

***Cladotanytarsus crassus*, a new North American non-biting midge
with a distinctive hypopygial digitus (Diptera: Chironomidae)**

WOJCIECH GIŁKA^{*}, MATEUSZ PUCHALSKI

University of Gdańsk, Faculty of Biology, Department of Invertebrate Zoology and
Parasitology, Wita Stwosza 59, 80–308 Gdańsk, Poland

ABSTRACT. *Cladotanytarsus (Cladotanytarsus) crassus* **sp. n.** is described from the USA (Oregon, Wyoming) and Canada (Ontario). The distinctive structure of the adult male hypopygium, bearing a thickset digitus and a stout elongated superior volsella, is presented. Intraspecific morphological variations are described in order to compare *C. crassus* and *C. nigrovittatus* (GOETGHEBUER, 1922), treated as close relatives. The geographical distribution and ecology of the two species are commented on.

KEY WORDS: Diptera, Chironomidae, Tanytarsini, taxonomy, new species, biogeography.

INTRODUCTION

The male genital apparatus (hypopygium) in chironomids displays an enormous morphological diversity that is of prime importance in species delimitation and systematics. In some Chironomidae subfamilies the hypopygium evolved towards morphological complexity, reaching its highest level in several young groups. With three or four pairs of hypopygial appendices (incl. 3 pairs of volsellae), non-biting midges of the subfamily Chironominae and the tribe Tanytarsini are known as bearers of the most complex hypopygia. They are both the oldest fossil tribe representatives (e.g. GIŁKA et al. 2013, ZAKRZEWSKA & GIŁKA 2014, ZAKRZEWSKA et al. 2016, 2018) and the extant Tanytarsini of two known subtribes: the Zavreliina (e.g. GIŁKA 2005, EKREM 2007, EKREM & STUR 2009)

^{*} Corresponding author: wojciech.gilka@biol.ug.edu.pl

and the Tanytarsina (e.g. REISS & SÄWEDAL 1981, KYEREMATEN & SÆTHER 2000, EKREM 2001, EKREM et al. 2003, SANSEVERINO 2006, STUR & EKREM 2006, GILKA & PAASIVIRTA 2007, DANTAS & GILKA 2017, LIN et al. 2017). The fourth hypopygial appendix is defined as the inner apical finger of the superior volsella, called the digitus (SÆTHER 1980). The digitus clearly evolved independently within the subtribe Tanytarsina, either towards reduction or, more often, being developed into a process of sophisticated shape and/or a lobe distinctly enlarged in several genera, groups or species (op. cit.). Such a well-developed digitus is one of the most distinctive characters in the genus *Cladotanytarsus* KIEFFER, 1921. With few exceptions (e.g. *C. teres* HIRVENOJA, 1962), the digitus is long, extends far beyond the apex of the superior volsella and usually has a swollen finger-like tip or is covered with serrations (GILKA 2011a, 2011b). In the new species presented below, the digitus is uncommonly large, and together with a stout elongated superior volsella forms a character combination unknown in other species of the genus. *Cladotanytarsus* has a worldwide distribution: so far, 79 species have been described, including 22 species recorded from the Nearctic region (SÆTHER 1971, BILYJ & DAVIES 1989, GILKA 2011b, PUCHALSKI & GILKA 2017a, 2017b, PUCHALSKI et al. 2017, 2018).

MATERIALS AND METHODS

The specimens examined were collected using a sweep net and slide-mounted in Canada balsam. Measurements are in μm ; the lengths of leg segments and palpomeres have been rounded off to the nearest 5 and 1 μm respectively; the antennal, leg and venarum ratios (AR, LR, VR) have been calculated to the second decimal place. The morphological terminology and abbreviations follow SÆTHER (1980). The photographs were taken using a Leica DM6000 microscope and LAS Montage multifocus; the drawings were prepared using the technique by GILKA (2008). The type material, collected from Canada and the USA (the collection of M. & J.E. SUBLETTE) is booked to be deposited at the Department of Entomology, the University of Minnesota Insect Collection, St. Paul, USA. The other specimens examined are housed in the Department of Invertebrate Zoology and Parasitology, University of Gdańsk, Poland.

