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Cladotanytarsus molestus Hirvenoja, 1962 in Poland: toward the identification of bioindicative Tanytarsini (Diptera: Chironomidae)

by

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Abstract

A rare chironomid species, *Cladotanytarsus molestus* Hirvenoja, 1962, collected at Lake Straszyńskie (the drinking water reservoir for the city of Gdańsk), was recorded from Poland for the first time. The adult male of the species is redescribed, and intraspecific morphological variations of diagnostic structures are presented in detail. Data on the species' biology are also provided.

Key words: Chironomidae, *Cladotanytarsus*, systematics, biology, first record, Poland

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Introduction

Chironomidae is a large family of dipterans with more than 7000 extant species distributed worldwide (Pape et al. 2011). One of the largest chironomid subfamily, Chironominae, comprises the tribe Tanytarsini (~10% of known Chironomidae species) including *Cladotanytarsus* Kieffer, 1921. This genus, besides *Tanytarsus* van der Wulp, 1874, *Paratanytarsus* Thienemann et Bause, 1913 and *Micropsectra* Kieffer, 1909, is one of the largest in Tanytarsini, with ca. 70 species described, including 19 from Europe and 11 from Poland (Langton & McBean 2010; Giłka 2011a,b). Some *Cladotanytarsus* species are limnophilous or limnobiontic (op. cit.), with a narrow range of tolerance/preference of habitat conditions; they are thus bioindicators of considerable potential. However, due to the intraspecific variability in the diagnostic structures, *Cladotanytarsus* species are among the most difficult chironomids to identify. Unfortunately, the descriptions of many species, even the European ones, are insufficiently precise, and do not take into account the structural variability of diagnostic features. Such species include *Cladotanytarsus molestus* that was described over 50 years ago (Hirvenoja 1962), but outside of Finland (from where the locus typicus comes) it has been recorded just a few times – in Slovakia, Portugal and Great Britain (determinations based on pupae) (Bitušík 1993; Cobo et al. 2001; Langton & Ruse 2005). In this paper, we present a redescription of *C. molestus*, which includes the morphological variability of the male of this species, recently recorded for the first time in Poland. The variability demonstrated as differences in the most important structures indicate that their diagnostic value should be treated with a caution. We believe that the detailed redescription presented below will simplify the identification and complement the data on the geographical distribution and biology of this potentially bioindicative species.

Materials and Methods

The specimens of *Cladotanytarsus molestus* from Poland used in this work are part of the material collected within the framework of reports on chironomids from the tribe Tanytarsini inhabiting lakes in Eastern Pomerania (Giłka & Dominiak 2007; Giłka & Podlesińska 2009; Giłka & Jażdżewska 2010; 2012). The material collected from Lake Straszyńskie (Fig. 1) includes more than 4 200 adult males identified to the species level, taken at five localities in the closest vicinity of the lake during the whole season (April–September 2015) at two-week intervals (Zimny, unpublished data). The specimens examined in this work were also collected in Finnish Lapland (comparative material). The individuals were preserved in 70% ethanol, dissected and slide-mounted according to the method adjusted for tiny chironomids (Wirth & Marston 1968; Giłka & Paasivirta 2009). Lengths of leg segments and palpomeres were rounded off to the nearest 5 and 1 µm, respectively. The antennal, leg and venarum ratios (AR, LR,

Figure 1

Sampling site of *Cladotanytarsus* (*Cladotanytarsus*) *molestus* Hirvenoja, 1962 in Poland. For detailed physicochemical parameters of Lake Straszyńskie see WIOŚ (2015)

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VR) were calculated to the second decimal place. The morphological terminology and abbreviations follow Sæther (1980). The spatial greyscale illustrations were made using the technique by Giłka (2008). The examined specimens are housed in the Department of Invertebrate Zoology and Parasitology, University of Gdańsk, Poland (DIZP) or are booked to be deposited at the Department of Entomology, University of Minnesota, St. Paul, USA (DEUM).

Results

Cladotanytarsus (*Cladotanytarsus*) *molestus* Hirvenoja, 1962

Cladotanytarsus molestus Hirvenoja, 1962: 176 (male, pupa; Finland); Paasivirta 1972: 262 (Finland), 2001: appendix (Finland), 2012: 66 (Finland); Bitušík 1993: 193 (pupa, Slovakia); Cobo et al. 2001: 244 (Portugal); Langton & Ruse 2005: 137 (pupa, Great Britain); Giłka 2011b (Europe, distribution).

