legs dark brown with paler proximal tarsomeres, fore femur slightly swollen and armed with 12-22 ventral spines (Table 1). Female abdomen almost totally pale or with characteristic dark pattern with triangles (Fig. 1c-e). Two fuctional seminal capsules and third rudimentary present (Table 1). Male genitalia as in a Figs 3a-c; apical prolongation of aedeagus small (Fig. 3b); parameres fused into tongue-like bare structure (Fig. 3c).

Material examined

Czech Republic: 26 May 1995 1 ♀ (coll. J. KNOZ). **Poland:** Białowieża, Park Pałacowy, 4 June 1981, at light, 3 ♀♀, R. SZADZIEWSKI; Wyskok nr Kętrzyn, 25 June 1992, netting, 1 ♀, D. JABŁONOWSKA; 29 May 1993, breeding, 4 ♀♀, 1 ♂; 31 May 1993, netting, 2 ♀♀, 1 ♂ J. KRZYWIŃSKI; 30 May 1993, netting, 1 ♂; 31 May 1993, netting, 1 ♂; 27 June 1997, at light, 1 ♀; R. SZADZIEWSKI; 25 July 1994, netting , 2 ♀♀; E. KACZOROWSKA. Żakowo nr Sulęczyno, 25 July 1994, netting, 3 ♀♀, 1 ♂, E. KACZOROWSKA. Gdańsk-Osowa,17 May to 10 June 1993, breeding, 10 ♀, 5 ♂♂; 18-25 May 1993, J. KRZYWIŃSKI. Krzeszna nr Gdańsk, 19 May 1993, breeding, 2 ♀♀, 4 ♂♂, J. KRZYWIŃSKI. Kożyczkowo nr Chmielno, 21 June 1997 netting, 1 ♀, E. SONTAG. Słupsk, 13 June 1933, O. KARL (collection of Museum and Institute of Zoology, Warsaw). **Sweden**: Ryssby, 16 June-11 July 1924, C B. GAUNITZ (coll. Lund University).

Distribution and ecology

Rather rare species in Central, North Europe (Austria, Belgium, Belorus, Czech Republic, Denmark, France, Germany, Great Britain, Hungary, Romania, Estonia, Lithuania, the Netherlands, Poland, Russia, Slovakia, Sweden) Siberia and the Far East of Russia. Aquatic larvae usually inhabit lakes and ponds (GLUKHOVA 1979).

Sphaeromias pictus (MEIGEN, 1818)

Figs 2f-j, 3d-f

Ceratopogon pictus MEIGEN, 1818: 80 (female, Germany).
Sphaeromias pictus: GOETGHEBUER 1934: 59 (= *elegans*); REMM 1988: 16 (= *elegans*, *copiosa*); BORKENT & WIRTH 1997: 123 (= *elegans*, *copiosa*).
Ceratopogon punctatus MEIGEN, 1830: 264 (female, locality not stated, probably Germany). **New synonymy**.
Ceratopogon elegans WINNERTZ, 1852: 58 (female, Poland).
Xylocrypta miricornis KIEFFER, 1919: 77 (male, Hungary). **New synonymy**.
Ceratopogon candidatus LOEW, 1856: 23 (female, Austria). **New synonymy**.
Xylocrypta copiosa KIEFFER, 1925: 423 (female, Czech Republic).
Sphaeromias sparus BORKENT 1997: 123 (new name for *Ceratopogon punctatus* MEIGEN). **New synonymy**.

Diagnosis

Wing length 3.8-4.5 mm in females and 2.2-2.5 mm in males (Table 1). Eyes narrowly separated in females (Fig. 2f) and narrowly fused in males (Fig. 2h); vertex convex. Fifth palpal segment cylindrical in both sexes (Fig. 2g). Male flagellum relatively short, plume reduced, distal three flagellomeres elongated (Fig. 2i). Female flagellum with cylindrical proximal flagellomers (Fig. 2j). Mesonotum in dry specimens pale gray pollinose with 3 brown longitudinal stripes; scutum and scutellum covered with fine long pale hairs. Legs pale brown, usually with dark apex of tibiae; male legs darker than those in females. Fifth tarsomeres dark, each with 3-4 pairs of batonnets in females, and with 0-2 strong ventral spines in males. Fore femur slightly swollen. All femora armed with 5-14 ventral spines (Table 1). Female abdomen almost totally pale or with characteristic dark pattern with triangles. Two fuctional seminal capsules and third rudimentary present (Table 1). Male genitalia as in Fig. 3d-f; apical prolongation of aedeagus distinct (Fig. 3e); parameres fused into tongue-like structure covered with short hairs (Fig. 3f).