RESULTS

Family: Chironomidae NEWMAN, 1834

Subfamily: Chironominae NEWMAN, 1834

Tribe: Tanytarsini ZAVŘEL, 1917

Subtribe: Tanytarsina ZAVŘEL, 1917

Genus: *Cladotanytarsus* KIEFFER, 1921

Subgenus: *Cladotanytarsus s. str.* KIEFFER, 1921

***Cladotanytarsus (Cladotanytarsus) crassus* sp. n.**

Figs 1A, 2, 3A, 4A

Type material

Holotype, adult male: USA, OREGON, Douglas Co., Diamond Lake (43°09'N 122°09'W), 4 August 1966, J. WILCOX. Paratypes: 15 males as holotype; WYOMING, Teton Co., Yellowstone Lake, Bridge Bay (44°32'N 110°26'W), 27 June 1952, 1 male hypopygium, J.E. SUBLETTE; CANADA, ONTARIO, White Lake near Ottawa (45°21'N 76°30'W), 29 June 1968, 2 males, R.D. McDONALD.

Derivation of the name

The specific name, derived from the Latin word meaning bulky, refers to the robust hypopygial digitus.

Diagnosis

Anal point elongated, more or less lanceolate, usually with nipple-like tip. Superior volsella stout and elongated, evenly tapering towards blunt or horn-shaped apex, bearing dense microtrichia on 2/3 proximal surface dorsally. Digitus extending far beyond superior volsella, robust, parallel-sided or with hump at half-length, slightly swollen distally, apex rounded. Stem of median volsella with 4–6 furcate lamellae; stem and lamellae of similar length.

Description

Adult male (n = 18 specimens + 1 male hypopygium)

Colouration. Eyes black. Antennal pedicel, tentorium, scutal stripes, scutellum, postnotum and sternum dark brown. Antennal flagellum, legs and abdomen olive green to brown. Head capsule, mouthparts, ground colour of thorax and haltere pale brown with greenish undertone. Wing transparent.

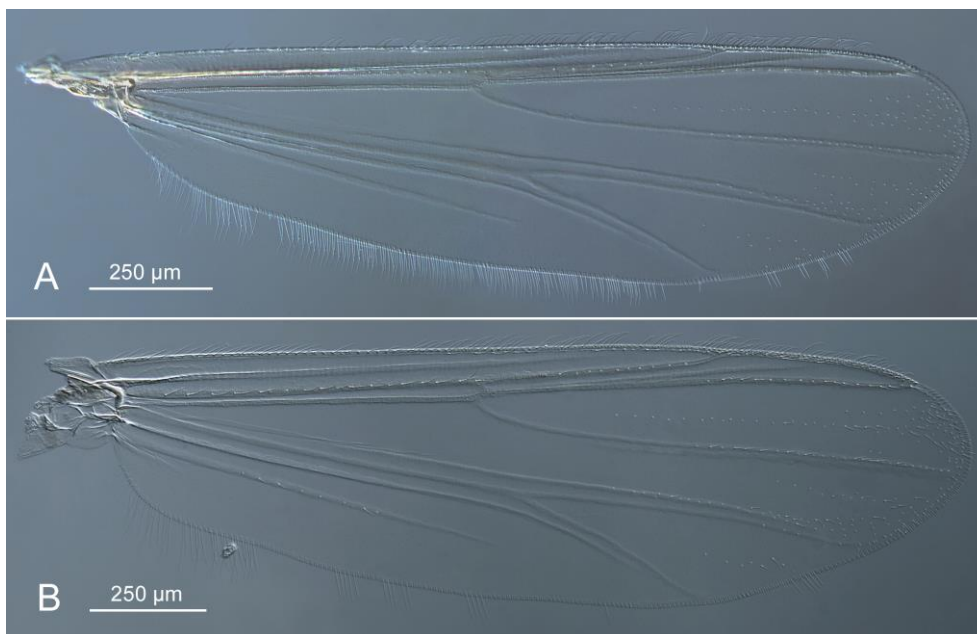


Fig. 1. Wing of male. A – *Cladotanytarsus (Cladotanytarsus) crassus* sp. n., B – *Cladotanytarsus (Cladotanytarsus) nigrovittatus* (GOETGHEBUER, 1922).

