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Cladotanytarsus Kieffer (Diptera: Chironomidae): several distinctive species reviewed on the basis of records from Canada and USA

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Abstract

Two species of the genus *Cladotanytarsus* Kieffer, 1921 are described as adult males, both peculiar in having distinctively elongated hypopygial anal points. The male of *Cladotanytarsus bilyji* Giłka *et* Puchalski, **sp. nov.** (Canada, Manitoba; USA, Ohio) is presumed to be a close relative of *C. nigrovittatus* (Goetghebuer, 1922). Another unknown *Cladotanytarsus* species (USA, Illinois and Louisiana) keys with the European *C. donmcbeani* Langton *et* McBean, 2010. The intraspecific variability of the male *C. acornutus* Jacobsen *et* Bilyj, 2007 is also presented on the basis of new records (Canada, Ontario; USA, South Carolina). *Cladotanytarsus* males with similarly structured elongate anal points are reviewed, including *C. tobaquardecimus* Kikuchi *et* Sasa, 1990, considered a junior synonym (**syn. nov.**) of *C. conversus* (Johannsen, 1932). As a compilation of this study, a key to the identification of the adult males of 14 *Cladotanytarsus* species is provided.

Key words: Diptera, Chironomidae, *Cladotanytarsus*, systematics, new species, key

Introduction

Cladotanytarsus Kieffer, 1921 is one of the most species-rich genera within the large tribe Tanytarsini (over 600 species) in the family Chironomidae (over 7 000 species) (Giłka 2011a, Pape *et al*. 2011). This genus includes more than 70 described species, inhabiting aquatic, mainly freshwater ecosystems situated in most of the world's regions (Giłka 2011b). The number of known species is certainly far from complete, as numerous *Cladotanytarsus* remain undescribed, including at least several Nearctic ones (Epler 2014, authors' unpubl. data). Although some systematic revisions have been published recently (Giłka 2011b, 2012; Giłka & Dobosz 2015), a substantial number of specific names, compatible with the diagnosis of *Cladotanytarsus*, remain in their original (erroneous) systematic combinations. Due to insufficiently precise descriptions, the status of numerous names included in *Cladotanytarsus* requires re-examination; moreover, some of the names are potential synonyms.

Even the best-known life stages of *Cladotanytarsus*, the adult/pharate males, are the most difficult to diagnose among the Tanytarsini. The intrageneric homogeneity of the morphological structures of the head, wing and legs usually restricts or even rules out the use of the characters of these body parts in identification. On the other hand, the intraspecific variability of the hypopygial structures may blur the borders between various species. In such a case, an integrative-systematic approach combining morphological and molecular analyses may shed new light on diagnostics of *Cladotanytarsus*, as it has been evidenced in other Tanytarsini (*e.g.* Anderson *et al.* 2013). Nevertheless, it is the hypopygium that possesses the key, and often the sole morphologically diagnostic characters of *Cladotanytarsus*. The diagnostically critical hypopygium structures include the tergite of the distal abdominal segment terminating in a specific anal point, the length/width of which, as well as the number/arrangement of the spinulae and the shape of the anal point crests, constitute a set of diagnostic characters.

This paper focuses on North American species of the subgenus *Cladotanytarsus s. str.* [the second known subgenus *Lenziella* Kieffer, 1922 has been recently revised (Giłka 2011b)], the adult males of which feature the distal tergite with a characteristic, strongly elongated and slender anal point. The species whose males exhibit such a hypopygial structure are not numerous, but are known from various regions of the world: Europe (Langton &

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Garcia 2000, Giłka 2001, Langton & McBean 2010), Africa (Reiss 1991), Asia and Australia (Glover 1973, Kikuchi & Sasa 1990, Sasa & Suzuki 2000, Giłka 2009a, Giłka & Dobosz 2015) and North America (Bilyj & Davies 1989, Jacobsen & Bilyj 2007). The present study concludes with a systematic review and identification key for males of these *Cladotanytarsus*, including two hitherto unknown species recorded in Canada and the USA.

Materials and methods

The specimens examined, mostly after being cleared, were slide-mounted in Canada balsam. The illustrations, descriptions and measurements were taken from these slide-mounted individuals. Measurements are in μm; 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, VR) were calculated to the second decimal place. The head structures, wing and legs were not measured in pharate specimens. The morphological terminology and abbreviations follow Sæther (1980). The photographs were taken using a Leica DM6000 microscope and LAS Montage multifocus. All the materials studied from the collections of M. & J.E. Sublette, including the type specimens, are booked to be deposited at the Department of Entomology, University of Minnesota, St. Paul, USA (DEUM) and in the Canadian National Collection, Ottawa (CNC). The other specimens examined are available from the Department of Invertebrate Zoology and Parasitology, University of Gdańsk, Poland (DIZP), or their photographs, referred to below, are displayed on the website of the National Museum of Nature and Science, Tokyo, Japan (NMNS).

Systematic review

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

Nearctic species

Cladotanytarsus acornutus Jacobsen *et* Bilyj

(Fig. 1)

Cladotanytarsus acornutus Jacobsen *et* Bilyj, 2007: Jacobsen & Bilyj 2007: 146 (adult male and female, pupa, larva; USA, Florida), Epler 2014: 20, 22, 23 (larva, in key; all stages, remarks; USA, Florida).

Material examined. CANADA. ONTARIO. North Kawartha, Julian Lake N of Peterborough (swarm at edge of lake), August 1968, 10 males, leg. John A. Spence. Waterloo, shallow pond, 2 males, leg. John A. Spence. USA. SOUTH CAROLINA. Oconee Co., Hartwell Lake, Clemson, 7 July 1973, 1 male, leg. P. Hudson. Oconee Co., Keowee Reservoir, 21 April, 1975, 1 male (abdomen with hypopygium), 11 May 1975, 1 male, 30 May 1975, 1 male, 6 June 1975, 3 pharate males in 3 Pex, leg. P. Hudson. Ex coll. M. & J.E. Sublette. Deposit in DEUM.

Diagnostic description (supplementations to the original description).

Adult male. *Head*. AR 0.68–0.98. Frontal tubercles small, cylindrical, 5–15 μm long. Length of palpomeres 2–5 (in μm): 25–35, 50–95, 70–100, 110–160. Clypeus semicircular, with 12–17 setae.

Thorax chaetotaxy. Ac usually absent, up to 3 if present (n = 3); Dc 6–8; Pa 1; Scts 2–4.

Wing. Length 1150–1500 μm. Shape, venation pattern and chaetotaxy as in original description; R, R_1 and R_{4+5} rarely with macrotrichia and m_{1+2}, r_{4+5} sometimes with sparse macrotrichia distally, VR_{Cu} 1.16–1.49 (1.25).