Material examined

Czech Republic: Sedlec, reared, 25 June 1997, 142 males, 102 females, plus pupae (from KNOZ coll.). **France:** La Réserve Naturelle de l'île de Rhinau, 3 June 1976, J.-C. DELÉCOLLE. **NE Poland:** Barciany, at the pond, 11-2 July1981, netting, 3 ♀♀, R. SZADZIEWSKI. Puszcza Białowieska: Białowieża, 4 June 1981, at light, 1 ♀, R. SZADZIEWSKI; Siemianówka, 3 July 2007, 1 ♀, A. KLASA; Siemieniakowszczyzna, 1 ♀, 3 June 2007, A. PALACZYK. Poleski Park Narodowy, Pieszowola, nr staw Graniczny, 1 ♀, A. KLASA. Silec nr Kętrzyn, 20-23

July 1981, netting, 1 ♀, R. SZADZIEWSKI.Wyskok nr. Kętrzyn, 29 May 1993, breeding, 2 ♀♀, 1 ♂, J. KRZYWIŃSKI; 25 – 26 July-3 Aug. 1993, at light, 4 ♀♀, R. SZADZIEWSKI; 5 July - 6 Aug 1994, at light, 6 ♀♀, R. SZADZIEWSKI; 9 July 1995, at light, 1 ♀ R. SZADZIEWSKI; **NW Poland:** Darłowo, beach, 2 Aug. 2004, netting, 1 ♀, E. KACZOROWSKA. Sobieszewska Island, Górki Wschodnie, beach, 12 July 2005, netting, 2 ♀♀, E. KACZOROWSKA. Wolin nr. Warnowo at the Lake Czajcze, 22 June 93, breeding, 21 ♀♀, 8 ♂♂, J. KRZYWIŃSKI. Lipiany at the Lake Będzin, 25 June 1993, breeding, 3 ♀♀, 5 ♂♂, J. KRZYWIŃSKI. Puszcza Notecka, 5 July 1992, sweeping, 1 ♀, J. KRZYWIŃSKI. **Romania:** Murighiol nr Tulcea, 19 June 2007 at light 78 ♀♀, P. DOMINIAK & R. SZADZIEWSKI. **Sweden:** norr Krankesjőn, Torrhed, 5 July 1970, 1 ♀, 1 July 1973, 3 ♀♀, 3 ♂♂,18 July 1975, 5 ♀, H. ANDERSSON (coll. of Lund University).

Distribution and ecology

A common arboreal species widely distributed in the Palaeartic: Central and North Europe (Austria, Belgium, Belorus, Czech Pepublic, Denmark, Estonia, Finland, France, Germany, Great Britain, Hungary, Italy, Lithuania, Poland, Romania, Russia, Slovakia, Ukraine, Sweden), Azerbaijan, Turkmenia, Kazakhstan, Mongolia, Japan. Larvae are common inhabitants of lakes and ponds (GLUKHOVA 1979).

Discussion

Colouration of abdomen and legs is greatly variable and has no diagnostic value. Specimens with dark tibiae and yellow subapical ring, identified with the key of GOETGHEBUER (1934) as *S. pictus* and those totally pale with a dark apex, diagnosed as *S. miricornis,* evidently represent the same species. In his original description of the female of *Ceratopogon punctatus* MEIGEN (1830) pointed out to a distinct dark pattern of abdomen (as in our Fig. 1e) and to a pale gray body with 3 brown stipes on mesonotum. The abdomen is similar in *S. fasciatus* and *S. pictus*. However, pinned specimens of both species show the thorax to be more grayish in *S. pictus,* the brown stripes being distinctly visible against the pale background. This indicates that *punctatus* is a junior synonym of *S. pictus* because the female mesonotum in *S. fasciatus* is usually of a distinctly darker brown colour.

REFERENCES

BORKENT A., WIRTH W.W. 1997. World species of biting midges (Diptera: Ceratopogonidae). Bulletin of the American Museum of the Natural History **233**: 1-257.

