

FIRST DATA ON CADDISFLY (INSECTA, TRICHOPTERA) FAUNA OF PEATLANDS IN CROATIA

ANA PREVIŠIĆ^{1*}, ANDREJA BRIGIĆ^{1**}, ZORANA SEDLAR²
& RENATA ŠOŠTARIĆ²

¹Division of Zoology, Department of Biology, Faculty of Science, University of Zagreb,
Rooseveltov trg 6, 10000 Zagreb, Croatia
(*ana.previsic@biol.pmf.hr; **andreja.brigic@biol.pmf.hr)

²Division of Botany, Department of Biology, Faculty of Science, University of Zagreb,
Marulićev trg 20/II, 10000 Zagreb, Croatia

Previšić, A., Brigić, A., Sedlar, Z. & Šoštarić, R.: First data on caddisfly (Insecta, Trichoptera) fauna of peatlands in Croatia. *Nat. Croat.*, Vol. 22, No. 2., 235–242, 2013, Zagreb.

Peatlands in Croatia are rare, small in size and isolated habitats. Due to the abandonment of traditional land-management practices, and particularly to the progressive vegetation succession, they are critically endangered. Caddisfly faunistics and ecology of peatlands in Croatia have never been studied. A total of seven caddisfly taxa were collected in this study at three different peatlands; Dubravica bog, Đon močvar bog and Jarak fen. The collection of *Adicella reducta* (McLachlan, 1865) represents a new record for the Croatian caddisfly fauna. Additionally, two tyrphophilous species, *Hagenella clathrata* (Kolenati, 1848) and *Rhadicoleptus alpestris* (Kolenati, 1848), were recorded for the first time in Croatia since an imprecise literature record from 1935 and two previous findings (from 1929 and 1997), respectively. Caddisfly larvae were also collected in two peatlands, belonging to the genera *Beraea* Stephens, 1836 and *Ernodes* Wallengren, 1891, which are often collected at peatbogs in larval stages.

Keywords: Dubravica bog, Đon močvar bog, Jarak fen, tyrphophilous species, *Adicella reducta*, new record

Previšić, A., Brigić, A., Sedlar, Z. & Šoštarić, R.: Prvi podaci o fauni tulara (Insecta: Trichoptera) cretova u Hrvatskoj. *Nat. Croat.*, Vol. 22, No. 2., 235–242, 2013, Zagreb.

Cretovi su u Hrvatskoj rijetka i izolirana staništa male površine. Kritično su ugroženi zbog napuštanja tradicionalnih poljoprivrednih djelatnosti, a posebno vegetacijske sukcesije. U Hrvatskoj nisu provedena istraživanja faune i ekologije tulara na cretovima. Tijekom istraživanja prikupljeno je sedam različitih svojiti tulara na tri različita creta; Dubravica, Đon močvar i Jarak. Vrsta *Adicella reducta* (McLachlan, 1865) predstavlja prvi nalaz za faunu Hrvatske. Nadalje, zabilježene su i dvije tirfofilne vrste, *Hagenella clathrata* (Kolenati, 1848) i *Rhadicoleptus alpestris* (Kolenati, 1848). Vrsta *R. alpestris* zabilježena je do sada u Hrvatskoj samo s dva primjerka (1929. i 1997. godine), dok za vrstu *H. clathrata* postoji samo neprecizan literaturni navod iz 1935. godine. Na dva creta prikupljene su i ličinke tulara iz rodova *Beraea* Stephens, 1836 i *Ernodes* Wallengren, 1891 koje često obitavaju na cretovima.

