

**CONTRIBUTION TO THE KNOWLEDGE  
OF THE BUTTERFLY FAUNA (INSECTA: LEPIDOPTERA)  
OF THE ADRIATIC ISLAND HVAR, CROATIA**

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**Abstract** - The island of Hvar was one of the first Adriatic islands visited by entomologists in the first half of the 19<sup>th</sup> century. The data however, are scattered among several papers and no systematic study of the island's butterflies exist. In 2011 and 2013, we conducted three visits to the island and recorded 49 butterfly species on 29 localities. Eight species are new records for the island: *Nymphalis antiopa*, *Melitaea cinxia*, *Cacyreus marshalli*, *Callophrys rubi*, *Lycaena thersamon*, *Scolitantides orion*, *Polyommatus bellargus* and *Pyrgus malvae*. The most interesting find is *L. thersamon*, which has not been recorded previously on any Adriatic island. It is a rare species and possibly threatened in Croatia. Together with all published records, the butterfly fauna of Hvar amounts to 57 species. This ranks Hvar in fourth place among the Adriatic islands in terms of butterfly diversity.

**KEY WORDS:** fauna, butterflies, Lepidoptera, Croatia, Hvar, biodiversity, distribution, *Lycaena thersamon*

**Izvleček** - PRISPEVEK K POZNAVANJU FAVNE DNEVNIH METULJEV (INSECTA: LEPIDOPTERA) JADRANSKEGA OTOKA HVARA, HRVAŠKA

Otok Hvar je bil med prvimi jadranskimi otoki, ki so ga entomologi - predvsem metuljarji, začeli obiskovati že v prvi polovici 19. stoletja. Vse do danes favna otoka ni bila sistematično preučevana, dosedanje najdbe se nanašajo le na posamezne obiske entomologov. V letih 2011 in 2013 smo v okviru treh odprav na otok

zabeležili 49 vrst metuljev iz 29 lokalitet. 8 vrst je novih za favno Hvara: *Nymphalis antiopa*, *Melitaea cinxia*, *Cacyreus marshalli*, *Callophrys rubi*, *Lycaena thersamon*, *Scolitantides orion*, *Polyommatus bellargus* and *Pyrgus malvae*. Najdba vrste *L. thersamon* predstavlja celo prvi podatek za jadranske otoke. Na Hrvaškem je ta vrsta redka in ogrožena. Za otok Hvar je bilo skupno doslej zabeleženih 57 vrst dnevnih metuljev, kar Hvar uvršča na četrto mesto po pestrosti dnevnih metuljev med vsemi jadranskimi otoki.

KLJUČNE BESEDE: favna, metulji, Lepidoptera, Hrvaška, Hvar, pestrost, razširjenost, *Lycaena thersamon*

## Introduction

The entomological excursions on the Island of Hvar (Lesina in Italian) have a quite long tradition. One of the first entomologists traveling through Dalmatia, also to Hvar, was the German collector Germar. In his paper on Dalmatian fauna Germar (1814) mentions only one, but very notable butterfly species for Hvar- *Charaxes jasius* (Linnaeus, 1767). Hvar attracted the attention of many other entomologists, who visited the island in a period from the beginning of the 20<sup>th</sup> century to the present (e.g. Galvagni, 1902; Galvagni, 1909b; Stauder, 1911; Wermers, 1982; Reinhardt, 1990; Withrington, 2008). All this were occasional visits without any systematic faunistical surveys. Another problem regarding the data from the old literature is a lack of detailed information on exact finds. In many cases there is no precise data on localities, and the island is cited as a single locality instead (e.g. Germar, 1814; Stauder, 1911). The comparison of historical and recent data is difficult especially in the case of rare and ecologically specialized species. According to Withrington & Verovnik (2008) the butterfly fauna of the island of Hvar is still insufficiently known. The aim of our paper is to contribute to better knowledge of the butterfly fauna of the island. We summarize all the known data of the butterflies of the island of Hvar and present new records.

## Materials and methods

### Study area

The island of Hvar belongs to the group of middle-sized Dalmatian Islands. Hvar is the fourth largest Croatian island with a surface area of 299.7 km<sup>2</sup> (Duplančić et al., 2004). It is surrounded by Brač Island to the north and Šćedro, Vis, Pakleni otoci and Korčula to the south. The island is 68 km long, while it's widest part measures only 10.5 km. The highest peak of the island is Sv. Nikola (628 m). Hvar is characterized by Mediterranean climate: mild winters and dry, hot summers with many sunny days almost without any precipitation. The mean annual precipitation is only 759 mm, while the mean annual temperature is 16.2° C (Mihovilović, 1995). The months with the highest precipitation are November and December, each with 130-150 mm. The vegetation on the island belongs to the eumediterranean vegetation zone, and consists mostly of maquis, small pine forests on karstic rocky pastures. Natural fires



**Fig. 1.** Abandoned lavender plantations around Humac are important nectar source for butterflies in dry summer. Photo: S. Gomboc.



**Fig. 2.** Dry karstic grasslands with shrubs overgrows from the fire-devastated areas, between Sučuraj and Selca. Photo: S. Gomboc.





**Fig. 3.** Shrubs on the south exposed rocky pastures near Zavala. Photo: S. Gomboc.

are frequent on the island due to the long summer drought. There are several natural springs and natural and human made ponds scattered around the island, however humid grasslands are not present. A large proportion of the island is also cultivated, with olive trees, vineyards and now abandoned lavender plantations.

