

THE MORPHOLOGY OF ADULTS OF CRYPTONEVRA LIOY,
1864 SPECIES (DIPTERA, CHLOROPIDAE) OCCURRING
ON THE COMMON REED (PHRAGMITES AUSTRALIS)

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The male genitalia of *Cryptonevra* LIOY, 1864 living in the galls of *Lipara* MEIGEN, 1830, on the common reed are described and illustrated with 24 drawings. The male genitalia of *C. consimilis* and *C. flavitarsis* are identical, and there is overlap between diagnostic characters. Accordingly, it is suggested that *C. consimilis* be a junior synonym of *C. flavitarsis*. The male genitalia of *C. nigratarsis* differ considerably from those of *C. flavitarsis*, their diagnostic characters being also different. Accordingly, *C. nigratarsis* should be recognised as a separate species. A key is presented for determination of *Cryptonevra* flies living in *Lipara* galls on the common reed.

Key words: *Cryptonevra*, Chloropidae, Diptera, *Phragmites australis*, morphology

INTRODUCTION

Twelve species of the genus *Cryptonevra* LIOY, 1864 occur in the Palaearctic Region (ANDERSSON 1977, NARTSHUK 1996). These species have been recorded from Europe, Asia, North Africa, the Canary Islands, the Azores and the Kurile Islands (KANMIYA 1983, BESCHOVSKI 1984, NARTSHUK 1984). *C. consimilis* COLLIN, 1932, *C. diadema* (MEIGEN, 1830), *C. flavitarsis* (MEIGEN, 1830), *C. nigratarsis* (DUDA, 1933) and *C. tarsata* (FALLÉN, 1820) have been recorded in Poland (NARTSHUK 1984, DASZKIEWICZ-HUBICKA, GROCHOWSKA 1985, SIEDLAR 1991). The first four species live in galls made by flies of the genus *Lipara* MEIGEN, 1830, on common reed stem tops (*Phragmites australis* (CAV.) TRIN) (NARTSHUK 1996).

The species which live on the common reed differ from one another mainly in body colouring and some structures of the cuticular surface (hairs, microsculpture) (MEIGEN 1830, COLLIN 1932, DUDA 1933). These characters are similar for three species (*C. flavitarsis*, *C. consimilis* and *C. nigratarsis*), which is why there is controversy over their separate identity as species. Just one year after COLLIN described *C. consimilis* as a species new to science in 1932, DUDA (1933) contested COLLIN's findings, regarding them as insufficient for the erection of a new species. An even more radical view was opinion by NARTSHUK *et al.* (1970) and BESCHOVSKI (1981), who recognized both *C. consimilis* and *C. nigratarsis* as junior synonyms

of *C. flavitarsis*. However, in 1984, NARTSHUK re-affirmed the separate status of all those species, without giving reasons for her position. Since then the view held by NARTSHUK (1984) has been repeated in faunistic and taxonomic studies (DASZKIEWICZ-HUBICKA, GROCHOWSKA 1985, NARTSHUK 1996). The most extensive collection of data regarding the morphology of *Cryptonevra* imagines can be found in ISMAY (1994). However, those data are also equivocal, mostly with respect to the key characters distinguishing *C. flavitarsis* and *C. consimilis* (colour of tibiae in the first pair of legs, and the pattern of hair on the thorax and abdomen), and the reported absence of differences in the appearance of male genitalia in *C. flavitarsis* and *C. nigratarsis*.

Because of differences in views on the subject and lack of sufficient documentation of morphological characters distinguishing these species, the variability of diagnostic characters in *Cryptonevra* was studied to assess the value of these characters. Emphasis was mainly placed on the examination of the male genitalia, whose structure is generally recognized as a crucial element in species distinction in insects. The male genitalia of *Cryptonevra* flies have frequently been analysed in the literature (ANDERSSON 1977, BESCHOVSKI 1981, ISMAY 1994). However, a few important findings that are relevant to the resolution of the above doubts have not been addressed.

