



SPIDERS (ARACHNIDA: ARANEAE) ON FLOODED AND NON-FLOODED MEADOWS IN LONJSKO POLJE NATURE PARK, CROATIA

LUKA KATUŠIĆ

Šestinski dol 12, 10000 Zagreb, Croatia

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Lonjsko Polje is one of the largest and the best preserved flood plains in Europe. Periodical flooding of this area occurs mostly during spring and autumn, and water stays on the ground for more than 100 days. These hydrological conditions provide high habitat diversity with specific ecological factors and represent interesting research objects. Field research for this paper was performed from April to November 2004 on two locations; one flooded and one non-flooded meadow. At both the sites, spider fauna and difference in species composition were determined.

Key words: Arachnida, Araneae, Lonjsko Polje Nature Park, flooded and non-flooded meadows, biodiversity

Katušić, L.: Pauci (Arachnida: Araneae) poplavnih i nepoplavnih livada Parka prirode Lonjsko polje, Hrvatska. *Nat. Croat.*, Vol. 17, No. 2., 113–130, 2008, Zagreb.

Lonjsko polje predstavlja jedno od najvećih i najbolje očuvanih poplavnih područja u Europi. Periodična poplavljanja na ovom području događaju se najčešće tijekom proljeća i jeseni pri čemu se voda na dijelu Lonjskog polja zadržava i do više od 100 dana. Ovakve hidrološke prilike stvaraju mnoštvo različitih staništa sa specifičnim ekološkim čimbenicima koji predstavljaju zanimljive objekte istraživanja. Istraživanje za ovaj rad provedeno je od travnja do studenog 2004. godine na dvije lokacije, jednoj poplavnoj te drugoj, nepoplavnoj livadi. Na obje istraživane lokacije utvrđena je fauna pauka te razlike u sastavu faune pauka.

Ključne riječi: Arachnida, Araneae, Park prirode Lonjsko polje, poplavne i nepoplavne livade, bioraznolikost

INTRODUCTION

The purpose of this research was to explore the spider fauna of the meadows of Lonjsko Polje and to determine if there are any differences in the number of species and species composition between flooded and non-flooded meadows.

Lonjsko Polje is one of the largest flooded areas in Europe (Fig.1). The largest part of this area, with its surface of 50 650 ha, has been protected in the category of Nature Park since 1990. After heavy rains during autumn, the water level of the Sava River and of its tributaries grows rapidly and the water overflows the banks, flooding the surrounding areas. On these flooded areas water is retained even until late spring (SCHNEIDER-JACOBY & ERN, 1993). This periodical flooding creates characteristic habitats that are inhabited by specialized communities adapted to such conditions.

Spiders (*Araneae*) are a poorly explored order in Croatia. The most significant research was conducted at the end of the 19th and the beginning of the 20th century (DAMIN, 1900; REIMOSER, 1929, DRENSKY, 1936) and to some extent in the 1950s by F. Nikolić. Since then, the spiders have been studied only sporadically, usually by foreign scientists (RUCNER & RUCNER, 1995; DOBRORUKA, 2004). More systematic research was carried out into the subterranean spider fauna throughout the century (ABSOLON & KRATOCHVIL, 1932; KRATOCHVIL, 1978; MILLER, 1938, 1978; DEELEMAN-REINHOLD, 1971, 1978).

Recently, vigorous research into cavernicolous spider fauna was conducted by Croatian Biospeleological Society (OZIMEC, 2002; PAVLEK, 2006), and research into certain protected areas was carried out by spider section of the Biology Student Association-BIUS (KEMFELJA *et al.*, 2005; MEŠTROVIĆ *et al.*, 2005).

Spiders occur in all habitats on Earth except on the open sea and in the air. The most important factors that influence their dispersal are temperature, humidity, wind, sunlight, food accessibility, competition and predators (FOELIX, 1996).

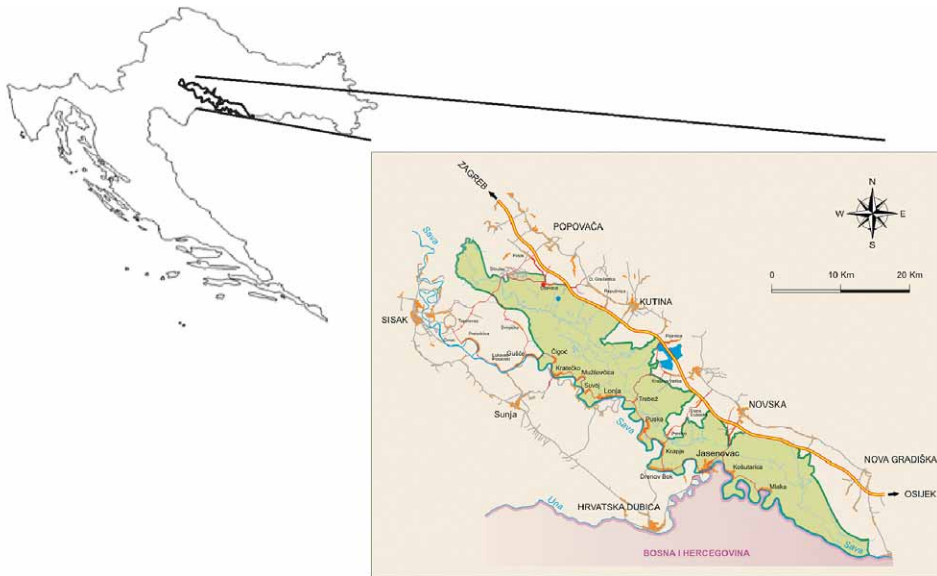


Fig. 1. Geographical position of Lonjsko Polje Nature Park
(<http://www.pp-lonjsko-polje.hr>)

Since flooded areas have extreme conditions, it is to be expected that some specialized species of spiders, adapted with their life cycles, life styles, foraging or physiological adaptations, will be present here. On non-flooded areas, species with different adaptations should be present, that is, the species composition should be different between flooded and non-flooded meadows (ROTHENBÜCHER, 2004; RUŽIČKA, 1987).