Ključne riječi: Dubravica, Đon močvar, Jarak, tirfofilne vrste, *Adicella reducta*, prvi nalaz

INTRODUCTION

Peatlands are a type of wetlands widely distributed across north Europe, Asia and North America (WIEDER *et al.*, 2006). They are highly endangered habitats in Europe and are listed as a priority habitat type in Annex I of the European Habitats Directive (ANONYMOUS, 1992). In contrast to northern and central Europe, peatlands in Croatia are rare, small in size and isolated habitats (HRŠAK, 1996; ŠOŠTARIĆ *et al.*, 2012; TOPIĆ & STANIČIĆ, 2006). According to the pH soil values, two types of peatlands are present in Croatia:

acidophyllous bogs and basophyllous fens. Due to their small size, isolation, drainage and the abandonment of traditional human activities, and particularly to the progressive vegetation succession, such habitats are among critically endangered habitats in Croatia (HRŠAK, 1996; ŠOŠTARIĆ *et al.*, 2012; TOPIĆ & STANČIĆ, 2006; TOPIĆ & VUKELIĆ, 2009).

Species that inhabit peatlands are often highly specialised. They can be classified into four ecological categories according to their habitat preferences: (a) tyrphobiotic species (occur only in bogs, bog specialists), (b) tyrphophilous species (more abundant on bogs but not strictly confined to them), (c) tyrphoneutral species (without any preference to bogs, distributed across various types of habitats and usually found in habitats that are surrounding bogs) and (d) tyrphoxenous species (vagrants or immigrants that cannot live in bogs) (e.g. BEZDĚK *et al.*, 2006; PEUS, 1932; ROUBAL, 1934; SPITZER *et al.*, 1999).

The faunistics and ecology of caddisflies at peatlands have been mostly studied in Northern and Central Europe where such habitats are more abundant (e.g. VAN DUINEN, 2003; LANGHEINRICH *et al.*, 2004; VAN KLEEF *et al.*, 2012). In Croatia, aquatic insect groups in peatlands, including caddisflies, have not been studied before, and this paper presents the first data on caddisfly faunistics from peatlands in Croatia.

MATERIAL AND METHODS

Study area

The study was conducted in three peatlands that differ in size, type and location (Fig. 1).

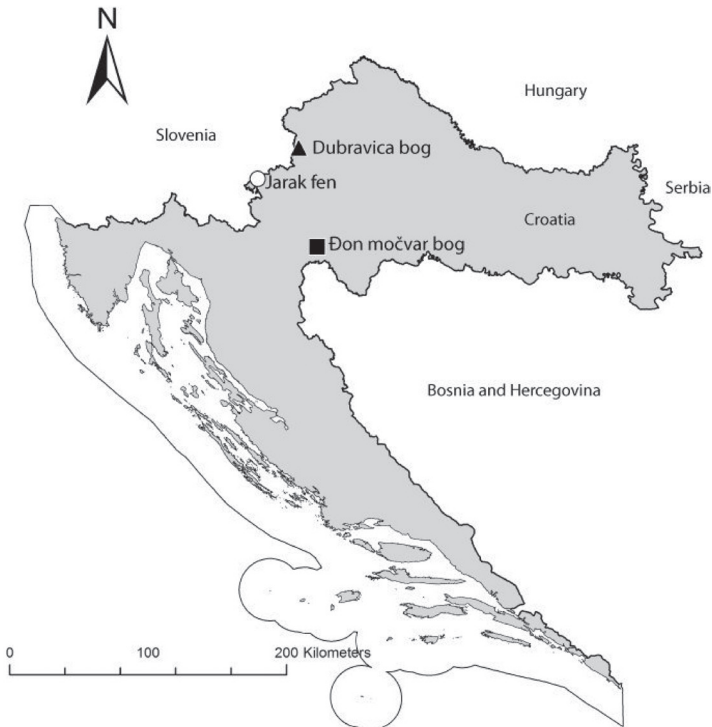


Fig. 1. Map of Croatia showing the location of the investigated peatlands.

Dubravica bog is located in the Hrvatsko zagorje region (N 45.9643; E 15.7543) at an altitude of 160 m asl. It is situated in sessile oak and hornbeam forest (ass. *Epimedio-Carpinetum betuli* (Ht.1938) Borh. 1963) and covers an area of 605 m². The bog vegetation belongs to the *Rhynchosporium albae* W. Koch 1926 association. This acidophilous bog has drastically decreased in area during the last 50 years, due to changes in the water level and the natural process of vegetation succession (HRŠAK, 1996). Since 1966 it has been protected as a Botanical Reserve and it is a potential NATURA 2000 site.