Material examined. POLAND. Straszyn near Gdańsk, at Lake Straszyńskie (54°16'31"N, 18°32'12"E; UTM CF31/CF41; Fig. 1), 2 May 2015, netting, 15 males, leg. F. Zimny (DIZP). Comparative material. FINLAND. Lapland (Kemin Lappi), Valkenjärvi near Muonio, 24 June 1982, 3 males, ex coll. L. Paasivirta (DIZP); (Sompion Lappi), Seitajärvi *ca* 60 km NE of Sodankylä, 20 June 1960, 2 males, leg. M. Hirvenoja (DEUM); Yläpostojoki *ca* 40 km N of Sodankylä, 10 June 2003, 2 males, ex coll. L. Paasivirta (DIZP).

Diagnostic description

Adult male (n = 15)

***Colouration* (in alcohol).** Antennal pedicel, tentorium, scutal stripes, scutellum, postnotum and sternum dark brown. Antennal flagellum, legs and abdominal segments brown. Head capsule mouthparts, ground colour of thorax, haltere and hypopygium olive brown. Wing membrane with brownish undertone; C, M and radial veins distinctly darker.

Head. Antenna with 13 well-separated flagellomeres, length of distal flagellomere (µm) 442-516 (474), AR 0.96-1.08 (1.00), plume fully developed. Frontal tubercles variable in size and shape (12-28 µm long, 4-8 µm wide at base). Palp slightly variable in length, palpomeres 2-5 (µm): 32-50 (41), 92-116 (109), 100-124 (113), 108-176 (143). Clypeus with 9-17 setae.

Wing. Length (µm) 1590-1790 (1715), width 480-534 (515). Shape, venation pattern and chaetotaxy typical for *Cladotanytarsus*. Veins C, R, R_1, M_{3+4}, M_{1+2} in 2/3 distal part and R_{4+5} in distal half with macrotrichia, several sparse macrotrichia on Cu and An. Membrane covered with macrotrichia in the distal part of cells r_{4+5} and m_{1+2}, with a row of macrotrichia in ¾ distal length of r_{4+5}. Remaining veins and cells bare. FCu slightly distal of RM; VR_{Cu} 1.19-1.37 (1.25). R_{4+5} ending slightly distally of M_{3+4} and well proximally of M_{1+2}.

Legs. Tibial spur of fore leg straight or slightly curved, 15-20 µm long. Tibial combs of mid and hind leg distinctly separated, each comb with spur; longer spur distinctly curved (ca. 25 µm long in mid leg, and *ca* 30 µm long on hind leg), shorter spur straight (ca. 20 µm long in mid leg and ca. 25 µm on hind leg). Basitarsus of mid leg with 2-3 sensilla chaetica. For length of leg segments and leg ratios, see Table 1.

Hypopygium (Figs 2, 3B-D, 4A). Gonostylus slender, 70-115 (90) µm long, slightly shorter than gonocoxite. Anal tergite with V-type bands broadly separated. Anal point with more or less developed nipple-like tip, variable in shape, as shown in Figs 2 and 3B, bearing narrow crests, 3-12 spinulae and dense microtrichia surrounding the base of the anal point. Superior volsella rounded at base, with distinct apical lip,

Table 1

Lengths (µm) of leg segments and leg ratios of male *Cladotanytarsus* (*Cladotanytarsus*) *molestus* Hirvenoja, 1962

	fe	ti	ta_1	ta_2	ta_3	ta_4	ta_5	LR
p_1	680-755 (725)	445-510 (475)	700-760 (745)	375-420 (405)	300-340 (320)	155-215 (205)	90-125 (120)	1.43-1.69 (1.57)
p_2	700-800 (770)	630-695 (650)	310-340 (335)	200-235 (220)	140-165 (155)	110-120 (115)	90-105 (95)	0.49-0.54 (0.52)
p_3	780-870 (810)	820-890 (850)	495-515 (505)	330-355 (345)	235-305 (270)	180-190 (185)	110-130 (120)	0.58-0.61 (0.60)

