New records of non-biting midges (Diptera: Chironomidae) from springs and streams of the Ukrainian Carpathians (Gorgany Massif)

Новые находки хирономид (Diptera: Chironomidae) из родников и ручьев Украинских Карпат (массив Горганы)

V.A. Baranov & A.A. Przhiboro*

В.А. Баранов, А.А. Пржиборо

V.A. Baranov, I.I. Schmalhausen Institute of Zoology, National Academy of Sciences of Ukraine, 15 B. Khmelnytskogo, 01601 Kiev, Ukraine; Leibniz Institute for Freshwater Ecology and Inland Fisheries, Müggelseedamm 310, 12587 Berlin, Germany. E-mail: baranowiktor@gmail.com

*A.A. Przhiboro, Zoological Institute, Russian Academy of Sciences, 1 Universitetskaya Emb., St Petersburg 199034, Russia. E-mail: dipteran@mail.ru *Corresponding author.*

Seven species of Chironomidae (Diptera) are recorded from Ukraine for the first time: *Krenopelopia binotata* (Wiedemann, 1817), *Chaetocladius gracilis* Brundin, 1956, *Limnophyes asquamatus* Andersen, 1937, *Paraphaenocladius exagitans monticola* Strenzke, 1950, *Thienemannia gracei* (Edwards, 1929), *T. gracilis* Kieffer, 1909, and *Micropsectra notescens* (Walker, 1856). The record of *C. laminatus* Brundin, 1947 from Ukraine is confirmed. Adults of all species emerged from semiaquatic substrata (moss, litter) collected from mountain springs and streams in the Gorgany Massif of the Ukrainian Carpathians; *C. gracilis*, *P. exagitans monticola* and *T. gracei* are for the first time recorded from springs. The type specimens of *C. gracilis* are reexamined, and the lectotype is designated. Emendations are proposed to the diagnosis of the genus *Thienemannia* Kieffer, 1911 and to the diagnostic characters of the male of *T. gracei*.

Семь видов хирономид (Diptera: Chironomidae) впервые отмечены с территории Украины: *Krenopelopia binotata* (Wiedemann, 1817), *Chaetocladius gracilis* Brundin, 1956, *Limnophyes asquamatus* Andersen, 1937, *Paraphaenocladius exagitans monticola* Strenzke, 1950, *Thienemannia gracei* (Edwards, 1929), *T. gracilis* Kieffer, 1909 и *Micropsectra notescens* (Walker, 1856). Подтверждена находка *C. laminatus* Brundin, 1947 на Украине. Имаго всех видов были выведены из полуводных субстратов (мхи, листовой опад), которые были собраны из горных родников и ручьев массива Горганы (Украинские Карпаты); *C. gracilis*, *P. exagitans monticola* и *T. gracei* впервые отмечены из родников. Переисследован типовой материал *C. gracilis*; обозначен лектотип этого вида. Предложены исправления диагноза рода *Thienemannia* Kieffer, 1911 и диагностических признаков самца *T. gracei*.

Key words: non-biting midges, distribution, diagnostic characters, larval habitats, springs, streams, Ukraine, Carpathians, Diptera, Chironomidae, *Chaetocladius*, *Thienemannia*, new records

Ключевые слова: хирономиды, распространение, диагностические признаки, биотопы личинок, родники, ручьи, Украина, Карпаты, Diptera, Chironomidae, *Chaetocladius*, *Thienemannia*, новые находки

INTRODUCTION

Non-biting midges (Diptera: Chironomidae) are among the most abundant macroinvertebrates in aquatic and semiaquatic environments. In Ukraine, chironomids of small running waters, especially springs and hygropetric habitats, are almost unstudied (Baranov, 2011). The Carpathian region is very interesting in biogeographical aspects of aquatic fauna, taking into account its connections with several other large Eu-

ropean mountain systems (Polishchuk & Gerasevich, 1986). Our study was focused on the chironomids from semiaquatic habitats in the Gorgany Massif of the Ukrainian Carpathians.