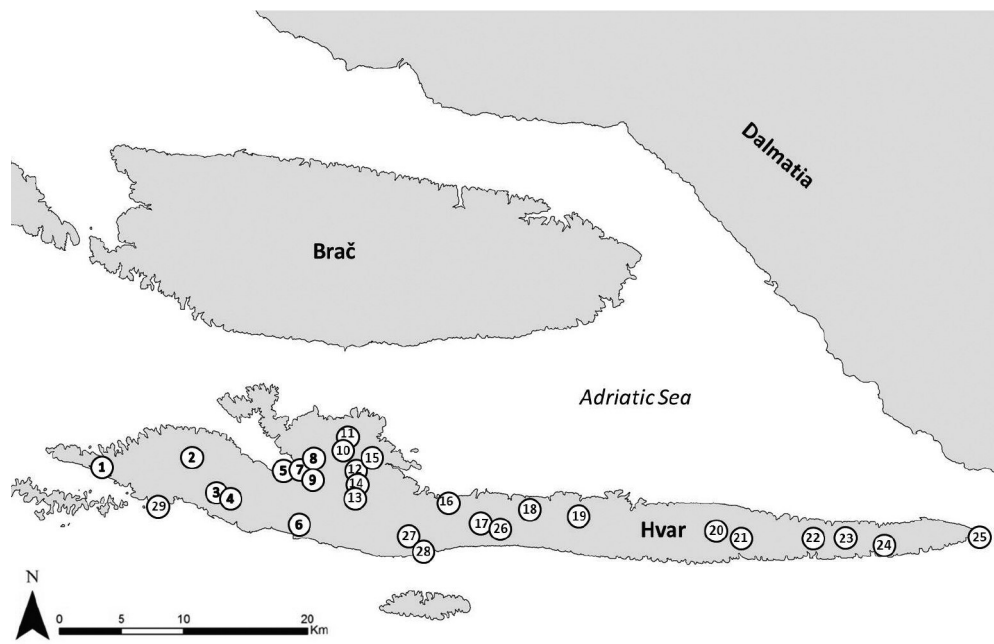
### **Data collection**

Data were collected during three field excursions to the island: 2<sup>nd</sup>-8<sup>th</sup> of May 2011, 19<sup>th</sup>-25<sup>th</sup> of September 2011 and from 25<sup>th</sup> of June to 6<sup>th</sup> of July 2013. A total of 29 localities were surveyed across the island (Tab. 1). Butterflies were observed and identified on the field or caught by an entomological net, identified and released afterwards. Only a few specimens were collected, for later identification or dissection (e.g. *Leptidea* spp., *Pyrgus* spp.). Butterflies were identified using standard identification literature (Tolman & Lewington, 2008). For some specimens the genital structure was checked for determination using Lorković (1993) and Higgins (1975).

The species' names follow Fauna Europaea (Karsholt & Nieuwerkerken, 2011).