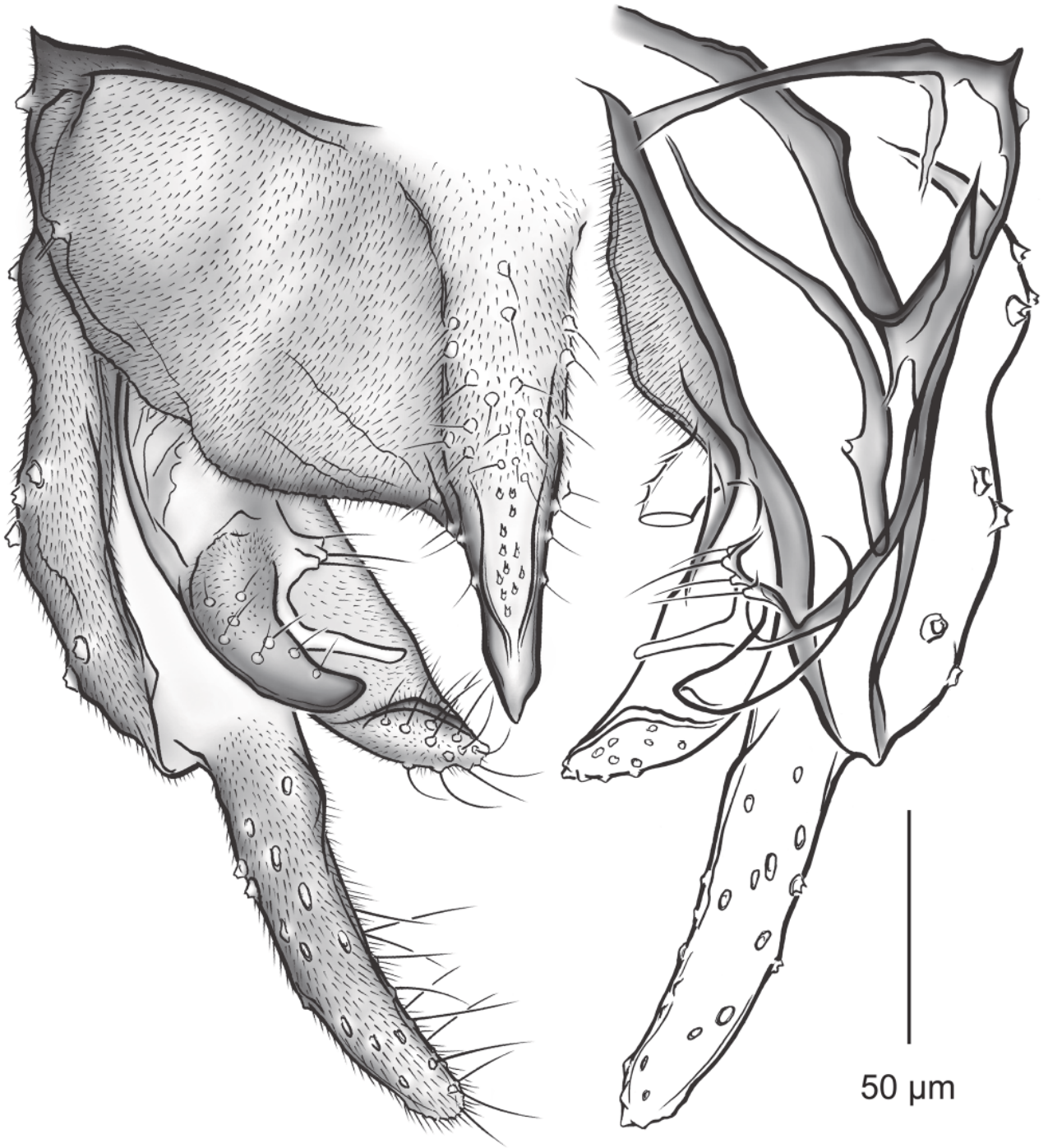

Figure 2

Cladotanytarsus (*Cladotanytarsus*) *molestus* Hirvenoja, 1962, adult male hypopygium (typical structure)