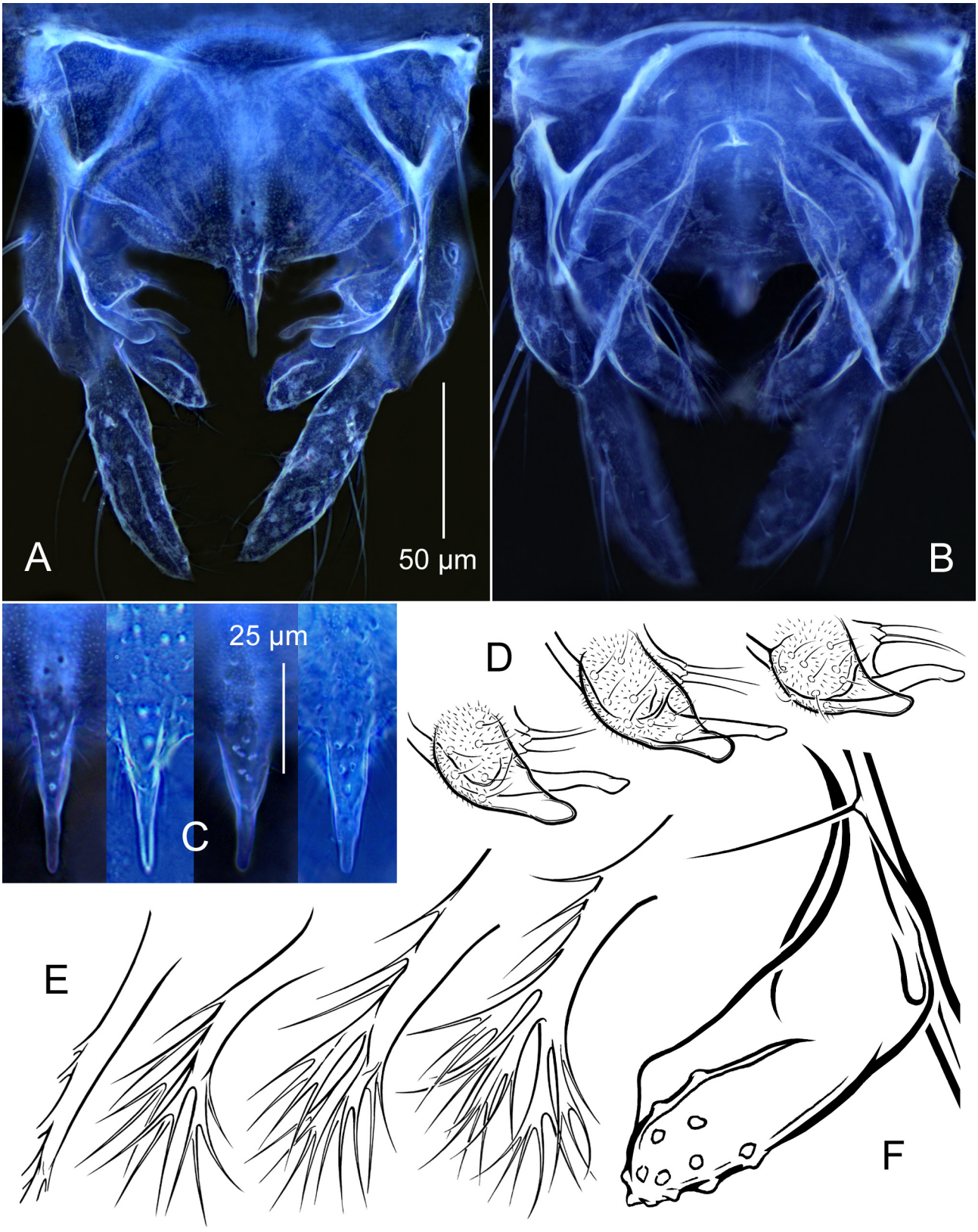

FIGURE 1. *Cladotanytarsus acornutus* Jacobsen *et* Bilyj, 2007, male. **A**, **B**—hypopygium in dorsal (A) and ventral aspect (B); **C**—anal point (variation); **D**—superior volsella and digitus (variation); **E**—median volsella and its stem (variation); **F**—inferior volsella, typical structure (D—magnified *ca.* 2 times relative to A; E, F—magnified *ca.* 3 times relative to A).

Legs. Fore leg tibia with straight spur *ca.* 20 µm long. Each comb of mid and hind leg tibiae bearing straight or slightly curved spur: *ca.* 15–20 µm long on mid leg and up to 25 µm long on hind leg. Basitarsus of mid leg usually without sensilla chaetica, sometimes with 2–4 hook-shaped sensilla present (n = 7). For lengths of leg segments and leg ratios, see Table 1.

TABLE 1. Lengths (µm) of leg segments and leg ratios of male *Cladotanytarsus acornutus* Jacobsen *et* Bilyj, 2007.

	fe	ti	ta_1	ta_2	ta_3	ta_4	ta_5	LR
p_1	480–650 (530)	265–375 (310)	525–710 (595)	250–370 (315)	235–295 (260)	150–215 (170)	65–105 (90)	1.75–2.16 (1.89)
p_2	480–640 (555)	390–510 (440)	215–265 (235)	120–160 (135)	85–110 (95)	60–80 (70)	50–70 (60)	0.50–0.55 (0.53)
p_3	560–685 (610)	540–655 (600)	345–430 (375)	220–265 (240)	160–225 (200)	130–150 (140)	80–95 (90)	0.59–0.67 (0.62)

Hypopygium (Fig. 1). Gonostylus *ca.* 75 µm long, with apical seta placed on conical tubercle. Anal tergite with V-type separated bands and 4–10 setae arranged in irregular rows or setae dispersed at base of anal point. Anal point variable in shape, elongate, evenly tapering towards apex, with up to 6 spinulae between narrow crests or crests not developed (Fig. 1A, C). Superior volsella pear-shaped in dorsal aspect, with more on less narrowed distal part, bearing field of microtrichia on proximal (swollen) part, 6–9 dorsal setae and 3 long setae placed on conical tubercles at base. Digitus straight or slightly curved, long, extending far beyond superior volsella, with finger-like tip (Fig. 1A, D). Stem of median volsella relatively long (*ca.* 35 µm), straight or finely curved, as shown in Fig. 1E, bearing several setiform and 4–5 furcate lamellae: 3–4 strong and 1–2 weaker (Fig. 1B, E). Inferior volsella with slight lateral knee-like extension at base, distinctly curved and posteromedially or medially directed, darkly pigmented dorsomedian ridge narrow (Fig. 1A, B, F).

Remarks. In the Sublettes' collection of North American *Cladotanytarsus*, nearly 20 adult and pharate male specimens as well as their pupal exuviae were identified as *C. acornutus*. Records of this species have so far been confined to the Florida Everglades, where *C. acornutus* has been defined as one of the most abundant chironomids and an outstanding indicator of nutrient-poor and minimally disturbed habitats (Jacobsen & Bilyj 2007, Epler 2014). Our records from southern Ontario, Canada, and from the northern part of South Carolina, USA, provide evidence that the geographical distribution of *C. acornutus* is wider than that previously assumed. According to Epler (*op. cit.*), larvae outside of the Everglades believed to be this species are determinable after association with a pupa that lacks a thoracic horn and/or with an adult male that has weak hypopygial anal point crests and lacks acrostichal setae. Indeed, the currently examined specimens have thin or reduced crests, and the acrostichals are usually absent (at most 3 if present). The pupal exuviae are also consistent with those originally described, except for a TII hooklet row that consists of a slightly larger number of hooklets at 1/2 width of the segment; none of the pupal exuviae examined have a thoracic horn.

Cladotanytarsus bilyji Giłka *et* Puchalski, sp. nov.

(Figs 2, 3)

Type material. Holotype, adult male: CANADA, MANITOBA, Lake Winnipeg, Old Fishing Dock (51°33' N / 96°43' W), 16 June 1971, leg. E. Johnson & M. Roberts (prep. O.A. Sæther). Paratype: USA. OHIO. Clermont County, Shayler Run at Baldwin Road (39°07'06" N / 84°12'59" W), 20 September 1999, 1 adult male, leg. J. Trybula. Ex coll. M. & J.E. Sublette. Deposit in DEUM.

Derivatio nominis. The specific epithet honours Bohdan Bilyj (Etobicoke, Canada), to commemorate his contribution to the study of Nearctic *Cladotanytarsus*.

Diagnosis. Anal point strongly elongate, evenly tapering toward apex. Superior volsella slender, narrowed at mid length, with field of microtrichia on basal part dorsally. Stem of median volsella *ca.* 40 µm long, longer than its setiform and 7–8 furcate lamellae, all arranged evenly on median and apical part of stem. Inferior volsella with lateral knee-like extension at base, with well-developed angular dorsomedian ridge.