MATERIALS AND METHODS

The materials were specimens of adult flies of the genus *Cryptonevra*. The flies were captured with a sweeping net or laboratory-reared from larvae and pupae, which were mostly found in *Lipara* galls in apical parts of common reed stems. Laboratory rearing, was conducted in filter-paper lined Petri dishes. The insects were collected in 1982, 1984, 2000, and 2002 in reedbeds in the vicinity of Lublin – the southeast Poland. A total of 109 (71 ♂♂, 38 ♀♀) *Cryptonevra* flies were examined. Specimens from the Natural History Museum in London were also analysed.

Preparations of male genitalia were obtained from all males collected in Poland. Genital segments were detached from specimens, macerated in 10% KOH for 24 hours at room temperature, washed in distilled water, cleared in chloralhydrate and chloralphenol, and then preserved in glycerol.

The terminology used in the morphological description follows that of NARTSHUK (1977), McALPINE (1981) and CUMMING *et al.* (1995).

RESULTS

A total of 84 specimens of *Cryptonevra* flies were identified in material, of which 28 (15 ♂♂, 13 ♀♀) bore characters of *C. flavitarsis*, 16 (9 ♂♂, 7 ♀♀) exhibited characters of *C. consimilis*, 20 (10 ♂♂, 10 ♀♀) demonstrated characters of *C.*

nigritarsis, and 20 (10 ♂♂, 10 ♀♀) exhibited characters of *C. diadema*. The remaining 25 (19 ♂♂, 6 ♀♀) specimens bore some characters of *C. flavitarsis* and some of *C. consimilis*.

Imagines of *C. flavitarsis* had the following characters: tarsi yellow or brown; fore tibiae black; mesonotum black, shining, dark- or bright-haired; frons black (in very few specimens – narrow dark brown at the front); genae black, third antennal segment black.

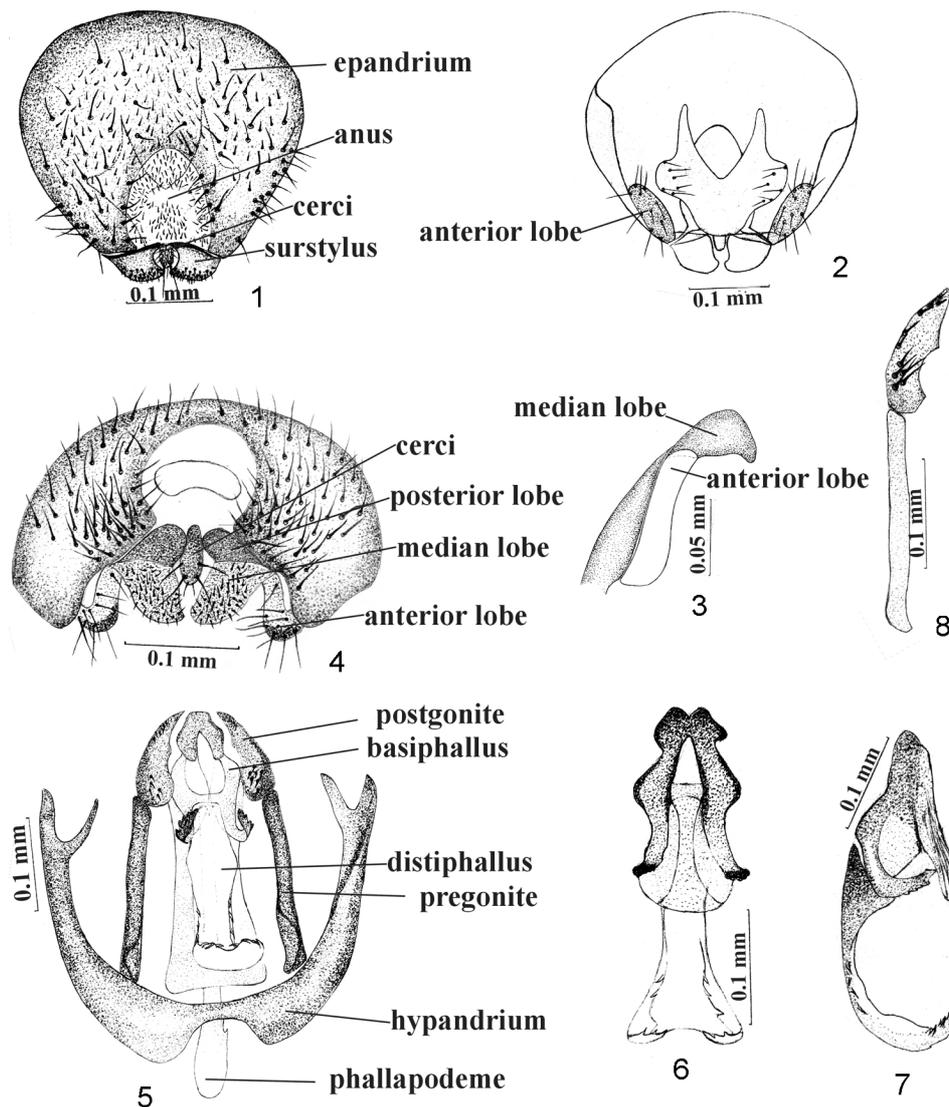
Imagines of *C. consimilis* had the following characters: tarsi yellow; fore tibiae yellow, or brown in the middle part; mesonotum dark grey, matt, bright-haired; frons black; genae black; third antennal segment black.