Head. Eyes reniform, broadly separated. Antenna with 13 flagellomeres, AR 0.96–1.21 (1.07), plume fully-developed. Frontal tubercles conical, up to 15 µm long and 5 µm wide at base. Lengths of palpomeres 2–5 (in µm): 31–41 (34), 92–113 (102), 87–108 (97), 110–177 (151); $pm_3 > pm_4$ (n = 11) or $pm_3 \leq pm_4$ (n = 4). Clypeus with 10–20 setae.

Thorax chaetotaxy. Ac 4–6; Dc 4–10 usually 6 or 7 on each side; Pa 1 on each side; Scts 2–4 usually 2.

Wing. Length 1550–1765 (1675) µm. Venation pattern and chaetotaxy typical of the genus as shown in Fig. 1A. Veins C, R, middle section of R_1 , distal half of R_{4+5} and M_{1+2} , and apical section of false vein above M_{3+4} with macrotrichia, An rarely with 1–3 macrotrichia (n = 4), Cu_1 exceptionally with macrotrichia (n = 1), other veins bare; membrane with macrotrichia placed in row at 3/4 length of r_{4+5} and in distal area of r_{4+5} , m_{1+2} and m_{3+4} other cells bare. VRCu 1.10–1.29 (1.20).

Legs. Fore leg tibia with straight spur ca. 5 µm long. Combs of mid and hind leg tibiae separated, spurs straight or longer spur slightly curved at apex: 10–20 µm long on mid leg and 20–35 µm long on hind leg. Basitarsus of mid leg with 2–3 sensilla chaetica. Lengths of leg segments and leg ratios as shown in Table 1.

