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AQUATIC INSECTS IN KOPAČKI RIT NATURE PARK (HETEROPTERA: NEPOMORPHA, GERROMORPHA AND COLEOPTERA: HYDRADEPHAGA, HYDROPHILOIDEA)

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Fauna and seasonal dynamics of aquatic insects have been investigated in the wider area of Kopački Rit Nature Park over a period of two years. The investigation, carried out at biological localities, included channels as permanent habitats of water insects. Among 42 species of water insects, 14 belong to the order Heteroptera and 28 to the order Coleoptera. Fluctuation in numbers of water insects during the season has been recorded and the greatest numbers of insects were recorded during August. The most abundant are *Plea minutissima* and *Ilyocoris cimicoides*. Situated in the midst of the floodplains, Kopački Rit provides specific ecological living conditions for water insects.

Key words: water insects, list of species, seasonal dynamics, Kopački Rit

Merdić, E., Keža, N. & Csabai, Z.: Vodeni kukci Parka prirode Kopački rit (Heteroptera: Nepomorpha, Gerromorpha i Coleoptera: Hydradephaga, Hydrophiloidea). Vol. 14, No. 4, 263–272, Zagreb, 2005.

Tijekom dvije godine istraživani su fauna i sezonska dinamika vodenih kukaca na širem području Parka prirode Kopački rit. Istraživanje je vršeno na biološkim lokalitetima, a obuhvatilo je i kanale kao stalna staništa vodenih kukaca. Od 42 vrste vodenih kukaca 14 ih pripada redu Heteroptera a 28 redu Coleoptera. Zabilježena je fluktuacija u brojnosti vodenih kukaca tijekom sezone, a najveći broj kukaca je zabilježen tijekom kolovoza. Najbrojnije vrste su *Plea minutissima* i *Ilyocoris cimicoides*. S obzirom na svoj položaj usred poplavne ravnice, Kopački rit omogućuje specifične ekološke uvjete potrebne za život vodenih kukaca.

Ključne riječi: vodeni kukci, popis vrsta, sezonska dinamika, Kopački rit

INTRODUCTION

The area of Kopački Rit is a result of shift of the confluence of the Drava River with the Danube as well as of the main flow of the Danube and its cutting through more solid material (MIHALJEVIĆ *et al.*, 1999). It is one of the largest fluvial plains in Europe, intersected by marshland and stretching over a territory of approximately 17 700 hectares. This floodplain, extending along the right bank of the Danube, is situated in the region of Baranja in the north-east of Croatia. It is the lowest part of this region, reaching an altitude of only 82 metres above sea-level. The basic ecological character of this region has been given by flooding dynamics and intensity. Parts of Kopački Rit, water and land alike, change their size, shape and function as the waters advance or recede.

Kopački Rit offers favourable living conditions for various representatives of invertebrates. Research into invertebrates in the territory of Kopački Rit started as early as 1943 within the framework of the Albertina Biological Station. In terms of entomology, Kopački Rit is, however, generally speaking, a poorly investigated area. Most research in the territory of Kopački Rit Nature Park is related to mosquitoes (MERDIĆ, 1993; MERDIĆ & LOVAKOVIĆ, 1999; MERDIĆ & SUDARIĆ, 2003). Information on butterflies (PULITIKA, 2000; DRAGANIĆ, 2000; KRČMAR, 2004), dragonflies (BOGDANOVIĆ *et al.*, 2002), horseflies (KRČMAR, 2002), ground beetles (GALOVIĆ, 2001), isopods (FARKAŠ & KRČMAR, 2004) and hymenopterans (PEROVIĆ, unpublished data) also exists. The objective of this research was to collect adult aquatic insects in the Nature Park Kopački Rit, compile the first list of species living there and obtain insight into their seasonal dynamics.

MATERIAL AND METHODS

Insects were collected during two seasons, from August to November 2003 and from April to October 2004, every two weeks. Six stations were included but localities 5 and 6 were visited only occasionally (Fig. 1). These are:

1. Podunavski channel
2. Tikveš – Podunavski channel
3. Mali Dunav– 2 kilometres in front of Zlatna greda
4. Mali Dunav– 1 km behind Zlatna greda
5. Linjov Channel
6. Water behind the embankment near Zlatna greda

Sampling of water insects was carried out by collection with a net. Two separate types of nets, a smaller and a larger one, were used. The smaller one is funnel-shaped, 25 cm in diameter, with an attachment resembling a wider test-tube, the whole device being attached to a short wooden handle. The larger net is 60 cm in diameter. It is attached to a firm and fairly light frame, appended to a 3 metre long handle. Every sample consisted of five sweeps for 1 meter along the surface of the water, among the submerged or emergent vegetation. Sampling was the same



Fig. 1. Map of research area; localities are marked with circles with numbers 1 Podunavski channel; 2 Tikveš – Podunavski channel; 3 Mali Dunav– 2 kilometres in front of Zlatna greda; 4 Mali Dunav– 1 km behind Zlatna greda; 5 Linjov Channel; 6 Water behind the embankment near Zlatna greda

in all localities, in order to provide comparable results. The larger net proved to be more effective because it was possible to collect more insects and thus obtain high quality material with only a few attempts. They were sacrificed and preserved in bottles with 75% alcohol. Keys for determination of water insects NILSSON (1996), CSABAI (2000) and CSABAI *et al.* (2002) were used, as well as some Internet sites.