Specimens with characters of *C. flavitarsis* and *C. consimilis* had yellow or brown tarsi; black fore tibiae; dark grey, matt, dark-haired mesonotum; or yellow fore tibiae; dark and shining, bright-haired mesonotum; black frons; and black third antennal segment.

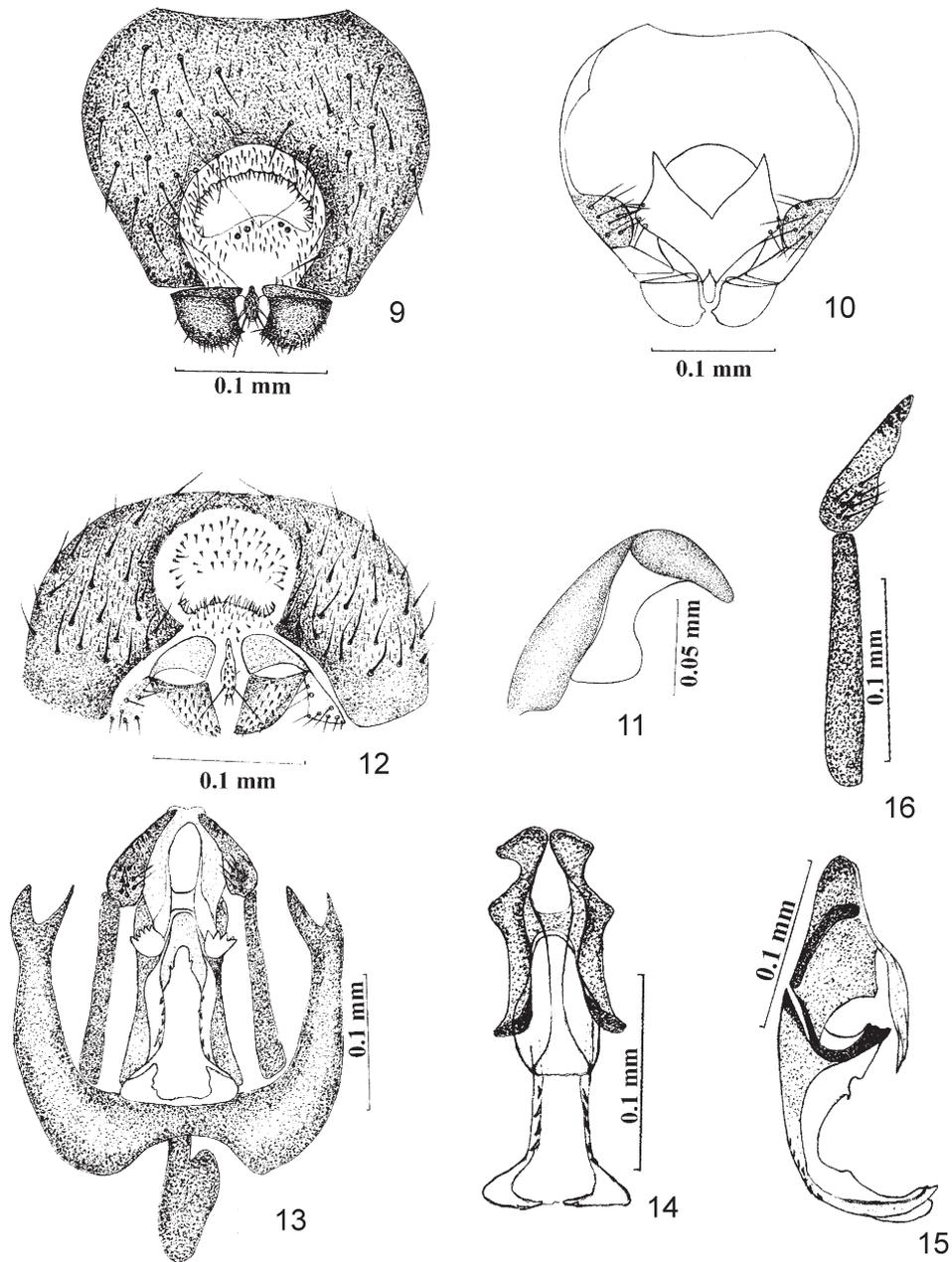
Specimens of *C. consimilis* collected in Poland were compared to historical specimens from the Natural History Museum in London. The diagnostic characters were entirely identical. The museum specimens labelled *C. flavitarsis* included some with a dark-grey, mat mesonotum and dark hair, and some with a black shiny mesonotum and light-coloured hair, similar to the Polish specimens. The tibiae of the first pair of legs were black or brown in the museum specimens of *C. flavitarsis*, i.e. much darker than in *C. consimilis*. The colour of the tibiae of the first pair of legs was doubtless the basic criterion for distinguishing both species.