This paper shows only a portion of the results, that is, the faunistic characteristics given by the research made for the graduation thesis: Faunistic characteristics and seasonal dynamics of spiders (*Arachnida: Araneae*) on flooded and non-flooded meadows of Lonjsko Polje Nature Park, accepted by the Department of Biology of the Faculty of Science, University of Zagreb, Croatia.

In general, the main goal of the research was to represent the faunistic characteristics of spiders on the meadows in the Lonjsko Polje Nature Park, as well as to determine whether long term submersion of the meadows and accompanying vegetation has any impact on spider communities, and, if so, to what extent.

MATERIALS AND METHODS

This research was conducted from April until November 2004 on two locations (Fig. 2).

The first meadow explored lies near Osekovo village, on the northern boundary of Lonjsko Polje Nature Park (N 45°29'54.29", E 16°37'59.0', altitude 96 m), and represents the category non-flooded meadow. At this station the research was performed from 2nd of April until 17th of November. The meadow was mown twice, at the end of June and at the beginning of August.

The second meadow lies within the flooded area, 2.6 kilometres SE of the first location (N 45°30'39.8", E 16°37'2.9", altitude 95 m). On this meadow, the research was conducted from 3rd of May until 22nd of October. The reason for the shorter period of research was the brevity of suitable conditions for exploration on the meadows, as a result of the great moisture of the terrain. The meadow was mown once, on the 12th of August. To a small extent, the meadow is also used for pasture.

Three sampling methods were used during this research:

1. Sampling with pitfall traps
2. Sampling with an aspirator or pooter
3. Sampling with a sweep net

Pitfall traps were placed in the period between 3rd of May and 17th of November on the non-flooded meadow, and from 24th of May until 22nd of October 2004 on the flooded meadow.

Plastic cups of 0.5 liter, 8.5 centimeters in diameter, were used as traps. Every cup was planted in the ground so that the mouth of the trap was level with the soil surface and covered with a plastic plate supported with three wooden sticks and erected 7 centimeters from the ground as protection from rain. On both meadows,

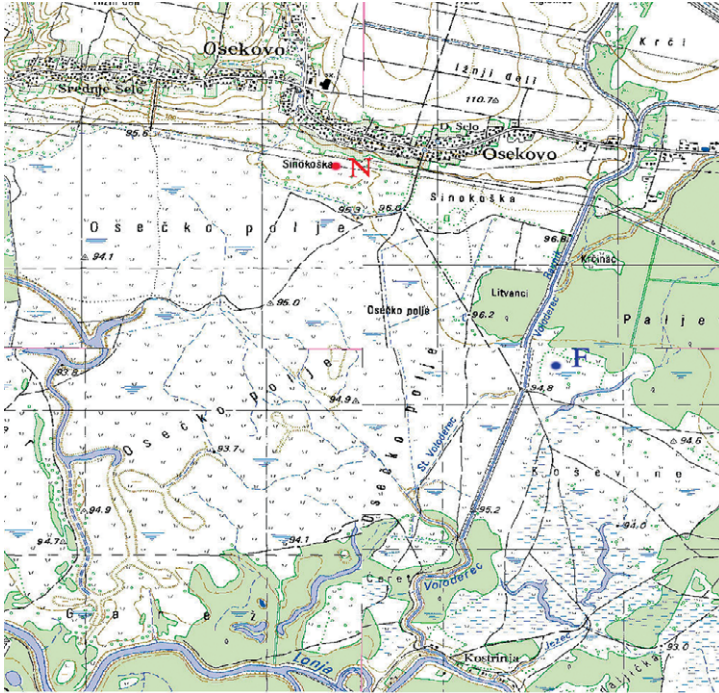


Fig. 2. Researched sites in Lonjsko polje (N-non-flooded, F-flooded site)

pitfall traps were arranged in the same order. A 10×10 m plot was measured, with 9 cups planted in it in three rows at 4 m distance (Fig. 3).

About 200 cc of ethylene-glycol water solution (1:1 ratio) and a few drops of dishwashing detergent were poured in every cup. Ethylene-glycol (antifreeze) served as a preservative and detergent as a surface tension reducer to ensure that the

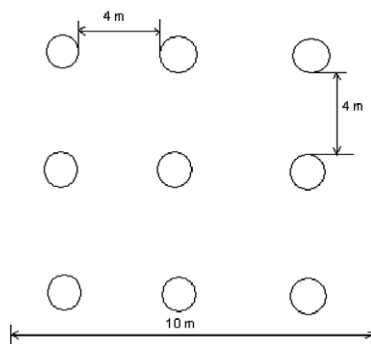


Fig. 3. Arrangement of pitfall traps

spiders would sink (ROBERTS, 1995). During the total of 198 days of exposure, pit-falls were emptied 17 times, every 10 to 15 days.

The aspirator sampling method was conducted from April until June. A pooter or aspirator is a very simple apparatus made of two rubber tubes and one between them made of glass or plastic and a piece of gauze or stocking (ROBERTS, 1995). This method was used to collect spiders from the ground and vegetation.

A method using a sweep net was used from April until August. A strong short-handled net was used as a sweep net. This method is used to collect spiders that dwell (build webs, hunt) on grass and other low herbage (CODDINGTON *et al.*, 1990).

The collected spiders were sorted from the other groups of animals and stored in 70% solution of the ethanol. All the material has been labelled and deposited in the author's collection. Species identification was made according to FUHN & NICOLESCU-BURLESCU (1971), HEIMER & NENTWIG (1991), ROBERTS (1995) and NENTWIG *et al.* (2003 – On line key). The nomenclature and systematics of the determined species are coordinated with the World Spider Catalogue (PLATNICK, 2008).

RESULTS AND DISCUSSION

During this research, a total number of 6 337 specimens were collected. A total of 4 382 specimens were sampled on the non-flooded meadow and 3 603 specimens from that number were adult. On the flood meadow, 1 955 specimens were sampled; 1688 specimens were adult.