STUDY LOCALITIES AND HABITATS

The springs and streams studied are situated in the vicinity of Bystritsa-Nadvirnyanska Village (48°27′N 24°15′E, ca. 30 km SW of Nadvirna Town, Ivano-Frankovsk Province of Ukraine). The study sites are situated in five localities in the basins of Dzhurdzhii (=Derdinets) and Studenyi, two cold mountain streams (water temperature 4–10 °C in the sampling period), both being the tributaries of the Bystritsa River. The material was taken at the shorelines, only from semiaquatic habitats represented by two major substrate types, mosses and beech litter. Below, the study sites and habitats are briefly characterized.

Site 1: a small unnamed shaded stream in forest (spruce, fir and beech predominant), tributary of Dzhurdzhii Stream in its middle course; ca. 4 km NEE of central part of Bystritsa-Nadvirnyanska Vill., ca. 850 m. Habitats: mosses on limestone gravel/stones, beech litter with rotten wood.

Site 2A: spring (rheocrene) at the shore of Dzhurdzhii Stream some hundred meters of site 1; ca. 800 m. Habitat: mosses with *Cardamine amara* on limestones.

Site 2B: water margin of Dzhurdzhii Stream, same locality. Habitat: mosses on limestones.

Site 3: upper reach of Dzhurdzhii Stream (narrow canyon in spruce forest); ca. 4.5 km E of central part of Bystritsa-Nadvirnyanska Vill., ca. 1300 m. Habitat: mosses on limestones.

Site 4: spring, head of Studenyi Stream in beech forest; ca. 3 km NNE of central part of Bystritsa-Nadvirnyanska Vill., 1180 m. Habitats: mosses on limestone gravel/stones, beech litter with rotten wood.

Site 5A: Studenyi Stream 100 m upstream of the confluence with Bystritsa River, 3 km NE of central part of Bystritsa-Nadvirnyanska Vill., 710 m. Habitats: thick moss cushions on limestones and on wood.

Site 5B: spring, a tributary of Studenyi Stream 200 m upstream of the confluence with Bystritsa River, same locality, 750 m. Habitats: same as at site 5A.

A more detailed description of study sites and their conditions will be provided in a paper on chironomid assemblages (Przhiboro & Baranov, in preparation).

MATERIAL AND METHODS

All Carpathian chironomids considered in this paper are adult specimens reared in the laboratory from semiaquatic substrates collected on August 15–21, 2004. Rearing techniques were used as described by Przhiboro & Shamshev (2007) and Przhiboro & Paasivirta (2011), but the temperature usually did not exceed 15 °C. The Carpathian material was collected by A. Przhiboro. The Chironomidae adults were determined in permanent euparal slides or in temporary water/glycerole slides. Morphological terminology and measurements follow Sæther (1980). The photographs were taken from permanent slides with a Leica DFC320 digital camera on a Leica DM5000B microscope with Nomarski contrast. Series of photos taken at different focal planes were stacked using Helicon Focus 5.1 and the resulting images were further enhanced using Adobe Photoshop CS software. Most part of the material is housed at the Zoological Institute, St Petersburg; some slides are kept in the collection of V. Baranov.

RESULTS

Among the chironomids collected, 19 species were recorded (Przhiboro & Baranov, in preparation). Seven species and the genera *Thienemannia* Kieffer, 1911 and *Krenopelopia* Fittkau, 1962 were recorded for the first time from Ukraine. An annotated list of new records is given below. Diagnostic characters of five species are il-

lustrated in Figs 1–10. For the Carpathian localities, only the numbers of sites are given (for details, see Material and Methods), as well as the dates of emergence of adults. The habitat (substrate) type is moss if not specified as litter.

Family **CHIRONOMIDAE**

Subfamily **TANYPODINAE**

Krenopelopia binotata (Wiedemann, 1817)

Material. **Ukraine**, *Ivano-Frankovsk Prov.*: 15 males, 17 females, site 4, 1.X.2004; site 2A, site 4 (litter), site 5B, all 8.III.2005. *Crimea*: 1 larva, Yalta, Uchan-Su River, Polyana Skazok, 8.V.2011, V. Baranov leg.