The male genitalia of *C. consimilis* and *C. flavitarsis* are identical. The epandrium is horseshoe-shaped (Figs 1, 2), its convex surface, densely covered with long setae (Fig. 1), lateral lobes of epandrium narrow, far narrower than anal area. Anterior lobes of surstyli situated at the anteroventral margin of epandrium, long and narrow (Figs 3, 4), overlapping anterior part of epandrium (Fig. 2). Median lobes scapula-shaped, with apices pointing inward (Fig. 4), clearly separated from posterior lobes. Both lobes densely covered with hair and setae. Posterior lobes with arcuate upper margin and flat base without hairs or setae (Fig. 4). Cerci joined together in the form of single lobe with long setae (Figs 1, 4). Hypandrium open U-shaped with forked loose arms (Fig. 5). The phallic complex is the phallus and the gonites. The basal end of phallus (basiphallus), articulates with the posterior end of phallapodeme. Distiphallus bell-shaped, membranous, with spikes (Figs 5, 6); C-shaped laterally (Fig. 7). On both sides of phallus a pair of sclerotized gonites divided into two parts (Figs 5, 8). Pregonites rod-shaped, far longer than postgonites. Postgonites wide, triangular-shaped, with protrusions on paracentral part, of which the lower is more or less visible, as well as with setae and sensory foveae. Length ratio of pregonite to postgonite length – 1.7:1.

Material examined: England, Natural History Museum – Wicken Fen, Cambs.: 3 ♂♂, 2 ♀♀, *C. consimilis* VI. 1929, bred *L. similis* galls, G. M. Spooner in the BMNH. One male is labelled “cotype”, 1 ♂ labelled paralectotype, and 1 ♂, 2 ♀♀ labelled syntype; Poland – Borki: 8 ♂♂, 1 ♀, 3.V.2002, bred *L. pullitarsis* galls; 2 ♂♂, 6.V.2002, bred *L. lucens* galls; 2 ♀♀, 9.V.2002, bred *L.*



Figs 1–8. *C. flavitarsis*. Epandrium: 1 = posterior view, 2 = anterior view, 3 = anterior lobe, antero-ventral view, 4 = ventral view; Hypandrium and phallic complex: 5 = frontal view, 6 = phallus, frontal view, 7 = phallus, lateral view, 8 = gonite