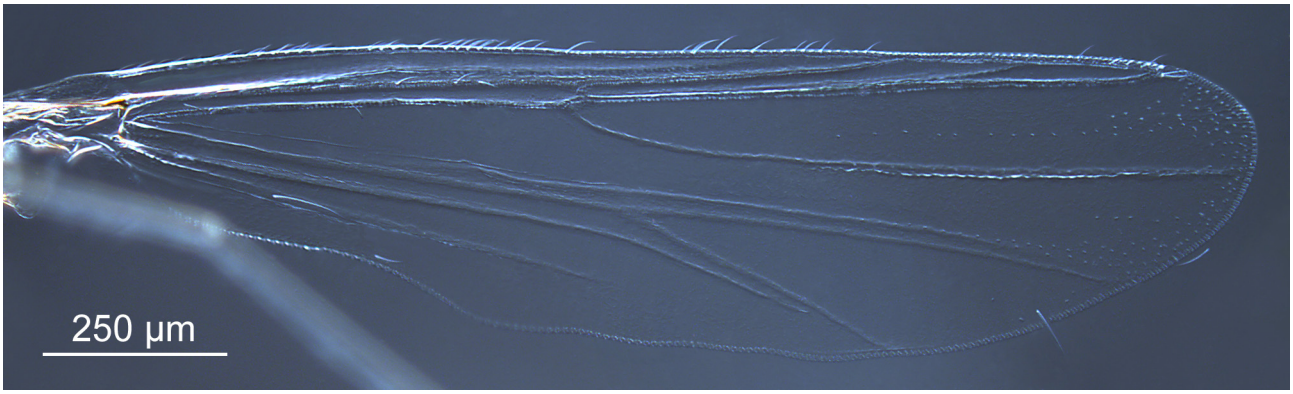

FIGURE 2. *Cladotanytarsus bilyji* Giłka *et* Puchalski, **sp. nov.**, male. Wing.

Description. **Adult male** (n = 2).

Colouration (slide-mounted specimens). Eyes black. Antennal pedicel, tentorium, scutal stripes, scutellum, postnotum and sternum dark brown. Head capsule, antennal flagellum, mouthparts and abdomen greenish to light brown; hypopygium and legs slightly darker. Wing membrane transparent with greenish undertone, veins brownish.

Head. Eyes reniform, broadly separated. Antenna with 13 flagellomeres, AR 0.92–0.94; plume fully-developed. Frontal tubercles cylindrical, 12–24 µm long. Lengths of palpomeres 2–5 (in µm): 32–36, 84–104, 100–108, 164 (n = 1). Clypeus semicircular, with 14–15 setae.

Thorax chaetotaxy. Ac 7–8, Dc 8, Pa 1, Scts 4–6.

Wing (Fig. 2). Length 1520–1720 µm. Shape, venation pattern and chaetotaxy typical of the genus, as shown in Fig. 2; Cu_1, R_1 and m_{3+4} bare or with few macrotrichia at most; VR_{Cu} 1.18–1.28.

Legs. Fore leg tibia with straight spur *ca.* 20 µm long. Combs of mid and hind leg tibiae separated, each bearing straight spur: *ca.* 15–20 µm long on mid leg and up to *ca.* 30 µm long on hind leg. Basitarsus of mid leg with 2–4 hook-shaped sensilla chaetica. For lengths of leg segments and leg ratios, see Table 2.

TABLE 2. Leg segment lengths (µm) and leg ratios of male *Cladotanytarsus bilyji* **sp. nov.** (n = 1 when segments missing or deformed).

	fe	Ti	ta_1	ta_2	ta_3	ta_4	ta_5	LR
p_1	627–715	369	731	398	399	221	111	1.98
p_2	649–900	472–642	288–295	162–192	118–140	66–73	52–70	0.46–0.61
p_3	704–826	915–964	450	288	244	155	103	0.65

Hypopygium (Fig. 3). Gonostylus shorter than gonocoxite, *ca.* 70 µm long, with blunt apex. Anal tergite with V-type separated bands and 7–8 median setae placed in two rows. Anal point elongate, evenly tapering towards slender apex (slightly deformed in paratype specimen, Fig. 3C), bearing 7–8 spinulae between well-developed crests, entire area surrounding base of anal point covered with microtrichia (Fig. 3A, C). Superior volsella slender, elongate, more or less narrowed at mid length, bearing field of microtrichia dorsally only on basal part or proximal 1/3 at most, 6–11 dorsal setae, 1–2 setae on anteromedian margin and 3 long setae placed on conical tubercles at base. Digitus curved, long, extending far beyond superior volsella, with finger-like tip (Fig. 3A, D). Stem of median volsella slightly curved and directed posteriorly, long (*ca.* 40 µm), bearing several setiform and 7–8 furcate lamellae: 4 strong and 3–4 weaker, all arranged evenly on median and apical part of stem (Fig. 3B, E). Inferior volsella with lateral knee-like extension at base, evenly curved and directed posteromedially, darkly pigmented dorsomedian ridge distinctly protruding, angular (Fig. 3A, B, F).

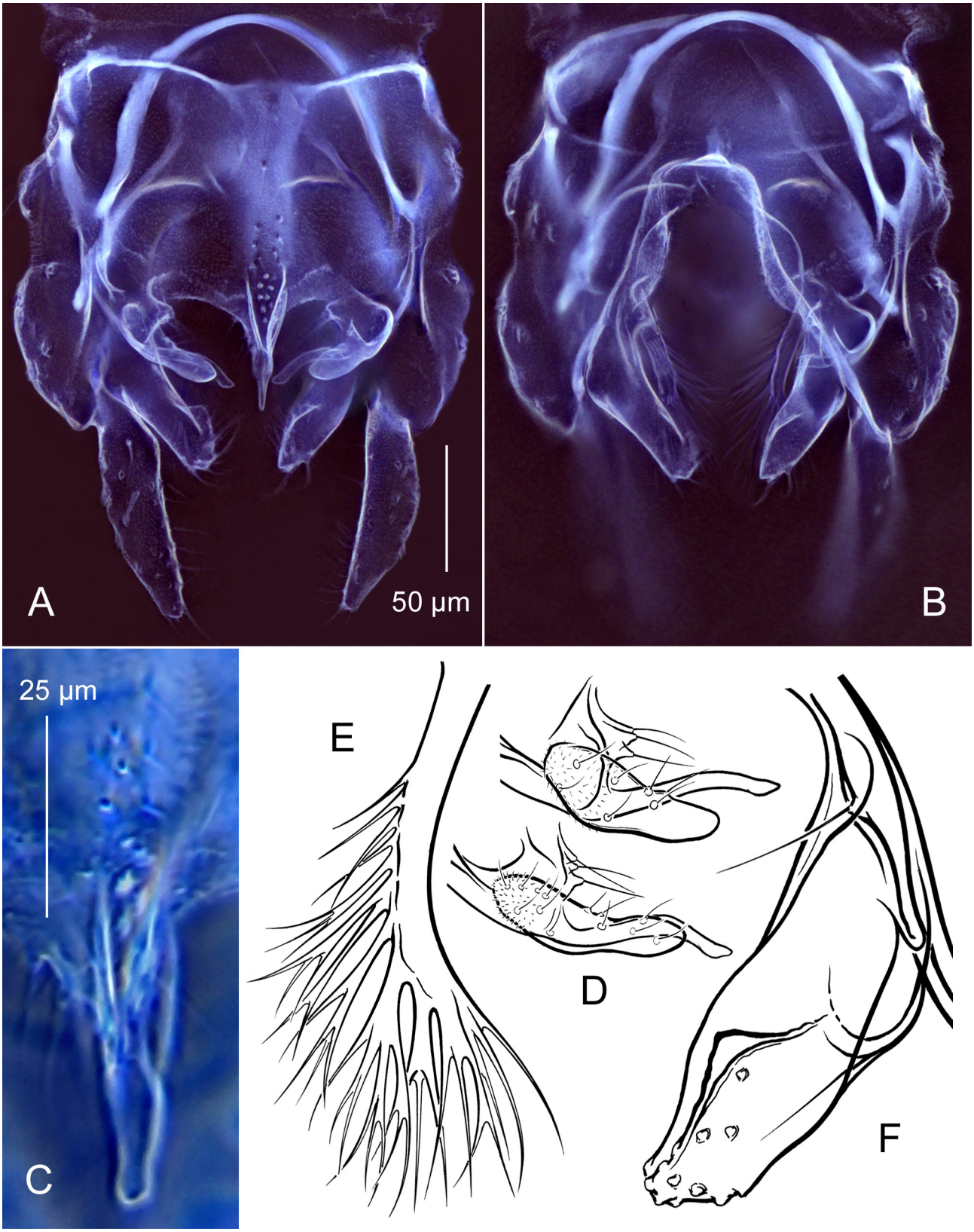

FIGURE 3. *Cladotanytarsus bilyji* Giłka *et* Puchalski, **sp. nov.**, male. **A**, **B**—hypopygium in dorsal (A) and ventral aspect (B) (holotype); **C**—anal point (variation, paratype); **D**—superior volsella and digitus (variation); **E**—median volsella (holotype); **F**—inferior volsella (paratype) (D—magnified *ca.* 2 times relative to A; E, F—magnified *ca.* 3 times relative to A).