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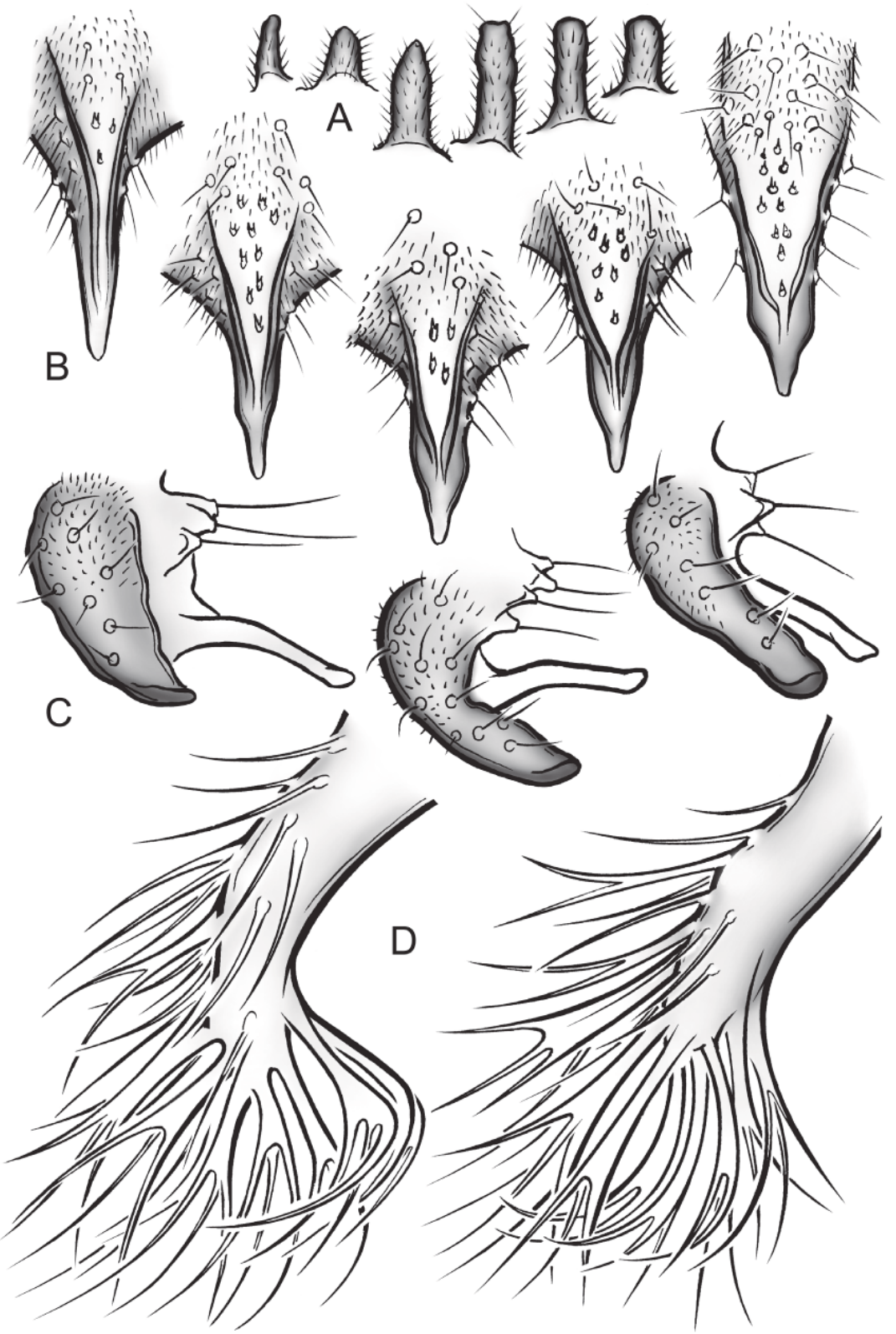

Figure 3

Morphological variations of diagnostic structures in the adult male of *Cladotanytarsus* (*Cladotanytarsus*) *molestus* Hirvenoja, 1962: A – frontal tubercle, B – hypopygial anal point, C – superior volsella and digitus, D – median volsella