Notes. The species and the genus are recorded for the first time from Ukraine. *Krenopelopia binotata* is widespread in western Europe and Siberia (Ashe & O'Connor, 2009; Sæther & Spies, 2013).

The adults in our material are paler and less contrastingly coloured as compared to the published descriptions of *K. binotata* (Goetghebuer, 1936; Fittkau, 1962; Langton & Pinder, 2007) and to the specimens from the collection of the Zoological Institute (collected by Chernovskii, 1938, Leningrad Prov.).

Subfamily **ORTHOCLADIINAE**

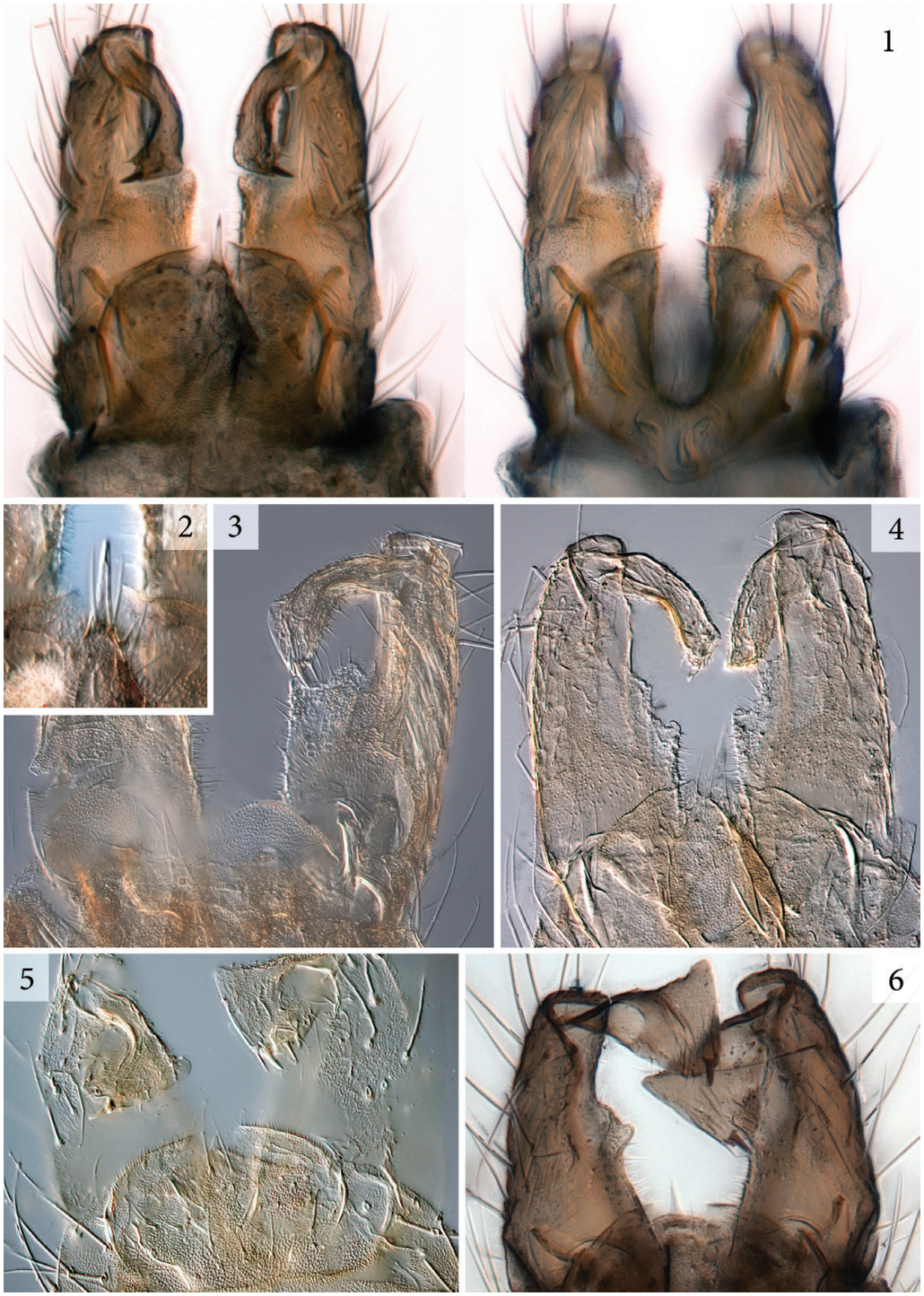
Chaetocladius gracilis Brundin, 1956 (Figs 1–4)