**Table 1.** List of the surveyed localities on the island of Hvar.

|    | <b>Locality</b>                           | <b>UTM</b> | <b>N</b> | <b>E</b> | <b>Habitat type</b>                              | <b>Dates</b>                         |
|----|---|------------|----------|----------|--|--------------------------------------|
| 1  | Hvar, above the city of Hvar              | XH18       | 43.18205 | 16.42551 | dry karstic grasslands with shrubs               | 4.5.2011                             |
| 2  | Hvar, Brusje                              | XH28       | 43.18978 | 16.50103 | dry karstic grasslands with shrubs               | 4.5.2011                             |
| 3  | Hvar, Velo Grablje                        | XH28       | 43.17092 | 16.52624 | dry karstic grasslands with shrubs, forest edge  | 21.9.2011                            |
| 4  | Hvar, Selce - Stari Grad, near Sv. Vid    | XH28       | 43.16730 | 16.54216 | dry karstic grasslands with shrubs               | 2.5.2011                             |
| 5  | Hvar, Stari Grad, Kamp Jurjevac           | XH28       | 43.17963 | 16.58134 | dry karstic grasslands with shrubs               | 2.5.2011                             |
| 6  | Hvar, Sv. Nikola                          | XH27       | 43.14581 | 16.59631 | dry karstic grasslands with shrubs               | 7.5.2011,<br>19.9.2011               |
| 7  | Hvar, Starigradsko polje                  | XH28       | 43.17915 | 16.59875 | dry karstic grasslands with shrubs               | 2.5.2011                             |
| 8  | Hvar, Starigradsko polje 2                | XH38       | 43.18632 | 16.61436 | dry karstic grasslands with shrubs               | 5.5.2011                             |
| 9  | Hvar, 600 m E from Dol                    | XH38       | 43.16851 | 16.60786 | dry karstic grasslands with shrubs               | 8.5.2011,<br>21.9.2011               |
| 10 | Hvar, Starigradsko polje, pond Dračevica  | XH38       | 43.18876 | 16.63488 | dry karstic grasslands with shrubs, olive groves | 2.5.2011                             |
| 11 | Hvar, Starigradsko polje, toward Jurjevac | XH38       | 43.19769 | 16.63641 | dry karstic grasslands with shrubs, olive groves | 8.5.2011,<br>20.9.2011               |
| 12 | Hvar, Vrbanj                              | XH38       | 43.17265 | 16.64132 | dry karstic grasslands with shrubs               | 5.5.2011                             |
| 13 | Hvar, Vrisnik                             | XH38       | 43.15447 | 16.64263 | dry karstic grasslands with shrubs, forest edge  | 6.5.2011                             |
| 14 | Hvar, Svirče - Dol                        | XH38       | 43.16470 | 16.64056 | dry karstic grasslands with shrubs               | 6.5.2011                             |
| 15 | Hvar, Vrbanj, Mala blača                  | XH38       | 43.17907 | 16.65541 | dry karstic grasslands with shrubs               | 2.5.2011                             |
| 16 | Hvar, Jelsa                               | XH38       | 43.15714 | 16.72197 | dry karstic grasslands with shrubs, maquis       | 8.5.2011                             |
| 17 | Hvar, 1 km W from Humac                   | XH47       | 43.14120 | 16.74990 | dry karstic grasslands with shrubs               | 5.5.2011                             |
| 18 | Hvar, Poljica, near the pond Svirak       | XH48       | 43.15058 | 16.79562 | dry karstic grasslands with shrubs, olive groves | 4.5.2011                             |
| 19 | Hvar, Zastražišće, around the village     | XH57       | 43.14404 | 16.84691 | dry karstic grasslands with shrubs, maquis       | 5.5.2011,<br>20.9.2011,<br>29.6.2013 |
| 20 | Hvar, Gdinj, pond                         | XH57       | 43.13190 | 16.95751 | dry karstic grasslands with shrubs               | 6.5.2011                             |
| 21 | Hvar, Bogomolje                           | XH67       | 43.13105 | 16.98651 | dry karstic grasslands with shrubs               | 5.5.2011                             |
| 22 | Hvar, Zaglav-Selca kod Bogomolja          | XH67       | 43.12938 | 17.04724 | dry karstic grasslands with shrubs, maquis       | 5.5.2011                             |
| 23 | Hvar, Selca kod Bogomolja                 | XH67       | 43.12854 | 17.07906 | dry karstic grasslands with shrubs               | 6.5.2011                             |
| 24 | Hvar, Selca kod Bogomolja - Sućuraj       | XH77       | 43.12473 | 17.11170 | dry karstic grasslands with shrubs               | 4.5.2011                             |
| 25 | Hvar, Sućuraj                             | XH77       | 43.12653 | 17.19263 | dry karstic grasslands with shrubs               | 5.5.2011,<br>29.6.2013               |
| 26 | Hvar, Humac                               | XH47       | 43.1400  | 16.7600  | dry karstic grasslands with shrubs, maquis       | 1.7.2013                             |
| 27 | Hvar, Zavala, south slope                 | XH37       | 43.1300  | 16.6900  | dry karstic grasslands with shrubs, maquis       | 1.7.2013                             |
| 28 | Hvar, Zavala                              | XH37       | 43.1200  | 16.7000  | dry karstic grasslands with shrubs               | 1.7.2013                             |
| 29 | Hvar, Hvar city                           | XH18       | 43.1700  | 16.4400  | ruderal vegetation and gardens                   | 27.6.2013                            |



**Fig. 4.** Map of surveyed localities on the island of Hvar. The numbers correspond to the list of localities in the table.

## Results

During the three excursions to the island, we recorded 49 butterfly species (Tab. 2). The number of species per locality varied between 1 and 33, depending on the observation period and vegetation. Eight species are new to the fauna of Hvar: *Nymphalis antiopa*, *Melitaea cinxia*, *Cacyreus marshalli*, *Callophrys rubi*, *Lycaena thersamon*, *Scolitantides orion*, *Polyommatus bellargus* and *Pyrgus malvae*. The most interesting find is *L. thersamon*, which is recorded for the first time for the Adriatic islands.

## Discussion

Unlike some other larger Adriatic islands, where only few data on butterflies exists (e.g. Lastovo, Šolta) (Withrington & Verovnik, 2008), data about butterflies of Hvar were published in 19 different papers. Unfortunately, many of those papers include only a single species record for the island (Germar, 1814; Stauder, 1911; Lorković, 1971; Lorković, 1974; Lorković, 1976; Sijarić, 1991; Jakšić, 1993). Up to 10 species records were published in Galvagni, 1909; Stauder, 1921; Stauder, 1922; Stauder, 1923; Mladinov, 1973; Wermers, 1982; Hensle, 2008; Lorković, 2009. Only a few papers include more than 10 records (Galvagni, 1902- 13 records; Galvagni, 1935- 23 records; Reinhardt, 1990- 29 records; Withrington, 2008- 33 records).



