

BUTTERFLY FAUNA (LEPIDOPTERA: HESPERIOIDEA & PAPILIONOIDEA) OF CENTRAL ISTRIA (CROATIA)

TONI KOREN¹ & LJILJANA LADAVAC²

¹Univerza na Primorskem, Znanstveno-raziskovalno središče Koper,
Inštitut za biodiverzitetne študije, Garibaldijeva 1, SI-6000 Koper, Slovenija
(koren.toni1@gmail.com)

²Vela Traba 5, HR-52 000 Pazin, Croatia

Koren, T. & Ladavac, Lj.: Butterfly fauna (Lepidoptera: Hesperioidea & Papilionoidea) of Central Istria (Croatia). Nat. Croat., Vol. 19, No. 2., 369–380, 2010, Zagreb.

Between the years 1981–1986 and 2001–2010, 102 butterfly species were identified in the Pazin area and four surrounding localities. The estimated diversity and endangerment status of certain species is discussed. Also, a comparison between past and recent lists of species is also given. Including historical records a total of 104 butterfly species are known from Pazin region. Thirteen species recorded during this research are new for Istria.

Key words: Rhopalocera, fauna, diversity, Istria

Koren, T. & Ladavac, Lj.: Fauna dnevnih leptira (Lepidoptera: Hesperioidea & Papilionoidea) središnje Istre (Hrvatska). Nat. Croat., Vol. 19, No. 2., 369–380, 2010, Zagreb.

U razdoblju između 1981. i 1986. godine, kao i od 2001. pa do 2010. godine, na području Pazina i četiri okolna lokaliteta zabilježene su 102 vrste danjih leptira. U radu se navodi njihova raznolikost te stupanj ugroženosti za neke vrste. Isto tako, dana je i usporedba s dosadašnjim nalazima na području Pazina te se na temelju toga daje popis od 104 vrste danjih leptira. Čak 13 vrsta zabilježeno je po prvi puta za Istru.

Ključne riječi: Rhopalocera, fauna, raznolikost, Istra

INTRODUCTION

Studies of butterflies in Croatia started as early in the 19th century and with small or larger breaks have been continued until the present; however, during the last ten years several new species were added to the List of Croatian butterfly fauna (MIHOČI & ŠAŠIĆ, 2009). With *Cacyreus marshalli* (Butler, 1898) (KOSMAČ & VEROVNIK, 2009) increased the number of species in the Croatian butterfly fauna to about 193. Recent faunistic data are not uniform throughout Croatia and, for example, the butterfly fauna of the territory of Istria could be considered insufficiently

studied (KUČINIĆ *et al.*, 1999; ŠAŠIĆ & MIHOČI, 2007). This is even truer for central Istria, where only STAUDER (1925) reported 11 species collected at the beginning of the 20th century in the surroundings of Pazin (referring to Pazin as Pizino or Mitterburg). The main aim of our paper is to fill the knowledge gap pertaining to recent butterfly fauna of central part of Istria.

MATERIALS AND METHODS

All the butterflies were collected with an entomological net. Only one pair per species was sacrificed to form a new entomological collection of butterflies of the Pazin area, which is held in a private collection. All other butterflies caught were photographed and released. During field work, butterflies were determined using TOLMAN & LEWINGTON (2008). Nomenclature follows the European Red List of Butterflies (VAN SWAAY *et al.*, 2010). Genital analysis of the genus *Leptidea* was done according to LORKOVIĆ (1993).

The first part of our study of butterflies includes records between 1981 and 1986 from the collection of second author, who collected butterflies exclusively in a radius of one kilometre around Pazin. Pazin is a small city located in the centre of the Istria peninsula. It is located in a valley surrounded by small hills. This area, according to ŠUGAR (1984), is a mosaic of different mesophilic and thermophilic plant communities from two main phytogeographical regions, Eurosiberian-Northamerican and Mediterranean. In total, 92 species from the butterfly collection of that time were identified. Field studies of butterflies in part of the broader surrounding of Pazin were continued in the years 2001–2010 by both authors. This part of survey was conducted in five localities (Fig. 1). The localities were visited at irregular intervals over the years, but a each year a minimum of five field trips per locality were conducted between March and October each year.

List of researched localities:

1. Pazin, in a one kilometre radius around the city, meadows and forest edges, 320 m a.s.l. (coordinates: 5414371/5011727)
2. Zarečki krov, meadows and agricultural land, 260 m a.s.l. (coordinates: 5418648/5012183)
3. S of the village of Beram, large meadow close to the main road mostly covered with clover, 320 m a.s.l. (coordinates: 5413755/5011970)
4. Vela Traba, meadows, mixed oak and pine woods, forest clearings and rural habitats, 370 m a.s.l. (coordinates: 5410108/5011757)
5. Limska Draga, above Vela Traba, meadows near a small spring creek, road verges and forest paths, 270 m a.s.l. (coordinates: 5410352/5011150)