During the analysis, 85 species belonging to 48 genera and 13 families were determined. According to the NIKOLIĆ & POLENEC Spider catalogue from 1981, 18 species of that number were recorded in Croatia for the first time.

74 species from 12 families were collected using pitfall traps, 17 species from 7 families with the sweep net, and 13 species from 5 families with the aspirator.

Eleven species and one family (Clubionidae) that were not trapped with pitfall traps were sampled with the aspirator and sweep net sampling methods.

From the total of 85 determined species, 74 of them were collected on the non-flooded meadow, and 51 species are sampled on the flooded one. Respectively, 23 species more are recorded on the non-flooded meadow. Thirty four species were found only on the non-flooded meadow, while 11 species were found only on the flooded area. There were 40 species occurring in both habitats. (Tab. 1)

Six species, each represented with more than 5 specimens and found only on the non-flooded meadow, are: *Mangora acalypha* (Araneidae), *Alopecosa pulverulenta*, *A. cuneata* (Lycosidae), *Xysticus acerbus* (Thomisidae), *Thanatus striatus*, *Tibellus oblongus* (Phlo-dromidae), *Haplodrassus signifer* (Gnaphosidae). These findings correspond to the data found in the literature describing the ideal habitat of these species as more or less dry, sunny, open grasslands (ROBERTS, 1995; NENTWIG *et al.*, 2003). There were no species represented with more than 5 individuals found exclusively on the flooded meadow.

The only species that was represented by a significantly higher number of individuals on the flooded than on the non-flooded meadow is *Arctosa leopardus*.

Tab. 1. The list of species collected on the flooded and non-flooded meadows:
 N – number of specimens on non-flooded meadow
 F – number of specimens on flooded meadow

Species name	N	F
THERIDIIDAE		
<i>Enoplognatha mandibularis</i> Lucas, 1846	0	1
<i>Enoplognatha mordax</i> (Thorell, 1875)*	2	2
LINYPHIIDAE		
<i>Araeoncus humilis</i> (Blackwall, 1841)	3	1
<i>Bathyphantes parvulus</i> (Westring, 1851)*	4	2
<i>Cnephalocotes obscurus</i> (Blackwall, 1834)*	0	2
<i>Diplostyla concolor</i> (Blackwall, 1841)	2	2
<i>Erigone dentipalpis</i> (Wider, 1834)	36	1
<i>Meioneta rurestris</i> (C.L.Koch, 1836)	2	0
<i>Meioneta saxatilis</i> (Blackwall, 1844)*	42	5
<i>Nematogmus sanguinolentus</i> (Walckenaer, 1841)	2	1
<i>Neriere clathrata</i> (Sundenvall, 1830)	0	3
<i>Oedothorax apicatus</i> (Blackwall, 1833)*	0	4
<i>Pelecopsis menzei</i> (Simon, 1884)*	2	0
<i>Pelecopsis parallela</i> (Wider, 1834)	1	0
<i>Pocadicnemis juncea</i> Locket & Millidge, 1953*	2	0
TETRAGNATHIDAE		
<i>Pachygnatha clercki</i> Sundenvall, 1823	1	13
<i>Pachygnatha degeeri</i> Sundenvall, 1830	423	19
<i>Pachygnatha listeri</i> Sundenvall, 1830	6	3
ARANEIDAE		
<i>Agalenatea redii</i> (Scopoli, 1763)	4	1
<i>Araneus diadematus</i> Clerck, 1757	1	0
<i>Araneus quadratus</i> Clerck, 1757	3	0
<i>Hypsosinga pygmaea</i> (Sundenvall, 1831)	3	0
<i>Mangora acalypha</i> (Walckenaer, 1802)	8	0
<i>Singa nitidula</i> C.L.Koch, 1844	1	0
LYCOSIDAE		
<i>Alopecosa cuneata</i> (Clerck, 1757)	46	0
<i>Alopecosa fabrilis</i> (Clerck, 1757)	2	0
<i>Alopecosa pulverulenta</i> (Clerck, 1757)	112	0
<i>Arctosa leopardus</i> (Sundenvall, 1833)	63	216
<i>Pardosa agrestis</i> (Westring, 1861)	266	38
<i>Pardosa blanda</i> (C.L. Koch, 1833)	1	1
<i>Pardosa lugubris</i> (Walckenaer, 1802)	1	0
<i>Pardosa monticola</i> (Clerck, 1757)	3	0
<i>Pardosa palustris</i> (Linnaeus, 1758)*	89	26
<i>Pardosa prativaga</i> (L.Koch, 1870)	1104	1077
<i>Pardosa proxima</i> (C.L.Koch, 1847)	602	3
<i>Pardosa pullata</i> (Clerck, 1757)	20	1