Remarks. Apart from the strongly elongate anal tergite point, this new species can be distinguished from other *Cladotanytarsus* on the following combination of characters: the superior volsella slender and narrowed at mid length, with field of microtrichia only on basal part dorsally, the median volsella composed of a long stem and 7–8 furcate lamellae and the inferior volsella with a lateral knee-like extension at the base, bearing a well-developed angular dorsomedian ridge.

According to preliminary determinations (Sublette, Sæther; pers. comm.), there are at least 8 or 9 additional *Cladotanytarsus* species recorded from the Lake Winnipeg region (*locus typicus* of *C. bilyji*), which should be compared with those described by Bilyj and Davies (1989) from northwestern Ontario. We examined all the *Cladotanytarsus* species by Bilyj (*op. cit.*) known from adult males (excl. *C. aeiparthenus* Bilyj, 1989). However, even when atypical variations are included, most of the males examined (except for *C. muricatus* Bilyj, 1989, see remarks below) do not fully fit the present concept of the strongly elongate and narrow hypopygial anal point. Males of those species have relatively short anal points (*C. daviesi* Bilyj, 1989, *C. pinnaticornis* Bilyj, 1989), without a distinct distal elongation and/or at least distinctly broadened at the base. Males of *C. elaensis* Bilyj, 1989 have acute anal points, but are relatively broad and surrounded with a microtrichia-free area at the base; in *C. tribelus* Bilyj, 1989 the anal point is narrow and parallel-sided but moderately long (Bilyj & Davies 1989; figs 6, 8). As far as the general shape of the anal point is concerned, there is a slight resemblance between the males of *C. fusiformis* Bilyj, 1989 and those of *C. bilyji*; although these two species can be easily separated also by the shape of the superior volsella, which in the former is nearly half as long as the digitus, and the median volsella has a smaller number of lamellae (*cf.* Fig. 3 and Bilyj & Davies 1989, fig. 4). Originally, *C. fusiformis* was also compared with *C. nigrovittatus* (Goetghebuer, 1922). The latter species is presumed to be the closest relative of *C. bilyji* (see the key below). Finally, the males of *C. mancus* (Walker, 1856) [or the *C. mancus* group *sensu* Giłka (2001)], often misidentified with *C. nigrovittatus*, should also be included in this comparison. They differ in the length proportions of the median volsella stem-lamellae (the stem longer relative to its lamellae in *C. bilyji*), the number of lamellae (greater in *C. bilyji*), and the arrangement of median setae on the anal tergite (dispersed in C. mancus).

Cladotanytarsus muricatus Bilyj

Cladotanytarsus muricatus Bilyj, 1989: Bilyj & Davies 1989: 956 (adult male and female, pupa; Canada, Ontario).

Material examined. Adult male specimen dissected and mounted under 6 cover slips, labelled as follows: Can. Nat. Coll., Type No. 19724, *Cladotanytarsus muricatus* B. Bilyj, ♂ PARATYPE, Slide No. 1, E.L.A. 70 km ESE Kenora, On, Lake 223 no. X1025.A3, 30.VI.-1.VII.1976 (leg. I. Davies). Deposit in CNC.

Remarks. The examined specimen shows an anal point with a strong spine-like elongation, similar to that shown in figure 7 by Bilyj and Davies (1989) but slightly longer. Adult males of this species are also distinct in the shape of the superior volsella, narrowed in distal half, and the median volsella with a few weak lamellae placed distally on a long stem. Due to the latter character, the species falls into the couplet 13 of the present key (see below).

Cladotanytarsus viridiventris (Malloch)

Tanytarsus viridiventris Malloch, 1915: Malloch 1915: 491 (adult male; USA, Michigan).
?*Cladotanytarsus viridiventris* (Malloch, 1915): Oliver *et al*. 1990: 56 (in catalogue, distribution); Bilyj & Davies 1989: 949 (pupa, in key); Giłka 2011b: 24 (remarks).

Remarks. The specific name has so far presumably been erroneously and repeatedly ascribed to various species (Giłka 2011b; J. Sublette, pers. comm.), and a subgeneric placement for *Cladotanytarsus viridiventris* cannot not be defined with certainty. For this reason it is not included in the present key. Nevertheless, a male specimen originally illustrated, having an elongate anal point and a long stem of the median volsella (Malloch 1915, pl. xxxvi, fig. 8), couples with *C. acornutus*, *C. bilyji*, *C. muricatus* or *C. nigrovittatus*. Following Malloch's figure, the triangular superior volsella separates *C. viridiventris* from *C. bilyji* and *C. muricatus*, and the relatively short digitus and apically rounded inferior volsella from all the species compared.