The habitats visited there can be divided into two groups. During the first part of the research (1981–1986), primarily meadows and forest edges near the town were surveyed. Twenty years later, during the second part of the study, most of those habitats had been destroyed due to the expansion of the city in all directions. The majority of small springs which then surrounded Pazin are now in built up ar-

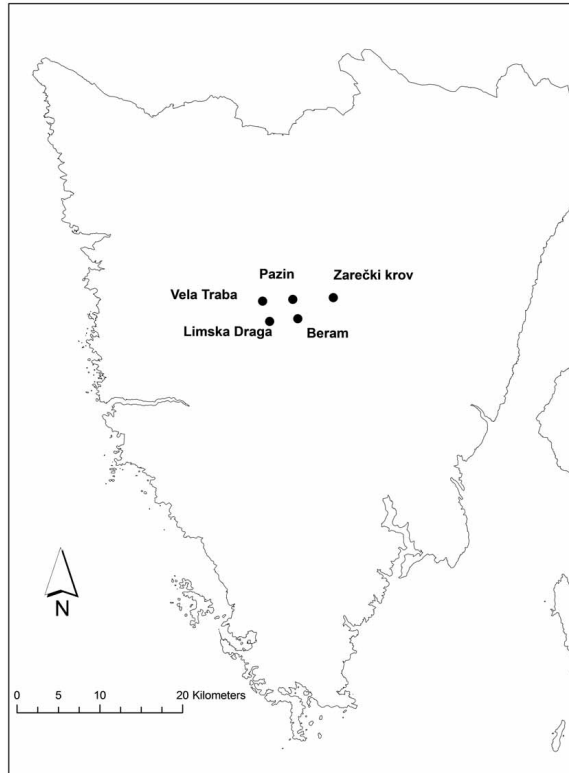


Fig. 1. Map of surveyed sites in central Istria.

eas, and consequently almost all the humid meadows have disappeared. Because of that, research was not possible at the same locations, so we tried to find new, similar sites nearby, so the data could be comparable.

RESULTS AND DISCUSSION

A total of 102 species were observed in the two investigation periods, 89 in the last decade. Systematic list of recorded species along with the date of first finding on each locality are in Tab. 1, while a comparison between research periods is shown in Tab. 2. Pazin was by far the richest locality, with a total of 92 species. Around the village of Vela Traba we counted a total of 84 species, while in the locality close to the village of Beram, we found only 22 species. In Limska Draga we counted a total of 71 species, but only a small part beneath the village Vela Traba was surveyed. Zarečki krov turned to be the poorest locality, with just 11 species recorded, however two species found in Zarečki krov were not found anywhere around Pazin: *Limnitis camilla* (Linnaeus, 1764) and *Leptotes pirithous* (Linnaeus, 1767).

Including the data from STAUDER (1925), 104 butterfly species have been noted in the central recorded in Istria (calculated after JAKŠIĆ, 1988 and ŠAŠIĆ & MIHOČI, 2007).

Tab. 1. Systematic list of all butterfly fauna present at the researched localities with the first dates of finding.

Hesperiidae
<p><i>Erynnis tages</i> (Linnaeus, 1758) Pazin, July 17th, 1982; Vela Traba, July 7th, 2008; Draga, June 20th, 2009; Beram, July 5th, 2008; Zarečki krov, July 15th, 2008.</p>
<p><i>Carcharodus alceae</i> (Esper, 1780) Pazin, August 1th, 1982; Vela Traba, July 9th, 2008, Draga, June 20th, 2009.</p>
<p><i>Spialia sertorius</i> (Hoffmannsegg, 1804) Pazin, July 29th, 1982</p>
<p><i>Pyrgus malvae</i> (Linnaeus, 1758) Pazin, May 20th, 1982; Vela Traba, April 4th, 2007; Draga, April, 2007.</p>
<p><i>Pyrgus armoricanus</i> (Oberthür, 1910) Pazin, July 20th, 1982.</p>
<p><i>Heteropterus morpheus</i> (Pallas, 1771) Pazin, June 9th, 1982; Vela Traba, June 5th, 2008, Draga, June 20th, 2009.</p>
<p><i>Carterocephalus palaemon</i> (Pallas, 1771) Vela Traba, May 19th, 2009.</p>
<p><i>Thymelicus lineola</i> (Ochsenheimer, 1808) Pazin, June 6th, 1982, Vela Traba, June 16th, 2010, Draga, June 20th, 2009.</p>
<p><i>Thymelicus sylvestris</i> (Poda, 1761) Pazin, June 13th, 1982, Vela Traba, June 16th, 2010, Draga, June 20th, 2009.</p>
<p><i>Thymelicus acteon</i> (Rottemburg, 1775) Pazin, June 4th, 1983; Vela Traba, June, 2001.</p>
<p><i>Hesperia comma</i> (Linnaeus, 1758) Pazin, July 20th, 1982.</p>
<p><i>Ochlodes sylvanus</i> (Esper, 1777) Pazin, June 9th, 1982; Pazin, July 17th, 1982; Vela Traba, July 27th, 2008, Draga, June 20th, 2009.</p>
Papilionidae
<p><i>Zerynthia polyxena</i> (Denis & Schiffermüller, 1775) Vela Traba, April, 2001; Draga, April 14th, 2007.</p>
<p><i>Iphiclides podalirius</i> (Linnaeus, 1758) Pazin, July 20th, 1982; Vela Traba, July, 2001; Beram, June, 2007; Zarečki krov, June, 2008.</p>
<p><i>Papilio machaon</i> Linnaeus, 1758 Pazin, May 7th, July 15th, August 2th, 1982; Vela Traba, July 17th, 2001; Beram, August, 2008, Zarečki krov, July, 2007.</p>
Pieridae
<p><i>Leptidea sinapis</i> (Linnaeus, 1758) Pazin, April 24th, May 13th, June 3rd, 1982; Vela Traba, July 7th, 2008; Draga, August, 2008; Beram, August 27th, 2007.</p>
<p><i>Antocharis cardamines</i> (Linnaeus, 1758) Pazin, May 9th, 1982; Vela Traba, May 7th, 2007; Draga, May, 2007.</p>
<p><i>Aporia crataegi</i> (Linnaeus, 1758) Pazin, June 17th, June 25th, 1982; Vela Traba, June 15th, 2001; Draga, June 20th, 2009.</p>
<p><i>Pieris brassicae</i> (Linnaeus, 1758) Pazin, June 25th, 1982; Vela Traba, July, 2001; Draga, June 20th, 2009.</p>
<p><i>Pieris mannii</i> (Mayer, 1851) Pazin, April 12th, 1982; Vela Traba, July 7th, 2007; Draga, June 20th, 2009.</p>

