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BLACKFLIES FROM THE INFLOWS OF LAKE BALATON AND THE FIRST RECORDS OF *SIMULIUM TRIFASCIATUM* CURTIS, 1839 IN HUNGARY (DIPTERA: SIMULIIDAE)

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BALATON KÖRNYÉKI KISVÍZFOLYÁSOK PÚPOSSZÚNYOG-FAUNÁJA ÉS A *SIMULIUM TRIFASCIATUM* CURTIS, 1839 (DIPTERA: SIMULIIDAE) ELSŐ ELŐFORDULÁSA MAGYARORSZÁGON

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ABSTRACT: Despite the large number of faunistical research conducted on the aquatic macroinvertebrates in the catchment area of Lake Balaton, no data are available on blackfly fauna. Our study presents the first published data on simuliid species of watercourses of the region. Samplings were carried out seasonally in 2006 from spring to autumn at 58 localities. Altogether twelve blackfly taxa were found, among them *Simulium ornatum* was the most frequent species. *Simulium trifasciatum* Curtis, 1839 proved to be new to the Hungarian fauna. The larvae of this species were often found together with *S. erythrocephalum*, *S. angustitarse*, *S. lundstromi*, *S. costatum*, the members of the *S. aureum* species-group and *S. ornatum*.

Key words: blackflies, faunistics, streams, Lake Balaton, *Simulium trifasciatum*

KIVONAT: A Balaton környéki kisvízfolyások vízi makroszkopikus gerinctelenjeire irányuló nagyszámú faunisztikai vizsgálat ellenére e patakoknak a púposszúnyog-faunájáról semmilyen információval nem rendelkezünk, így jelen munkánk az első adatközlés a területről. A faunisztikai gyűjtésekre 2006-ban három alkalommal (tavasz, nyár, ősz) került sor, összesen 58 mintavételi helyen. Összesen tizenkét cseszle taxont azonosítottunk, melyek közül a leggyakoribb faj a *Simulium ornatum* volt. A *Simulium trifasciatum* Curtis, 1839 a magyar faunára újnak bizonyult. E faj lárvái gyakran fordultak elő a *S. erythrocephalum*, a *S. angustitarse*, a *S. lundstromi*, a *S. costatum*, a *S. ornatum* és a *S. aureum* fajcsoport lárváival egy élőhelyen.

Kulcsszavak: cseszlék, faunisztika, patakok, Balaton, *Simulium trifasciatum*

Introduction

Lake Balaton is the largest shallow lake in Central Europe. Due to the intensive researches, its physico-chemical and biological characteristics are well-known, but such information on streams in its catchment area is still weak. Macroinvertebrate communities of the inflows were poorly known, due to mainly sporadic data were given in previous publications (see MÓRA et al. 2007). The turning-point of the faunistical investigations on stream dwelling macroinvertebrates was an intensive survey in 2006, considering most of watercourses flowing into Lake Balaton. This work (MÓRA et al. 2007) has given new information on the occurrence of many taxa (Malacostraca, Ephemeroptera, Odonata, Plecoptera, Heteroptera, Coleoptera, Trichoptera and Diptera: Chironomidae). Despite of the large number of faunistical studies on aquatic macroinvertebrates in the catchment area of Lake Balaton, no data were available on blackfly fauna, so our study gives information on the distribution of simuliid species in these inflows for the first time. Moreover, few papers are known to deal with blackflies of the Transdanubian region; data of these works are restricted to only a small number of localities (SZABÓ 1964, KÚDELA 2003).

Material and methods

In the frame of the above mentioned survey in 2006, 58 sites of 27 streams (18 north and 9 south of Lake Balaton) were studied (MÓRA et al. 2007). Blackfly larvae were collected at 36 sites (Table 1). Samples were taken seasonally (three times) from spring to autumn, due to the phenological characteristics of the investigated aquatic insects. Macroinvertebrates were collected in all available microhabitats using a pond-net, and in the case of sessile organisms (e.g. blackflies) collections from the surface of submerged branches, leaves and stones were made manually as well. Collected specimens were preserved in 70% ethanol. Blackfly larvae were identified to species level when it was possible, but taxa which are indistinguishable as larvae by morphological characters (sibling species or complexes) were determined as species-groups (e.g. *Simulium aureum* species-group or *Simulium ornatum* complex). Identification was made by using the keys proposed by JENSEN (1984, 1997), BASS (1998), SEITZ (1998), BELQAT and DAKKI (2004), LECHTHALER and CAR (2005). Nomenclature follows ADLER and CROSSKEY (2008).