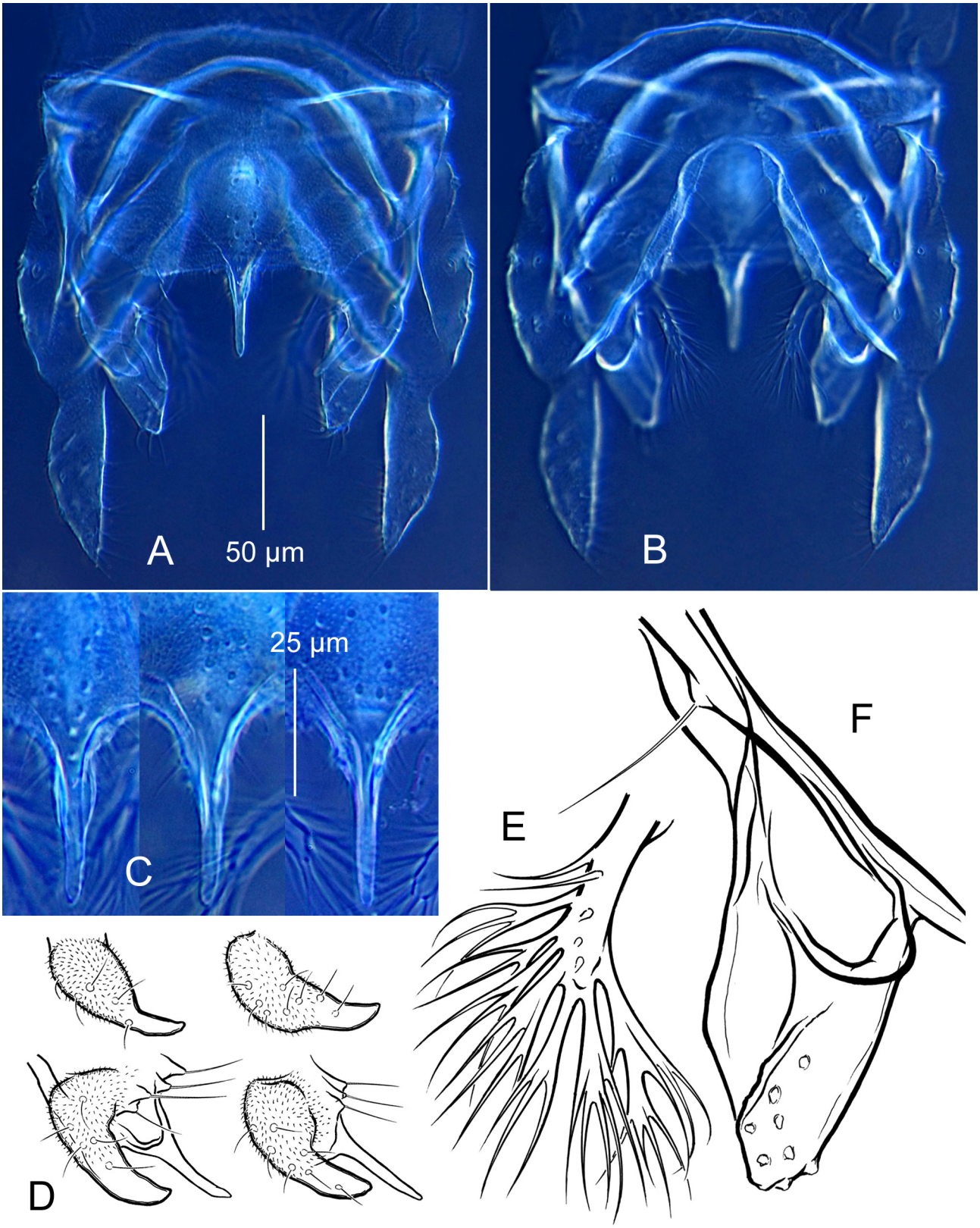

FIGURE 4. *Cladotanytarsus* sp., male. **A**, **B**—hypopygium in dorsal (A) and ventral aspect (B); **C**—anal point (variation); **D**—superior volsella and digitus (variation); **E**—median volsella (typical structure); **F**—inferior volsella (typical structure) (D—magnified *ca.* 2 times relative to A; E, F—magnified *ca.* 3 times relative to A).

Cladotanytarsus sp.
(Fig. 4)

Material examined. USA. ILLINOIS. Du Bois, 24 April 1914, 1 male hypopygium (S66-1261). LOUISIANA. New Orleans, 14 May 1952, 4 male hypopygia (S64-818, 821, 822, 823). Main body parts missing. Ex coll. M. & J.E. Sublette (legator unknown). Deposit in DEUM.

Diagnostic description. **Adult male** (n = 5, hypopygia).

Hypopygium (Fig. 4). Gonostylus shorter than gonocoxite, *ca.* 85 µm long, with apex pointed. Anal tergite with V-type separated bands and 7–9 median setae placed in two irregular rows. Anal point with parallel-sided distal elongation, apically blunt or rounded, bearing 3 spinulae at most or spinulae absent (Fig. 4A, C). Superior volsella horn-shaped, with pointed apex, bearing field of microtrichia on 2/3 basal part or basal half at least, 5–8 dorsal setae and 3 long setae placed on conical tubercles at base. Digitus straight or very slightly curved, apex narrow, extending far beyond superior volsella (Fig. 4A, D). Stem of median volsella stocky, *ca.* 30 µm long, shorter than its longest lamellae, bearing several setiform and 6–7 branched lamellae (4 strong and 2–3 weaker) (Fig. 4B, E). Inferior volsella as drawn in Fig. 4F, strongly broadened at base, with distinct round margin on ventral side, dorsomedian ridge thin (Fig. 4A, B, F).

Remarks. Among the oldest specimens sampled from the Sublettes' collection we found several male hypopygia belonging to a species which, in view of the set of diagnostic characters, deserves to be presented. The slender anal point with the parallel-sided distal elongation, the horn-shaped superior volsella, the stocky stem of the median volsella bearing stout branched lamellae and the inferior volsella strongly broadened at the base may indicate a close similarity to *Cladotanytarsus donmcbeani* Langton *et* McBean, 2010 (*cf.* Fig. 4 and Langton & McBean 2010, figs 1–4). According to the original description (*op. cit.*), these two *Cladotanytarsus* species differ as adult males in the presence/absence of anal point spinulae and the shape of the digitus, apically hooked in *C. donmcbeani*.

Other species

Cladotanytarsus bilinearis Glover

Cladotanytarsus bilinearis Glover, 1973: Glover 1973: 433 (adult male and female, Australia).

Remarks. Diagnostic characters for the adult male of this species were recently analysed by comparison with *Cladotanytarsus conversus* (Johannsen), *C. isigacedeus* (Sasa *et* Suzuki) and *C. stylifer* Giłka, known to occur in the Australasian and Indo-Pacific regions (Giłka & Dobosz 2015, table 2).

Cladotanytarsus conversus (Johannsen)
(Fig. 5A, B)

Tanytarsus conversus Johannsen, 1932: Johannsen 1932: 543 (adult male and female, Sumatra).
Cladotanytarsus conversus (Johannsen, 1932): Langton & Garcia 2000: 199 (adult male and female, pupa, larva; South Asia; Europe: France, Greece).
Cladotanytarsus tobaquardecimus Kikuchi *et* Sasa, 1990: Kikuchi & Sasa 1990: 314 (adult male, Sumatra), **syn. nov.**

Material examined. BULGARIA. Danube, Svishtov, 17 September 2007, 16 males, leg. Wolfram Graf (ex coll. B. Janecek, deposit in DIZP). Holotype of *Cladotanytarsus tobaquardecimus*, adult male slide-mounted (No. 200:070): 5 photographs (slide + abdomen + hypopygium magnified) displayed on the NMNS website.

Remarks. This widely distributed species is known from Indonesia in the south-east through Thailand and India to Europe in the north-west (Langton & Garcia 2000). With regard to the structural variations of the male hypopygium (*cf.* Fig. 5A & B, Langton & Garcia 2000, figs 1 & 2, Kikuchi & Sasa 1990, fig. 20 and NMNS, photographs of the holotype), body colouration and the main metric/meristic characters (Table 3), we found no significant differences between specimens described as *Cladotanytarsus conversus* and *C. tobaquardecimus*, both names originally coming from Sumatra. Consequently, we propose to treat them as synonyms.

TABLE 3. Variations of metric and meristic characters in male *Cladotanytarsus conversus* (Johannsen, 1932), according to Langton & Garcia (2000), Kikuchi & Sasa (1990, as *C. tobaquardecimus*), supplemented.

character/source	Kikuchi & Sasa (1990), Sumatra	Langton & Garcia (2000), southern Eurasia	supplementary material, Bulgaria
AR	0.67–0.78	0.71–1.22	0.82–0.88
frontal tubercles	conical 5 µm long	papillate 6–24 µm long	papillate or cylindrical 4–10 µm long
pm_3, pm_4, pm_5 length (µm)/ratio	*ca.* 1 : 1 : 1.5	50–102, 72–112, 86–160	75–79, 83–99, 151–155
clypeals	8–10	8–13	11–14
Ac, Dc, Pa, Scts	6–9, 6–7, 1–2, 4	4–10, 6–10, 1–2, 4	3–5, 6–7, 1–2, 4
wing length	1.06–1.19 mm	1.2–1.95 mm	1.25–1.31
wing veins M and An - setation	M bare, An with setae	M setae on apical half, An?	M bare, An bare or setae on apical part
VR	1.22–1.33	?	1.35–1.43
LR_1	2.32–2.58	1.80–2.35	2.22–2.30
LR_2	0.59–0.65	0.57–0.70	0.59–0.62
LR_3	0.64–0.69	0.61–0.69	0.63–0.66
tibial spurs of p_2	each comb with spur	each comb with spur	each comb with spur
tibial spurs of p_3	each comb with spur	inner comb without spur	each comb with spur or inner comb without spur

Cladotanytarsus cyrylae Giłka

Cladotanytarsus cyrylae Giłka, 2001: Giłka 2001: 309 (adult male, Poland); Giłka 2009b: 378 (Poland, Ukraine); Paasivirta 2012: 66 (Finland).

Material examined. Holotype and paratypes (Giłka 2001). New data. POLAND. Lake Czarne at Niesiołowice near Stężyca, 9 June 2010, 1 male, leg. W. Giłka. Lake Straszyńskie near Gdańsk, 5 August 2014, 57 males, 15 September 2014, 3 males; leg. F. Zimny. Deposit in DIZP.