CURTIS J. 1829. British Entomology; being illustrations and descriptions of the genera of insects found in Great Britain and Ireland: containing coloured figures from nature of the most rare and beatiful species, and in many instances of the plants upon which they are found. Vol. **6**, pls. 242-289. London.

DEBENHAM M.L. 1974. A revision of the Australian and New Guinea predatory Ceratopogonidae (Diptera: Nematocera) of the tribes Heteromyiini and Sphaeromiini. Australian Journal of Zoology, Supplementary Series **28**: 1-92.

DE MEIJERE J.C.H. 1946. Zevende Supplement op de Nieuwe Naamlijst van Nederlandsche Diptera van 1898 (Eerste Supplement op mijne Naamlijst van 1939). Tijdschrift voor Entomologie **87**: 1-25.

DE MEILLON B., WIRTH W.W. 1991. The genera and subgenera (excluding *Culicoides*) of the Afrotropical biting midges (Diptera: Ceratopogonidae). Annals of the Natal Museum **32**: 27-147.

EDWARDS F.W. 1926. On the British biting midges (Diptera, Ceratopogonidae). Transactions of the Entomological Society of London **74**: 389-426, 2 pls.

GLUKHOVA V. M. 1979. Larvae of the biting midges of the subfamilies Palpomyiinae and Ceratopogoninae of the Soviet Union. - Keys to the Soviet Union Fauna. Nauka, Leningrad, 121, 231 pp. [In Russian].

GOETGHEBUER M. 1934. 13a. Heleidae (Ceratopogonidae). In LINDNER: Die Fliegen der palearktichen Region, **3**(2): 1-148.

KIEFFER J. J. 1899. Description d`un nouveau genre et tableau des genres européens de la famille des Chironomides. Bulletin de la Soc. Ent. Fr., 1899: 66-70.

KIEFFER J. J. 1919. Chironomides d'Europe conservés au Musée Natiomal Hongrois de Budapest. Annales Historico-Naturales Musei Nationalis Hungarici **17**: 1-160.

KIEFFER J.J. 1924. Quelques chironomides nouveaux et remarquables du nord de l`Europe. Annales de la Société Scientifique de Bruxelles **43:** 390-397.

KIEFFER J.J. 1925. Nouveaux genres et nouvelles espéces de Chironomides piqueurs. Archives de l'Institut Pasteur Algérie **3**: 405-430.

LOEW H. 1856. Neue Beiträge zur Kenntnis der Dipteren. Vierter Beitrag. Programm der Königlichen Realschule zu Meseritz, 1856: 1-57.

MEIGEN J.W. 1804. Klassifikazion und Beschreibung der europäischen zweiflügeligen (Diptera Linn.). Erster Band. Abtheilung I. 1-152 pp., pls. 1-8. Brauschweig.

MEIGEN J.W. 1818: Systematische Beschreibung der bekannten europäischen zweiflügeligen Insekten. Aachen, **1**: 36+333 pp. pls 1-11.

MEIGEN J.W. 1830. Systematische Beschreibung der bekannten europäischen zweiflügeligen Insekten. vol. 6, iv+401 pp., pls 55-66, Aachen.

REMM. H. 1988. Ceratopogonidae. [in:] Á. SOOS, L. PAPP (eds.) Catalogue of Palaearctic Diptera. **3**: 11-16.

SZADZIEWSKI R. 1991. Ceratopogonidae. [in:] J. RAZOWSKI (eds.) Wykaz zwierząt Polski. **2**: 103-109.

SZADZIEWSKI R., KRZYWIŃSKI J., GIŁKA W. 1997. Ceratopogonidae, [in:] A. NILSSON (ed.) Aquatic Insects of North Europe - A taxonomic handbook, vol. 2 Odonata - Diptera, str. 243-263, Apollo Books, Stenstrup, Denmark.

WINNERTZ J. 1852. Beitrag zur Kenntnis der Gattung *Ceratopogon* MEIGEN. Linnaea Entomologica **6:** 1-80.

WIRTH W.W., GROGAN W.L. 1979. Natural history of Plummers Island, Maryland. XXIV. Biting midges (Diptera: Ceratopogonidae) 2. The species of the tribes Heteromyiini and Sphaeromiini. Proceedings of the Biological Society of Washington **91**: 847-903.

ZETTERSTEDT J. W. 1855. Diptera scandinavia disposita et descripta. Lundae, **12:** I – XX+4547-4942.

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