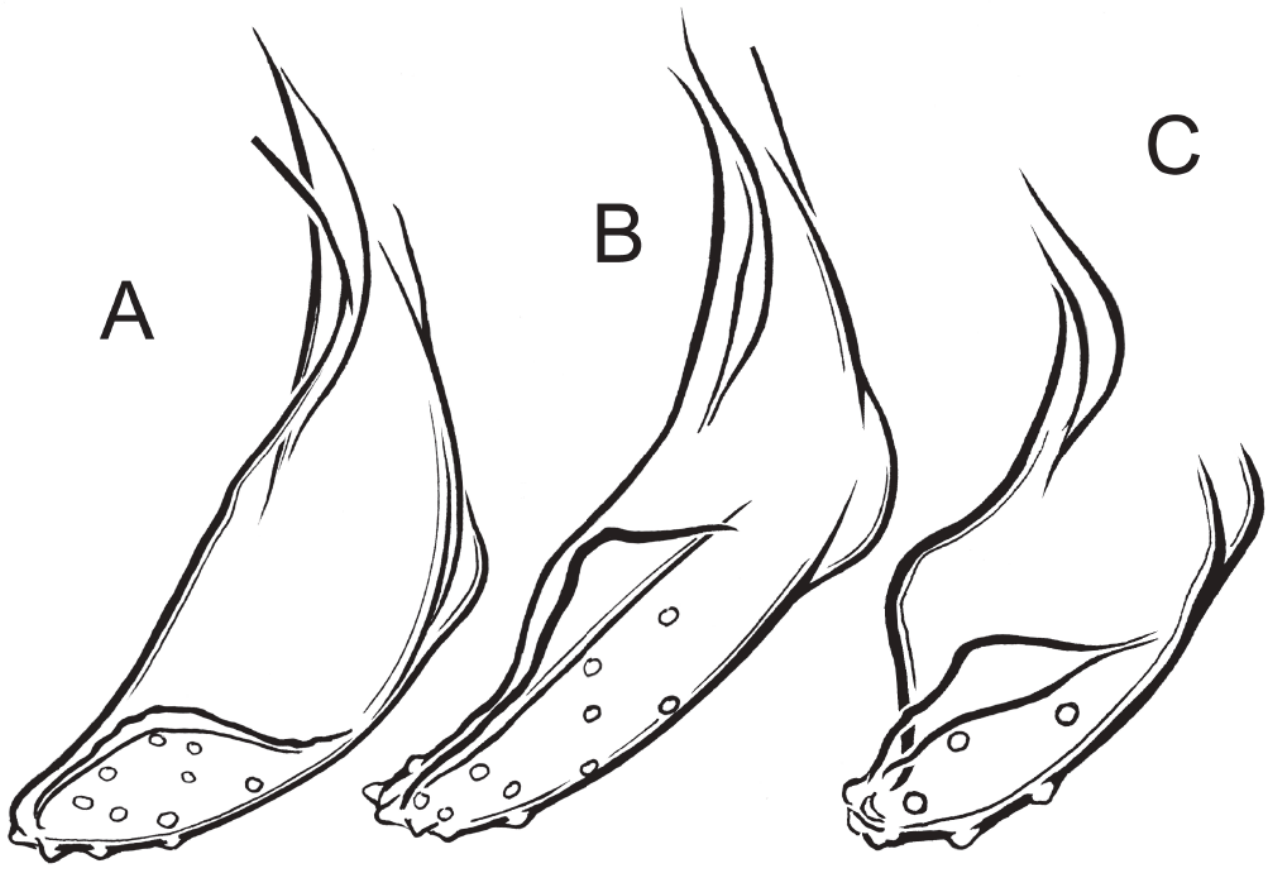

Figure 4

Inferior volsella – diagnostic structure for three close species: *Cladotanytarsus* (*Cladotanytarsus*) *molestus* Hirvenoja, 1962 (A), *Cladotanytarsus* (*Cladotanytarsus*) *matthei* Giłka, 2001 (B) and *Cladotanytarsus* (*Cladotanytarsus*) *atridorsum* Kieffer, 1924 (C)

covered with dense microtrichia in basal part; digitus long, extending far beyond superior volsella, with slightly swollen finger-like tip; 3-4 long inner setae placed on distinct protuberance at base of superior volsella (Figs 2, 3C). Stem of median volsella stout, slightly curved at mid-length and posteriorly directed, bearing 7-8 stout furcate lamellae (Fig. 3D). Inferior volsella relatively broad, evenly tapering to round apex, with narrow dorsomedian ridge (Figs 2, 4A).

Discussion

Morphological variability

Variability in the diagnostic structures in the male of *Cladotanytarsus molestus*, so far known from the original description based on three specimens (Hirvenoja 1962), applies both to metric and meristic characters of the head (Fig. 3A), wings and legs, but first of all to the hypopygial features: the anal point (Fig. 3B), the superior volsella and digitus (Fig. 3C) and the stem and lamellae of the median volsella (Fig. 3D). Adult males of *C. atridorsum* Kieffer, 1924 and *C. matthei* Giłka, 2001 have a similar shape of these structures (but never in combination as shown in Figures 2-4). The crucial diagnostic character best separating the above species is the shape of the inferior volsella: broad, evenly tapering to a round apex, with a narrow dorsomedian ridge in *C. molestus* (Figs 2, 4A), arcuate with a broad and long, strongly pigmented dorsomedian ridge in *C. matthei* (Fig. 4B) or U-shaped in transversal section, with a concave apex and with a broad but short dorsomedian ridge in *C. atridorsum* (Fig. 4C) (*cf.* Giłka 2001). The median volsella, with its stem somewhat curved at the mid-length can also be treated as a key character for *C. molestus* (Fig. 3D). The Polish specimens

of *C. molestus* are slightly different from those collected in Finland in having a shorter wing (ca. 1.6-1.8 vs 2.0 mm), lower AR (0.96-1.08 vs 1.05-1.11) and higher LR (1.43-1.69 vs 1.35-1.50).