RESULTS

In 2003 and 2004 as many as 873 specimens were collected and 42 species were determined. The species were classified into 2 orders, 13 families and 29 genera.

Among the species determined, 14 belong to the order Heteroptera and 28 to the order Coleoptera.

A systematic list of water insect species has been made according to CSABAI (2000) and CSABAI *et al.* (2002).

ORDER Heteroptera

NEPOMORPHA

Family Pleidae

Plea minutissima (Leach, 1817)

Family Naucoridae

Ilyocoris cimicoides (Linnaeus, 1758)

Family Nepidae

Ranatra linearis (Linnaeus, 1758)

Nepa cinerea (Linnaeus, 1758)

Family Corixidae

Sigara nigrolineata (Fieber, 1848)

Cymatia coleoptrata (Fabricius, 1777)

Family Notonectidae

Notonecta viridis (Delcourt, 1909)

Notonecta maculata (Fabricius, 1794)

Notonecta glauca (Linnaeus, 1758)

GERROMORPHA

Family Gerridae

Aquarius paludum (Fabricius, 1794)

Aquarius najas (De Geer, 1773)

Gerris lacustris (Linné, 1758)

Gerris odontogaster (Zetterstedt, 1828)

Family Mesoveliidae

Mesovelia furcata (Mulsant & Rey, 1852)

ORDER Coleoptera

Family Haliplidae

- Haliplus ruficollis* (De Geer, 1774)
Haliplus fluviatilis (Aubé, 1836)
Pelodytes caesus (Duftschmid, 1805)

Family Noteridae

- Noterus crassicornis* (O. F. Müller, 1776)

Family Agabidae

- Ilybius fenestratus* (Fabricius, 1781)

Family Dytiscidae

- Laccophilus poecilus* (Klug, 1834)
Laccophilus minutus (Linnaeus, 1758)
Hygrotus impressopunctatus (Schaller, 1783)
Hygrotus inaequalis (Fabricius, 1777)
Hygrotus versicolor (Schaller, 1783)
Hygrotus parallelogrammus (Ahrens, 1812)
Porhydrus lineatus (Fabricius, 1775)
Hydaticus transversalis (Pontoppidan, 1763)
Dytiscus dimidiatus (Bergstrasser, 1778)
Cybister lateralimarginalis (De Geer, 1774)

Family Spercheidae

- Spercheus emarginatus* (Schaller, 1783)

Family Hydrophilidae

- Berosus signaticollis* (Charpentier, 1825)
Coelostoma orbiculare (Fabricius, 1775)
Hydrochara caraboides (Linnaeus, 1758)
Hydrobius fuscipes (Linnaeus, 1758)
Limnoxenus niger (Zschach, 1788)
Helochaeres obscurus (Müller, 1776)
Enochrus ochropterus (Marsham, 1802)
Enochrus quadripunctatus (Herbst, 1797)
Enochrus melanocephalus (Olivier, 1792)
Enochrus bicolor (Fabricius, 1792)
Hydrophilus piceus (Linnaeus, 1758)
Hydrophilus aterrimus (Eschscholtz, 1822)

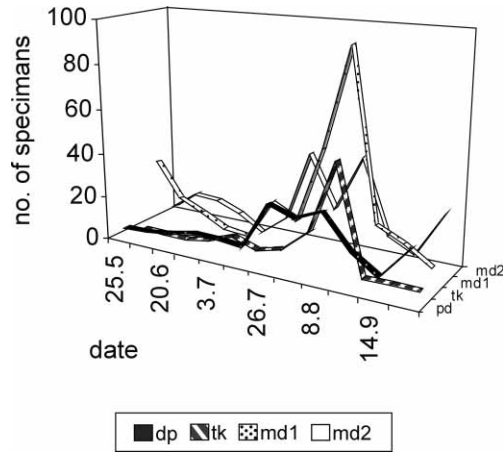


Fig. 2. Fluctuation in numbers of aquatic insects in Kopački Rit in 2004 at the research localities.