Figs 9–16. *C. nigritarsis*. Epandrium: 9 = posterior view, 10 = anterior view, 11 = anterior lobe, antero-ventral view, 12 = ventral view; Hypandrium and phallic complex: 13 = frontal view, 14 = phallus, frontal view, 15 = phallus, lateral view, 16 = gonite

lucens galls; 1 ♀, 5.V.2002, in tip of *Phragmites*; Prawiedniki: 1 ♂, 2 ♀♀, 5.V.2002, bred *L. pullitarsis* galls; 1 ♂, 6.VI.2002, bred *L. pullitarsis* gall; 5 ♂♂, 3 ♀♀, 5.V.2002, bred *L. lucens* galls; 1 ♂, 5.VI.2002, in tip of *Phragmites*; 1 ♂, 12.V.2002, sweeping net; Niewęgłosz: 7 ♂♂, 3 ♀♀, 3.V.2002, bred *L. similis* galls, 4 ♂♂, 11.V.2002, bred *L. similis* galls; 8 ♂♂ 3.V.2002, bred *L. lucens* galls; 2 ♀♀, 1.V.2002, bred *L. lucens* gall; 2 ♂♂, 1 ♀, 1.V.2002, in tip of *Phragmites*; 3 ♀♀, 11.V.2002, sweeping net; Ćmiłów: 1 ♂, 16.IV.2002, bred *L. pullitarsis* gall; Snopków: 1 ♂, 17.VI.84; 1 ♂, 28.VI.84; 6 ♂♂, 1.VII.1984; 2 ♂♂, 15.VII.1984, all sweeping net.

Imagines of *C. nigritarsis* had the last segment or last two segments of tarsi black, mesonotum dark grey, bright-haired, whole frons black or brown-red at the front, genae black, third antennal segment black, seldom brown.

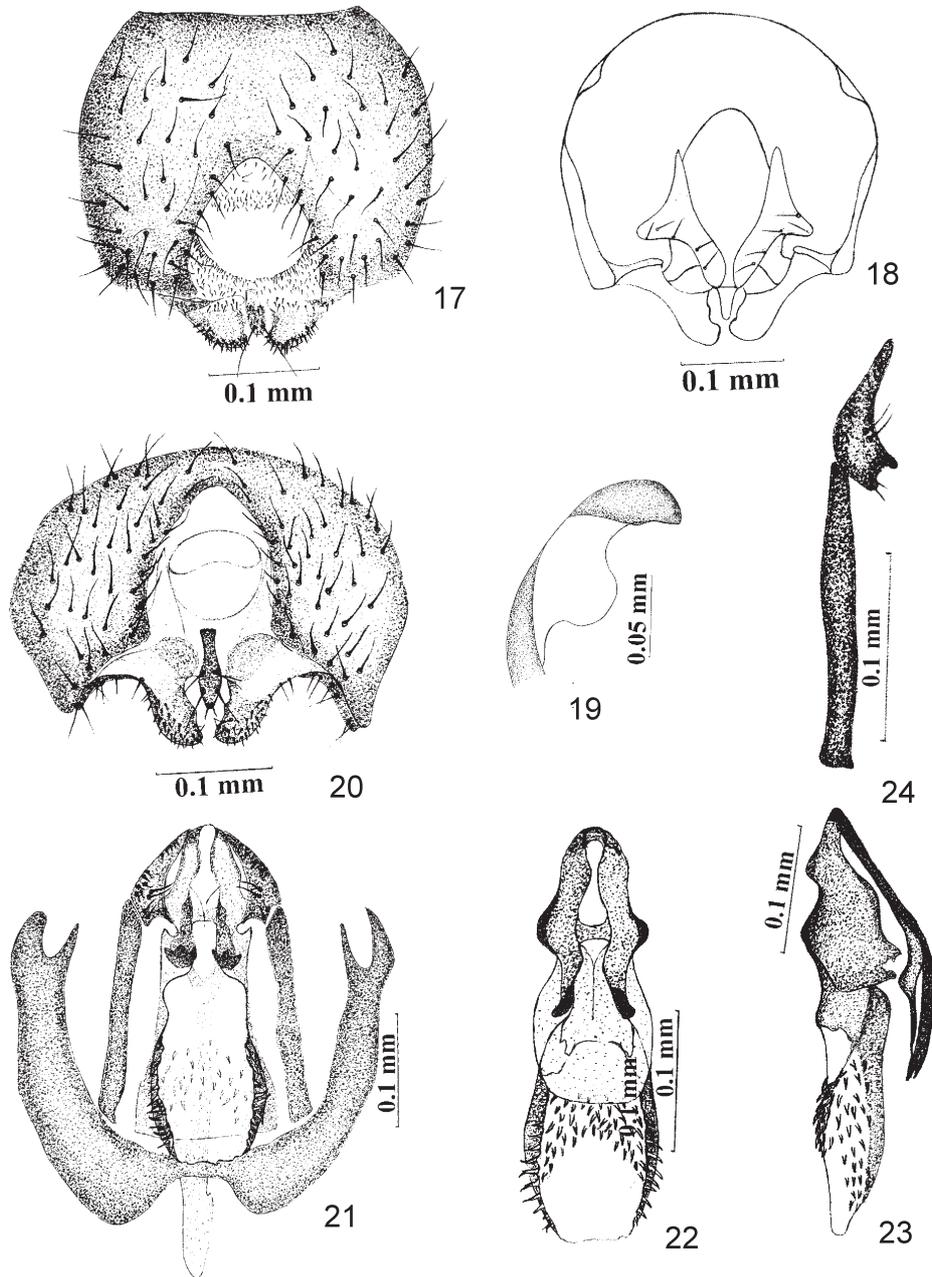
The epandrium was horseshoe-shaped (Figs 9, 10), lateral epandrium lobes narrow, far narrower than anal area. Anterior lobes of surstyli located at antero-ventral margin of epandrium, short and wide with indentation in the medial part (Figs 11, 12), overlapping anterior part of epandrium (Fig. 10). Median lobes scapula-shaped, with apices pointed towards each other, clearly separate from posterior lobes (Fig. 12). Posterior lobes, with arcuately bent upper margin, not covered with setae (Fig. 12). Cerci joined together, single lobe-shaped, with long setae (Figs 9, 12). Hypandrium open (Fig. 13). Distiphallus bell-shaped, membranous with spikes (Figs 13, 14); C-shaped laterally (Fig. 15). Sclerotized gonites divided into two parts (Fig. 16). Length ratio of pregonite to postgonite – 1.7:1.