Geographical distribution and biology

Cladotanytarsus molestus is a boreal (boreo-alpine) species with a distribution center in northern Europe and with a few localities in central and southern Europe (Giłka 2011b). To date, *C. molestus* has been recorded mainly in the northern bioprovinces of Finland, including all the bioprovinces of Lapland (Paasivirta 2012). Apart from Finland, this species has been noted in the highlands of Scotland (Langton & Ruse 2005), Slovakia (Bitušík 1993) and in Portugal (Aveiro district) (Cobo et al. 2001). Now it has been recorded for the first time in Poland, at Lake Straszyńskie (Fig. 1) situated in the Kashubian Lakeland mesoregion of the Southern Baltic Lakeland subprovince.

According to the data hitherto available, the preferred habitats of *Cladotanytarsus molestus* immatures are oligotrophic lakes, such as those typical in northern Finland (Hirvenoja 1962; Paasivirta 1972; 2001; 2012). Pupae of this species were found in a similar habitat at Loch na Bruthaich in the Scottish Highlands (Langton & Ruse 2005), in a calcareous fen in Slovakia (Rakšianske rašelinisko, Turčianska valley) (Bitušík 1993) and from the Río Vouga (in the middle course) near Albergaria-á-Velha in central Portugal (Cobo et al. 2001).

Lake Straszyńskie (Goszyńskie), where *Cladotanytarsus molestus* has now been found, is a small reservoir (area ca. 75 ha, volume 3.5 million m^3) supplied by the waters of the River Radunia. Since 1983 it has been used as a source of drinking water for the inhabitants of Gdańsk. The waters of Lake Straszyńskie, and also of the Radunia's catchment area upriver of the reservoir, are of a much higher quality than those of other, neighbouring waterbodies and are routinely analyzed to monitor their physicochemical parameters; biomonitoring is also a standard practice (Stepnowski et al. 2010; Radtke et al. 2011). This is not to say they are entirely free of toxic compounds and contaminants of various origin (e.g. Kobos et al. 2013; Caban et al. 2015): the quality of the water is classified as A3 according to the overall assessment of the Provincial Inspectorate of the Environment (WIOŚ 2015).

Adult males of *Cladotanytarsus molestus* were sampled from a site situated *ca* 200 m above the point where the Radunia enters Lake Straszyńskie (Fig. 1). They were found in a large sample of *Cladotanytarsus atridorsum*, an eurytopic species, in Poland typical of meso- and eutrophic lakes (Giłka & Podlesińska 2009). Sympatric species recorded at Lake Straszyńskie in the 2015 season were also represented by species from the *Cladotanytarsus mancus* group (Walker, 1856) (eurytopic, >39% of specimens collected), *Tanytarsus verralli* Goetghebuer, 1928 (eutrophic/mesotrophic lakes, ca. 20%), *T. mendax* Kieffer, 1925 (eutrophic/mesotrophic lakes, ca. 10%), *T. occultus* Brundin, 1949 (eurytopic, ca. 9%) and *Paratanytarsus inopertus* (Walker, 1856) (eurytopic, ca. 9%) (Paasivirta 2001; Giłka & Dominiak 2007; Giłka & Podlesińska 2009; Zimny, unpublished data). These data are similar to those obtained from Lake Raduńskie and Lake Żarnowieckie. The trophic status of the former lake can be described as mesotrophic, whereas that of the latter as intermediate between β-mesotrophic and eutrophic, with eutrophication tending to intensify; both lakes compared are dominated by the same species with a high tolerance to the trophic level (Dubrawski et al. 2003; Giłka & Dominiak 2007, Giłka & Podlesińska 2009); however, *C. molestus* has not been recorded so far at the two studied lakes. A synthesis of all the information hitherto gathered about the habitat preferences of *C. molestus* indicates that its range of tolerance to the trophic level is somewhat broader than originally thought.

The data obtained throughout the season indicate that adults of *Cladotanytarsus molestus* make their appearance in early May (they were not found at other times), which in this region is probably univoltine.

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