<i>Pardosa vittata</i> (Keyserling, 1863)	65	17
<i>Pirata latitans</i> (Blackwall, 1841)	15	11
<i>Pirata piraticus</i> (Clerck, 1757)	0	3
<i>Pirata tenuitarsis</i> Simon, 1876*	1	1
<i>Pirata uliginosus</i> (Thorell, 1856)*	2	0
<i>Trochosa ruricola</i> (De Geer, 1778)	137	47
<i>Xerolycosa nemoralis</i> (Westring, 1861)	1	1
Species name	N	F
PISAUROIDAE		
<i>Dolomedes fimbriatus</i> (Clerck, 1757)	1	1
<i>Pisaura mirabilis</i> (Clerck, 1757)	8	1
CORINNIDAE		
<i>Phrurolithus festivus</i> (C.L.Koch, 1835)	2	0
AMAUROBIIDAE		
<i>Urocoras longispina</i> (Kulczynski, 1897)*	0	1
CLUBIONIDAE		
<i>Clubiona stagnatilis</i> Kulczynski, 1897*	1	0
GNAPHOSIDAE		
<i>Drassyllus lutetianus</i> (L.Koch, 1866)*	140	84
<i>Drassyllus praeficus</i> (L.Koch, 1866)	1	0
<i>Drassyllus pusillus</i> (C.L.Koch, 1833)	22	9
<i>Drassyllus villicus</i> (Thorell, 1875)	2	0
<i>Haplodrassus minor</i> (O.P.-Cambridge, 1879)*	3	0
<i>Haplodrassus signifer</i> (C.L.Koch, 1839)	6	0
<i>Kishidaia conspicua</i> (L.Koch, 1866)	0	1
<i>Micaria pulicaria</i> (Sundenvall, 1831)	7	1
<i>Trachyzelotes pedestris</i> (C.L.Koch, 1837)	10	3
<i>Zelotes latreillei</i> Simon, 1878	2	1
PHILODROMIDAE		
<i>Thanatus arenarius</i> L.Koch, 1872	1	0
<i>Thanatus formicinus</i> (Clerck, 1757)	0	1
<i>Thanatus striatus</i> C.L.Koch, 1845	8	0
<i>Tibellus maritimus</i> (Menge, 1875)*	1	1
<i>Tibellus oblongus</i> (Walckenaer, 1802)	6	0
THOMISIDAE		
<i>Misumena vatia</i> (Clerck, 1757)	4	2
<i>Ozyptila simplex</i> (O.P.-Cambridge, 1862)	131	6
<i>Ozyptila trux</i> (Blackwall, 1846)	5	2
<i>Synaema globosum</i> (Fabricius, 1775)	2	2
<i>Xysticus acerbus</i> Thorell, 1872	8	0
<i>Xysticus audax</i> (Schrank, 1803)	1	0
<i>Xysticus cristatus</i> (Clerck, 1757)	1	1
<i>Xysticus kochi</i> Thorell, 1872	135	13
<i>Xysticus lineatus</i> (Westring, 1851)*	1	0
<i>Xysticus luctuosus</i> (Blackwall, 1836)	1	0

<i>Xysticus ulmi</i> (Hahn, 1831)	12	2
SALTICIDAE		
<i>Evarcha arcuata</i> (Clerck, 1757)	2	0
<i>Evarcha falcata</i> (Clerck, 1757)	1	0
<i>Heliophanus auratus</i> C.L.Koch, 1835	0	2
<i>Heliophanus flavipes</i> (Hahn, 1832)	3	3
<i>Leptorchestes berlinensis</i> (C.L.Koch, 1846)*	1	0
<i>Phlegra fasciata</i> (Hahn, 1826)	1	0
<i>Phlegra cinereofasciata</i> (Simon, 1868)	1	0
<i>Sibianor aurocinctus</i> (Ohlert, 1865)	1	1
<i>Sitticus caricis</i> (Westring, 1861)*	2	0
<i>Sitticus floricola</i> (C.L.Koch, 1837)	0	3
<i>Talavera aequipes</i> (O.P.-Cambridge, 1871)	0	1

* = a new species for Croatia

According to the literature, *A. leopardus* is found mostly on wetlands and marshy areas (ROBERTS, 1995; NENTWIG *et al.*, 2003).

Among the total number of specimens found on both meadows, the family represented with the largest percentage is the family Lycosidae (76%). The next family is Tetragnathidae (9%), and then the families Thomisidae, Gnaphosidae (6%) and Linyphiidae (2%) (Fig. 4).

Among the total number of species found on both meadows, the family Lycosidae (23%) is again represented with the largest percentage. The next family is the family Linyphiidae (15%), and then the families Thomisidae, Gnaphosidae and Salticidae (13%) (Fig. 5).

These results partially correspond to the research carried out in similar habitats (e.g. RUŽIČKA, 1987; KRUMPALOVA, 1999). In his paper Ružička states that the family Lycosidae has a higher proportion in the total number of specimens, but the highest

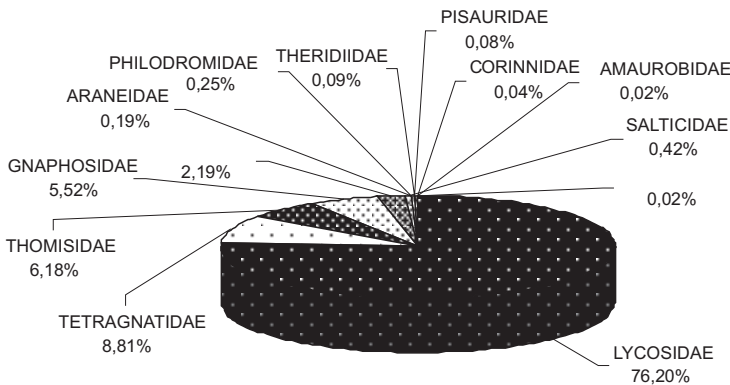


Fig. 4. Share of specimens of the individual family in the total number of specimens on both meadows

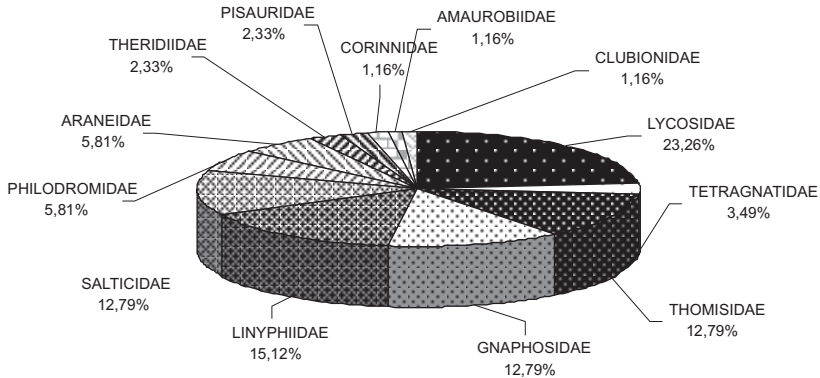


Fig. 5. Share of species of the individual family in the total number of species on both meadows

number of species belongs to the family Linyphiidae, followed by the family Lycosidae. Krumpalova in her paper also states that the eudominant species on the flooded habitat investigated belong to the families Lycosidae and Linyphiidae. The family Linyphiidae was again represented with a higher number of species.