Pieris rapae (Linnaeus, 1758)

Pazin, July 20th, 1982; Vela Traba, July, 2008; Draga June 27th, 2007; Beram, August 29th, 2007.

Pieris napi (Linnaeus, 1758)

Pazin, June 25th, 1982; Vela Traba, June 7th, 2007; Draga, June 20th, 2009.

Pontia edusa (Fabricius, 1777)

Pazin, June 23rd, July 23rd, 1982; Vela Traba, June 7th, 2007.

Colias croceus (Fourcroy, 1785)

Pazin, July 30th, 1982; Vela Traba, July 15th, 2001; Draga, June, 2007; Beram, July 23rd, 2007; Zarečki krov, July, 2007.

Colias hyale (Linnaeus, 1758)

Pazin, July 5th, August 17th, 1982; Vela Traba July 7th, 2008; Draga, August 27th, 2007; Beram, June 24th, 2007; Zarečki krov, July 13th, 2008.

Colias alfajariensis Ribbe, 1905

Pazin, July 18th, 1982; Vela Traba July 4th, 2008; Draga, June 20th, 2009.

Gonepteryx rhamni (Linnaeus, 1758)

Pazin, June 25th, August 6th, 1982; Vela Traba, July 10th, 2002; Draga, July, 2008.

Gonepteryx cleopatra (Linnaeus, 1767)

Pazin, June 26th, 1982.

Riodinidae***Hamearis lucina*** (Linnaeus, 1758)

Pazin, July 7th, 1982; Vela Traba, July, 2001; Draga, June 20th, 2009.

Lycaenidae***Lycaena phlaeas*** (Linnaeus, 1761)

Pazin, June 4th, 1982; Vela Traba, July 11th, 2007; Draga, June 20th, 2009; Beram, June 20th, 2007; Zarečki krov, July 16th, 2008.

Lycaena tityrus (Poda, 1761)

Beram, July, 2001, Vela Traba, July 22rd, 2009.

Lycaena alciphron (Rottenburg, 1775)

Vela Traba, July 3rd, 2008.

Neozephyrus quercus (Linnaeus, 1758)

Pazin, July 19th, 1982; Vela Traba, July 10th, 2007.

Callophrys rubi (Linnaeus, 1758)

Pazin, April 13th, 1982; Vela Traba, April 10th, 2007; Draga, June 20th, 2009.

Satyrrium w-album (Knoch, 1782)

Pazin, July 4th, 1982; Draga, June 20th, 2009.

Satyrrium pruni (Linnaeus, 1758)

Vela Traba, June 20th, 2009, Vela Traba, June 12th, 2009; Draga, June 20th, 2009.

Satyrrium spini (Denis & Schiffermüller, 1775)

Pazin, June 26th, 1982; Vela Traba, July 9th, 2008.

Satyrrium ilicis (Esper, 1779)

Pazin, June 24th, 1982; Vela Traba, July 10th, 2008; Draga, June 20th, 2009.

Satyrrium acaciae (Fabricius, 1787)

Pazin, June 24th, 1982; Vela Traba, June 2nd, 2008; Draga, June 20th, 2009.

Lampides boeticus (Linnaeus, 1767)

Vela Traba, July 15th, 2001; Vela Traba, July 17th, 2008.