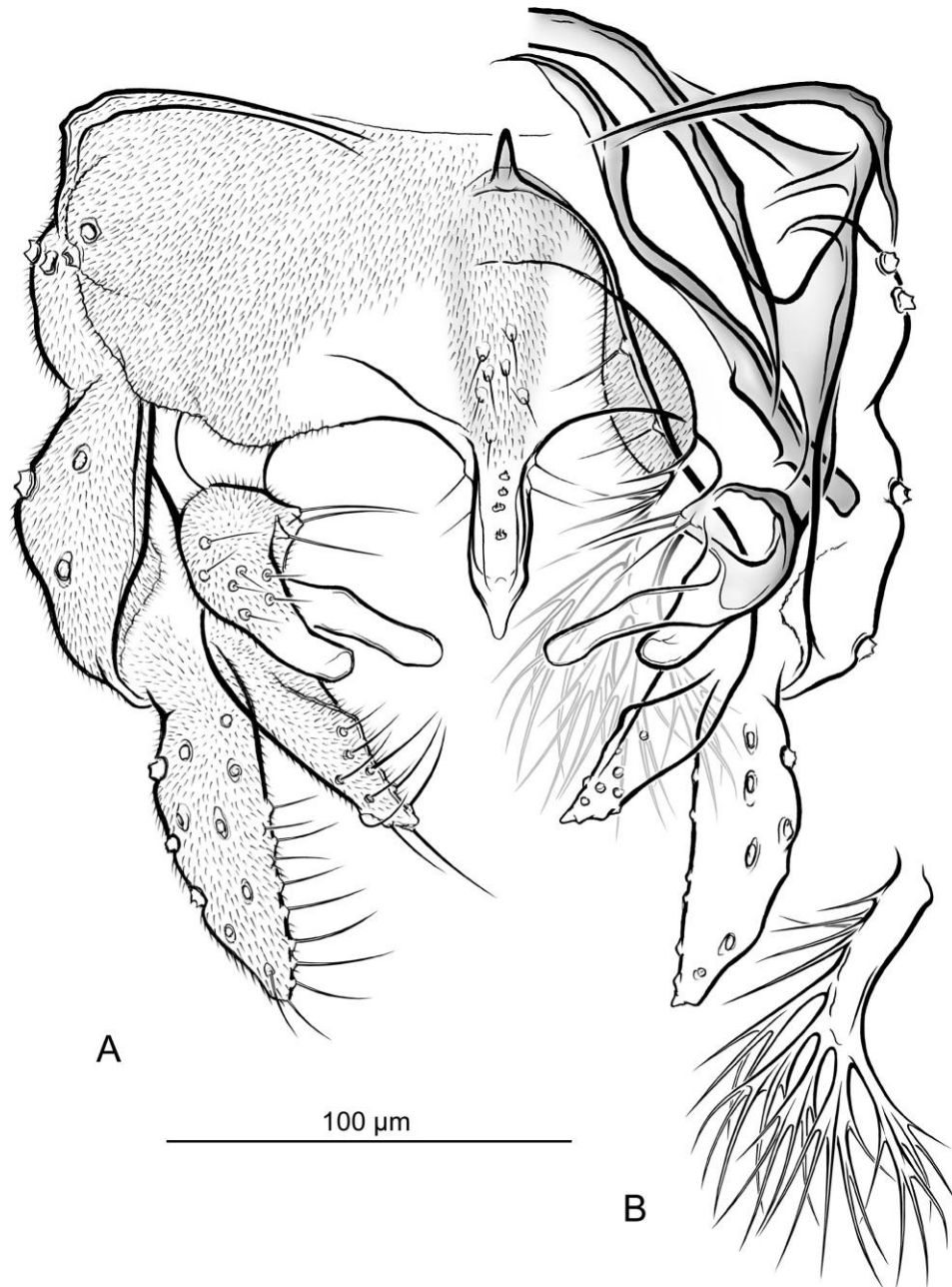


Fig. 2. *Cladotanytarsus* (*Cladotanytarsus*) *crassus* sp. n., male. A – hypopygium, B – median volsella.