Results

Altogether twelve blackfly taxa (eight species, two species-groups, and one subgenus) were found. Based on their occurrences in the percentage of all samples the most common species were *Simulium ornatum* and *Simulium lundstromi* while *Simulium lineatum* and *Wilhelmia* sp. were the less frequent (Fig. 1). The most significant result is the first records of *Simulium (Simulium) trifasciatum* Curtis, 1839, which proved to be new to the Hungarian fauna. Larvae were collected from nine localities in four UTM grids (Fig. 2). Voucher specimens are stored in the first author's collection.

Table 1. Collecting sites of Simuliidae at the catchment area of Lake Balaton.

Sampling sites	Latitude (N)	Longitude (E)	UTM	Altitude (m a.s.l.)
Aszófői-séd (Aszófő)	46°55'55"	17°50'02"	YN10	120
Büdös-gáti-víz (Balatonőszöd)	46°49'22"	17°48'38"	YM18	121
Büdös-gáti-víz (Szólád)	46°47'35"	17°49'42"	YM18	115
Burnót-patak (Ábrahámhegy)	46°49'27"	17°34'00"	XM98	126
Csopaki-séd (Csopak)	46°58'20"	17°55'39"	YN20	110
Denti-séd (Kapolcs)	46°57'18"	17°36'27"	XN90	182
Eger-víz (Szigliget)	46°48'26"	17°27'42"	XM88	103
Eger-víz (Gyulakeszi)	46°52'26"	17°28'21"	XM89	129
Eger-víz (Hegyesd)	46°54'54"	17°31'37"	XM99	147
Eger-víz (Monostorapáti)	46°55'41"	17°33'42"	XN90	158
Eger-víz (Vigántpetend)	46°57'46"	17°37'31"	YN00	186
Hidegkúti-séd (Balatonszőlős)	46°57'51"	17°50'18"	YN10	181
Koloska-patak, belterület (Balatonfüred)	46°57'26"	17°54'34"	YN10	107
Kőröshegyi-séd (Kereki)	46°47'18"	17°54'49"	YM28	150
Kőröshegyi-séd (Kőröshegy)	46°49'56"	17°53'52"	YM29	118
Lesence, Gubacsi malom (Lesencetomaj)	46°51'04"	17°22'58"	XM89	129
Lovasi-séd (Felsőörs)	47°00'42"	17°56'49"	YN21	205
Lovasi-séd (Lovas)	46°59'37"	17°57'32"	YN20	141
Lovasi-séd (Paloznak)	46°58'47"	17°57'00"	YN20	111
Marót-völgyi-csatorna, Kisvid (Nemesvid)	46°30'38"	17°17'39"	XM75	126
Örvényesi-séd (Örvényes)	46°55'02"	17°49'11"	YN10	108
Örvényesi-séd, Klárapuszta (Pécsely)	46°56'37"	17°47'46"	YN10	171
Pogány-völgyi-víz (Lengyeltóti)	46°39'23"	17°36'40"	XM96	115
Pogány-völgyi-víz (Pamuk)	46°33'29"	17°38'19"	YM05	134
Szőlősi-séd, Malom-völgy (Balatonfüred)	46°57'25"	17°50'29"	YN10	165
Szőlősi-séd, szeméttelep (Balatonfüred)	46°57'04"	17°51'21"	YN10	140
Szőlősi-séd, torkolat (Balatonfüred)	46°56'13"	17°51'49"	YN10	107
Tapolca (Szigliget)	46°48'27"	17°25'57"	XM88	108
Tapolca (Tapolca)	46°51'53"	17°26'14"	XM89	135
Tetves-patak (Somogybabod)	46°40'06"	17°47'08"	YM17	155
Tetves-patak (Vadépuszta)	46°36'11"	17°48'22"	YM16	165
Tetves-patak (Visz)	46°43'38"	17°46'46"	YM17	127
Vázsonyi-séd (Nagyvázsony)	46°59'16"	17°40'42"	YN00	228
Világos-patak, Váradi malom (Nemesvita)	46°50'02"	17°24'25"	XM89	104
Viszlói-patak (Ódörögd)	46°56'54"	17°24'56"	XN80	193
Viszlói-patak (Raposka)	46°51'11"	17°25'14"	XM89	117

New records

In the list following data are shown for each taxa: name of watercourses (administrative unit in parentheses), collecting date(s), number of specimens (larvae), names of collectors signed by their name initials (CsE = Eszter Csoma, DÁ = Ágnes Debreceni, HZ = Zoltán Horváth, KK = Krisztina Kézér, MA = Arnold Móra, TM = Mónika Tóth, TP = Péter Takács, UH = Helga Urbán).