Leptotes pirithous (Linnaeus, 1767)

Vela Traba, August 27th, 2007; Beram, August, 2007; Zarečki krov, July 25th, 2008.

Cupido minimus (Fuessly, 1775)

Pazin, May 16th, 1982; Vela Traba, May 14th, 2007; Draga, June 20th, 2009.

Cupido argiades (Pallas, 1771)

Pazin, July 17th, 1982; Vela Traba, August 12th, 2007; Beram, July 7th, 2007.

Cupido decolorata (Staudinger, 1886)

Vela Traba, June 20th, 2009; Draga, June 20th, 2009.

Cupido alcetas (Hoffmannsegg, 1804)

Pazin, June 26th, 1982; Vela Traba, June 27th, 2008; Draga, June 20th, 2009.

Celastrina argiolus (Linnaeus, 1758)

Pazin, June 26th, 1982; Vela Traba, July 4th, 2007; Draga, June 20th, 2009.

Pseudophilotes vicrama (Moorse, 1865)

Pazin, June 14th, 1982; Draga, June 20th, 2009.

Scolitantides orion (Pallas, 1771)

Pazin, April 14th, July 5th, 1982; Draga, June 20th, 2009.

Glaucopsyche alexis (Poda, 1761)

Pazin, June 20th, 1982.

Phengaris arion (Linnaeus, 1758)

Pazin, July, 1981.

Phengaris alcon (Denis & Schiffermüller, 1775)

Pazin, June 24th, 1982.

Plebejus argus (Linnaeus, 1758)

Pazin, July 24th, 1982; Vela Traba, August 27th, 2008; Draga, June 20th, 2009.

Plebejus argyrognomon (Bergsträsser, 1779)

Pazin, July 21st, 1982.

Aricia agestis (Denis & Schiffermüller, 1775)

Pazin, June 27th, 1982; Vela Traba, July 10th, 2008; Draga, June 20th, 2009; Beram, August, 2007; Zarečki krov, July 25th, 2008.

Cyaniris semiargus (Rottemburg, 1775)

Pazin, June 2th, 1982; Vela Traba, June 22th, 2007.

Polyommatus dorylas (Denis & Schiffermüller, 1775)

Pazin, July, 1982.

Polyommatus amandus (Schneider, 1792)

Vela Traba, June 18th, 2010; Draga, June 20th, 2009.

Polyommatus icarus (Rottemburg, 1775)

Pazin, May 20th, 1982; Vela Traba, July 11th, 2008; Draga, June 14th, 2008; Beram, August, 2007; Zarečki krov, July 25th, 2008.

Polyommatus thersites (Cantener, 1834)

Pazin, April 20th, 1982.

Polyommatus bellargus (Rottemburg, 1775)

Pazin, May 19th, 1982; Vela Traba, August 16th, 2008; Draga, June 14th, 2008; Beram, August 29th, 2007.

Polyommatus coridon (Poda, 1761)

Pazin, July 23rd, 1983; Vela Traba, July 11th, 2008; Draga, June 20th, 2009.

Nymphalidae*Libythea celtis* (Laicharting, 1782)

Pazin; Vela Traba April, 2002; Vela Traba, April 15th, 2001.

Argynnis paphia (Linnaeus, 1758)

Pazin, June 16th, 1982, Vela Traba, July 10th, 2002; Draga, June 20th, 2009.

Argynnis aglaja (Linnaeus, 1758)

Pazin, July 15th, 1982; Vela Traba, July 10th, 2008; Draga, June 20th, 2009.

Argynnis adippe (Denis & Schiffermüller, 1775)

Pazin, April, 1982; Vela Traba, April, 2002.

Argynnis niobe (Linnaeus, 1758)

Pazin, July 4th, 1982; Vela Traba, July, 2002; Draga, June 20th, 2009.

Issoria lathonia (Denis & Schiffermüller, 1775)

Pazin, July 25th, 1982, Vela Traba, July, 2001; Draga, June 20th, 2009.

Brenthis daphne (Denis & Schiffermüller, 1775)

Pazin, June 17th, 1982, Vela Traba, July, 2001; Draga, June 20th, 2009.

Brenthis hecate (Denis & Schiffermüller, 1775)

Pazin, June 10th, 1982; Vela Traba, June 8th, 2008; Draga, June 21th, 2009.

Boloria dia (Linnaeus, 1767)

Pazin, August 16th, 1982; Vela Traba July, 2001; Draga, April, 2007.

Vanessa atalanta (Linnaeus, 1758)

Pazin, June 30th, 1982; Vela Traba, June 17th, 2001; Draga, April, 2001; Beram, August 2008.

Vanessa cardui (Linnaeus, 1758)

Pazin, June 26th, 1982; Vela Traba, June 14th, 2001; Draga, April 14th, 2001; Beram, July 2007.

Aglais io (Linnaeus, 1758)

Pazin, July 3rd, 1982; Vela Traba, June 17th, 2001; Draga, April 14th, 2001.