The results shown were expected, but should be taken with precaution, since the main method for collecting spiders was that of pitfall traps, which usually gives a certain distortion of the real composition of spider species in the location investigated, overestimating the number of cursorial species, especially of the family Lycosidae (UETZ & UNZICKER, 1976).

The dominant species on both meadows is *Pardosa prativaga*. On the non-flooded meadow this species accounts for 30.64 % of the collected specimens, whereas on the flooded meadow it represents 63.8 % of the specimens collected.

Most of the specimens of this species were found during May and June on both meadows, when the moisture of the terrain was still very high. After June, due to the lack of rain, the terrain was constantly drying out, and the numbers of *P. prativaga* declined rapidly.

According to the literature, this species occurs in a wide variety of habitats, but is often very abundant on wetlands and humid to very humid meadows and fields (ROBERTS, 1995; BUCAR & RUŽIČKA, 2002; NENTWIG *et al.*, 2003). In some research carried out in similar habitats *P. prativaga* was frequently a dominant species (RELYS *et al.*, 2002; KUPRYJANOWICZ, 2003; ROTHENBÜCHER, 2004).

Review of the species recorded for first time in Croatia:

References: BUCAR & RUŽIČKA (2002), NENTWIG *et al.* (2003), NIKOLIĆ & POLENEC (1981), PLATNICK (2008), ROBERTS (1995), VAN HELSDINGEN (2007)

Enoplognatha mordax (Thorell, 1875)

- 01-15/07/2004, (1♀, 1♂); N 45°29'54.29", E 16°37'59.0"; altitude 96 m; non-flooded, twice a year mowed meadow near village Osekovo; pitfall traps.

- 17/06-01/07/2004, (2♀); N 45°30'39.8", E 16°37'2.9"; altitude 95 m; flooded, once a year mowed meadow near village Osekovo; pitfall traps.
- **Synonyms:** *E. crucifera* (Thorell, 1875), *E. maritima* Simon, 1884, *E. schaufussi* (L. Koch, 1882)
- **Habitat:** at ground level, sandy areas, marshes near the sea coast, sometimes in inland
- **Distribution:** Palaearctic – Transpalaearctic
- **Occurrence:** rare
- **Species of the genus in Croatia:** *E. lineata*, *E. mandibularis*, *E. thoracica*
- **Presence in surrounding countries:** Hungary

***Bathyphantes parvulus* (Westring, 1851)**

- 04-17/06/2004., (1♂); 15-25/07/2004, (1♂); 25/07-10/08/2004, (1♂); 24/09-07/10/2004, (1♂); N 45°29'54.29", E 16°37'59.0"; altitude 96 m; non-flooded, twice a year mowed meadow near village Osekovo; pitfall traps.
- 15-25/07/2004, (1♂); 11-24/09/2004, (1♂); N 45°30'39.8", E 16°37'2.9"; altitude 95 m; flooded, once a year mowed meadow near village Osekovo; pitfall traps.
- **Synonyms:** –
- **Habitat:** in detritus, moss, on lower grass, moist meadows and forests
- **Distribution:** Palaearctic outside Mediterranean
- **Occurrence:** widespread, common and abundant
- **Species of the genus in Croatia:** *B. gracilis*, *B. nigrinus*
- **Presence in surrounding countries:** Italy

***Cnephalocotes obscurus* (Blackwall, 1834)**

- 24/05-04/06/2004, (2♂); N 45°30'39.8", E 16°37'2.9"; altitude 95 m; flooded, once a year mowed meadow near village Osekovo; pitfall traps.
- **Synonyms:** *Nematogmus obscurus* Bösenberg, 1902, *C. molliculus* (L. Koch, 1879)
- **Habitat:** sunny, moist habitats, moss, peat bogs, spruce forests
- **Distribution:** Holarctic, outside Mediterranean
- **Occurrence:** abundant
- **Species of the genus in Croatia:** –
- **Presence in surrounding countries:** Serbia & Montenegro, Slovenia

***Meioneta saxatilis* (Blackwall, 1844)**

- 04-17/06/2004, (2♂); 01-15/07/2004, (14♂); 15-25/07/2004, (24♂); 25/07-10/08/2004, (2♂); N 45°29'54.29", E 16°37'59.0"; altitude 96 m; non-flooded, twice a year mowed meadow near village Osekovo; pitfall traps.
- 01-15/07/2004, (4♂); 15-25/07/2004, (1♂); N 45°30'39.8", E 16°37'2.9"; altitude 95 m; flooded, once a year mowed meadow near village Osekovo; pitfall traps.
- **Synonyms:** *M. hamburgensis* (Bösenberg, 1902), *M. montana* (Kulczynski, 1898)
- **Habitat:** among grass, lower plants, various forests, open habitats
- **Distribution:** Europe including Great Britain and Russia
- **Occurrence:** abundant

- **Species of the genus in Croatia:** *M. fuscipalpis*, *M. rurestris*
- **Presence in surrounding countries:** Hungary, Slovenia

***Oedothorax apicatus* (Blackwall, 1850)**

- 01-15/07/2004, (1♀, 2♂); 25/08-11/09/2004, (1♂); N 45°30'39.8", E 16°37'2.9"; altitude 95 m; flooded, once a year mowed meadow near village Osekovo; pitfall traps.
- **Synonyms:** *Erigone apicata* Dahl, 1883; *Gongylidium apicatum* Simon, 1884; *Neriere apicata* Simon, 1894; *Kulczynskiellum apicatum* F. O. P.-Cambridge, 1895;
- **Habitat:** fields, urban grasslands, inundated grasslands, moist open areas, loamy river banks
- **Distribution:** Palaearctic- Euro-Turanian area
- **Occurrence:** common and abundant
- **Species of the genus in Croatia:** *O. agrestis*, *O. fuscus*, *O. retusus*
- **Presence in surrounding countries:** Hungary, Slovenia, Serbia and Montenegro