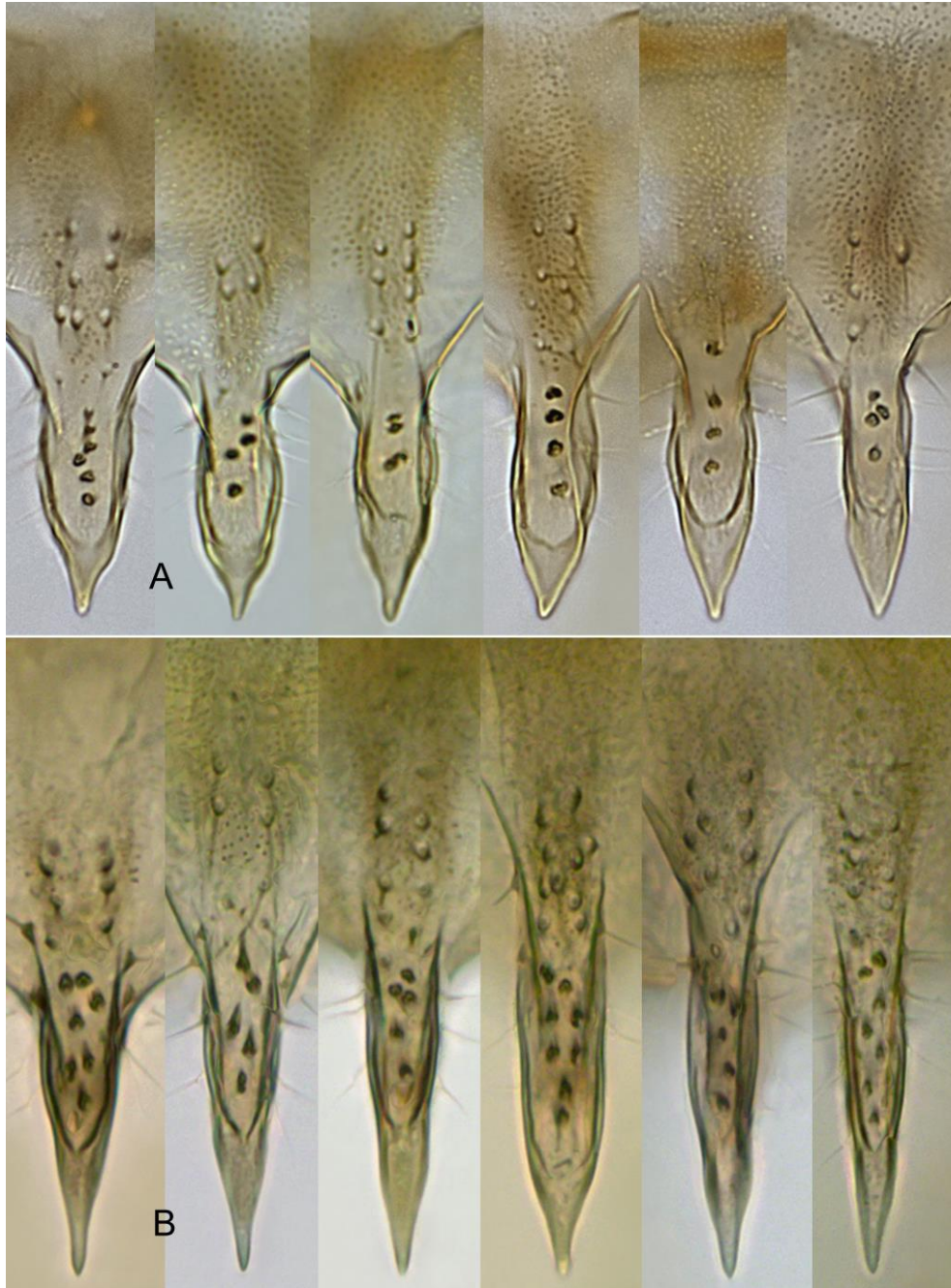


Fig. 3. Hypopygial anal point, variations. A – *Cladotanytarsus (Cladotanytarsus) crassus* sp. n., B – *Cladotanytarsus (Cladotanytarsus) nigrovittatus*.