In cases of some geographical terms the original Hungarian form were left for the localities being more identifiable: belterület = built-up area; csatorna = channel; malom = mill; patak, séd, víz = stream; szeméttelep = dump; torkolat = mouth of a stream; völgyi = valley.

Genus**: *Simulium*** Latreille, 1802

Subgenus: *Boophthora* Enderlein, 1925

Simulium (Boophthora) erythrocephalum (De Geer, 1776) – Büdös-gáti-víz (Balatonőszöd): 01.06.2006, 2, MA-TP – Eger-víz (Hegyesd): 09.08.2006, 1, DÁ-KK-MA-TM-TP – Eger-víz (Szigliget): 09.08.2006, 2, DÁ-KK-MA-TM-TP – Lovasi-séd (Paloznak): 08.04.2006, 6, KK-MA-UH; 12.05.2006, 10, CsE-MA-TP – Pogány-völgyi-víz (Lengyeltóti): 08.06.2006, 2, MA-TP – Pogány-völgyi-víz (Pamuk): 15.08.2006, 1, DÁ-HZ-MA-TP.

Subgenus: *Eusimulium* Roubaud, 1906

Simulium (Eusimulium) aureum species-group – Hidegkúti-séd (Balatonszőlős): 03.04.2006, 2, MA; 08.08.2006, 3, DÁ-MA-TM-TP – Lovasi-séd (Paloznak): 08.04.2006, 1, KK-MA-UH.

Subgenus: *Nevermannia* Enderlein, 1921

Simulium (Nevermannia) angustitarse (Lundström, 1911) – Aszófői-séd (Aszófő): 02.04.2006, 3, MA-TM-TP – Lesence, Gubacsi malom (Lesencetomaj): 10.08.2006, 3,HZ-MA-TM-TP – Lovasi-séd (Lovas): 12.05.2006, 5, CsE-MA-TP – Örvényesi-séd (Örvényes): 08.08.2006, 1, DÁ-MA-TM-TP – Szőlősi-séd, szeméttelep (Balatonfüred): 02.04.2006, 1, MA-TM-TP – Viszlói-patak (Raposka): 15.05.2006, 1, MA-TP.

Simulium (Nevermannia) lundstromi (Enderlein, 1921) – Büdös-gáti-víz (Szólád): 01.06.2006, 6, MA-TP – Eger-víz (Monostorapáti): 15.06.2006, 2, MA-TP – Eger-víz (Szigliget): 15.06.2006, 2, MA-TP; 09.08.2006, 2, DÁ-KK-MA-TM-TP – Kőröshegyi-séd (Kereki): 02.06.2006, 1, MA-TP – Kőröshegyi-séd (Kőröshegy): 14.08.2006, 3, DÁ-HZ-MA-TP – Lesence, Gubacsi malom (Lesencetomaj): 15.05.2006, 2, MA-TP; 10.08.2006, HZ-MA-TM-TP – Marót-völgyi-csatorna, Kisvid (Nemesvid): 08.06.2006, 2, MA-TP – Örvényesi-séd, Klárapuszta (Pécsely): 08.08.2006, 6, DÁ-MA-TM-TP – Szőlősi-séd, szeméttelep (Balatonfüred): 07.08.2006, 1, DÁ-KK-MA-TM-TP – Tapolca (Szigliget): 06.05.2006, 1, MA-TP – Világos-patak, Váradi malom (Nemesvita): 15.05.2006, 1, MA-TP – Viszlói-patak (Raposka): 15.05.2006, 9, MA-TP; 09.08.2006, 5, DÁ-KK-MA-TM-TP.

Simulium (Nevermannia) costatum (Friderichs, 1920) – Hidegkúti-séd (Balatonszőlős): 03.04.2006, 1, MA – Koloska-patak, belterület (Balatonfüred): 07.08.2006, 5, DÁ-KK-MA-TM-TP – Lovasi-séd (Felsőörs): 08.04.2006, 1, KK-MA-UH; 07.08.2006, 1, DÁ-KK-MA-TM-TP – Lovasi-séd (Lovas): 08.04.2006, 3, KK-MA-UH; 12.05.2006, 1, CsE-MA-TP; 07.08.2006, 8, DÁ-KK-MA-TM-TP – Örvényesi-séd (Örvényes): 08.08.2006, 7, DÁ-MA-TM-TP; 09.08.2006, 1, DÁ-KK-MA-TM-TP – Szőlősi-séd, Malom-völgy (Balatonfüred): 02.04.2006, 2, MA-TM-TP.