Don močvar bog is situated in Central Croatia (N 45.31787; E 15.90912), at 130 m a.s.l. It spreads over an area of 10 ha and it represents one of the largest and oldest peatbogs in Croatia (GIGOV & NIKOLIĆ, 1960). Moreover, it is a complex ecosystem, encompassing a mosaic of different habitats from open woodless *Sphagnum* L. sites with hummocks, deep hollows and small ponds, to swampy areas dominated by *Phragmites* Adans. species or shaded habitats of *Alnus* Geartn. and *Salix* L. species. Abandonment of traditional land-management practices, such as mowing and grazing, has led to a severe process of succession, thus its area decreased from 40 ha to 10 ha by the beginning of the 20th century (ALEGRO & ŠEGOTA, 2008). However, the bog and surrounding area are protected as a Botanical Reserve and it is a potential NATURA 2000 site (ALEGRO & ŠEGOTA, 2008).

The basophilous Jarak fen is located along the Jarak stream in the Žumberak – Samoborsko gorje Nature Park, located in the western mountain part of Croatia at an altitude of 690 m (N 45.7629; E 15.3670). It covers an area of 0.24 ha. The vegetation belongs to *Eriophoro latifolio-Caricetum panicae* Horvat ex Trinajstić 2002 association (ŠOŠTARIĆ *et al.*, 2012). The fen vegetation is well formed, however it is seriously threatened by the rather aggressive *Phragmites australis* (Cav.) Trin. ex Steud., which is overgrowing the fen (ŠOŠTARIĆ *et al.*, 2012).

Sampling of caddisflies

Caddisflies were collected by pitfall traps during soil arthropod surveys (e.g. ANTONOVIĆ *et al.*, 2012; BUJAN, 2010; BRIGIĆ *et al.*, 2009). The traps (polythene pots 8.5 cm wide and 12.0 cm deep) were partially filled with saturated salt solution and a drop of neutral-smelling detergent was added in order to reduce the surface tension of the liquid. A Styrofoam roof was placed a few centimetres above each trap to protect the traps from litter and rain. The trapping period covered the whole vegetation season of two years (2008-2009), from the end of April to the beginning of December. The traps were emptied once a month. Identification of adult caddisflies was based on MALICKY (2004), identification of larvae on WARINGER & GRAF (2011), and systematic review on MALICKY (2005).

RESULTS & DISCUSSION

A total of seven caddisfly taxa were collected in this study in three different peatlands in Croatia. Adults were collected at each of the three peatbogs, even though only in low numbers (Tab. 1). Collection of the female of *Adicella reducta* (McLachlan, 1865) represents a new record for the Croatian caddisfly fauna (ČUK & VUČKOVIĆ, 2009; 2010; GRAF & SCHMIDT-KLOIBER, 2011; KUČINIĆ *et al.*, 2011; 2012; MALICKY, 2009; MARINKOVIĆ-GOSPODNETIĆ, 1979; PREVIŠIĆ *et al.*, 2007; 2010; 2013; RADOVANOVIĆ 1935). Caddisfly larvae were collected in two peatlands; Jarak fen and Don močvar bog (Tab. 2). Larvae of three different taxa were collected at Jarak fen (Tab. 2).

Tab. 1. List of caddisfly species collected as adults in three peatlands in Croatia. Abbreviations explaining ecological preference of species regarding peatlands: tph – tyrphophilous species, tn – tyrphoneutral species, m – males, f – females.