***Pelecopsis mengei* (Simon, 1884)**

- 01-15/07/2004, (2♂); N 45°29'54.29", E 16°37'59.0"; altitude 96 m; non-flooded, twice a year mowed meadow near village Osekovo; pitfall traps.
- **Synonyms:** *P. excavata* (Emerton, 1911), *P. parumpunctata* (Simon, 1881), *Trichopterna mengei* Palmgren, 1976
- **Habitat:** wetlands, among grass on inundated meadows
- **Distribution:** Holarctic, outside Mediterranean
- **Occurrence:** scarce
- **Species of the genus in Croatia:** *P. elongata*, *P. parallela*, *P. turgida*
- **Presence in surrounding countries:** Hungary

***Pocadicnemis juncea* Locket & Millidge**

- 04/06-17/06/2004, (1♀, 1♂); N 45°29'54.29", E 16°37'59.0"; altitude 96 m; non-flooded, twice a year mowed meadow near village Osekovo; pitfall traps.
- **Synonyms:** *P. neglecta* Millidge, 1976
- **Habitat:** open wetlands, among grass and moss on wet meadows
- **Distribution:** Palearctic
- **Occurrence:** not rare
- **Species of the genus in Croatia:** –
- **Presence in surrounding countries:** Serbia & Montenegro

***Pardosa palustris* (Linnaeus, 1758)**

- 03-13/05/2004, (2♀, 4♂); 13-24/05/2004, (1♀, 21♂); 24/05-04/06/2004, (1♀, 28♂); 04-17/06/2004, (1♀, 17♂); 17/06-01/07/2004, (2♀, 11♂); 15-25/07/2004, (1♂); N 45°29'54.29", E 16°37'59.0"; altitude 96 m; non-flooded, twice a year mowed meadow near village Osekovo; pitfall traps.
- 24/05-04/06/2004, (2♀, 22♂); 04-17/06/2004, (1♂); 01-15/07/2004, (1♀); N 45°30'39.8", E 16°37'2.9"; altitude 95 m; flooded, once a year mowed meadow near village Osekovo; pitfall traps.
- **Synonyms:** *P. herbigrada* (Blackwall, 1857), *P. thoracica* (Storm, 1898), *P. tarsalis ehiki* (Kolosváry, 1943),

- **Habitat:** open meadows, heathlands
- **Distribution:** Holarctic, outside Mediterranean
- **Occurrence:** common and abundant
- **Species of the genus in Croatia:** *P. agrestis*, *P. agricola*, *P. amentata*, *P. atomaria*, *P. blanda.*, *P. hortensis*, *P. luctinosa*, *P. lugubris*, *P. monticola*, *P. morosa*, *P. nemorosa*, *P. paludicola*, *P. prativaga*, *P. proxima*, *P. pullata*, *P. riparia*, *P. vittata*, *P. wagleri*
- **Presence in surrounding countries:** Hungary, Slovenia, Serbia & Montenegro

Pirata tenuitarsis Simon, 1876

- 17/06-01/07/2004, (1♂); N 45°29'54.29", E 16°37'59.0"; altitude 96 m; non-flooded, twice a year mowed meadow near village Osekovo; pitfall traps.
- 01-15/07/2004, (1♂); N 45°30'39.8", E 16°37'2.9"; altitude 95 m; flooded, once a year mowed meadow near village Osekovo; pitfall traps.
- **Synonyms:** *P. piraticus moravicus* Kratochvíl, 1931, *Lycosa piraticus t.* Simon, 1937, *P. moravicus* Buchar, 1966
- **Habitat:** wetlands, sphagnum bogs, wet meadows, near ponds
- **Distribution:** Palaearctic to Central Asia
- **Occurrence:** widespread in northern Europe, not so common in the rest of Europe
- **Species of the genus in Croatia:** *P. hygrophilus*, *P. knorri*, *P. latitans*, *P. piraticus*
- **Presence in surrounding countries:** Hungary, Italy, Slovenia

Pirata uliginosus (Thorell, 1856)

- 04-17/06/2004, (1♀); 17/06-01/07/2004, (1♂); N 45°29'54.29", E 16°37'59.0"; altitude 96 m; non-flooded, twice a year mowed meadow near village Osekovo; pitfall traps.
- **Synonyms:** *P. moodyi* Hull, 1950
- **Habitat:** sunny moist areas, wetlands, peat bogs, the least dependent on moisture of all species of the genus *Pirata*
- **Distribution:** Palaearctic-Eurosiberian area
- **Occurrence:** widespread in northern Europe, scarce in the rest of Europe
- **Species of the genus in Croatia:** *P. hygrophilus*, *P. knorri*, *P. latitans*, *P. piraticus*
- **Presence in surrounding countries:** Hungary, Italy, Slovenia

Urocoras longispinus (Kulczynski, 1897)

- 07-22/10/2004, (1♂); N 45°30'39.8", E 16°37'2.9"; altitude 95 m; flooded, once a year mowed meadow near village Osekovo; pitfall traps.
- **Synonyms:** *Coelotes longispina* Kulczynski, 1897
- **Habitat:** under stones
- **Distribution:** central, south-east Europe
- **Occurrence:** very scarce
- **Species of the genus in Croatia:** *U. munieri*
- **Presence in surrounding countries:** Hungary, Serbia & Montenegro

Clubiona stagnatilis Kulczynski, 1897

- 24/05/2004, (1♀); N 45°29'54.29", E 16°37'59.0"; altitude 96 m; non-flooded, twice a year mowed meadow near village Osekovo; sweep net.