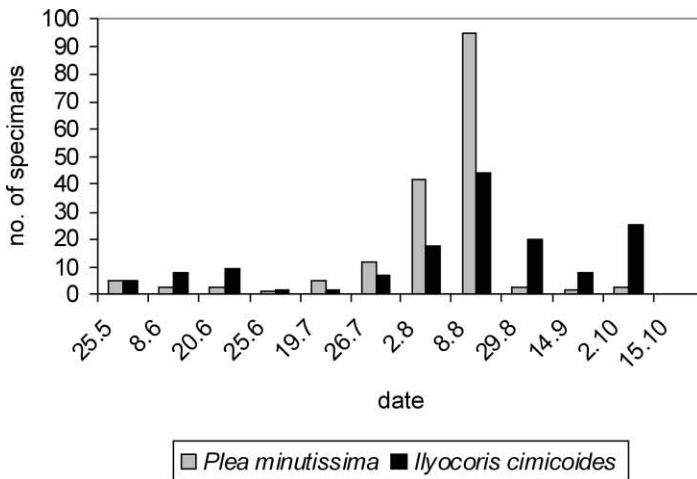


Fig. 3. Fluctuation in numbers of species *Plea minutissima* and *Ilyocoris cimicoides* in 2004.

The seasonal dynamics of water insects was determined in the following way: the total presence of specimens in the samples was recorded on each location visit. An analysis of seasonal dynamics was made for four stations (Fig. 2). The first station was Podunavski kanal, the second Tikveš – Podunavski kanal, the third 'Mali Dunav'– 2 km in front of Zlatna Greda and the fourth 'Mali Dunav' – 1 km behind Zlatna Greda (Fig. 1).

In terms of dynamics, the Podunavski kanal station differs from the rest. The number of insects is at its peak in the middle of October and fairly high in August.

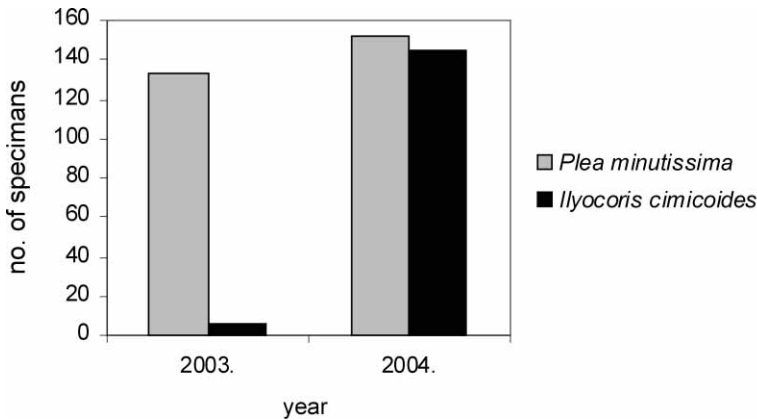


Fig. 4. Comparison between abundances of species *Plea minutissima* and *Ilyocoris cimicoides* in 2003 and 2004.

In other localities the highest number of insects was recorded in August. Considerable fluctuation was recorded at the stations located in the 'Mali Dunav' backwater. In the third station the number of insects increased at the end of May and the end of August. As for the fourth station the number was highest at the end of August and the end of September.

Among 873 collected specimens, the two most-represented species are *Plea minutissima* (accounting for 285, or 32,65%) and *Ilyocoris cimicoides* (accounting for 150 or 17,18%). Both species belong to the order Heteroptera. Abundance fluctuation of these species is shown in figure 3. Both species are in abundance in August.

In comparing the abundance of these species (Fig. 4) in two research years, a substantial difference in the number of specimens of *Ilyocoris cimicoides* was observed. As for the number of the species *Plea minutissima*, it is approximately the same in both 2003 and 2004.

DISCUSSION

There are 45 recorded species of aquatic insects belonging to the order Heteroptera in Croatia (www.agr.hr/hed/). However, not much information is available on species belonging to the order Coleoptera. Actually, even other families of the order Coleoptera have been insufficiently researched. Also, a certain amount of data in this respect has yet to be published. At the Web site of European fauna (www.faunaeur.org), for Croatia, 222 aquatic Coleoptera are noted, and all 28 species found in the present investigation are on that list. The Web site gives a list of 36 Heteroptera for Croatia, and of the 14 species found in this investigation, *Sigara nigrolineata*, *Aquarius paludum* and *Gerris odontogaster* are missing from the Faunaeur list.