Material. **Ukraine**, *Ivano-Frankovsk Prov.*: 1 male, site 3, 1.X.2004.

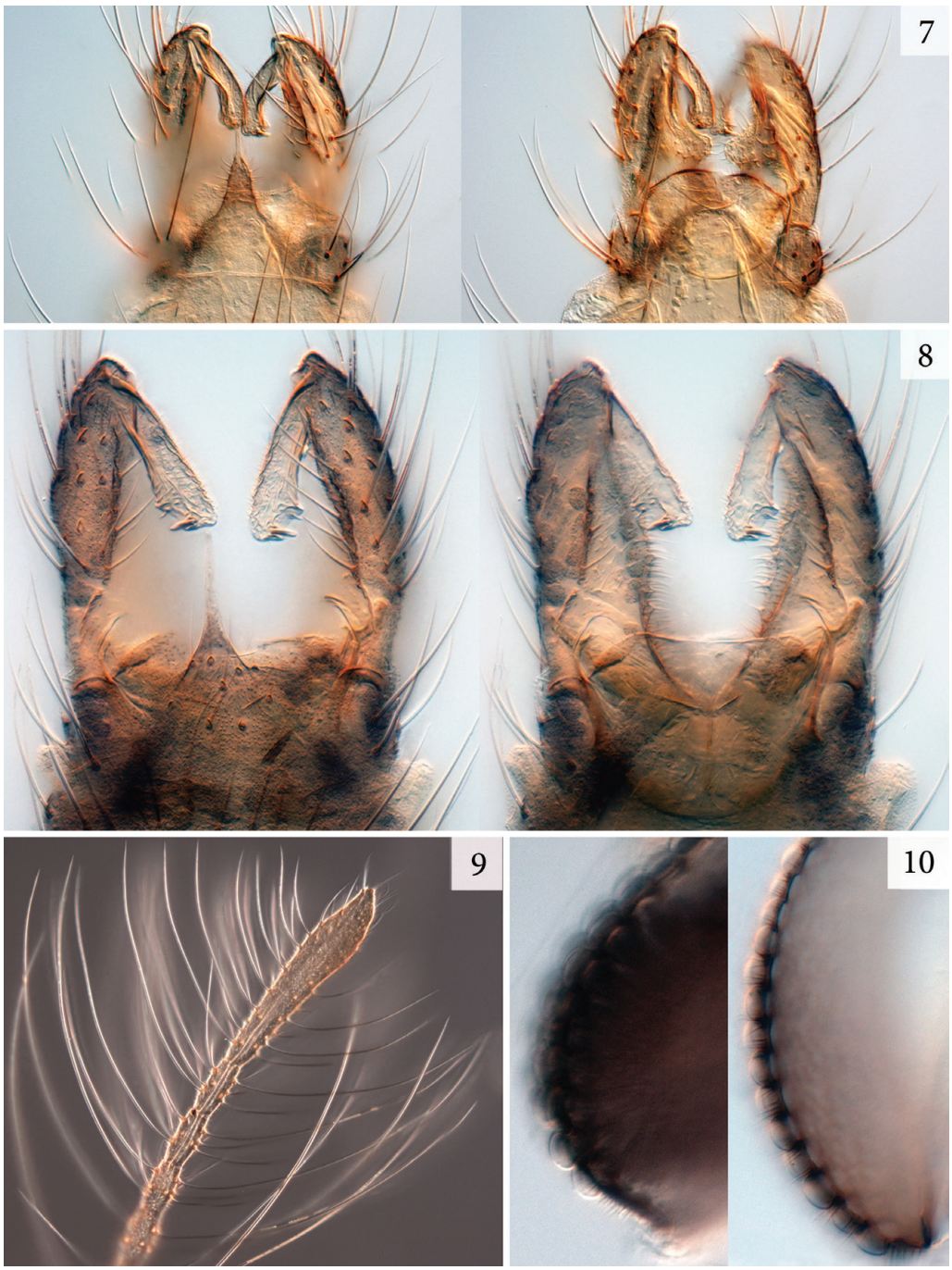
Type material (reexamined). *Lectotype* (designated here). Male; "Schwedisch-Lappland, Torneträskgebiet: am 9.9.1950 an der Nordböschung des Riksgränsfjället fliegend" [**Sweden**, Lapplandia, area of Torneträsk, flying at northern slope of Riksgränsfjället Mountain near border with Norway, 9 September 1950, Brundin leg.] (no. NHRS-BYWS000000803). *Paralectotypes.* **Sweden**: 1 male, same data as in lectotype (no. NHRS-BYWS000000804); 5 males, same area, stream mouth at shore of Vassijaure Lake [near Riksgränsfjället], 11 September 1950, Brundin leg. (nno. NHRS-BYWS000000805-809). The types are kept at the Swedish Museum of Natural History in Stockholm.