Aglais urticae (Linnaeus, 1758)

Pazin, July 17th, 1982; Vela Traba, July 12th, 2001; Draga, July, 2001.

Polygonia c-album (Linnaeus, 1758)

Pazin, July 6th, 1983; Vela Traba, July 12th, 2001; Draga, July, 2001.

Nymphalis antiopa (Linnaeus, 1758)

Pazin, July, 1982.

Nymphalis polychloros (Linnaeus, 1758)

Pazin, July 3th, 1982; Vela Traba, August 25th, 2008; Draga, July, 2002.

Euphydryas aurinia (Rottemburg, 1775)

Pazin, May 14th, 1982; Vela Traba, May 15th, 2001; Draga May 12th, 2003; Vela Traba, May 25th, 2008; Draga, May, 2008.

Melitaea cinxia (Linnaeus, 1758)

Pazin, June 9th, 1982; Vela Traba, June 2nd, 2008; Draga, April 20th, 2009.

Melitaea athalia (Rottemburg, 1775)

Pazin, June 5th, 1982; Vela Traba, June 5th, 2008; Draga, June 20th, 2009.

Melitaea phoebe (Denis & Schiffermüller, 1775)

Pazin, June 2th, 1982; Vela Traba, July 22th, 2006; Draga, June 20th, 2009.

Melitaea trivialis (Denis & Schiffermüller, 1775)

Pazin, June 12th, 1982; Vela Traba, June 2nd, 2008.

Melitaea didyma (Esper, 1778)

Pazin, June 30th, 1982; Vela Traba, June 27th, 2006; Draga, June 20th, 2009; Beram, August 29th, 2007.

Melitaea aurelia Nickerl, 1850

Pazin, 1982.

Limenitis camilla (Linnaeus, 1758)

Vela Traba, June 15th, 2002; Draga, June 20th, 2009; Zarečki krov, July, 2008.

Limenitis reducta Staudinger, 1901

Pazin, July 13th, 1982; Vela Traba July 9th, 2001; Draga, July, 2001.

Apatura ilia (Denis & Schiffermüller, 1775)

Pazin, July 18th, 2010.

Pararge aegeria (Linnaeus, 1758)

Pazin, April 17th, 1982.; Pazin, August 11th, 1982; Vela Traba, June 12th, 2007; Beram, July, 2001; Draga, June, 2001; Zarečki krov, July, 2008.

Lasionmanta megera (Linnaeus, 1767)

Pazin, July 8th, 1982; Pazin, July 23th, 1982; Vela Traba, July, 2008; Draga, July 2007.

Lasionmata maera (Linnaeus, 1758)

Pazin, June 6th, 1982; Vela Traba, June, 2008; Draga, July, 2008.

Lopinga achine (Scopoli, 1763)

Pazin, August 15th, 1982.

Coenonympha arcania (Linnaeus, 1761)

Pazin, June 9th, 1982; Vela Traba, July, 2008; Draga, June 20th, 2009.

Coenonympha pamphilus (Linnaeus, 1758)

Pazin, April 24th, 1982; Vela Traba, July, 2008; Draga, July, 2008; Beram, July, 2008.

Pyronia tithonus (Linnaeus, 1767)

Pazin, July 23th, 1982; Vela Traba, July 16th, 2008; Draga, June 20th, 2009.

Maniola jurtina (Linnaeus, 1758)

Pazin, June 10th, 1982; Vela Traba, June 2nd, 2008; Draga, July, 2008; Beram, June, 2008.

Melanargia galathea (Linnaeus, 1758)

Pazin, June 10th, 1982; Vela Traba, July 17th, 2001; Draga, June, 2007; Beram, July, 2008.

Minois dryas (Scopoli, 1763)

Pazin, July 29th, 1982; Vela Traba, June 28th, 2001.

Hypparchia fagi (Scopoli, 1763)

Pazin, July 5th, 1982; Vela Traba, June 2th, 2008; Draga, July, 2008.

Hypparchia semele (Linnaeus, 1758)

Pazin, July 1th, 1982; Vela Traba, June 15th, 2008; Draga, July, 2008; Beram, June, 2008.

Arethusana arethusa (Denis & Schiffermüller, 1775)

Pazin, August 13th, 1982; Vela Traba, July 29th, 2008.

Brintesia circe (Fabricius, 1775)

Pazin, July 4th, 1982; Vela Traba, July 14th, 2008; Draga, July, 2008.

Chazara briseis (Linnaeus, 1764)

Pazin, July 30th, 1982; Pazin, August 30th, 1982.