Results on the number of species of aquatic insects on the territory of Kopački Rit Nature Park have been compared with results on the number of species of aquatic insects in Hungary, or more precisely, at Lake Balaton, along the Szuha River with its tributaries and Nemzeti Park. At Lake Balaton only specimens from the order Heteroptera were collected. Sampling of insects was carried out at 44 localities in the course of two years. The presence of 31 species of aquatic bugs was determined (BIRO, 2003). Along the Szuha River and its tributaries, specimens from both orders, Heteroptera and Coleoptera, were sampled. Sampling was carried out at 34 localities in the course of one season. The presence of 17 species from the order Heteroptera and 65 species from the order Coleoptera was determined (CSABAI *et al.*, 2004). In the area of Nemzeti Park sampling was carried out in 35 localities and 83 water beetle species were recorded (CSABAI *et al.*, 1999). However, sampling in this research was carried out in a significantly smaller number of localities.

Sampling stations were channels, or permanent water, clean and rich in nutrients. Such water offers very favourable habitats for species from the families Gerridae, Mesoveliidae, Haliplidae, Nepidae, Naucoridae, Notonectidae, Corixidae, Pleidae and Dytiscidae (NILSSON, 1996). The Mali Dunav Station – 1 km behind Zlatna Greda, was overgrown with water plants and consequently represented a habitat type suitable for species of the family Hydrophilidae (NILSSON, 1996).

In terms of specimen numbers, the first station is different from the remaining three. This difference is probably caused by the size of the channels and the representation of aquatic vegetation. Two peak values probably indicate the development of two generations of water insects.

The highest numbers of aquatic insects was recorded in August in the other three localities, which makes them similar in respect of the number of specimens. At the Tikveš-Podunavski kanal Station only one peak value was recorded. At the Mali Dunav Station – 2 km in front of Zlatna Greda the number of specimens increased as early as the end of May, which can be ascribed to the end of the hibernation period; this is when their reproductive i.e., egg-laying phase begins.

At the Mali Dunav Station – 1 km behind Zlatna Greda, the number of aquatic insects increased several times during the season. The development of as many as three generations of insects at this station makes it different from the remaining three. The highest number of generations at this station is probably due to favourable ecological conditions.

Among species registered during the research, the two largest species stand out (*Plea minutissima* and *Ilyocoris cimicoides*). The fluctuations in their numbers is given. The largest abundance of both species was recorded in August. According to the results denoting the abundance of specimens of *Plea minutissima* and *Ilyocoris cimicoides*, a peak value probably indicating the development of one generation during the season can be observed. The life cycle of these species encompasses the egg-stage and five larvae-stages. These larvae require around 60 – 70 days to develop into adult insects. (www.benthos.org).

Comparison of abundance between the most represented species in 2003 and 2004 is given in figure 4. The number of the species *Plea minutissima* is approxi-

mately the same in both years (2003 and 2004). In 2004 the number of specimens of the species *Ilyocoris cimicoides* varies significantly. In 2004 the number of specimens of the species *Ilyocoris cimicoides* is similar to the number of specimens of the species *Plea minutissima*. In 2003 only a few specimens were collected, and it is highly likely that this can be ascribed to the severe summer drought.

In reviewing accessible reference materials we have not been able to find any recorded data on aquatic insects in the Kopački Rit Nature Park. Accordingly, this is the first list of aquatic insects in this area. Future research findings can be expected to provide data on other species once the floodplain area has been covered.

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SUMMARY

Aquatic Insects in Kopački Rit Nature Park

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In order to expand the knowledge of entomofauna of Nature Park Kopački Rit, aquatic insects were investigated at four stations, covering permanent water. Material was collected in the adult stage. In the period from August to November 2003 and from April to October 2004, 873 specimens of aquatic insects were collected. The presence of 42 species of aquatic insects was determined. They were classified into two orders, 13 families and 29 genera. 14 species belong to the order Heteroptera and 28 to the order Coleoptera.

There are differences in the abundance of water insects at the four localities. At the Tikveš – Podunavski kanal, Mali Dunav – 2 km in front of Zlatna Greda and Mali Dunav – 1 km behind Zlatna Greda stations the number of insects was at its peak in August, whereas at the Podunavski kanal Station the number was the highest in October. This difference is most likely caused by the size of channels and the presence of aquatic vegetation. Abundance of water insects is characterised by considerable fluctuations, i. e., the number increases many times during the season, which probably indicates the development of generations.

The two most represented species are *Plea minutissima* (accounting for 32.65%) and *Ilyocoris cimicoides* (accounting for 17.18%). Results for the representation of the species *Plea minutissima* and *Ilyocoris cimicoides* indicate the development of one generation during one season.

Water insects on the territory of Kopački Rit have not previously been investigated and this research provides the first list of water insects. Future research findings can be expected to provide data on other species once the floodplain area has been covered. None of these species is rare but their present findings in Croatia reflect the insufficiency of the study of this group of insects and underline the necessity for further research in order to expand the knowledge of fauna, biological characteristics and the range of species already recorded.