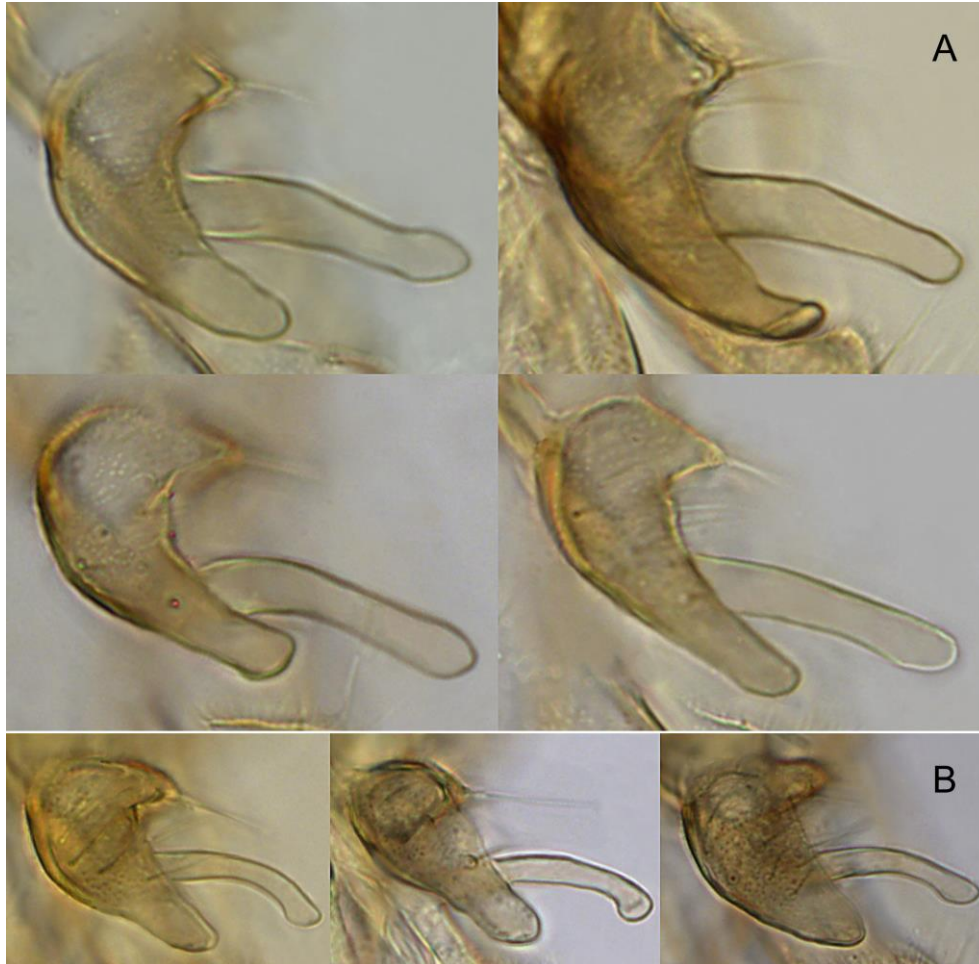


Fig. 4. Hypopygial superior volsella and digitus, variations. A – *Cladotanytarsus* (*Cladotanytarsus*) *crassus* sp. n., B – *Cladotanytarsus* (*Cladotanytarsus*) *nigrovittatus*.

Hypopygium (Figs 2–4). Gonostylus shorter than gonocoxite, 70–100 (85) μm long. Phallapodeme distinctly broadened in anterior section. Anal tergite with V-type separated bands, 1–2 lateral setae on each side, 4–11 (7) median setae placed in two rows or arranged irregularly, and with extensive microtrichia-free area at base of anal point (Fig. 2A). Anal point elongated, lanceolate, broadened at mid length, usually with nipple-like tip, slightly variable in shape as shown in Figs 3A; 2–6 (4) spinulae arranged in more or less regular row between prominent crests. Superior volsella stout and elongated, rounded at base, narrowed in middle part, evenly tapering towards blunt or horn-shaped apex, bearing 4–7

(5) dorsal setae and dense microtrichia covering 2/3 proximal surface dorsally; digitus extending far beyond superior volsella, robust, parallel-sided or with hump at half-length, slightly swollen distally, apex rounded (Figs 2A, 4A). Stem of median volsella 35–45 (40) μm long, slightly curved, bearing several setiform and 4–6 furcate lamellae; stem and lamellae of similar length (Fig. 2B). Inferior volsella slender, with knee-like extension at base, prominent angular dorsomedian ridge and narrow pointed apex (Fig. 2A).

Table 1. Leg segment lengths (μm) and leg ratios of male *Cladotanytarsus* (*Cladotanytarsus*) *crassus* sp. n.

	fe	ti	ta ₁	ta ₂	ta ₃	ta ₄	ta ₅	LR
P ₁	635–760 (705)	390–460 (430)	670–800 (755)	370–450 (415)	290–350 (320)	210–245 (225)	115–135 (120)	1.66–1.95 (1.76)
P ₂	695–790 (750)	535–650 (610)	310–400 (345)	195–230 (210)	145–205 (160)	105–125 (110)	70–105 (90)	0.53–0.58 (0.55)
P ₃	780–860 (820)	760–880 (840)	480–545 (520)	330–380 (360)	265–295 (285)	185–205 (195)	115–125 (120)	0.72–0.81 (0.77)

Table 2. Comparison of diagnostic characters in male *Cladotanytarsus* (*Cladotanytarsus*) *crassus* sp. n. and *C. (Cladotanytarsus) nigrovittatus*.