Species	Ecological preferences	Dubravica bog						Don močvar bog			Jarak fen		
		May 2008		May 2009		June 2009			Oct 2008				
		m	f	m	f	m	f	m	f	m	f		
Phryganeidae <i>Hagenella clathrata</i> (Kolenati, 1848)	tph								1				
Limnephilidae <i>Chaetopteryx major</i> McLachlan, 1876	tn											1	1
<i>Rhadicoleptus alpestris</i> (Kolenati, 1848)	tph			1									
Leptoceridae <i>Adicella reducta</i> (McLachlan, 1865)	tn			1									

Tab. 2. List of caddisfly taxa collected solely in larval stage in two peatlands in Croatia. Abbreviations explaining ecological preference of species regarding peatlands: tn – tyrphoneutral species.

Taxa	Ecological preferences	Jarak fen										Don močvar bog							
		May 2008		Jun 2008		Jul 2008		Sept 2008		May 2009		Jun 2009		Jul 2009		Oct 2009		Dec 2009	
Limnephilidae <i>Potamophylax nigricornis</i> (Pictet, 1834)	tn		1																
Limnephilidae non det.																			
Beraeidae <i>Beraea</i> sp.				1				2		11		12		9		4			
<i>Ernodes vicinus</i> (McLachlan, 1879)	tn													1					

A single female of *Hagenella clathrata* (Kolenati, 1848) was collected at Đon močvar bog in 2009 (Tab. 1). It was found in the centre of the bog where the peat is infra-aquatic but overgrown by *Phragmites australis*. *H. clathrata* is considered a rare species and it is a phytal habitat specialist inhabiting pools and ponds (GRAF *et al.*, 2008; GRAF & SCHMIDT-KLOIBER, 2011). Moreover, in Central Europe it is considered a tyrphophilous species (H. MALICKY, personal communication), preferring acidic habitats (GRAF *et al.*, 2008; GRAF & SCHMIDT-KLOIBER, 2011). In Poland, its occurrence was associated with the presence of *Sphagnum* moss in different peatland habitats (BUCZYŃSKA *et al.*, 2012). Although rare and threatened in many countries, this species is distributed all over Central and Northern Europe (GRAF *et al.*, 2008; GRAF & SCHMIDT-KLOIBER, 2011; BUCZYŃSKA *et al.*, 2012). However, information on its distribution in Croatia is limited to an imprecise record of RADOVANOVIĆ (1935) stating that it was recorded in the surroundings of Zagreb. Since peatbogs in Croatia have hitherto not been the subject of studies of caddisfly faunistics, the lack of records of such species is not surprising.

Chaetopteryx major McLachlan, 1876 was collected in October 2008 at Jarak fen (Tab. 1). It is a typical inhabitant of crenal and rhithral zones (GRAF *et al.*, 2008; GRAF & SCHMIDT-KLOIBER, 2011), thus its collection at Jarak fen could be rather related to the proximity of a stream and collection sites than to its preference for peatlands. Distribution of this species covers whole Central Europe, including Croatia (GRAF *et al.*, 2008; GRAF & SCHMIDT-KLOIBER, 2011; PREVIŠIĆ & POPIJAČ, 2010) and its finding in October corresponds to the known life cycle of most Chaetopterygini Hagen, 1858 species (i.e. autumn and winter flight period, MALICKY, 1973).

Two females of *Rhadicoleptus alpestris* (Kolenati, 1848) were collected at Dubravica bog, i.e. at the bog edge and surrounding forest (Tab. 1). Most probably the females collected at Dubravica bog belong to the nominate subspecies *Rhadicoleptus alpestris alpestris* (Kolenati, 1848). Besides the nominate subspecies, distributed all over Central and Northern Europe, additional subspecies occurring in the Balkans is *Rhadicoleptus alpestris macedonicus* Botosaneanu & Riedel, 1965 (GRAF *et al.*, 2008; GRAF & SCHMIDT-KLOIBER, 2011). Female of the latter subspecies was not described yet. In Croatia, a single female of *R. alpestris* was collected in 1929 in the surroundings of Varaždin (MALICKY, 2009) and a single male assigned to the nominate subspecies in the Plitvice Lakes NP in 1997 (KUČINIĆ, 2002). Generally, its occurrence at the bog is in line with its ecology, since *R. alpestris alpestris* is considered a tyrphophilous species inhabiting peatbogs in Central Europe (H. MALICKY, personal communication). Moreover, it is a phytal habitat specialist inhabiting pools, ponds and temporary water bodies, and even brackish waters (GRAF *et al.*, 2008; GRAF & SCHMIDT-KLOIBER, 2011).