Our survey contributed records for 49 species, which is the highest number so far. Of the eight newly recorded species, the presence of *L. thersamon* was the least expected. Historically this species was present in the larger part of northern Croatia, including the Zagreb area (Vukotinović, 1879; Grund, 1916; Taušanović, 1954; Lorković, 2009), Varaždin (Taborsky, 1910; Marčec, 2008), several areas in Slavonia (Bonatch, 1892; Abafy-Aigner, 1896; Koča, 1901; Gussich, 1917; Lorković, 2009) and Baranja (Krčmar et al., 1996). Almost all these literature records are more than 50 years old, including recent publications of Marčec (2008) and Lorković (2009), where the authors present records from the first half of the 20<sup>th</sup> century. Only a single recent record is known from northeastern Croatia from Drava river area between Legrad and Donji Miholjac, but without specified locality (Abraham, 2008). Aside from northeastern Croatia, this species was also recorded in several localities in the southern part of the country, Dalmatia (Mann, 1869; Wermers, 1982; Koren et al., 2011; Mihoci et al., 2011). *L. thersamon* was never before recorded on any Adriatic island (Wittrington & Verovnik, 2008; Verovnik, 2011). On Hvar only a single female specimen was recorded near the village Dol. The population on the Island of Hvar requires ad-



**Fig. 5.** Larva and male of geranium bronze (*Cacyreus marshalli*) on *Pelargonium peltatum* in Zavala. Photo: S. Gomboc.



ditional studies to see if the species has a permanent population on the island or our record represents vagrant stray individual from the mainland.

The record of an invasive species, *C. marshalli*, was somewhat expected as this species has spread in the last decade almost throughout the whole Adriatic coast and many Adriatic islands (Kučinić et al., 2013). It was recorded in two localities on the island, with more than 20 observed adult specimens and also as caterpillars feeding on geraniums - *Pelargonium* sp. Adult specimens were observed in urban areas and near surroundings, feeding both on geraniums and wild plant species.

Two species recorded on Hvar, *Nymphalis antiopa* and *Scolitantides orion*, had previously been known only from two Adriatic islands. *S. orion* has previously been reported from the island of Krk (Habeler, 2003) and Mljet (Kučinić et al., 2010), while *N. antiopa* was known only from Brač (Stauder, 1922) and Mljet (Kučinić et al., 2010). While *S. orion* is a common species in Dalmatia, *N. antiopa* is a much more local species, usually confined to the mountain and coline areas (Koren and Gomboc, pers. obs).



One species, quoted for the island of Hvar by Withrington & Verovnik (2008), needs to be excluded from the fauna of Hvar. The authors report *Tarucus balkanica* (Freyer, 1844) based on a publication of Galvagni (1909). In his paper however, Galvagni (1909) reports *T. balkanica* only from Vis island (Galvagni used the Italian name for the island - Lissa) and does not mention any other records. No records for this species for Hvar were found in any other publication. It is possible that this Mediterranean species occurs on Hvar island, but for now, it is still not confirmed.

Additional 8 species, known from the literature, were not confirmed during this study: *Polyommatus thersites*, *Satyrum spini*, *Leptotes pirithous*, *Aphantopus hyperantus*, *Hypparchia syriaca*, *Pyronia cecilia*, *Gegenes pumilio* and *Gegenes nostradamus*. Some of the mentioned species could possibly be recorded with additional visits to the island, especially in June and July. In case of closely related *H. fagi* and *H. H. syriaca*, additional surveys and studies are recommended. In literature both species are reported from the island but we were not able to find both during our visits, only *H. fagi*. It could be that the authors did not take into account the separation of these two closely related species, or misidentified the specimens.

With these new additions and the exclusion of one species, the total number of butterflies known for the island of Hvar is 57. Only few Adriatic islands have a higher butterfly diversity. Krk Island, with 104 known species (Verovnik, 2011), is probably the best-studied island, surveyed by Habeler (2003) and other lepidopterozoologists. Krk is followed by Brač with 74 species, Cres and Lošinj with 70, and now Hvar with 57 species (Withrington & Verovnik, 2008). With those, Mljet, Pašman and Ugljan are the only larger islands with newly published records. So far 49 species were recorded on Mljet (Kučinić et al., 2010), 50 on Pašman and 43 on Ugljan (Verovnik, 2011).

The first record of *L. thersamon* for the Adriatic islands raises the number of species occurring on the islands to 122, which represents 62.5 % of all the butterfly species known from Croatia (Šašić & Mihoci, 2011).

One of the nearest islands, the Island of Brač, situated approx. 2 km north of Hvar has an additional 25 butterfly species not yet recorded on Hvar. Since the vegetation and climate of both islands are very similar, it is possible that many of these 25 species could be found also on the island of Hvar in the future. For seven of them the occurrence on the island of Brač is highly doubtful (Withrington & Verovnik, 2008). The other 18 species known from Brač, but not from Hvar island are: *Aporia crataegi* (Linnaeus, 1758), *Pieris napi* (Linnaeus, 1758), *Euchloe ausonia* (Hübner, 1804), *Gonepteryx cleopatra* (Linnaeus, 1767), *Aglais io* (Linnaeus 1758), *Argynnis adippe* ([Denis & Schiffermuller], 1775), *Argynnis niobe* (Linnaeus, 1758), *Melitaea athalia* (Rottemburg, 1775), *Euphydryas aurinia* (Rottemburg, 1775), *Melanargia galathea* (Linnaeus, 1758), *Melanargia larissa* (Geyer, 1828), *Chazara briseis* (Linnaeus, 1764), *Tarucus balkanica* (Freyer, 1844), *Plebejus idas* (Linnaeus 1761), *Polyommatus dorylas* ([Denis & Schiffermuller], 1775), *Erynnis tages* (Linnaeus, 1758), *Thymelicus acteon* (Rottemburg, 1775), *Ochlodes sylvanus* (Esper 1777). Since all the mentioned species are present on Brač and on the nearby mainland (Jakšić, 1988) there is a high possibility that they occur also on Hvar.