Subgenus: *Simulium* Latreille, 1802

Simulium (Simulium) noelleri Friderichs, 1920 – Büdös-gáti-víz (Balatonőszöd): 01.06.2006, 1, MA-TP – Pogány-völgyi-víz (Lengyeltóti): 08.06.2006, 2, MA-TP.

Simulium (Simulium) ornatum species-group – Eger-víz (Gyulakeszi): 09.08.2006, 5, DÁ-KK-MA-TM-TP – Koloska-patak, belterület (Balatonfüred): 07.08.2006, 1, DÁ-KK-MA-TM-TP – Marót-völgyi-csatorna, Kisvid (Nemesvid): 08.06.2006, 1, MA-TP – Tetves-patak (Vadépuszta): 05.05.2006, 1, MA-TP – Tetves-patak (Visz): 03.05.2006, 3, MA-TP – Tapolca (Tapolca): 16.05.2006, 1, MA-TP – Viszlói-patak (Ódörögd): 15.05.2006, 5, MA-TP.

Simulium (Simulium) cf. ***intermedium*** – Csopaki-séd (Csopak): 07.08.2006, 1, DÁ-KK-MA-TM-TP – Szőlősi-séd, Malom-völgy (Balatonfüred): 02.04.2006, 2, MA-TM-TP.

Simulium (Simulium) ornatum Meigen, 1818 – Burnót-patak (Ábrahámhegy): 16.05.2006, 10, MA-TP; 08.08.2006, 3, DÁ-KK-MA-TM-TP – Büdös-gáti-víz (Szólád): 01.06.2006, 1, MA-TP – Csopaki-séd (Csopak): 07.08.2006, 3, DÁ-KK-MA-TM-TP – Eger-víz (Gyulakeszi): 13.05.2006, 1, CsE-MA-TP – Eger-víz (Monostorapáti): 16.05.2006, 12, MA-TP; 09.08.2006, 3, DÁ-KK-MA-TM-TP – Eger-víz (Szigliget): 16.05.2006, 1, MA-TP – Eger-víz (Vigántpetend): 13.05.2006, 1, CsE-MA-TP – Hidegkúti-séd (Balatonszőlős): 12.05.2006, 2, CsE-MA-TP – Koloska-patak, belterület (Balatonfüred): 07.08.2006, 3, DÁ-KK-MA-TM-TP – Lesence, Gubacsi malom (Lesencetomaj): 15.05.2006, 2, MA-TP – Lovasi-séd (Felsőörs): 08.04.2006, 1, KK-MA-UH – Lovasi-séd (Paloznak): 08.04.2006, 5, KK-MA-UH – Örvényesi-séd (Örvényes): 09.08.2006, 3, DÁ-KK-MA-TM-TP – Szőlősi-séd, szeméttelep (Balatonfüred): 02.04.2006, 1, MA-TM-TP; 07.08.2006, 5, DÁ-KK-MA-TM-TP – Szőlősi-séd, Malom-völgy (Balatonfüred): 02.04.2006, 1, MA-TM-TP – Szőlősi-séd, torkolat (Balatonfüred): 03.04.2006, 2, MA-TM – Tapolca (Tapolca): 10.08.2006, 1, HZ-MA-TM-TP – Vázsonyi-séd (Nagyvázsony): 13.05.2006, 13., 5, CsE-MA-TP.

Simulium (Simulium) trifasciatum Curtis, 1839 – Denti-séd (Kapolcs): 13.05.2006, 1, CsE-MA-TP – Eger-víz (Monostorapáti): 16.05.2006, 4, MA-TP – Hidegkúti-séd (Balatonszőlős): 03.04.2006, 2, MA – Koloska-patak, belterület (Balatonfüred): 08.04.2006, 1, KK-MA-UH; 07.08.2006, 13, DÁ-KK-MA-TM-TP – Örvényesi-séd (Örvényes): 08.08.2006, 3, DÁ-MA-TM-TP – Szőlősi-séd, szeméttelep (Balatonfüred): 07.08.2006, 3, DÁ-KK-MA-TM-TP – Szőlősi-séd, torkolat (Balatonfüred): 03.04.2006, 1, MA-TM – Tapolca (Tapolca): 16.05.2006, 1, MA-TP – Tetves-patak (Somogybabod): 05.05.2006, 4, MA-TP.