A single female of *Adicella reducta* (McLachlan, 1865) collected at Dubravica bog in 2008 (Tab. 1) represents a first record of this species in Croatia, although this species has a wide distribution all over Europe, including the ecoregion Dinaric Western Balkan (ER5; ILLIES, 1978) (GRAF *et al.*, 2008; GRAF & SCHMIDT-KLOIBER, 2011). It is however, generally a rare species (GRAF *et al.*, 2008; GRAF & SCHMIDT-KLOIBER, 2011). Although it typically inhabits the rhithral zone and has no preference regarding the pH value of the water, it is a habitat specialist of organic habitats (GRAF *et al.*, 2008; GRAF & SCHMIDT-KLOIBER, 2011). Its finding at Dubravica bog could be attributed to the vicinity of a slow-flowing stream rich in organic habitats.

Data on larval caddisfly collections are mostly not used in faunistic overviews (e.g. MARINKOVIĆ-GOSPODNETIĆ, 1979; PREVIŠIĆ *et al.*, 2007; 2010; 2013), due to inability and/or uncertainty of identification to the species level in some cases (WARINGER & GRAF,

2011). We considered the current data as an important contribution to the knowledge on caddisfly faunistics of peatlands in Croatia, thus data on larvae are also listed here (Tab. 2). The occurrence of species of the genera *Beraea* Stephens, 1836 and *Ernodes* Wallengren, 1891 is particularly worth mentioning, since some of them are often collected at peatlands in larval stages (e.g. *Beraea pullata* (Curtis, 1834), *Ernodes articularis* (Pictet, 1834), *Ernodes vicinus* (McLachlan, 1879); H. MALICKY, personal communication).

Even though this study provided only limited insight into the caddisfly faunistics, it represents the first information on this group of insects of peatlands in Croatia. Since peatlands are rare and declining habitats in Croatia, a further systematic survey of caddisflies but also other aquatic insect groups is necessary.

ACKNOWLEDGEMENTS

The authors would like to thank Antun Alegro, Vedran Šegota, Denis Križanić and Stjepan Križanić for their help in the field sampling. The study was partially supported by the State Institute for Nature Protection, Republic of Croatia (grant no. 888/08-3) and Žumberak-Samoborsko gorje Nature Park (PI: R. Šoštarčić).