Remarks. For the systematics, including intraspecific morphological variations, and biology of this species, see Giłka (2001, 2009b). Recent records of *Cladotanytarsus cyrylae* come from Lake Straszyńskie, the drinking water reservoir for the city of Gdańsk (Puchalski *et al*. 2016).

Cladotanytarsus donmcbeani Langton *et* McBean

Cladotanytarsus donmcbeani Langton *et* McBean, 2010: Langton & McBean 2010: 109 (adult male, pupa; Great Britain).

Remarks. Our laboratory colleague, Marta Zakrzewska, attempted to collect *Cladotanytarsus donmcbeani* on the shores of Loch Leven, Scotland (*locus typicus*; Langton & McBean 2010, see also fig. 9), at the turn of April and May 2016. Among several tanytarsine species recorded [*Micropsectra atrofasciata* (Kieffer, 1911), *Paratanytarsus dimorphis* Reiss, 1965, *Tanytarsus bathophilus* Kieffer, 1911, *T. pallidicornis* (Walker, 1856), *T. usmaensis* Pagast, 1931)], unfortunately, we did not find this rare midge.

Cladotanytarsus ecristatus Reiss

Cladotanytarsus ecristatus Reiss, 1991: Reiss 1991: 45 (adult male, Morocco).

Remarks. In terms of the structure of the hypopygial anal point, which bears a longitudinal bar but no crests or spinulae, as well as the shape of hypopygial volsellae and the body colouration, *Cladotanytarsus ecristatus* is one of the most peculiar species within the genus. All known records come from the Atlas Mountains (Reiss 1991).

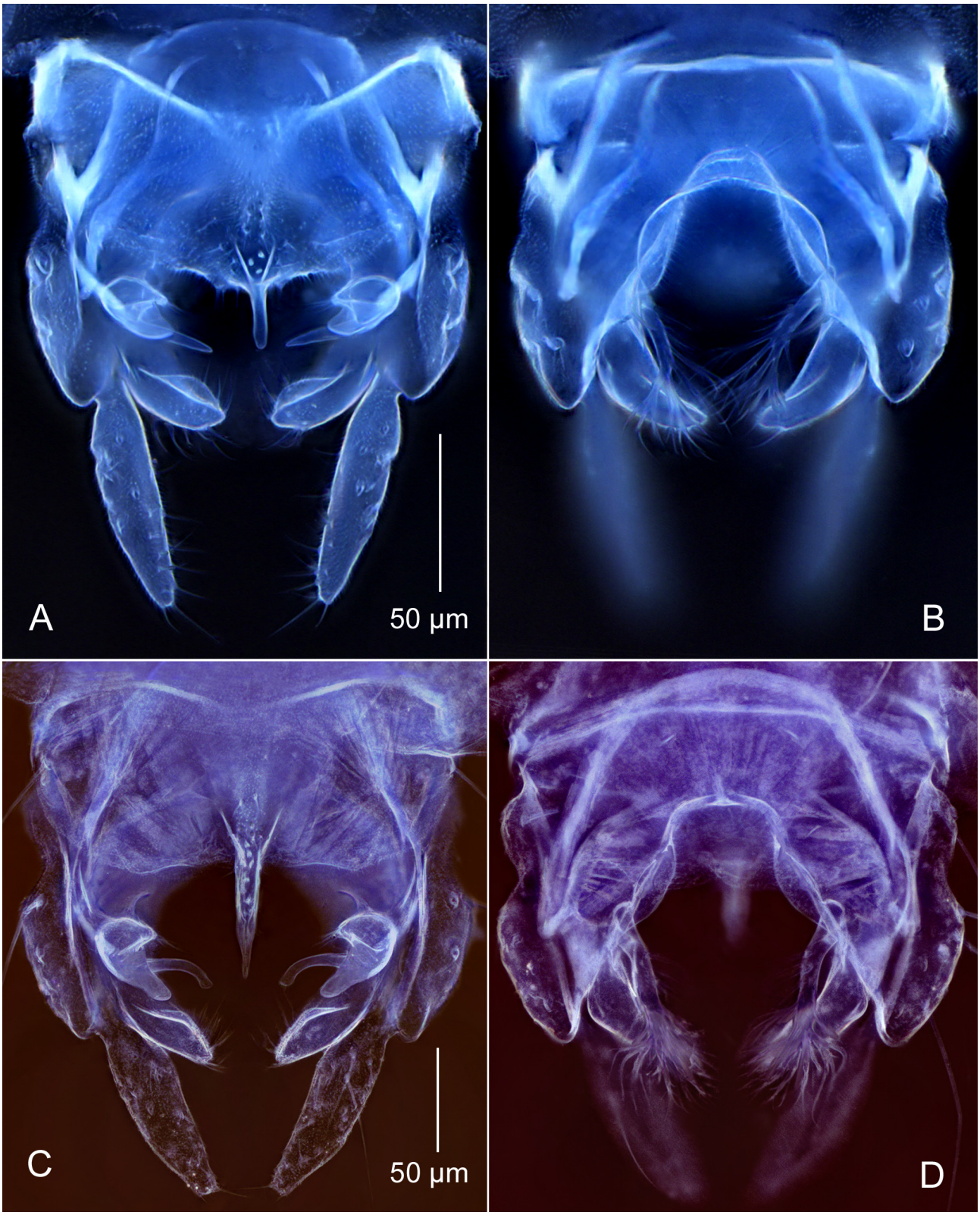

FIGURE 5. *Cladotanytarsus conversus* (Johannsen, 1932) (**A**, **B**) and *C. nigrovittatus* (Goetghebuer, 1922) (**C**, **D**), male. Hypopygium in dorsal (**A**, **C**) and ventral aspect (**B**, **D**).

Cladotanytarsus isigacedeus (Sasa *et* Suzuki)

Tanytarsus isigacedeus Sasa *et* Suzuki, 2000: Sasa & Suzuki 2000: 6 (adult male, Japan).
Cladotanytarsus isigacedeus (Sasa *et* Suzuki, 2000): Giłka & Dobosz 2015: 130 (generic transfer).

Material examined. Holotype, adult male slide-mounted (No. 385:002): 4 photographs (slide + hypopygium magnified) displayed on the NMNS website.

Remarks. The key characters for the adult male of this species were recently analysed by comparison with *Cladotanytarsus bilinearis*, *C. conversus* and *C. stylifer* from the Australasian and Indo-Pacific regions (Giłka & Dobosz 2015, table 2).

Cladotanytarsus nigrovittatus (Goetghebuer)
(Fig. 5C, D)

Tanytarsus nigrovittatus Goetghebuer, 1922: 41 (adult male, Belgium).
Cladotanytarsus mancus (Walker): Brundin 1947: 80 (adult male, Sweden); Hirvenoja 1962: 180 (adult male and female, pupa; Finland); Giłka 2001: 319 (adult male, Poland).

Material examined. FINLAND. Inari-Vuopajanniemi, 28 July 2002, 6 males. Lemmenjoki-Njurgalahti, 20 July 2002, 50 males. Menesjärvi near Lemmenjoki, 17 July 2002, 20 males, 29 July 2002, 2 males. Rovaniemi, 13 July 2002, 35 males. Saarijärvi, 14 July 2002, 13 males. Veskoniemi, 19 July 2002, 10 males. POLAND. Delowo near Stężyca, 18 June 2009, 1 male [for other records from Poland, see Giłka (2001)]. SWEDEN. Ångermanälven, 20 July 03, 2 males. Bjursås, 18 July 2003, 16 males. Jokkmokk, 21 July 2003, 12 males. Hammerdalssjön, 20 July 2003, 74 males. Malmesjaure, 20 July 2003, 97 males. Rätanssjön, 19 July 2003, 40 males. Sälen (river and fish-ponds), 1 July 2006, 17 males. Sorsele, 20 July 2003, 22 males. All specimens collected by W. Giłka (deposit in DIZP).

Remarks. This well-known species has already been redescribed in detail, so only photographs of a typical hypopygium are presented to delimit this species among other *Cladotanytarsus* males with strongly elongate anal points (Fig. 5C, D). New records come mainly from lakes in Scandinavia.