Subgenus: *Wilhelmia* Enderlein, 1921

Simulium (Wilhelmia) lineatum (Meigen, 1804) – Világos-patak, Váradi malom (Nemesvita): 15.05.2006, 2, MA-TP.

Simulium (Wilhelmia) sp. – Tapolca (Tapolca): 10.08.2006, 3, HZ-MA-TM-TP.

Discussion

The survey carried out in 2006 provided more data and information on blackflies living in the inflows of Lake Balaton, which are a poorly known insect group in Hungary at the present. Altogether twelve simuliid taxa were found and out of them *Simulium trifasciatum* was new to the Hungarian fauna.

Simulium ornatum was the most common species (Fig. 1), which is not surprised, since it is one of the most widely distributed and common species in all Europe (REIDELBACH and CHRISTL 2002; SCHEDER 2004).

The new species for Hungarian fauna, *Simulium trifasciatum* is distributed all over Europe, except for the Mediterranean countries (CROSSKEY and HOWARD 2004; ADLER and CROSSKEY 2008), such its presence in the country was expected. According to OFENBÖCK et al. (2002) it is spread over a wide altitudinal range with preferences of elevations from 200 to 500 m. In our samples larvae were associated with *Simulium erythrocephalum*, *Simulium angustitarse*, *Simulium lundstromi*, *Simulium costatum*, the members of *Simulium aureum* species-group and *Simulium ornatum*. It was partly coincide with LECHTHALER and CAR (2005), who found *S. trifasciatum* to be coexistent with *Prosimulium latimucro*, *Prosimulium rufipes*, *Simulium carthusiense*, *Simulium costatum*, *Simulium cryophilum*, *Simulium monticola*, *Simulium ornatum* and *Simulium reptans*.

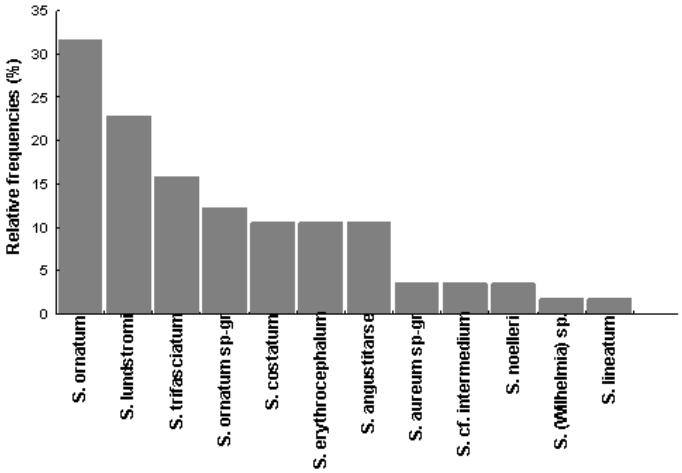

Fig. 1. The relative frequencies of the collected simuliid taxa based on their occurrences in the percentage of all samples.

S. trifasciatum belongs to the *Simulium ornatum* complex. Albeit the identification based on morphological characters of larvae of this species-group could sometimes be very doubtful, but the keys proposed by BASS (1998), SEITZ (1998) and LECHTHALER and CAR (2005) were usable in our case. An other member of the above mentioned species-complex is listed, namely the *Simulium* cf. *intermedium*. The currently available keys (e.g. SEITZ 1998, BELQAT and DAKKI 2004, CROSSKEY and BÁEZ 2004) on larvae are very heterogeneous, such in this study this species couldn't be identified with entire certainty. To verify the occurrence of this species, larvae, pupae and adults would also be collected. If future collection of pupae and adults will confirm with it *Simulium intermedium* will also be new to fauna of Hungary.