Received February 9, 2013

REFERENCES

- ALEGRO, A. & ŠEGOTA, V., 2008: Florističke i vegetacijske značajke botaničkog rezervata „Don močvar“ u Blatuši. Izvještaj. DZZP. p. 35.
- ANONYMOUS, 1992: Official Journal of the European Communities. <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:1992:206:0007:0050:EN:PDF>.
- ANTONOVIC, I., BRIGIC, A., SEDLAR, Z., BEDEK, J. & ŠOŠTARIĆ, R., 2012: Terrestrial isopod community as indicator of succession in a peat bog. *Zookeys* **176**, 171-188.
- BEZDĚK, A., JAROŠ, J. & SPITZER, K., 2006: Spatial distribution of ground beetles (Coleoptera: Carabidae) and moths (Lepidoptera) in the Mrtvý luh bog, Šumava Mts (Central Europe): a test of habitat island community. *Biodiversity and Conservation* **15**, 395-409.
- BRIGIĆ, A., ALEGRO, A., SEDLAR, Z., ŠEGOTA, V., ŠOŠTARIĆ, R. & VUJČIĆ-KARLO, S., 2009: Carabid beetles (Coleoptera, Carabidae) in Croatian peat bogs. In: HENGVELD, R., NOORDIJK, J., OPSTEEG, T., TURIN, R. & VERMUELEN, H. J. W. (eds): XIV European Carabidologists Meeting „Carabid Beetles as Bioindicators, The use of ground beetles in ecological and environmental studies; the usefulness and threats of methods used for monitoring species and populations“. Book of abstracts. Westerbork. p. 30-30.
- BUCZYŃSKA, E., CICHOCKI, W. & DOMINIAK, P., 2012: New data on the distribution and habitat preferences of *Hagenella clathrata* (Kolenati, 1848) (Trichoptera: Phryganeidae) in Poland – the species from the Polish Red Book of Animals. *Annales Universitatis Mariae Curie – Skłodowska* **67**, 27-34.
- BUJAN, J., 2010: Fauna mrava (Hymenoptera: Formicidae) cretova u Hrvatskoj. Diplomski rad Sveučilišta u Zagrebu. Zagreb. p. 1-82.
- ČUK, R. & VUČKOVIĆ, I., 2009: First record of caddisfly *Rhyacophila laevis* Pictet, 1834 (Insecta: Trichoptera) in Croatia. *Natura Croatica* **18**(2), 449-453.
- ČUK, R. & VUČKOVIĆ, I., 2010: *Ironoquia dubia* Stephens, 1837 (Insecta: Trichoptera), a caddisfly species new for Croatia. *Natura Croatica* **19**(1), 231-237.
- GRAF, W., MURPHY, J., DAHL, J., ZAMORA-MUÑOZ, C. & LÓPEZ RODRÍGUEZ, M. J., 2008: Distribution & ecological preferences of European freshwater organisms. Vol. 1: Trichoptera. Pensoft. Sofia-Moscow. p. 388.
- GIGOV, A. & NIKOLIĆ, V., 1960: Rezultati analize polena na nekim tresavama u Hrvatskoj. *Glasnik Prirodnačkog muzeja* **15**, 5-26.
- GRAF, W. & SCHMIDT-KLOIBER, A., 2011: Additions to and update of the Trichoptera Indicator Database. www.freshwaterecology.info, version 5.0 (accessed on 20 November 2012).
- HRŠAK, V., 1996: Vegetation succession at acidic fen near Dubravica in the Hrvatsko zagorje region. *Natura Croatica* **5**(1), 1-10.
- ILLIES, J., 1978: Limnofauna Europaea. A Checklist of the Animals Inhabiting European Inland Waters, with an Account of their Distribution and Ecology. Gustav Fischer Verlag. Stuttgart. p. 552.