## Conclusions

Hvar is the fourth largest Adriatic island, and also the fourth richest in butterfly species. In this study additional eight butterfly species are reported for the island, with *L. thersamon* for the first time for the Adriatic islands. The high number of butterflies indicates a high diversity of habitats and host plants on the Hvar island. Future surveys may still reveal additional species for the island, as some of them are already known from the neighboring islands and the mainland.

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## References

- Abafi-Ainger, L., Pavel, J., Uhryk, F.**, 1896: Fauna Regni Hungariae. Lepidoptera. *Regia Societas Scientiarum Naturalium Hungarica*: 1-82.
- Ábrahám, L.**, 2008: Baseline survey and biological monitoring of butterflies (Lepidoptera) in Croatian areas along the Drava river. *Biodiversity studies along the Drava river*: 237-248.
- Bohatsch, O.**, 1892: Beiträge zur Lepidopteren-Fauna Slavoniens. *Wiener Entomologischen Vereines* 2: 31-50.
- Duplančić Leder, T., Ujević, T., Čala, M.**, 2004: Duljine obalne crte i površine otoka na hrvatskom dijelu Jadranskog mora određene s topografskih karata mjerila 1:25 000. *Geoadria* 9(1): 5-32.
- Galvagni, E.**, 1902: Beiträge zur Kenntnis der Fauna einiger dalmatischer Inseln. *Verhandlungen zoologisch-botanischen Gesellschaft in Wien* 52: 362-380.
- Galvagni, E.**, 1909: Die zoologische Reise des Naturwissenschaftlichen Vereines nach Dalmatien im April 1906 (Beiträge zur Kenntnis der Lepidopterenfauna der Adriatischen Inseln). *Sonder-Abdruck aus den Mitteilungen des Naturwissenschaftlichen Vereines der Universität Wien* 7: 154-254.
- Galvagni, E.**, 1935: Ergänzung zur Kenntnis der Schmetterlings-fauna von Hvar (Lesina). *Sonder-Abdruck aus den Mitteilungen des Naturwissenschaftlichen Vereines auf der Universität Wien* 84: 118-121.
- Germar, E.**, 1814: Reise durch Österreich und Tyrol nach Dalmatien und Ragusa. Brockhaus, Leipzig, 1: 273-280.
- Grund, A.**, 1916: Beiträge zur kroatischen Lepidopteren-Fauna. *Glasnik hrvatskog prirodoslovnog društva* 28(1-2): 95-105, (3-4): 114-168.
- Gussich, B.**, 1917: Ein Beitrag zur Schmetterlingsfauna Kroatiens. *Glasnik hrvatskog prirodoslovnog društva* 29(3-4): 209-225.

- Habeler, H.**, 2003: Die Schmetterlinge der Adria-Insel Krk. Eine ökofaunistische Studie. Delta Druck, Verlag Heinz Peks, Graz: 1-221.
- Hensle, J.**, 2008: Papilionidae, Pieridae, Nymphalidae und Lycaenidae 2007. *Atalanta* 39(1-4): 13-154.
- Higgins, L. G.**, 1975: The classification of European butterflies. Collins, London: 1-320.
- Jakšić, P.**, 1988: Karte rasprostranjenja dnevnih leptira Jugoslavije. Jugoslovensko entomološko društvo, posebno izdanje 1, Zagreb: 1-125.
- Jakšić, P.**, 1993: The M. Rogulja collection of the Rhopalocera (Lepidoptera) from the former state of Yugoslavia. *Entomologist's Gazette* 44: 85-95.
- Karsholt, O., Nieukerken, E.J. van** (Ed.) 2011: Lepidoptera. Fauna Europaea version 2.4, <http://www.faunaeur.org> (visited 10.2013).
- Koča, Gj.**, 1901: Prilog fauni leptira (Lepidoptera) Hrvatske i Slavonije. *Glasnik hrvatskog naravoslovnog društva*, 13: 1-67.
- Koren, T., Bjelić, M., Božinovska, E., Štih, A., Burić, I.**, 2011: Contribution to the knowledge of butterfly fauna (Lepidoptera: Rhopalocera) of Zrmanja River region Croatia. *Acta Entomologica Slovenica* 19(2): 155-168.
- Krčmar, S., Merdić, E., Vidović, S.**, 1996: Danji leptiri Baranje (Lepidoptera, Rhopalocera) prilog poznavanju leptira Hrvatske. *Poljoprivreda* 2(1-2): 33-40.
- Kučinić, M., Mihoci, I., Tvrtković, N., Šašić, M., Bojanić-Varezić, D., Joković, S., Mazija, M., Popijač, A.**, 2010: Raznolikost danjih leptira (Insecta: Lepidoptera, Rhopalocera) otoka Mljeta. In: Benović, A. & Durbešić, P. (eds.) Proceedings of the Symposium Branimir Gušić Days: 111-125.
- Kučinić, M., Koren, T., Mihoci, I., Vuković, M., Jakovljević, T., Jenčić, S.**, 2013: Can spreading of the Geranium Bronze *Cacyreus marshalli* (Butler, 1898) (Insecta, Lepidoptera, Lycaenidae) in Croatia be assigned to climate change? *Periodicum Biologorum* (in press).
- Lorković, Z.**, 1971: *Gegenes nostradamus* F. and *G. pumilio* Hffgg. on the eastern Adriatic coast. *Acta Entomologica Jugoslavica* 7(2): 56.
- Lorković, Z.**, 1974: Die Verteilung der Variabilität von *Hipparchia statilinus* Hufn. (Lepidoptera, Satyridae) in Beziehung zum Karstboden des ostadriatischen Küstenlandes. *Acta Entomologica Jugoslavica* 10(1-2): 41-53.
- Lorković, Z.**, 1976: Taxonomische, ökologische und chorologische Beziehungen zwischen *Hipparchia fagi* Scop., *H. syriaca* Stgr. und *H. alcyone* D.&S. (Lepidopt. Satyridae). *Acta Entomologica Jugoslavica* 12(1-2): 11-33.
- Lorković, Z.**, 1993: *Leptidea reali* Reissinger 1989 (=lorkovici Real 1988), a new European species (Lepid., Pieridae). *Natura Croatica* 2(1): 1-26.
- Lorković, Z.**, 2009: The Rhopalocera Fauna of Croatia with Special Respect to the Fauna of Plitvice Lakes. *Entomologia Croatica* 13(1): 15-78.
- Mann, J.**, 1869: Lepidopteren gesammelt während dreier reisen nach Dalmatien in den Jahren 1850, 1862 und 1868. *Verhandlungen zoologisch-botanischen Gesellschaft in Wien* 19: 371-388.
- Marčec, V.**, 2008: Dnevni leptiri (Insecta, Rhopalocera) zbirke Franje Koščeca Gradskog muzeja Varaždin i komparacija s današnjim stanjem istraživanog područja.