- **Synonyms:** –
- **Habitat:** in moss, on low vegetation in damp situations, moist meadows and forests
- **Distribution:** Palaearctic, Euro-Asia
- **Occurrence:** common and widespread throughout northern Europe
- **Species of the genus in Croatia:** *C. brevipes*, *C. caerulescens*, *C. comta*, *C. corticalis*, *C. decora*, *C. frutetorum*, *C. genevensis*, *C. germanica*, *C. neglecta*, *C. phragmitis*, *C. reclusa*, *C. similis*, *C. subtilis*, *C. terrestris*, *C. trivialis*
- **Presence in surrounding countries:** Hungary, Italy

***Drassyllus lutetianus* (L.Koch, 1866)**

- 24/05-04/06/2004, (4♂); 04-17/06/2004, (7♀, 44♂); 17/06-01/07/2004, (18♀, 54♂); 01-15/07/2004, (6♀, 4♂); 15-25/07/2004, (3♂); N 45°29'54.29", E 16°37'59.0"; altitude 96 m; non-flooded, twice a year mowed meadow near village Osekovo; pitfall traps.
- 04-17/06/2004, (1♀, 8♂); 17/06-01/07/2004, (4♀, 16♂); 01-15/07/2004, (19♀, 28♂); 15-25/07/2004, (7♀, 1♂); N 45°30'39.8", E 16°37'2.9"; altitude 95 m; flooded, once a year mowed meadow near village Osekovo; pitfall traps.
- **Synonyms:** *Prosthesima lutetiana* Simon, 1878, *Zelotes lutetianus* (L.Koch, 1866)
- **Habitat:** under stones, among detritus, moss and low vegetation on wetlands, floodplains, marsh areas
- **Distribution:** Europe to Kazakhstan
- **Occurrence:** common and widespread
- **Species of the genus in Croatia:** *D. praeficus*, *D. pusillus*, *D. villicus*
- **Presence in surrounding countries:** Hungary, Slovenia, Serbia and Montenegro

***Haplodrassus minor* (O.P.-Cambridge, 1879)**

- 04-17/06/2004, (2♀, 1♂); N 45°29'54.29", E 16°37'59.0"; altitude 96 m; non-flooded, twice a year mowed meadow near village Osekovo; pitfall traps.
- **Synonyms:** *Drassodes m.* Simon, 1914
- **Habitat:** wetlands, fields, salt marshes, limestone quarry, dry coastal areas, shingle
- **Distribution:** Europe, including Great Britain and Russia to the Urals
- **Occurrence:** rare
- **Species of the genus in Croatia:** *H. dalmatensis*, *H. signifer*
- **Presence in surrounding countries:** Hungary, Italy, Serbia and Montenegro

***Tibellus maritimus* (Menge, 1875)**

- 01-15/07/2004, (1♂); N 45°29'54.29", E 16°37'59.0"; altitude 96 m; non-flooded, twice a year mowed meadow near village Osekovo; pitfall traps.
- 01/07/2004, (1♀); N 45°30'39.8", E 16°37'2.9"; altitude 95 m; flooded, once a year mowed meadow near village Osekovo; sweep net.
- **Synonyms:** –
- **Habitat:** among long grass on wet or dry sunny places
- **Distribution:** Holarctic outside Mediterranean
- **Occurrence:** widespread throughout northern Europe, not so common in other parts of Europe

- **Species of the genus in Croatia:** *T. macellus*, *T. oblongus*
- **Presence in surrounding countries:** Hungary, Italy

***Xysticus lineatus* (Westring, 1851)**

- 04-17/06/2004, (1♂); N 45°29'54.29", E 16°37'59.0"; altitude 96 m; non-flooded, twice a year mowed meadow near village Osekovo; pitfall traps.
- **Synonyms:** *Thomisus l.* Westring, 1851
- **Habitat:** on low vegetation on marshy areas, moors, rock steppe
- **Distribution:** Palaearctic, Euro-Asian area
- **Occurrence:** rare
- **Species of the genus in Croatia:** *X. acerbus*, *X. audax*, *X. brevidentatus*, *X. cor*, *X. cristatus*, *X. graecus*, *X. kempeleni*, *X. kochi*, *X. lalandei*, *X. lanio*, *X. luctuosus*, *X. ninnii*, *X. robustus*, *X. sabulosus*, *X. striatipes*, *X. thessalicus*, *X. ulmi*
- **Presence in surrounding countries:** Hungary, Italy, Slovenia, Serbia

***Leptorchestes berolinensis* (C.L.Koch, 1846)**

- 03/05/2004, (1♂); N 45°29'54.29", E 16°37'59.0"; altitude 96 m; non-flooded, twice a year mowed meadow near village Osekovo; aspirator (pooter).
- **Synonyms:** -
- **Habitat:** on vegetation on sun-exposed forest, on sunny walls, fences, tree barks
- **Distribution:** Euro-Asian area to Turkmenistan
- **Occurrence:** widespread throughout northern Europe, not so common in the rest of the Europe
- **Species of the genus in Croatia:** *L. mutilloides*, *L. cinctus*
- **Presence in surrounding countries:** Hungary, Italy

***Sitticus caricus* (Westring, 1861)**

- 04-17/06/2004, (2♀); N 45°29'54.29", E 16°37'59.0"; altitude 96 m; non-flooded, twice a year mowed meadow near village Osekovo; pitfall traps.
- **Synonyms:** *Attus c.* Westring, 1861
- **Habitat:** wetlands, among moss, low vegetation and detritus in swampy areas, peat bogs
- **Distribution:** Palearctic, outside Mediterranean
- **Occurrence:** not common
- **Species of the genus in Croatia:** *S. atricapillus*, *S. damini*, *S. distinguendus*, *S. dzieduszyckii*, *S. floricola*, *S. littoralis*, *S. manni*, *S. penicillatus*, *S. saltator*, *S. truncorum*
- **Presence in surrounding countries:** Hungary, Italy, Serbia & Montenegro

Most of the species described above were found in a habitat that is identical or very similar to the characteristic habitat for the species described in the literature.

Slight differences can be noticed with the species *Leptorchestes berolinensis* whose characteristic habitats are sunny walls, fences, tree barks (ROBERTS, 1995; NENTWIG *et al.*, 2003; BUCHAR & RUŽIČKA, 2002). The difference between literature and field data could be explained by the fact that the nearest trees exposed to the sun (a character-

istic habitat) are fifty meters away from the researched location, so the only specimen of the species was very likely collected during migration between ideal habitats.

Some discrepancies between the literature and field data can also be noticed regarding species *Sitticus caricus*, *Xysticus lineatus*, *Clubiona stagnatilis*, *Pirata uliginosus*, *Pocadicnemis juncea* and *Pelecopsis menzei*. The literature states that these species can be found on wetlands, moist meadows, but the only specimens of the species in this research were found on the non-flooded meadow. Due to the small number of specimens of each species (one to two specimens) no significant conclusion can be made. It must also be stressed that all the specimens of these species were found during periods with a lot of rain and moisture even on the non-flooded meadow, so this can be a possible explanation for their presence on this habitat.