- KUČINIĆ, M., VUČKOVIĆ, I., KUTNJAK, H., ŠERIĆ JELASKA, L. & MARGUŠ, D., 2011: Diversity, distribution, ecology and biogeography of caddisflies (Insecta: Trichoptera) in the Krka River (National Park „Krka”, Croatia). *Zoosymposia* **5**, 255-268.
- KUČINIĆ, M., 2002: Biodiversity and distribution of caddisflies (Trichoptera, Insecta) of Plitvice Lakes. PhD Thesis. University of Zagreb, p. 1-139.
- KUČINIĆ, M., MALICKY, H., PREVIŠIĆ, A., VUČKOVIĆ, I., CERJANEC, D., KUTNJAK, H., ŽIVIĆ, I. & GRAF, W., 2012: First Check List of Caddisflies (Insecta: Trichoptera) of Croatia. 14th International Symposium on Trichoptera. Vladivostok, Russia. p. 30-31.
- LANGHEINRICH, U., TISCHEW, S., GERSBERG, R. M. & LÜDERITZ, V., 2004: Ditches and canals in management of fens: opportunity or risk? A case study in the Drömling Natural Park, Germany. *Wetlands Ecology and Management* **12**, 429-445.
- MALICKY, H., 1973: Trichoptera (Handbuch der Zoologie). Walter de Gruyter. Berlin. p. 114.
- MALICKY, H., 2004: Atlas of European Trichoptera. Springer. Dordrecht. p. 359.
- MALICKY, H., 2005: Ein kommentiertes Verzeichnis der Köcherfliegen (Trichoptera) Europas und des Mittelerrangebietes. *Linzer biologische Beiträge* **37**(1), 533-596.
- MALICKY, H., 2009: Die Köcherfliegen (Insecta, Trichoptera) der Sammlung von Franjo Koščec im Museum Varaždin, Kroatien. *Natura Croatica* **18**, 129-134.
- MARINKOVIĆ-GOSPODNETIĆ, M., 1979: Trichoptera (Insecta) velikih karstnih izvora u Dinaridima. In: RAUŠ, Đ. (ed.), Second Congress of Ecologists of Yugoslavia. Savez društava ekologa Jugoslavije. Zagreb. p. 1837-1849.
- PEUS, F., 1932: Die Tierwelt der Moore unter besonderer Berücksichtigung der europäischen Hochmoore. Handbuch Moorkunde 3. Berlin. p. 277.
- PREVIŠIĆ, A., MIHALJEVIĆ, Z. & KEROVEC, M., 2007: Caddisfly (Insecta: Trichoptera) fauna of altered and man-made habitats in the Drava River, NW Croatia. *Natura Croatica* **16**(3), 181-189.
- PREVIŠIĆ, A. & POPIJAČ, A., 2010: Caddisfly (Insecta: Trichoptera) fauna of Kupa and Čabranka rivers and their tributaries, Gorski kotar, W Croatia. *Natura Croatica* **19**, 357-368.
- PREVIŠIĆ, A., GRAF, W. & KUČINIĆ, M., 2010: Caddisfly (Trichoptera) fauna of the Plitvice Lakes National Park, Croatia. *Denisia* **29**, 287-294.
- PREVIŠIĆ, A., IVKOVIĆ, M., MILIŠA, M. & KEROVEC, M., 2013: Caddisfly (Insecta: Trichoptera) fauna of the Papuk Nature Park, Croatia. *Natura Croatica* **22**(1), 1-13.
- RADOVANOVIĆ, M., 1935: Trihoptere Jugoslavije. *Glasnik Zemaljskog Muzeja u Bosni i Hercegovini* **47**, 73-84.
- ROUBAL, J., 1934: Die Coleopterenwelt (Tyrphobionte, Tyrphophile, Tyrphoxene, etc.) der Treboner (Wittingauer) Moore. *Folia Zoologica et Hydrobiologica (Riga)* **7**(1), 56-97.
- SPITZER, K., BEZDĚK, A. & JAROŠ, J., 1999: Ecological succession of a relict Central European peat bog and variability of its insect biodiversity. *Journal of Insect Conservation* **3**, 97-106.
- ŠOŠTARIĆ, R., SEDLAR, Z. & MAREKOVIĆ, S., 2012: An endangered rich fen habitat along the Jarak stream (Nature Park Žumberak-Samoborsko gorje, Croatia). *Natura Croatica* **21**(2), 335-348.
- TOPIĆ, J. & STANČIĆ, Z., 2006: Extinction of fen and bog plants and their habitats in Croatia. *Biodiversity and Conservation* **15**, 3371-3381.
- TOPIĆ, J. & VUKELIĆ, J., 2009: Priručnik za određivanje kopnenih staništa u Hrvatskoj prema Direktivi o staništima EU. Državni zavod za zaštitu prirode. Zagreb. p. 376.
- VAN DUINEN, G.-J. A., BROCK, A. M. T., KUPER, J. T., LEUVEN R. S. E. W., PEETERS, T. M. J., ROELOFS, J. G. M., VAN DER VELDE, G., VERBERK, W. C. E. P. & ESSELINK, H., 2003: Do restoration measures rehabilitate fauna diversity in raised bogs? A comparative study on aquatic macroinvertebrates. *Wetlands Ecology and Management* **11**, 447-459.
- VAN KLEEF, H. H., VAN DUINEN, G.-J. A., VERBERKA, W. C. E. P., LEUVENB, R. S. E. W., VAN DER VELDEC, G. & ESSELINKA, H., 2012: Moorland pools as refugia for endangered species characteristic of raised bog gradients. *Journal for Nature Conservation* **20**, 255-263.
- WARINGER, J. & GRAF, W., 2011: Atlas der mitteleuropäischen Köcherfliegenlarven – Atlas of Central European Trichoptera Larvae. Erik Mauch Verlag. Dinkelscherben. p. 468.
- WIEDER, R. K., VITT, D. H. & BENSCHOTER, B. W., 2006: Peatlands and the Boreal Forest. In: WIEDER, R. K. & VITT, D. H. (eds.) Boreal Peatland Ecosystems. Ecological Studies 188, Springer Verlag. Berlin Heidelberg. p. 1-8.