Character / species	<i>C. crassus</i>	<i>C. nigrovittatus</i>
Tentorium	dark brown	transparent, greenish
Phallapodeme	anterior section broad	anterior section narrow
Anal point	lanceolate, broadened at mid length, usually with nipple-like tip	subtriangular, narrow, evenly tapering towards pointed tip
Digitus	robust, parallel-sided, apex rounded	slender, apex swollen finger-like
Digitus / SVo apices	equally sized or digitus apex broader than SVo apex	digitus apex never as broad as SVo apex
MVo stem/lamellae	stem and lamellae of similar length	stem distinctly longer than lamellae

Comments

The main metric characters, the wing venation pattern, the thorax chaetotaxy, the elongated hypopygial anal point and digitus, and the setation of the anal tergite and superior volsella indicate that *Cladotanytarsus crassus* and *C. nigrovittatus* are closely related. The two species differ, however, as shown in Figures 3 & 4 and Table 2. Because of the median

volsella stem/lamellae length proportions, *C. crassus* falls into the couplet 5 of the key given by PUCHALSKI and GILKA (2017a), otherwise directing to couplets 13–15 for *C. muricatus* BILYJ, 1989, *C. bilyji* GILKA & PUCHALSKI, 2017 and *C. nigrovittatus*.

All records of *Cladotanytarsus crassus* adults come from the surroundings of lakes, which suggests that the larvae of this species are limnophilous or limnobiontic.

***Cladotanytarsus (Cladotanytarsus) nigrovittatus* (GOETGHEBUER, 1922)**

Figs 1B, 3B, 4B

Tanytarsus nigrovittatus GOETGHEBUER, 1922: 41 (male, Belgium).

Cladotanytarsus mancus: BRUNDIN 1947: 80 (male, Sweden); HIRVENOJA 1962: 180 (male, pupa; Finland).

Cladotanytarsus nigrovittatus: LINDEBERG 1964: 74 (male, pupa; Finland); OLIVER & DILLON 1997: 625 (Canada); MAZUMDAR et al. 2000: 196 (male, India); GILKA 2001: 319 (male, Poland); GILKA 2002: 419, 421 (Poland); WANG & GUO 2004: 8 (male, China); MAKARCHENKO et al. 2005: 413 (Russian Far East); GILKA 2011a: 63 (male, Poland); GILKA 2011c: 18 (Europe); RUSE 2015: 83 (Poland); PUCHALSKI & GILKA 2017a: 355 (male; Finland, Poland, Sweden).

Material examined (new records)

FINLAND: Äänekoski (N62°36'10" E25°41'43"), 12 July 2002, 1 male; Hietajärvi (N66°30'43" E28°20'00"), 1 August 2002, 3 males; Inari-Pappila (N68°54'26" E27°01'54"), 17 July 2002, 1 male; Inari-Vuopajanniemi (68°54'37"N 27°01'44"E), 4 August 2003, 2 males; Lake Keitele (N62°48'34" E25°48'26"), 12 July 2002, 1 male; Kemijoki near Maula (N65°53'38" E24°38'07"), 8 August 2003, 4 males; Kōnkäänjärvi (N68°42'41" E27°50'04"), 20 July 2003, 4 males; Korvala (N66°53'53" E26°11'48"), 14 July 2002, 5 males; Kotka-Mussalo (N60°26'10" E26°52'00"), 5 August 2002, 7 males; Lemmenjoki-Njurgalahti (N68°45'31" E26°14'03"), 27 July 2002, 12 males; Menesjärvi (N68°43'46" E26°21'25"), 25 July 2002, 7 males; Pohjois-Ii (N65°19'50" E25°22'50"), 13 July 2002, 1 male; Puruvesi (N61°50'35" E29°44'00"), 5 August 2002, 2 males; Simpelejärvi (N61°27'46" E29°26'53"), 5 August 2002, 6 males; Solojärvi (N68°49'49" E26°46'33"), 4 August 2003, 2 males; Syysjärvi (N69°16'32" E27°11'39"), 26 July 2003, 4 males; Tervola (N66°05'03" E24°47'28"), 22 July 2003, 4 males, 19 July 2006, 1 male; Tuurujärvi (N69°09'30" E27°13'08"), 26 July 2003, 1 male; Vajukosken Allas (N67°47'52" E26°46'42"), 8 August 2003, 4 males; Yläpostojoki (N67°44'08" E26°45'28"), 31 July 2002, 1 male; all specimens collected by W. GILKA. POLAND: Ocypel (N53°47'55" E18°18'41") 4 July 2016, 4 males, N. Welniak. SWEDEN: Bureå (N64°36'34" E21°14'30"),