Concerning the species *Enoplognatha mordax*, it is stated in the literature that the preferred habitats are sandy areas and marshes near the sea coast (ROBERTS, 1995; BUCAR & RUŽIČKA, 2002), but NENTWIG *et al.* (2003) state that the species can be found also in inland.

All the species described can be found across the whole of Europe, except for the Mediterranean. Every genus is represented in the Croatian spider fauna with at least one additional species, except for the genus *Cnephalocotes* and *Pocadicnemis*, whose only representatives are the species *Cnephalocotes obscurus* and *Pocadicnemis juncea*. All the species recorded for the first time in Croatia during this research are recorded in at least one surrounding country (VAN HELSDINGEN, 2007).

CONCLUSION

During this research, 85 species of spiders were collected in the areas investigated. On the non-flooded meadow 74 species were found, and 51 on the flooded land. There were 40 species in common to both sites. Eighteen species were recorded for the first time in Croatia (according to NIKOLIĆ & POLENEC, 1981).

The characteristic habitat quoted in the literature for most of the species found exclusively, or in a significantly higher number in one of these locations, is identical or very similar to the one they were found in during the research.

The results obtained show that there is a certain difference in species composition and to some extent confirm the initial assumption that the non-flooded meadow will have a larger number of species than the flooded one, but for proving the actual differences in species composition between these two habitats, more thorough analysis are needed.

The results concerning the family with the highest number of specimens and species were expected and correspond to the results from other research carried out in similar habitats, but it should be taken into account that the main method used for collecting the spiders (pitfall traps) overestimates the number of cursorial species, especially Lycosidae, on account of the family Linyphiidae.

The dominant species in both meadows is *Pardosa prativaga* (30.64 % in the non-flooded, 63.8 % in the flooded). The period of the largest abundance of this

species in both meadows coincides with the period in which the land is wettest. This species is very abundant and frequently found in this kind of habitat.

For the 18 species recorded for the first time in Croatia, habitat and distribution data correspond to the data found in the literature.

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S A Ž E T A K

Pauci (Arachnida: Araneae) poplavnih i nepoplavnih livada Parka prirode Lonjsko polje, Hrvatska

L. Katušić

U razdoblju od mjeseca travnja do studenog 2004. godine provedeno je istraživanje faune pauka na području Parka prirode Lonjsko polje. Istraživanje je provedeno na dvije lokacije: poplavnoj i nepoplavnoj livadi. Primijenjene su tri metode prikupljanja pauka: metoda lovnih posuda, metoda sakupljanja ekshaustorom te metoda sakupljanja pomoću kečera. Sakupljeno je ukupno 6337 jedinki, od čega 5291 adulta i 1046 juvenilna primjerka. Analizom adultnih primjeraka utvrđeno je 85 vrsta pauka iz 13 porodica i 48 rodova, od čega je 18 vrsta novih za faunu Hrvatske.

Kvalitativna analiza dvaju staništa pokazala je da na nepoplavnoj livadi obitavaju 74 vrste, dok je za poplavnu utvrđeno 23 vrste manje, odnosno 51 vrsta. Za obje analizirane lokacije zajedničko je 40 vrsta.

Među vrstama koje su zastupljene s više od pet jedinki u ukupnom broju ulovljenih jedinki, njih šest je uzorkovano samo na nepoplavnoj livadi (*Mangora acalypha*, *Alopecosa pulverulenta*, *A. cuneata*, *Xysticus acerbus*, *Thanatus striatus*, *Tibellus oblongus*, *Haplodrassus signifer*), dok niti jedna vrsta s više od pet jedinki nije zabilježena samo na poplavnoj livadi. Jedina vrsta koja je u znatno većem broju zastupljena na poplavnoj nego na nepoplavnoj livadi jest vrsta *Arctosa leopardus*.

Tip staništa na kojemu su ove vrste pronađene odgovara karakterističnom staništu pojedine vrste, navedenom u literaturi.

Ovi rezultati pokazuju da između istraživanih područja postoje određene razlike u sastavu zajednica pauka, no za dokazivanje stvarnih razlika između ovih dvaju staništa, potrebne su detaljnije analize prikupljenih podataka.

U ukupnom broju jedinki, porodica Lycosidae je najzastupljenija. Iza nje slijede porodice Tetragnathidae i Thomisidae. Porodica Lycosidae je također najzastupljenija u ukupnom broju određenih vrsta. Nju slijede porodice Linyphiidae te Thomisidae.

Dominantna vrsta na obje plohe je vrsta *Pardosa prativaga*. Najveći broj jedinki ove vrste ulovljen je tijekom vlažnog perioda na obje livade. S dolaskom sušeg razdoblja, učestalost ove vrste znatno opada.

Tijekom istraživanja pronađeno je 18 vrsta prvi puta zabilježenih za faunu Hrvatske. To su vrste: *Enoplognatha mordax*, *Bathypantes parvulus*, *Cnephalocotes obscurus*, *Meioneta saxatilis*, *Oedothorax apicatus*, *Pelecopsis menzei*, *Pocadicnemis juncea*, *Pardosa palustris*, *Pirata tenuitarsis*, *Pirata uliginosus*, *Urocoras longispina*, *Clubiona stagnatilis*, *Drassyllus lutetianus*, *Haplodrassus minor*, *Tibellus maritimus*, *Xysticus lineatus*, *Leptorchestes berolinensis* i *Sitticus caricis*.

Sve opisane vrste su prisutne u cijeloj Europi, izuzevši područja s mediteranskom klimom. Svi rodovi su zastupljeni u fauni pauka Hrvatske s najmanje jednom vrstom, osim rodova *Cnephalocotes* i *Pocadicnemis*, čiji su jedini predstavnici vrste *Cnephalocotes obscurus* i *Pocadicnemis juncea*.