SAŽETAK

Prvi podaci o fauni tulara (Insecta: Trichoptera) cretova u Hrvatskoj

A. Previšić, A. Brigić, Z. Sedlar & R. Šoštarčić

Cretovi su rašireni na području sjeverne i središnje Europe, dok su u Hrvatskoj rijetka i izolirana staništa male površine. U Hrvatskoj su kritično ugroženi zbog napuštanja tradicionalnih poljoprivrednih djelatnosti, a posebno vegetacijske sukcesije (HRŠAK, 1996; ŠOŠTARIĆ *et al.*, 2012; TOPIĆ & STANČIĆ, 2006). I biljne i životinjske vrste koje obitavaju na cretovima, često su vrlo specijalizirane. Fauna i ekologija tulara na cretovima dobro su istražene na područjima sjeverne i središnje Europe gdje su takva staništa i mnogo češća (e.g. VAN DUINEN, 2003; LANGHEINRICH *et al.*, 2004; VAN KLEEF *et al.*, 2012). U Hrvatskoj do sada nisu provedena istraživanja faune i ekologije tulara na cretovima.

Tijekom ovog istraživanja prikupljeno je sedam različitih svojiti tulara na tri različita creta; Dubravica, Don močvar i Jarak. Vrsta *Adicella reducta* (McLachlan, 1865) koja je prikupljena na acidofilnom cretu Dubravica, predstavlja prvi nalaz za faunu Hrvatske. Iako se radi o široko rasprostranjenoj vrsti u Europi, ona je također i rijetka vrsta (GRAF *et al.*, 2008; GRAF & SCHMIDT-KLOIBER, 2011). Nadalje, zabilježene su i dvije tirfofilne vrste, *Hagenella clathrata* (Kolenati, 1848) i *Rhadicoleptus alpestris* (Kolenati, 1848). Vrsta *H. clathrata* prikupljena je na acidofilnom cretu Don močvar, a do sada je za Hrvatsku postojao samo jedan neprecizan literaturni navod (RADOVANOVIĆ, 1935). Ova vrsta preferira acidofilna staništa, rijetka je i ugrožena diljem Europe (GRAF *et al.*, 2008; GRAF & SCHMIDT-KLOIBER, 2011; BUCZYŃSKA *et al.* 2012). Vrsta *R. alpestris* je u Hrvatskoj do sada zabilježena s jednim primjerkom ženke iz 1929. godine iz okolice Varaždina (MALICKY, 2009) te jednim mužjakom s područja Plitvičkih jezera iz 1997. godine (KUČINIĆ, 2002). Smatra se također tirfofilnom vrstom, iako naseljava različita staništa (GRAF *et al.*, 2008; GRAF & SCHMIDT-KLOIBER, 2011). Na dva creta, Don močvar i Jarak, prikupljene su i ličinke tulara iz rodova *Beraea* Stephens, 1836 i *Ernodes* Wallengren, 1891 koje često obitavaju na cretovima.