This shows the great diversity of butterflies in this region, which is expected because of plant cover diversity in central Istria (ŠUGAR, 1984). Our investigations contribute 13 species recorded for the first time in the Croatian part of Istria: *Pyrgus armoricanus* (Oberthur, 1910), *Carterocephalus palaemon* (Pallas, 1771), *Lycaena tityrus* (Poda, 1761), *Lycaena alciphron* (Rottemburg, 1775), *Satyrrium w-album* (Knoch, 1782), *Satyrrium pruni* (Linnaeus, 1758), *Cupido decolorata* (Staudinger, 1886), *Phengaris arion* (Linnaeus, 1758), *Phengaris alcon* (Denis & Schiffermüller, 1775), *Polyommatus amandus* (Schneider, 1792), *Polyommatus thersites* (Cantener, 1835), *Melitaea aurelia* Nickerl, 1850 and *Minois dryas* (Scopoli, 1763). Some more interesting data about e.g. *Papilio alexanor* Esper, 1799, *Leptidea sinapis* (Linnaeus, 1758), *Gonepteryx cleopatra* (Linnaeus, 1767), *Lopinga achine* (Scopoli, 1763) and others, are discussed in more detail.

STAUDER (1925) reports altogether 11 species for Pazin. Among these, *Papilio alexanor* Esper, 1799 and *Hipparchia statilinus* (Hufnagel, 1766) were not found in any of the surveyed sites. In the case of *H. statilinus* we expected its main distribution in the karst area along the western and southern coast of Istria, but the presence of *Papilio alexanor* in Istria and Croatia in general was not confirmed by any of the published studies in the last 50 years. From the other representatives of the Papilionidae family we found *Papilio machaon* and *Iphiclides podalirius* in all surveyed localities and in great numbers. *Zerynthia polyxena* was found only in Vela Traba and Draga, with only a few observed specimens.

We found 13 species of Pieridea around Pazin. Genital analysis of (ten) *Leptidea* specimens from Pazin showed that all were only *Leptidea sinapis*. The same results were obtained by LORKOVIĆ (1993) from three localities in Istria, showing the first preliminary results for the distribution of the sibling species *Leptidea reali* Reissinger, 1988 in Croatia. Currently, the only known record of *Leptidea reali* in the coastal part of Croatia is from Krk Island (HABELER, 2003). *Gonepteryx cleopatra* was found in great numbers around Pazin in 1982, but was not observed here in the years 2001 and onwards.

The most interesting species found in Pazin was Woodland Brown, *L. achine*, this being the second record for Istria, after Čepić polje (ŠAŠIĆ & MIHOČI, 2007). This species was caught only once in 1982, in the village of Mečari close to Pazin. According to previous findings, this species is rare in Croatia and further studies of the distribution of Woodland Brown in Istria are needed. Another two species that were caught only once in Pazin, in 1982 are *Nymphalis antiopa* (Linnaeus, 1758) and *M. aurelia* indicating changes of the faunistic composition of butterflies around Pazin in the last 20 years.

For Lycaenidae family, all the records by STAUDER (1925) were confirmed. However no fewer than six species were found in the years 1981 to 1986 alone, but not in recent surveys: *Scolitantides orion* (Pallas, 1771), *P. arion*, *P. alcon*, *Plebeius argyrognomon* (Bergsträsser, 1779), *Polyommatus dorylas* (Denis & Schiffermüller, 1775) and *P. thersites*. This loss of habitat specialist species certainly indicates habitat degradation in central Istria. On the other hand *L. tityrus*, found only in Beram and Vela Traba and *L. alciphron*, observed in several occasions at Vela Traba, are new additions to the fauna of central Istria.

STAUDER (1925) mentions only three species of Skippers (Hesperiidae) for Pazin: *Heteropterus morpheus* (Pallas, 1771), *Thymelicus sylvestris* (Poda, 1761) and *Thymelicus lineola* (Ochsenheimer, 1808). During our research, we confirmed the presence of these species and found an additional seven species. *Hesperia comma* (Linnaeus, 1758), *P. armoricanus* and *S. sertorius* were found only during the surveys in the 1980-is.

Of the all species found during our study period, 10 are listed in the Red List of Butterflies of Croatia (ŠAŠIĆ & KUČINIĆ, 2004). These are *P. alcon* (CR), *Glaucopsyche alexis* (NT), *H. morpheus* (NT), *S. orion* (NT), *Euphydryas aurinia* (DD), *L. achine* (DD), *P. arion* (DD), *M. aurelia* (DD), *Pseudophilotes vicrama* (Moore, 1865) (DD) and *Thymelicus acteon* (Rottemburg, 1775) (DD). Also, seven species are listed in the Red List of European Butterflies (VAN SWAAY *et al.*, 2010): *P. arion* (EN), *L. achine* (VU), *T. acteon* (NT), *P. dorylas* (NT), *P. vicrama* (NT), *Hipparchia fagi* (Scopoli, 1763) (NT) and *M. aurelia* (NT).