Notes. Species diagnostics in *Chaetocladius* is problematic, and the genus needs a revision. *Chaetocladius gracilis* was described from the males collected in two localities in northern Sweden. In the original description, Brundin (1956: 124–125) listed one male from Riksgränsfjället and numerous males from Vassijaure. Upon our request, Dr. Yngve Brodin kindly examined the collection of the Swedish Museum of Natural History and found two males from the first locality and 37 ones, from the second, with the Brundin's identification labels "*Chaetocladius gracilis*" and other label data corresponding to those in the original description. All the material was kept in ethanol. In one male from the first locality, the abdomen was separated and cleared. The second author examined both the specimens from Riksgränsfjället and five best preserved specimens from Vassijaure, and slide-mounted in euparal all specimens from Vassijaure and a specimen with separated abdomen from Riksgränsfjället (some parts of one specimen from Vassijaure were slide-mounted in Berlese fluid).

Brundin (1956) did not designate the holotype, hence all the specimens should be considered as syntypes. The only specimen with separated and cleared abdomen was probably used for drawing the hypopygium, according to the Brundin's drawing technique described in the same paper (Brundin, 1956: 14–15). This specimen fits well to the original description, so we designate it as a lectotype. The hypopygium of the lectotype (Fig. 4) slightly differs from the Brundin's drawing (Brundin, 1949: 123, Fig. 87) in the shape of the gonostyle but the differences may be explained by the different position of the gonostyles on the slide and in ethanol. The paralectotypes mostly share the characters of the lectotype and fit to the original description, but differ from these in the inferior volsella, which looks wider and differently-shaped (Fig. 3). However, an examination of the specimens in



Figs 1–6. *Chaetocladius* spp., male hypopygia: **1**, *C. gracilis*, specimen from Carpathians (left, dorsal part; right, ventral part); **2**, same specimen, anal point; **3**, *C. gracilis*, paralectotype from Vassijaure (Sweden); **4**, *C. gracilis*, lectotype (Sweden); **5–6**, *C. laminatus*, specimens from Carpathians.



Figs 7–10. 7, *Paraphaenocladius exagitans monticola*, male, hypopygium (left, dorsal part; right, ventral part); **8–9**, *Thienemannia gracei*, male: **8**, hypopygium (left, dorsal part; right, ventral part); **9**, apical segments of antenna; **10**, setation on eye of males of *Thienemannia gracei* (left) and *T. gracilis* (right).

ethanol revealed that the differences mostly resulted from the different position of the volsella on the slides.