- In: Vargović, E. & A. Bregović (eds.) Franjo Košćec i njegovo djelo 1882.–1968. Zbornik radova sa znanstvenog skupa održanog 13. i 14. studenog 2008. u Varaždinu. Hrvatska akademija znanosti i umjetnosti, Zavod za znanstveni rad u Varaždinu: 103-128.
- Mihoci, I., Hršak, V., Kućinić, M., Mićetić Stanković, V., Deliћ, A., Tvrtković, N.,** 2011: Butterfly diversity and biogeography on the Croatian karst mountain Biokovo: Vertical distribution and preference for altitude and aspect. *European Journal of Entomology* 108: 623-633.
- Mihovilović, M. A.,** 1995: Otok Hvar, Matica hrvatska, Zagreb: 1-512.
- Mladinov, L.,** 1973: Lepidoptera (Rhopalocera) zbirki Hrvatskog narodnog zoološkog muzeja u Zagrebu. *Hrvatski narodni zoološki muzej* 8: 1-125.
- Reinhardt, R.,** 1990: Beitrag zur Tagfalterfauna der mitteldalmatinischen Adriaküste (Lepidoptera, Papilionoidea). *Nachrichten des entomologischen Vereins Apollo. Neue Folgen* 11(2): 113-117.
- Sijarić, R.,** 1991: Katalog naučne zbirke Lepidoptera (Insecta) donatora Bore Mihljevića iz Sarajeva. *Glasnik Zemaljskog muzeja Bosne i Hercegovine. Prirodne nauke, Nova serija, Sarajevo*, 30: 169-360.
- Stauder, H.,** 1911: Beiträge zur Kenntnis der Makrolepidopteren-Fauna der adriatischen Küstengebiete. *Bollettino della Società Adriatica di Scienze Naturali in Trieste* 25(2): 93-120.
- Stauder, H.,** 1921: Die Schmetterlingsfauna der illyro-adriatischen Festland- und Inselzone (Faunula Illyro-Adriatica). *Zeitschrift für wissenschaftliche Insektenbiologie Berlin* 16(1/2): 16-23; (3/4): 43-49; (5/6): 101-108; (7/8): 143-153; (9/10): 166-176; (11/12): 219-224.
- Stauder, H.,** 1922: Die Schmetterlingsfauna der illyro-adriatischen Festland- und Inselzone (Faunula Illyro-Adriatica). *Zeitschrift für wissenschaftliche Insektenbiologie Berlin* 17(1/2): 14-21, (3/4): 58-64, (5/6): 83-92, (7/8): 135-147, (9/12): 165-176.
- Stauder, H.,** 1923: Die Schmetterlingsfauna der illyro-adriatischen Festland- und Inselzone (Faunula Illyro-Adriatica.). *Zeitschrift für wissenschaftliche Insektenbiologie Berlin* 18(1/2): 10-18, (3/4): 58-68, (5/7): 106-114, (8/9): 187-202, (10/11): 253-267, (12): 317-327.
- Šašić, M., Mihoci, I.,** 2011: Annotated checklist of Croatian butterflies with vernacular names. *Natura Croatica* 20(2): 425-436.
- Taborsky, V.,** 1910: Eine grössere Sammeltour im slavischen Süden. *Entomologische Zeitschrift*, 23(51): 224, 230; 24(4): 18-19, 24-25.
- Taušanović, S.,** 1954: Dnevni leptiri zagrebačke okolice. Diplomski rad. Prirodoslovno - matematički fakultet Sveučilišta u Zagrebu, Zoologijski zavod, Zagreb: 1-28.
- Tolman, T., Lewington, R.,** 2008: Butterflies of Britain & Europe. Harper Collins Publishers, London: 1-384.
- Verovnik, R.,** 2011: Butterflies (Lepidoptera: Rhopalocera) of the Croatian islands: an update on published records and new surveys of Pašman and Ugljan. *Entomologist's Gazette* 62: 251-263.