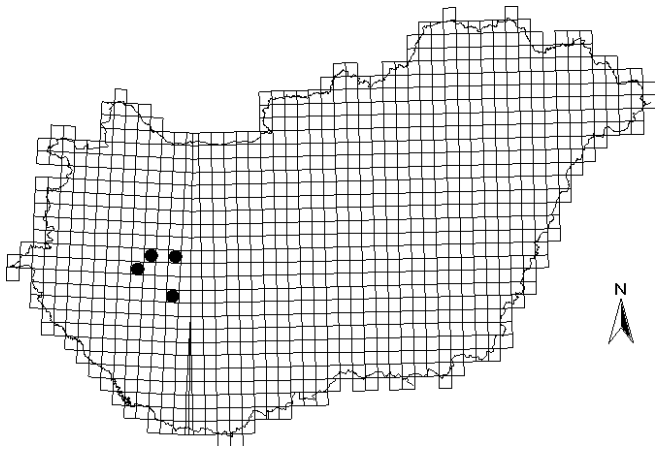

Fig. 2. Known distribution of *Simulium trifasciatum* Curtis, 1839 on 10x10 km UTM gridmap.

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References

ADLER, P. H. – CROSSKEY, R.W. (2008): World blackflies (Diptera: Simuliidae): A fully revised edition of the taxonomic and geographical inventory. – http://entweb.clemson.edu/biomia/pdfs/blackflyinventory.pdf [Accessed July 24 2008].

BASS, J. A. B. (1998): Last-instar larvae and pupae of the Simuliidae of Britain and Ireland. A key with brief ecological notes. – Freshwater Biological Association, Scientific Publication 55. Ambleside 102 pp.

BELQAT, B. – DAKKI, M. (2004): Clés analytiques des Simulies (Diptera) du Maroc. – Zoologica baetica 15: 77–137.

CROSSKEY, R. W. – BÁEZ, M. (2004): A synopsis of present knowledge of Simuliidae (Diptera) of the Canary Islands, including keys to larval and pupal stages. – Journal of Natural History 38: 2085–2117.

CROSSKEY, R. W. – HOWARD, T. M. (2004): A revised taxonomic and geographical inventory of world blackflies (Diptera: Simuliidae). – The Natural History Museum, London. 78 pp.

JENSEN, F. (1984): A revision of the taxonomy and distribution of the Danish black-flies (Diptera: Simuliidae), with keys to larval and pupal stages. – Natura Jutlandica 21: 69–116.

JENSEN, F. (1997): Diptera, Simuliidae, Blackflies. In: NILSSON, A.N. (ed.): Aquatic insects of North Europe. A taxonomic handbook, 2. (Odonata-Diptera). – Apollo Books, Stenstrup, pp. 209–241.

KÚDELA, M. (2003): First Hungarian records of three blackfly species representing the subgenus *Wilhelmia* (Diptera: Simuliidae, Simulium). – Folia entomologica hungarica 64: 363–365.

LECHTHALER, W. – CAR, M. (2005): Simuliidae – Key to larvae and pupae from Central and Western Europe. – CD-Rom Edition, Vienna.

MÓRA A. – BARNUCZ E. – BODA P. – CSABAI Z. – CSER B. – DEÁK CS. – PAPP L. (2007): A Balaton környéki kisvízfolyások makroszkopikus gerinctelen faunája (On the macroinvertebrate fauna of inflows of Lake Balaton). – Acta biologica debrecina, Supplementum oecologica hungarica 16: 105–167.

OFENBÖCK, T. – MOOG, O. – CAR, M. (2002): Do the Austrian blackfly fauna (Diptera: Simuliidae) support the typological approach of the EU framework directive? – Limnologica 32: 255–272.

REIDELBACH, J. – CHRISTL, H. (2002): A quantitative investigation into the temporal and spatial variations in the emergence of adult blackflies (Diptera: Simuliidae) from the Breitenbach, a small upland stream in Germany. – Limnologica 32: 206–235.

SCHEDER, C. (2004): The National Park Kalkalpen as a refuge area for rare species: *Simulium* (*Obuchovia*) *auricoma* and *Simulium* (*Simulium*) *degrangei* – recorded for the first time in upper Austria. – Acta Zoologica Universitatis Comenianae 45: 31–37.

SEITZ, G. (1998): Bestimmungsschlüssel für die Präimaginalstadien der Kriebelmücken Deutchlands (Stand: 01.11.1998). In: Bayerisches Landesamt für Wasserwirtschaft: Dienstbesprechung biologisch-ökologische

Gewässeruntersuchung 1998, Materialien Nr. 77 (November 1998). – München pp. 140–154.

SZABÓ, J. B. (1964): Mass impairment of health caused by an invasion of black flies (Diptera: Simuliidae) in Tata, Hungary. – Opuscula Zoologica, Budapest, 5: 113–117.