With respect to threatened species, a new locality for the rare and local *P. alcon* is very interesting, because it is the third confirmed site of this species in Croatia (ŠAŠIĆ, 2004; MIHOČI *et al.*, 2007). Three specimens of *P. alcon* were collected in June 1982, on a grassy meadow with *Gentiana pulmonata* near Pazin, but their presence there could not be confirmed by surveys in the years 2001 to 2010. Actually, mesophilous habitats seem to have been completely destroyed by infrastructure and agricultural improvements. Similar habitats in the wider surroundings of Pazin should be checked for presence of this species. Also, *P. arion* and *M. aurelia* were found only once, in 1982, and yet suitable dry grasslands enabling the survival of this species are still present in the wider surroundings. The only species of conservation

Tab. 2. Differences in butterfly species observed between the two research periods.

Species	1981–1986	2001–2010
<i>Spialia sertorius</i> (Hoffmannsegg, 1804)	•	
<i>Pyrgus armoricanus</i> (Oberthür, 1910)*	•	
<i>Carterocephalus palaemon</i> (Pallas, 1771)*		•
<i>Hesperia comma</i> (Linnaeus, 1758)	•	
<i>Zerynthia polyxena</i> (Denis & Schiffermüller, 1775)		•
<i>Gonepteryx cleopatra</i> (Linnaeus, 1767)	•	
<i>Lycaena tityrus</i> (Poda, 1761)*		•
<i>Lycaena alciphron</i> (Rottemburg, 1775)*		•
<i>Satyrrium pruni</i> (Linnaeus, 1758)*		•
<i>Lampides boeticus</i> (Linnaeus, 1767)		•
<i>Syntarucus pirithous</i> (Linnaeus, 1767)		•
<i>Cupido decolorata</i> (Staudinger, 1886)*		•
<i>Scolitantides orion</i> (Pallas, 1771)	•	
<i>Phengaris arion</i> (Linnaeus, 1758)*	•	
<i>Phengaris alcon</i> (Denis & Schiffermüller, 1775)*	•	
<i>Plebeius argyrognomon</i> (Bergsträsser, 1779)	•	
<i>Polyommatus dorylas</i> (Denis & Schiffermüller, 1775)	•	
<i>Polyommatus amandus</i> (Schneider, 1792)*		•
<i>Polyommatus thersites</i> (Cantener, 1834)*		•
<i>Nymphalis antiopa</i> (Linnaeus, 1758)	•	
<i>Melitaea aurelia</i> Nickerl, 1850*	•	
<i>Apatura ilia</i> (Denis & Schiffermüller, 1775)		•
<i>Lopinga achine</i> (Scopoli, 1763)	•	
<i>Chazara briseis</i> (Linnaeus, 1764)	•	

*Species recorded for the first time in Istria

concern that forms large and viable populations in the region is *E. aurinia*. It was found in three out of five researched localities; Pazin (1982), Vela Traba (2001–2010) and Draga (2008). It was very common in all three localities. Interesting is to note that 14 species (Tab. 2) have been recorded for the first time in Istria, which demonstrates still further how poorly Istria is researched.

Altogether 15 species recorded either by STAUDER (1925) or in the period between 1981 and 1986 were not found in surveys in the last decade. This means that 14% of the species possibly went extinct during the last 20 years. Reasons for this could be habitat loss due to abandonment or conversion to arable land or urban areas, but probably climate change and other factors as well. To confirm that all those species have disappeared in central Istria, additional surveys in the wider area should be carried out in the future. However, we expect that future monitoring will confirm our result showing the rapidly decline of butterfly diversity in the Pazin environment.

ACKNOWLEDGMENTS

We would like to thank Dr. Nikola Tvrčković for great help with the preparation of this manuscript as well as two anonymous reviewers.