- Vukotinović, Lj.**, 1879: Fauna leptirah u okolišu zagrebačkom. *Jugoslavenska akademija znanosti i umjetnosti* 48: 1-130.
- Wermers, M.**, 1982: Tagfalterbeobachtungen in Dalmatien/Jugoslawien. *Atalanta* 13(3): 217-224.
- Withrington, D.**, 2008: Butterflies of the island of Hvar, Croatia. *The Bulletin of the Amateur Entomologists' Society* 67(480): 193-196.
- Withrington, D. K. J., Verovnik, R.**, 2008: Butterflies (Rhopalocera) of the Croatian islands. *Entomologist's Gazette* 59: 3-25.

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Table 2. List of butterfly species recorded on the Island of Hvar.

| Species list   | Localities visited in this study (2011, 2013)*          | Literature records  |
|--|---|---|
| <b>Papilionidae</b>  |   |   |
| 1. <i>Papilio machaon</i> Linnaeus, 1758                   | 2, 3, 5, 6, 7, 9, 11, 14, 16, 19, 26, 27, 28, 29        | Galvagni (1902), Galvagni (1935), Wermers (1982), Reinhardt (1990), Withrington (2008)                  |
| 2. <i>Iphiclidia podalirius</i> (Linnaeus, 1758)           | 4, 5, 9, 11, 15, 16, 17, 19, 20, 21, 23, 25, 26, 27, 29 | Galvagni (1902), Galvagni (1935), Reinhardt (1990), Withrington (2008)                                  |
| <b>Pieridae</b>  |   |   |
| 3. <i>Pieris brassicae</i> (Linnaeus, 1758)                | 5, 6, 8, 9, 14, 21                                      | Galvagni (1902), Galvagni (1935), Reinhardt (1990),   |
| 4. <i>Pieris rapae</i> (Linnaeus, 1758)                    | 5, 6, 9, 11, 13, 14, 15, 19, 23, 25, 26                 | Galvagni (1902), Galvagni (1935), Reinhardt (1990), Withrington (2008)                                  |
| 5. <i>Pieris ergane</i> (Geyer, 1828)                      | 9, 19, 20, 29   | Galvagni (1909), Stauder (1921), Withrington (2008)   |
| 6. <i>Pieris mannii</i> (Mayer, 1851)                      | 3, 6, 9, 12, 14, 19, 21, 28                             | Reinhardt (1990), Withrington (2008)  |
| 7. <i>Pontia edusa</i> (Fabricius, 1777)                   | 3, 6, 14, 15, 19  | Galvagni (1935), Reinhardt (1990), Withrington (2008)   |
| 8. <i>Anthocharis cardamines</i> (Linnaeus, 1758)          | 4, 6, 9, 12, 14, 17, 19, 20, 24                         | Galvagni (1909)   |
| 9. <i>Leptidea sinapis</i> (Linnaeus, 1758)                | 4, 5, 6, 9, 13, 16, 19, 26                              | Reinhardt (1990), Withrington (2008)  |
| 10. <i>Colias croceus</i> (Fourcroy, 1785)                 | 3, 6, 8, 9, 14, 15, 17, 19, 26, 27, 28                  | Galvagni (1902), Stauder (1921), Galvagni (1935), Reinhardt (1990), Hensle (2008), Withrington (2008)   |
| 11. <i>Gonepteryx rhamni</i> (Linnaeus, 1758)              | 5, 6, 9, 15, 16, 23, 25, 26                             | Withrington (2008)  |
| <b>Nymphalidae</b>   |   |   |
| 12. <i>Libythea celtis</i> (Laicharting, 1782)             | 12  | Withrington (2008)  |
| 13. <i>Charaxes jasius</i> (Linnaeus, 1767)                | 9, 26, 27, 28   | Germar (1814), Galvagni (1902), Galvagni (1935), Reinhardt (1990), Jakšić (1993), Lorković (2009)       |
| 14. <i>Limnitis reducta</i> Staudinger, 1901               | 6, 9, 13, 16, 19, 20, 21, 23, 25, 26, 27, 28, 29        | Reinhardt (1990), Withrington (2008), Lorković (2009)   |
| 15. <i>Nymphalis antiopa</i> (Linnaeus, 1758)**            | 9   | /   |
| 16. <i>Vanessa atalanta</i> (Linnaeus, 1758)               | 3, 5, 6, 7, 8, 9, 14, 15, 18, 19, 22                    | Galvagni (1902), Galvagni (1935), Wermers (1982), Reinhardt (1990), Withrington (2008)                  |
| 17. <i>Vanessa cardui</i> (Linnaeus, 1758)                 | 3, 6, 9, 14, 19, 20, 26, 27                             | Galvagni (1902), Galvagni (1935), Mladinov (1973), Wermers (1982), Withrington (2008)                   |
| 18. <i>Polygonia egea</i> (Cramer, 1775)                   | 11, 28  | Galvagni (1902), Galvagni (1935), Mladinov (1973), Wermers (1982), Reinhardt (1990), Withrington (2008) |
| 19. <i>Argynnis pandora</i> (Denis & Schiffermüller, 1775) | 6, 9, 15, 19, 26  | Mladinov (1973), Withrington (2008)   |