Material examined: Poland – Borki: 1 ♂, 2.V.2002, bred *L. lucens* gall; 1 ♀, 2.V.2002, bred *L. pullitarsis* gall; 1 ♀, 2.V.2002, in tip of *Phragmites*; Ćmiłów: 1 ♂, 1 ♀, 27.V.2000, sweeping net; Niewęgłosz: 2 ♂♂, 18.V.2002, sweeping net; Prawiedniki: 1 ♀, 15.IV.2002, ex gall on *Phragmites*; Snopków: 5 ♂♂, 28.VI.1984, sweeping net; 1 ♂, 1 ♀, 7.VII.1984, ex gall on *Phragmites*; 5 ♀♀, 22.VII.1984, sweeping net.

Imagines *C. diadema*: tarsi all yellow, mesonotum dark grey, bright-haired; the whole frons or only at the front red or brown red, genae brown red; third antennal segment yellow, sometimes black in the upper part.

Epandrium horseshoe-shaped (Figs 17, 18), lateral epandrial lobes as wide, as anal area. Anterior lobes of surstyli situated along ventral margin of epandrium, short and wide with lobe-like process in the middle (Figs 19, 20), not overlapping anterior part of epandrium (Fig. 18). Median lobes scapula-shaped, continuous with posterior lobes without distinct boundary (Fig. 20). Hypandrium open (Fig. 21). Distiphallus barrel-shaped with numerous spinae (Figs 21, 22), laterally straight (Fig. 23). Postgonites clearly thinner in top part, widened at base with characteristic indentation (Fig. 24). Length ratio of pregonite to postgonite – 2:1.