The male in our material slightly differs from the Brundin's original description in some characters of the gonostyle (outer margin with distal angle more pronounced and inner margin with a rather strong seta before the megaseta; Fig. 1), in the anal point without hairs except for the base (Fig. 2), and in the number of setae on vein *R* (13 vs. "about 10"). However, the comparison of our specimen with the lectotype has revealed that they are very similar in the details of the gonostyle and differ only in the hairs on the anal point. The lectotype has 10 setae on *R*, but paralectotypes, 10–12 ones.

Chaetocladius gracilis is recorded from Ukraine for the first time. It is a rare species previously known from Finland, France, Norway, Novaya Zemlya, Romania and Sweden (Ashe & O'Connor, 2012; Sæther & Spies, 2013). The species is recorded for the first time from springs (Lindegaard, 1995; Paasivirta, 2007).

Chaetocladius laminatus Brundin, 1947
(Figs 5–6)

Material. **Ukraine**, *Ivano-Frankovsk Prov.*: 1 female, site 1, 1.X.2004; 4 males, 1 female, site 2A, 1.X.2004; 1 female, site 2B, 9.IX.2004; 5 males, 24 females, site 3, 1.X.2004; 1 female, site 4, 1.X.2004; 1 female, site 5A, 1.X.2004; 2 females, site 5B, 9.IX.2004.

Notes. The occurrence of *Chaetocladius laminatus* in Ukraine is confirmed. The previous record (Baranov, 2011) was based on the larvae only, and thus could be considered as unreliable, due to difficulties in distinguishing larvae in the *Chaetocladius dentiforceps*-aggregate (Moller Pillot, 2013). The species is widespread in the Western Palaearctic (Ashe & O'Connor, 2012; Sæther & Spies, 2013).

Ekrem et al. (2010) recorded from Norway a very similar undescribed species ("*Chaetocladius* sp. 2") differing from *C. laminatus* in fine details of the hypopygium and COI sequences. However, they have not illustrated their species and do not have a photo of its hypopygium (E. Stur, pers. comm.). Based on the Brundin's original description (Brundin, 1947) and the brief diagnosis of "*C.* sp. 2" (Ekrem et al., 2010) we consider that our material fits well to *C. laminatus* (see Figs 5–6; in Fig. 5, anal point is not horizontal and so it looks shorter).

Limnophyes asquamatus Andersen, 1937

Material. **Ukraine**, *Ivano-Frankovsk Prov.*: 1 male, site 4 (litter), 5.XI.2004.

Notes. The species is recorded for the first time from Ukraine, widespread in Europe (Ashe & O'Connor, 2012; Sæther & Spies, 2013).

Paraphaenocladius exagitans monticola Strenzke, 1950
(Fig. 7)

Material. **Ukraine**, *Ivano-Frankovsk Prov.*: 2 males, site 1, 8.III.2005; 5 males, site 4 (litter), 8.III.2005; 1 male, site 5B, 9.IX.2004.

Notes. The subspecies and species are recorded for the first time from eastern Europe; it was known from eight countries in western and northern Europe (Ashe & O'Connor, 2012; Sæther & Spies, 2013). The species is recorded for the first time from springs (Lindegaard, 1995).

Thienemannia gracei (Edwards, 1929)
(Figs 8–10)

Material. **Ukraine**, *Ivano-Frankovsk Prov.*: 5 males, site 1, 7.IX.2004; 1 male, site 1, 5.XI.2004; 9 males, site 1 (litter), 1.X.2004; 4 males, site 2B, 9.IX.2004; 1 male, site 3, 9.IX.2004; 1 male, site 4, 9.IX.2004; 1 male, 2 females, site 4 (litter), 1.X.2004; 1 male, site 5A, 7.IX.2004; 2 males, site 5B, 9.IX.2004; 3 males, site 5B, 1.X.2004.