Cladotanytarsus sagittifer Giłka

Cladotanytarsus sagittifer Giłka, 2009: Giłka 2009a: 671 (adult male, UAE).

Material examined. Holotype and paratypes (Giłka 2009a). UNITED ARAB EMIRATES. Al Wathba Wetland Reserve (AWWR), October 2014, 1 male, June 2015, 1 male, Malaise traps, leg. A. Saji & A. van Harten. Deposit in DIZP.

Remarks. Adult males of this peculiar species have an extremely elongated, sagittate and darkly pigmented hypopygial anal point lacking crests and spinulae (Giłka 2009a, figs 13, 14). *Cladotanytarsus sagittifer* has so far been known from three sites in the United Arab Emirates. The present record comes from the Al Wathba Wetland Reserve (40 km SE of Abu Dhabi) - one of the most important inland wetlands in the UAE, waterlogged during the winter months, presumably the result of sub-surface flow and hydrostatic back-up during spring high tides (Soorae *et al*. 2014).

Cladotanytarsus stylifer Giłka

Cladotanytarsus stylifer Giłka, 2015: Giłka & Dobosz 2015: 128 (adult male, New Caledonia).

Material examined. Holotype (Giłka & Dobosz 2015).

Remarks. This species was recently described in detail as an adult male and compared with *Cladotanytarsus bilinearis*, *C. conversus* and *C. isigacedeus* (Giłka & Dobosz 2015, table 2).

Cladotanytarsus tobaquindecimus Kikuchi *et* Sasa

Cladotanytarsus tobaquindecimus Kikuchi *et* Sasa, 1990: Kikuchi & Sasa 1990: 316 (adult male, Sumatra).

Material examined. Holotype, adult male slide-mounted (No. 199:018): 4 photographs (slide + hypopygium magnified) displayed on the NMNS website.

Key to adult males with elongated hypopygial anal points of the subgenus *Cladotanytarsus s. str.*

1. Stem of median volsella bearing furcate/branched lamellae (Figs 1E, 3E, 4E, 5B, D) . . . . . *Cladotanytarsus* Kieffer ... 2
-. Median volsella never as above . . . . . other Tanytarsini ...not keyed
2. Apices of middle and hind leg tibiae without stout lobes armed with dense setae but with fan-shaped combs, at least one comb bearing spur (Kikuchi & Sasa 1990, fig. 20d, e; Giłka 2001, fig. 1f; Jacobsen & Bilyj 2007, fig. 4; Giłka 2009a, figs 11, 12). Inferior volsella never with globular swelling ventrally, with knee-shaped extension at most (Figs 1B, F, 3A, B, F, 4A, B, F, 5B, D; Giłka & Dobosz 2015, fig. 1d) . . . . . subgenus *Cladotanytarsus s. str.* Kieffer 3
-. Apices of middle and hind leg tibiae bearing stout lobes armed with dense setae, combs and spurs vestigial if present (Giłka 2011b, figs 2c, d, 4b–e, 5, 8, 11, 12: b, c). Inferior volsella bearing distinct globular swelling ventrally (Giłka 2011b, figs 2h, 4k, 5g, 8g, 11g, 12h) . . . . . subgenus *Lenziella* Kieffer ... not keyed
3. Anal point with longitudinal bar (Reiss 1991, fig. 2) . . . . . ***C. ecristatus*** (Morocco)
-. Anal point without longitudinal bar 4
4. Stem of median volsella shorter than its lamellae or stem and lamellae of similar length (Figs 4B, E, 5B; Glover 1973, fig. 24b; Langton & Garcia 2000, fig. 1a; Giłka 2001, fig. 1e; Giłka 2009a, fig. 16; Giłka & Dobosz 2015, fig. 1c) 5
-. Stem of median volsella distinctly longer than its lamellae (Figs 1B, E, 3B, E, 5D; Jacobsen & Bilyj 2007, fig. 5) 13
5. Anal point in shape of elongated arrow, evenly tapering to pointed apex (Glover 1973, fig. 24a; Kikuchi & Sasa 1990, fig. 21c; Sasa & Suzuki 2000, fig. 3i–k; Giłka 2009a, fig. 13), exceptionally truncate (Glover 1973, fig. 24d) 6
-. Anal point with parallel-sided distal elongation and/or apically blunt/rounded (Figs 4A, C, 5A; Langton & Garcia 2000, figs 1a, 2a, b; Langton & McBean 2010, figs 1–3; Giłka & Dobosz 2015, fig. 1a, b; NMNS 200:070) otherwise broad at base (Giłka 2001, fig. 1b, c) 9
6. Spinulae absent 7
-. Spinulae present 8
7. Anal point darkly pigmented, black or dark brown; gonostyli slender (Giłka 2009a, fig. 13) . . . . . ***C. sagittifer*** (United Arab Emirates)
-. Anal point ordinarily coloured; gonostyli stout (Glover 1973, fig. 24) . . . . . ***C. bilinearis*** (Australia)
8. Inferior volsella cuneiform, evenly tapering to narrow apex (Kikuchi & Sasa 1990, fig. 21f & NMNS 199:018) . . . . . ***C. tobaquindecimus*** (Sumatra)
-. Inferior volsella parallel-sided, with broadly rounded apex (Sasa & Suzuki 2000, fig. 3p, q & NMNS 385:002) . . . . . ***C. isigacedeus*** (Japan)
9. Inferior volsella with distinct lateral knee-shaped extension at base (Giłka & Dobosz 2015, fig. 1a, d) . . . . . ***C. stylifer*** (New Caledonia)
-. Inferior volsella without distinct lateral knee-shaped extension at base (Figs 4A, B, F, 5A, B; Langton & Garcia 2000, fig. 1a; Giłka 2001, fig. 1b; Langton & McBean 2010, fig. 1) 10
10. Inferior volsella slender at base (Fig. 5A, B; Langton & Garcia 2000, fig. 1a; Giłka 2001, fig. 1b). Stem of median volsella slender, bearing 3–4 branched lamellae, stem and its lamellae of similar length (Fig. 5B; Langton & Garcia 2000, fig. 1a; Giłka 2001, fig. 1e) 11
-. Inferior volsella strongly broadened at base (Fig. 4B, F; Langton & McBean 2010, fig. 1). Stem of median volsella stocky, bearing 6–7 branched lamellae, the longest lamella longer than its stem (Fig. 4B, E; Langton & McBean 2010, figs 1, 4) . 12
11. Anal point narrow at base, rounded apically or club-shaped (Fig. 5A; Langton & Garcia 2000, figs 1a, 2a, b; NMNS 200:070) . . . . . ***C. conversus*** (Eurasia)
-. Anal point broad at base, distal elongation pointed (Giłka 2001, fig. 1b, c) . . . . . ***C. cyrylae*** (Europe)
12. Spinulae absent, tip of digitus hooked (Langton & McBean 2010, figs 1–3). . . . . ***C. donmcbeani*** (Great Britain)
-. Spinulae usually present, digitus straight (Fig. 4A, C, D) . . . . . ***Cladotanytarsus* sp.** (USA)
13. Crests of anal point very thin or not developed (Fig. 1A, C; Jacobsen & Bilyj 2007, figs 5–7). Acrostichal setae usually absent . . . . . ***C. acornutus*** (Nearctic)
-. Crests of anal point well-developed (Figs 3A, C, 5C; Bilyj & Davies, fig. 7). Acrostichal setae always present 14
14. Median volsella with 2–3 weak branched lamellae; inferior volsella without distinct lateral knee-shaped extension at base or angular dorsomedian ridge (Bilyj & Davies, fig. 7). Small species, wing length *ca.* 1.2–1.4 mm . . . . . ***C. muricatus*** (Canada)

-. Median volsella with 6–7 strong branched lamellae (Figs 3B, E, 5D); inferior volsella with distinct lateral knee-shaped extension at base and well-developed angular dorsomedian ridge (Figs 3A, B, F, 5D). Species moderate in size, wing length *ca.* 1.5–2.5 mm. 15