Material examined: Poland – Borki: 1 ♀, 2.V.2002, bred *L. pullitarsis* gall; 1 ♀, 3.V.2002, in tip of *Phragmites*; Niewęgłosz: 1 ♂, 21.IV.2002, bred *L. similis* gall; 2 ♀♀, 24.IV.2002, bred *L. lucens* galls; 1 ♂, 29.IV.2002, bred *L. rufitarsis* gall; Prawiedniki: 1 ♀, 24.IV.2002, bred *L. rufitarsis*



Figs 17–24. *C. diadema*. Epandrium: 17 = posterior view, 18 = anterior view, 19 = anterior lobe, antero-ventral view, 20 = ventral view; Hypandrium and phallic complex: 21 = frontal view, 22 = phallus, frontal view, 23 = phallus, lateral view, 24 = gonite

gall; 1 ♂, 24.IV.2002, in tip of *Phragmites*; 1 ♂, 2.V.2002, bred *L. rufitarsis* gall; 2 ♀♀, 4.V.2002, in tip of *Phragmites*; 2 ♂♂, 2 ♀♀, 5.V.2002, bred *L. pullitarsis* galls; Snopków: 4 ♂♂, 28.VI.1984, sweeping net; 1 ♀, 6.VII.1982, in tip of *Phragmites*.

DISCUSSION

The analysis of characters currently used for the separation of species in *Cryptonevra* flies indicates their ambiguity. MEIGEN (1830) described *C. flavitarsis* as black, shining, with black femora and tibiae and yellow tarsi. According to COLLIN (1932), *C. consimilis* is similar to the former species but its fore tibiae are yellow, sometimes brown near its middle part. The colouring of tibiae of all legs is also lighter. DUDA (1933), however, found that fore tibiae are all yellow also in *C. flavitarsis*, while the remaining tibiae may be red yellow at the bottom. Analysis of *C. flavitarsis* and *C. consimilis* specimens from the Natural History Museum in London revealed that the two species had been classified as separate largely on the basis of the colour of the tibiae of the first pair of legs. Those specimens labelled *C. flavitarsis* had black or brown tibiae of the first pair of legs, while those labelled *C. consimilis* had tibiae that were light-coloured or showed a slightly darkened middle part. The Natural History Museum collection did not include specimens with tibiae showing a gradation of the dark colouring, such as those pointed out by DUDA (1933) and numerous among the Polish specimens. Comparisons of *C. flavitarsis* individuals studied by the present author with type individuals were not successful. The type specimen for *C. flavitarsis* described by ISMAY (1994), deposited at Naturhistorisches Museum, Vienna, labelled „*flavitarsis* Coll. Winth type”, cannot be found (PETER SEHNAL, e-mail communication). Other characters that have so far been recognized as distinctive are the hair, which is dark in *C. flavitarsis* and brighter and shorter in *C. consimilis*, and the colour of the mesonotum. An examination of these characters in a number of specimens will establish, however, that there are no distinct boundaries between these characters, with many specimens possessing characters of both species. It may be supposed that differences in the approach of various authors to the issue of separation of the species in this genus were due to the rather imprecise terms used (e.g. brighter, shorter) and an inappropriate choice of diagnostic characters (NARTSHUK *et al.* 1970, BESCHOVSKI 1981).

A detailed analysis of the male genitalia in specimens initially classified as *C. consimilis* and *C. flavitarsis* did not show any differences between them. Our results indicate unambiguously that *C. consimilis* cannot be recognized as a separate species but only as a junior synonym of *C. flavitarsis*. However, the other two species, i.e. *C. nigratarsis* and *C. diadema*, have structurally unique surstyli, which are

clearly different between the two species as well as different from what is seen in *C. flavitarsis*. Short and wide, medially narrowed anterior lobes of surstyli and black end-segments of tarsi co-occur in *C. nigratarsis*, which fully confirms the separate identity of this species.

A KEY TO THE SPECIES OF *CRYPTONEVRA*
LIVING IN *LIPARA* GALLS ON THE COMMON REED

- 1 (2) Anterior parts of anterior lobes overlap on the anterior part of epandrium (Figs 2, 10)
- Anterior lobes long and narrow (Fig. 3), tarsi yellow, front of frons black, sometimes narrowly dark brown, mesonotum black or dark grey, shining or matt, bright- or dark-haired *C. flavitarsis* (MEIGEN)
 - Anterior lobes short and wide, medially narrowed (Fig. 11), the last or last two tarsi segments black; front of frons black or brown red, mesonotum black, matt, bright-haired *C. nigratarsis* (DUDA)
- 2 (1) Anterior parts of anterior lobes do not overlap the anterior part of epandrium (Fig. 18)
- Anterior lobes short and wide with a lobe-like process in the middle (Fig. 19), tarsi yellow, front of frons red or brown red, mesonotum dark grey, shining, bright-haired *C. diadema* (MEIGEN)