Notes. The species and the genus are recorded for the first time from Ukraine. The species was previously recorded from eight European countries, Lebanon and China (Ashe & O'Connor, 2012; Sæther & Spies, 2013). The species is recorded for the first time from springs (Lindegaard, 1995).

The males in our material correspond well to the redescription of *T. gracei* provided by Sæther (1985) in the structure of the hypopygium (Fig. 8), the antepronotum and wing chaetotaxy. At the same time, our specimens differ from the redescription in the lower AR (0.35–0.40; n=6), smaller wing length (1.10–1.47 mm; n=6) and lower number of setae on squama (4–6; n=6). Both males examined by Sæther (1985) were collected in the Great Britain. We suppose that the above three characters are variable; hence, they may be used for the identification of *T. gracei* only with reservations.

In all males of *T. gracei* in our material, the eyes are pubescent (with microtrichia slightly shorter than the height of ommatidial lenses) only at the lower margin (Fig. 10). We could not see hairs throughout the eye surface. Moubayed-Breil described a similar arrangement of hairs for *T. fulvofasciata* (Kieffer, 1921) (Moubayed-Breil, 2013: 81, Fig. 3). Hairs or pubescence on eyes were considered one of the diagnostic characters of the genus *Thienemannia* (Sæther, 1985: 112–113; Cranston et al., 1989: 244). We propose the following emendation to the diagnosis of the genus: Eyes hairy or pubescent over the surface or only at lower margin.

Thienemannia gracilis Kieffer, 1909
(Fig. 10)

Material. **Ukraine**, *Ivano-Frankovsk Prov.*: 2 males, site 1, 7.IX.2004; 1 male, site 4, 9.IX.2004; 5 males, site 5A, 1.X.2004.

Notes. The species is recorded for the first time from Ukraine, widespread in Europe (Ashe & O'Connor, 2012; Sæther & Spies, 2013).

Subfamily **CHIRONOMINAE**

Tribe TANYTARSINI

Micropsectra notescens (Walker, 1856)

Material. **Ukraine**, *Ivano-Frankovsk Prov.*: 5 males, 3 females, site 2A, 8.III.2005.

Notes. The species is recorded for the first time from Ukraine, widespread in the Western Palaearctic (Sæther & Spies, 2013).

ACKNOWLEDGEMENTS

A. Przhiboro is grateful to Andrey Susulovsky (Lviv) and the administration of the Gorgany Nature Reserve for the substantial assistance during the field work in the Carpathians in 2004. The research of V. Baranov was supported by a grant for young scientists from the Russian Foundation for Basic Research, Ref. no. 13-04-90918 mol_in_nr. The research of A. Przhiboro was partially supported by a grant from the Russian Scientific Foundation, Ref. no. 14-14-01134.

Both authors are grateful to Yngve Brodin (Stockholm) for loaning the types of *Chaetocladius gracilis* and additional information on these, to Martin Spies (München), Joel Moubayed-Breil (Montpellier) and Elisabeth Stur (Trondheim) for valuable comments and discussion on different issues of Chironomidae taxonomy, and to Henk Moller Pillot (Tilburg) for reviewing the manuscript.

REFERENCES

Ashe P. & O'Connor J.P. 2009. *A World catalogue of Chironomidae* (*Diptera*). *Part 1. Buchonomyiinae, Chilenomyiinae, Podonominae, Aphroteniinae, Tanypodinae, Usambaromyiinae, Diamesinae, Prodiamesinae and Telmatogetoninae*. Dublin: Irish Biogeographical Society. 445 p.

Ashe P. & O'Connor J.P. 2012. *A World catalogue of Chironomidae* (*Diptera*). *Part 2. Orthocladiinae*. Dublin: Irish Biogeographical Society. xvi + 968 p.

Baranov V.A. 2011. A preliminary annotated checklist of non-biting midges (Diptera, Chironomidae) of Ukraine. *Ukrainska Entomofaunistyka*, **2**(1): 7–24. (In Ukrainian).