9 August 2003, 5 males; Emådalen (N61°21'13" E14°45'14"), 19 July 2003, 1 male; Kalix (N65°51'20" E23°07'41"), 22 July 2003, 3 males; Leipojärvi (N67°02'41" E21°12'44"), 21 July 2003, 2 males; Ljusnan (N62°02'55" E14°38'19"), 19 July 2003, 1 male; Råktjärv (N66°12'17" E22°48'33"), 22 July 2003, 1 male; Skarvsjön (N64°57'12" E17°03'44"), 20 July 2003, 4 males; Stenträsk (N66°20'02" E19°49'52"), 21 July 2003, 2 males; all specimens collected by W. GILKA. For other records from Finland, Poland and Sweden see GILKA (2001, 2002), RUSE (2015), and PUCHALSKI and GILKA (2017a).

Comments

A brief analysis of frequency and abundance, based on all the available materials examined here, indicates that *Cladotanytarsus nigrovittatus* is one of the most common Tanytarsini species in northern Europe. Among over 6400 Tanytarsini males (83 species) collected using a sweep net from 95 sites in Finland and Sweden in 2002–2006, 507 specimens of *C. nigrovittatus* (ca. 8%) were taken from 39 sites. In contrast, among over 6600 Tanytarsini males (106 species) collected using a sweep net, light, Malaise, Moericke and glue traps from 146 sites in Poland over a period of 43 years (1974–2016), only 73 individuals of *C. nigrovittatus* (ca. 1%) were sampled from 7 sites (the present senior author's inventory). These results clearly indicate that *C. nigrovittatus* is much more frequent and abundant in northern Europe, and presumably throughout the northern Palaearctic as well (*cf.* WANG & GUO 2004, MAKARCHENKO *et al.* 2005), although the species is rarely reported from North America. OLIVER & DILLON (1997) recorded *C. nigrovittatus* from Trout Lake (Yukon) and identified it as a circumpolar species. Barcodes of several specimens from the Prince Albert National Park (Saskatchewan) are available in the BoldSystems and GenBank data bases. A few further specimens from Bare Lake (Alaska) are registered at the Iowa State University, ISU Insect Collection (determinations by J.E. Sublette). However, we failed to find any specimen of *C. nigrovittatus* in the collection of North American *Cladotanytarsus* examined here (the SUBLETTE'S collection), which consists of over 1000 specimens sampled from nearly 200 localities across the USA and Canada (incl. Alaska, Northwest Territories and Nunavut) over a period of some 90 years. The records from the Nearctic region identified on the basis of morphology therefore require comparison of *C. nigrovittatus* with *C. crassus* and several similar species (*cf.* PUCHALSKI & GILKA 2017a, key: couplets 14 & 15).

Cladotanytarsus nigrovittatus is mainly a boreal inhabitant of freshwater bodies, mostly lakes and slow-flowing rivers (OLIVER & DILLON 1997; GILKA 2011c, present records). Interestingly, it has also been recorded from the Bengal Delta (MAZUMDAR *et al.* 2000).

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