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REFERENCES

- ANDERSSON, H. (1977) Taxonomic and phylogenetic studies on Chloropidae (Diptera) with special reference to Old World genera. *Entomologica Scandinavica* Suppl. **8**:1–200.
- BESCHOVSKI, V. L. (1981) On the taxonomy of the genus *Cryptonevra* Lioy, 1864 (Diptera, Chloropidae). *Reichenbachia* **19**(9): 51–54.

- BESCHOVSKI, V. L. (1984) A zoogeographic review of endemic palearctic genera of Chloropidae (Diptera) in view of their origin and formation. *Acta Zoologica Bulgarica* **21**: 3–26.
- COLLIN, J. E. (1932) The British species of the genus *Haplegis* (Diptera, Chloropidae) with description of a new species. *The Entomologist's Monthly Magazine* **68**: 112–113.
- CUMMING, J. M., SINCLAIR, B. J. & WOOD, D. M. (1995) Homology and phylogenetic implications of male genitalia in Diptera. – *Eremoneura*. *Entomologica Scandinavica* **26**: 121–151.
- DASZKIEWICZ-HUBICKA, J. & GROCHOWSKA, M. (1985) Chloropidae, Diptera trawiastych zbiorowisk Mezoregionu Pradoliny Wieprza. *Wiadomości Entomologiczne* **6** (1–2): 89–90.
- DUDA, O. (1933) 61. Chloropidae. Pp. 1–248. In LINDNER, E. (ed): *Die Fliegen der Palaearktischen Region*, vol. 6, (1). Schweizerbart, Stuttgart.
- ISMAY, J. W. (1994) A revision of the British *Neohaplegis* Beschovski and *Cryptonevra* Liroy (Dipt., Chloropidae). *The Entomologist's Monthly Magazine* **130**: 1–18.
- KANMIYA, K. (1983) A systematic study of the Japanese Chloropidae (Diptera). *Memoirs of the Entomological Society of Washington* **11**: 1–370.
- MCALPINE, J. F. (1981) Morphology and terminology, adults. Pp. 9 – 63. In MCALPINE, J. F. *et al.* (eds): *Manual of Nearctic Diptera*, vol. 1. Agriculture Canada, Ottawa.
- MEIGEN, J. W. (1830) *Systematische Beschreibung der bekannten europäischen zweiflügeligen Insekten*, vol. 6. Schulzische Buchhandlung, Hamm, 401 pp.
- NARTSHUK, E. P. (1977) Sravnitel'no-morfologicheskoe issledovanie bryushka i genital'nogo apparata u zlakovykh mukh (Diptera, Chloropidae). *Trudy Vsesoyuznogo Entomologicheskogo Obshchestva* **58**: 87–118.
- NARTSHUK, E. P. (1984) Family Chloropidae. Pp. 222–298. In SOÓS, Á & PAPP, L. (eds): *Catalogue of Palearctic Diptera*, vol. 10, Akadémiai Kiadó, Budapest.
- NARTSHUK, E. P. (1996) Sistema rastenie – fitofag na primere trostnika i ego konsumentov. *Zhurnal obshchey biologii* **57**(5): 628–641.
- NARTSHUK, E. P., SMIRNOV, E. S. & FEDOSEEVA, L. I. (1970) Sem. Chloropidae – zlakovye mukhi. Pp. 399–439. In BEY-BIENKO, G. YA. (ed.): *Opredelitel' nasekomykh evropejskoy chasti SSSR*, vol. 5 (2). Izdatel'stvo Nauka, Leningrad.
- SIEDLAR, E. (1991) Chloropidae. Pp. 228–230. In RAZOWSKI, J. (ed.): *Checklist of Animals of Poland* **2**, 32/25–29. Polska Akademia Nauk, Instytut Systematyki i Ewolucji Zwierząt, Warszawa.

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