Brundin L. 1956. Zur Systematik der Orthocladiinae (Dipt. Chironomidae). *Institute of Freshwater Research, Drottningholm,* Report **37**: 5–185.

Cranston P.S., Oliver D.R. & Sæther O.A. 1989. The adult males of Orthocladiinae (Diptera: Chironomidae) of the Holarctic region – Keys and diagnoses. *In:* **Wiederholm T.** (Ed.). *The adult males of Chironomi-*

dae (Diptera) of the Holarctic region – Keys and diagnoses. Entomologica scandinavica, Supplement **34**: 165–352.

Fittkau E.J. 1962. Die Tanypodinae (Diptera: Chironomidae) (Die Tribus Anatopyniini, Macropelopiini und Pentaneurini). *Abhandlungen zur Larvalsystematik der Insekten*, **6**: 1–453. Berlin: Akademie-Verlag.

Goetghebuer M. 1936. Tendipedidae (Chironomidae). a) Subfamilie Pelopiinae (Tanypodinae). A. Die Imagines. *In:* **Lindner E.** (Ed.). *Die Fliegen der palaearktischen Region*, **13b**: 1–50, Taf. I–VI. Stuttgart: E. Schweizerbart'sche Verlagsbuchhandlung.

Langton P.H. & Pinder L.C.V. 2007. Keys to the adult male Chironomidae of Britain and Ireland. Volumes 1–2. *Freshwater Biological Association Scientific Publications*, **64**. 239 + 168 pp.

Lindegaard C. 1995. Chironomidae (Diptera) of European cold springs and factors influencing their distribution. *Journal of the Kansas entomological Society*, **68**, Supplement: 108–131.

Moller Pillot H.K.M. 2013. *Chironomidae larvae III – biology and ecology of the aquatic Orthocladiinae*. Zeist: KNNV Publishing. 312 p.

Moubayed-Breil J. 2013. Description of *Thienemannia corsicana* sp. n. from the upstream of the Golu River in Corsica [Diptera, Chironomidae, Orthocladiinae]. *Ephemera*, **13**(2), 2011: 79–86.

Paasivirta L. 2007. Chironomid species in Finnish springs and their surroundings. *In*: **Andersen T.** (Ed.). *Contributions to the systematics and ecology of aquatic Diptera – a tribute to Ole A. Sæther*: 235–246. Columbus: The Caddis Press.

Polishchuk V.V. & Gerasevich I.G. 1986. *Biogeografichni aspekti vivchennya vodoim baseinu Dunayu v mezhakh SRSR* [Biogeographical aspects in research of waterbodies of the Danube basin in the borders of the USSR]. Kiev: Naukova Dumka. 272 p. (In Ukrainian).

Przhiboro A. & Paasivirta L. 2012. Chironomidae of semiaquatic lake shore habitats in the Karelian Isthmus (northwestern Russia). *Fauna norvegica*, **31**: 87–94.

Przhiboro A.A. & Shamshev I.V. 2007. Shore larval habitats of *Stilpon graminum* (Fallén, 1815) in Northwestern Russia (Diptera Hybotidae). *Bulletin et Annales de la Société Royale Belge d'Entomologie*, **143**: 12–18.

Sæther O.A. 1980. Glossary of chironomid morphology terminology (Diptera: Chironomidae). *Entomologica scandinavica*, Supplement **14**: 1–51.

Sæther O.A. 1985. Redefinition and review of *Thienemannia* Kieffer 1909 (Diptera: Chironomidae), with the description of *T. pilinucha* sp. n. *Aquatic Insects*, **7**(2): 111–131.

Sæther O.A. & Spies M. 2013. Fauna Europaea: Chironomidae. *In*: **Beuk P. & Pape T.** (Eds.). Fauna Europaea: Diptera Nematocera. Fauna Europaea, version 2.6.2. Updated August 29, 2013 [visited November 17, 2013]. Available from: <www.faunaeur.org>.

Received January 6, 2014 / Accepted April 17, 2014