15. Superior volsella slender, slightly swollen distally, covered with sparse microtrichia on basal part dorsally (Fig. 3A, D). Lamellae of median volsella slightly curved, arranged evenly on median and apical part of stem (Fig. 3B, E) . . . ***C. bilyji*** (Nearctic)

-. Superior volsella broad at base, tapering towards tip, covered with dense microtrichia on proximal 2/3 part (Fig. 5C; Giłka 2001, fig. 7b, d). Lamellae of median volsella strongly curved, densely placed on apical part of stem (Fig. 5D; Giłka 2001, fig. 7e) . . . . . ***C. nigrovittatus*** (Holarctic)

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References

Anderson, A.M., Stur, E. & Ekrem, T. (2013) Molecular and morphological methods reveal cryptic diversity and three new species of Nearctic *Micropsectra* (Diptera: Chironomidae). *Freshwater Science*, 32, 892–921. https://doi.org/10.1899/12-026.1

Bilyj, B. & Davies, I.J. (1989) Descriptions and ecological notes on seven new species of *Cladotanytarsus* (Chironomidae: Diptera) collected from an experimentally acidified lake. *Canadian Journal of Zoology*, 67, 948–962. https://doi.org/10.1139/z89-138

Brundin, L. (1947) Zur Kenntnis der Schwedischen Chironomiden. *Arkiv för Zoologi*, 39, 1–95.

Epler, J.H. (2014) *Identification guide to the larvae of the tribe Tanytarsini (Diptera: Chironomidae) in Florida*. Florida Department of Environmental Protection, Tallahassee, 77 pp. Available from: http://johnepler.com/Tanytarsini%202014.pdf (accessed 23 November 2016)

Giłka, W. (2001) A review of Polish *Cladotanytarsus* Kieffer (Diptera: Chironomidae) with description of three new species. *Polish Journal of Entomology*, 70, 307–328.

Giłka, W. (2009a) Order Diptera, family Chironomidae, tribe Tanytarsini. *In*: Sheikh, H.H., Al Nahyan, T.B.Z. (Patrons) & van Harten A. (Eds.), *Arthropod fauna of the United Arab Emirates*. *Vol. 2*. Dar Al Ummah Printing, Publishing, Distribution & Advertising, Abu Dhabi, pp. 667–682.

Giłka, W. (2009b) New and rare chironomids of the tribe Tanytarsini in Poland (Diptera: Chironomidae). *Polish Journal of Entomology*, 78, 377–384.

Giłka, W. (2011a) *Ochotkowate - Chironomidae, plemię: Tanytarsini, postaci dorosłe, samce. Klucze do oznaczania owadów Polski. [Non-biting midges - Chironomidae, tribe Tanytarsini, adult males. Keys for the Identification of Polish Insects]. No 177. Part XXVIII, Muchówki - Diptera, Issue 14b. Polskie Towarzystwo Entomologiczne*. Biologica Silesiae, Wrocław, 95 pp. [in Polish]

Giłka, W. (2011b) Six unusual *Cladotanytarsus* Kieffer: towards a systematics of the genus and resurrection of *Lenziella* Kieffer (Diptera: Chironomidae: Tanytarsini). *Zootaxa*, 3100, 1–34.

Giłka, W. (2012) Notes on the systematics of East Asian *Neozavrelia* Goetghebuer (Diptera: Chironomidae: Tanytarsini). *In*: Istomina, A.G. (Ed.), The 60th anniversary of Eugenii Anatolievich Makarchenko. *Euroasian Entomological Journal*, 11 (Supplement 2), 35–39.

Giłka, W. & Dobosz, R. (2015) A contribution to the systematics of Australasian Tanytarsini (Diptera: Chironomidae): first descriptions from New Caledonia. *Zootaxa*, 3980 (1), 127–135. https://doi.org/10.11646/zootaxa.3980.1.7

Glover, B. (1973) The Tanytarsini (Diptera: Chironomidae) of Australia. *Australian Journal of Zoology*, 23 (Supplement), 403–478. https://doi.org/10.1071/AJZS023

Goetghebuer, M. (1922) Nouveaux matériaux pour l'étude de la fauna de Chironomides de Belgique. *Annales de Biologie Lacustre*, 11, 38–62.

Hirvenoja, M. (1962) *Cladotanytarsus*-Arten (Dipt., Chironomidae) aus Finnisch-Lappand. *Annales Entomologici Fennici*, 28, 173–181.

Jacobsen, R.E. & Bilyj, B. (2007) An unusual new *Cladotanytarsus* from oligotrophic Florida Everglades marshes (Diptera: Chironomidae). *In*: Andersen, T. (Ed.), *Contributions to the Systematics and Ecology of Aquatic Diptera - A Tribute to Ole*

A. Sæther. The Caddis Press, Columbus, Ohio, pp. 145–154.
Johannsen, O.A. (1932) Chironominae of the Malayan subregion of the Dutch Indies. *Archiv für Hydrobiologie*, 11 (Supplement), 503–552.
Kikuchi, M. & Sasa, M. (1990) Studies on the chironomid midges (Diptera: Chironomidae) of the Lake Toba area, Sumatra, Indonesia. *Japanese Journal of Sanitary Zoology*, 41, 291–329. http://doi.org/10.7601/mez.41.291
Langton, P. & Garcia, X.-F. (2000) A review of *Cladotanytarsus conversus* (Johannsen) with first record from Europe (Insecta, Diptera, Chironomidae). *Spixiana*, 23, 199–206.
Langton, P.H. & McBean, S.F. (2010) *Cladotanytarsus donmcbeani* sp. nov. (Diptera, Chironomidae) from Loch Leven, Kinross-shire, Scotland. *Dipterists Digest*, 17, 109–114.
Malloch, J.R. (1915) The Chironomidae, or midges, of Illinois, with particular reference to the species occurring in the Illinois river. *Bulletin of the Illinois State Laboratory of Natural History*, 10, 275–543. Avaliable from: http://www.biodiversitylibrary.org/bibliography/9255#/summary (Accessed 9 Mar. 2017)
National Museum of Nature and Science (2014) *Type Specimen Database.* Available from: http://www.type.kahaku.go.jp/TypeDB/ (accessed 21 October 2016)
Oliver, D.R., Dillon, M.E. & Cranston, P.S. (1990) A catalog of Nearctic Chironomidae. *Research Branch Agriculture Canada Publication*, 1857/B, 1–89.
Paasivirta, L. (2012) Finnish Chironomidae. *Chironomus, Newsletter on Chironomidae Research*, 25, 47–70. https://doi.org/10.5324/cjcr.v0i25.1546
Pape, T., Blagoderov, V. & Mostovski, M.B. (2011) Order Diptera Linnaeus, 1758. *In*: Zhang, Z.-Q., (Ed.), Animal biodiversity: An outline of higher-level classification and survey of taxonomic richness. *Zootaxa*, 3148, 222–229.
Puchalski, M., Zimny, F. & Giłka, W. (2016) *Cladotanytarsus molestus* Hirvenoja, 1962 in Poland: toward the identification of bioindicative Tanytarsini (Diptera: Chironomidae). *Oceanological and Hydrobiological Studies*, 45, 316–323. https://doi.org/10.1515/ohs-2016-0030
Reiss, F. (1991) Drei neue Tanytarsini-Arten aus Marokko (Diptera, Chironomidae). *Nachrichtenblatt der Bayerischen Entomologen*, 40, 45–52.
Sæther, O.A. (1980) Glossary of chironomid morphology terminology (Diptera: Chironomidae). *Entomologica scandinavica*, 14 (Supplement), 1–51.
Sasa, M. & Suzuki, H. (2000) Studies on the chironomid species collected on Ishigaki and Iriomote islands, Southwestern Japan. *Tropical Medicine*, 42, 1–37. Avaliable from: http://hdl.handle.net/10069/4787 (Accessed 9 Mar. 2017)
Soorae, P.S., Al Zaabi, R., Saji, A., Sakkir, S., Ahmed, S. & Khan, S. (2014) Al Wathba Wetland Reserve Field Guide. Environment Agency, Abu Dhabi, 84 pp.