Received July 29, 2009

REFERENCES

- HABELER, H., 2003: Die Schmetterlinge der Adria-insel Krk. Esperiana, Buchreihe zur Entomologie, Graz, pp. 221.
- JAKŠIĆ, P., 1988: Privremene karte rasprostranjenosti dnevnih leptira Jugoslavije. Jugoslaven-sko entomološko društvo. Posebna izdanja **1**, pp. 214.
- KOSMAČ, M. & VEROVNIK, R., 2009: First record of *Cacyreus marshalli* (Lycaenidae) from the Balkan Peninsula. *Nota lepidopterologica* **32** (1), 81–82.
- KUČINIĆ, M., TVRČKOVIĆ, N. & KLETEČKI, E., 1999: The False ringlet (*Coenonympha oedippus* F.) is a member of the Croatian butterfly fauna after all. *Nat. Croat.* **8** (4), 399–407.
- LORKOVIĆ, Z., 1993: *Leptidea reali* Reissinger 1989 (=lorkovici Real 1988) a new European species (Lepid., Pieridae). *Nat. Croat.* **2** (1), 1–27.
- MIHOČI, I., TVRČKOVIĆ, N. & ŠAŠIĆ, M., 2005: Grecian copper *Lycaena ottomanus* (Lefèbvre, 1830) (Lepidoptera, Lycaenidae) – A new species in the Croatian butterfly fauna. *Nat. Croat.* **14** (4), 255–262.
- MIHOČI, I., VAJDIĆ, M. & ŠAŠIĆ, M., 2006: The status of the Damon Blue *Polyommatus (Agrodiaetus) damon* (Denis and Schiffermüller, 1775) (Papilionoidea: Lycaenidae, Polyommata) in the Croatian butterfly fauna. *Nat. Croat.* **15** (1–2), 15–25.
- MIHOČI, I., DELIĆ, A., GJURAŠIN, B., BUČAR, M. & KUČINIĆ, M., 2007: First finding of the critically endangered butterfly *Maculinea alcon* (Denis & Schiffermüller, 1775) (Lepidoptera: Lycaenidae) in the Pannonian part of Croatia. *Nat. Croat.*, **16** (1), 19–28.
- MIHOČI, I. & ŠAŠIĆ, M., 2009: Occurrence of the satyrine butterfly *Lasiommata petropolitana* (Fabricius, 1787) confirmed in Croatia. *Nat. Croat.* **18** (1), 175–180.
- STAUDER, H., 1925: Die Schmetterlingsfauna der Illyro-Adriatischen Festland- und Inselzone. (Faunula Illyro-Adriatica). *Zeitschrift für wissenschaftliche Insektenbiologie* **20**, 191–226.
- ŠAŠIĆ, M., 2004: Inventarizacija roda *Maculinea* i prijedlozi za zaštitu njihovih staništa na području Nacionalnog parka Plitvička jezera. In: PAVLUS, N. *et al.* (eds.), *Plitvički bilten* 6: 71–81.
- ŠAŠIĆ, M. & KUČINIĆ, M., 2004: Danji leptiri. In: MARKOVIĆ, D. (ur.) *Crveni popis ugroženih biljaka i životinja Hrvatske*. Državni zavod za zaštitu prirode, Zagreb, 71–74.
- ŠAŠIĆ, M. & MIHOČI, I., 2007: New findings of the wood brown *Lopinga achine* (Scopoli, 1763) (Lepidoptera: Nymphalidae: Satyrinae) in Croatia. *Entomol. Croat.* **11** (1–2), 63–67.
- ŠUGAR, I., 1984: Novi pogledi na biljni pokrov i biljnogeografsku rasčlanjenost Istre. *Acta Bot. Croat.* **43**, 225–234.
- TOLMAN, T. & LEWINGTON, R., 2008: *Butterflies of Britain & Europe*. Harper Collins Publishers, London, pp. 384.
- VAN SWAAY, C., CUTTELOD, A., COLLINS, S., MAES, D., LOPEZ MUNGUIRA, M., ŠAŠIĆ, M., SETTELE, J., VEROVNIK, R., VERSTRAEL, T., WARREN, M., WIEMERS, M. & WYNHOF, I., 2010: *European Red List of Butterflies*, Luxembourg: Publications Office of the European Union.

S A Ž E T A K

**Fauna danjih leptira (Hesperioidea & Papilionidea)
središnje Istre (Hrvatska)**

T. Koren & Lj. Ladavac

Istraživanje danjih leptira na području Pazina odvijalo se u dva razdvojena vremenska perioda; od 1981. do 1986. godine, kada je istraživanje vršeno samo na području Pazina te od 2001. do 2010. godine, kada se istraživanje odvijalo i na četiri dodatna lokaliteta (Zarečki krov, Beram, Limska Draga i Vela Traba). Istraživanjem danjih leptira zabilježene su ukupno 102 vrste, a uz dvije vrste koje se navode u literaturi (STAUDER, 1925) dolazimo do broja od ukupno 104 vrsta, ili 55% faune Hrvatske. U dosada objavljenoj literaturi jedino je STAUDER (1925) posjetio navedeno područje Pazina te je zabilježio 11 vrsta danjih leptira. Zanimljivo je da od tih 11 vrsta, dvije vrste nismo uspjeli potvrditi našim istraživanjem; *Papilio alexanor* i *Hipparchia statilinus*. Tijekom prvog perioda istraživanja zabilježena je ukupno 91 vrsta leptira, od kojih 13 vrsta nismo uspjeli ponovno potvrditi u drugom periodu istraživanja. Neke od njih su već i tada bile vrlo rijetke, poput *Nymphalis antiopa* ili *Phengaris arion*, no vrste poput *Gonepteryx cleopatra* i *Chazara briseis* bile su vrlo raširene i mnogobrojne. To ukazuje na promjenu u sastavu vrsta na istraživanom području u periodu od 20 godina. Upitno je da li su sve vrste koje nismo uspjeli pronaći uistinu nestale s područja Pazina, no nestanak i degradacija njihovih staništa, pogotovo livada, ukazuje na tu mogućnost. Glavni uzroci ugroženosti su urbanizacija, sukcesija livada, isušivanje potoka i intenzivna poljoprivreda. Daljnjim faunističkim istraživanjima potrebno je potvrditi ili opovrgnuti trenutnu prisutnost vrsta poput južnog lastinog repa (*Papilio alexanor*) na području Pazina.