|     | Species list   | Localities visited in this study (2011, 2013)*   | Literature records   |
|-----|--|--|--|
| 20. | <i>Issoria lathonia</i> (Linnaeus, 1758)             | 6, 8, 9, 19, 26  | Withington (2008)  |
| 21. | <i>Melitaea cinxia</i> (Linnaeus, 1758)**            | 16   | /  |
| 22. | <i>Melitaea didyma</i> (Esper, 1778)                 | 3, 6, 19   | Withington (2008), Lorković (2009)   |
| 23. | <i>Hipparchia fagi</i> (Scopoli, 1763)               | 9  | Galvagni (1902), Galvagni (1909), Stauder (1922), Galvagni (1935), Mladinov (1973), Lorković (1976), Reinhardt (1990), Withington (2008) |
| 24. | <i>Hipparchia syriaca</i> (Staudinger, 1871)         |  | Wermers (1982), Reinhardt (1990), Withington (2008)  |
| 25. | <i>Hipparchia semele</i> (Linnaeus, 1758)            | 6, 26  | Galvagni (1902), Stauder (1923), Galvagni (1935), Withington (2008)  |
| 26. | <i>Hipparchia statilinus</i> (Hufnagel, 1766)        | 9, 19  | Stauder (1922), Mladinov (1973), Lorković (1974), Wermers (1982)   |
| 27. | <i>Satyrus ferula</i> (Fabricius, 1793)              | 26, 27   | Galvagni (1909), Galvagni (1935), Reinhardt (1990), Withington (2008)  |
| 28. | <i>Maniola jurtina</i> (Linnaeus, 1758)              | 3, 6, 9, 11, 19, 25  | Galvagni (1935), Reinhardt (1990), Withington (2008)   |
| 29. | <i>Aphantopus hyperantus</i> (Linnaeus, 1758)        |  | Reinhardt (1990)   |
| 30. | <i>Pyronia cecilia</i> (Vallantini, 1894)            |  | Galvagni (1935), Withington (2008), Lorković (2009)  |
| 31. | <i>Coenonympha pamphilus</i> (Linnaeus, 1758)        | 1, 2, 3, 4, 5, 9, 10, 11, 12, 13, 14, 15, 16, 17, 19, 20, 21, 22, 23, 24, 25, 28, 29   | Galvagni (1902), Stauder (1923), Galvagni (1935), Reinhardt (1990), Withington (2008)  |
| 32. | <i>Pararge aegeria</i> (Linnaeus, 1758)              | 9  | Galvagni (1902)  |
| 33. | <i>Lasiommata megera</i> (Linnaeus, 1767)            | 1, 2, 3, 4, 6, 7, 8, 9, 11, 12, 14, 15, 16, 17, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28 | Stauder (1922), Reinhardt (1990), Withington (2008)  |
| 34. | <i>Lasiommata maera</i> (Linnaeus, 1758)             | 6, 9, 11, 19   | Stauder (1922), Galvagni (1935), Reinhardt (1990), Lorković (2009)   |
|     | <b>Lycenidae</b>                                     |  |  |
| 35. | <i>Satyrium ilicis</i> (Esper, 1779)                 | 19, 26   | Galvagni (1935), Reinhardt (1990), Sijarić (1991)  |
| 36. | <i>Satyrium spini</i> (Denis & Schiffermüller, 1775) |  | Withington (2008)  |
| 37. | <i>Cacyreus marshalli</i> Butler, 1898**             | 28, 29   | /  |
| 38. | <i>Callophrys rubi</i> (Linnaeus, 1758)**            | 4, 6, 16, 17, 19   | /  |
| 39. | <i>Lycæna phlaeas</i> (Linnaeus, 1761)               | 9, 19  | Galvagni (1935), Reinhardt (1990), Withington (2008)   |
| 40. | <i>Lycæna thersamon</i> (Esper, 1784)**              | 9  | /  |
| 41. | <i>Lampides boeticus</i> (Linnaeus, 1767)            | 3, 6, 9  | Galvagni (1902), Stauder (1923), Galvagni (1935), Hensle (2008), Lorković (2009)   |

| Species list   | Localities visited in this study (2011, 2013)* | Literature records  |
|--|--|---|
| 42. <i>Leptotes piritihous</i> (Linnaeus, 1767)            | /  | Reinhardt (1990)  |
| 43. <i>Cupido minimus</i> (Fuessly, 1775)                  | 28   | Withrington (2008)  |
| 44. <i>Celastrina argiolus</i> (Linnaeus, 1758)            | 6, 9   | Stauder (1923), Reinhardt (1990), Withrington (2008), Lorković (2009) |
| 45. <i>Glaucopsyche alexis</i> (Poda, 1761)                | 6, 9, 10, 11, 16, 19, 20, 24                   | Stauder (1923)  |
| 46. <i>Iolana iolas</i> (Ochsenheimer 1816)                | 4, 6   | Reinhardt (1990), Withrington (2008)                                  |
| 47. <i>Pseudophilotes vicrama</i> (Moore, 1865)            | 2, 19  | Lorković (2009)   |
| 48. <i>Scolitantides orion</i> (Pallas, 1771)**            | 4, 6, 7, 14, 16, 19, 20, 21                    | /   |
| 49. <i>Aricia agestis</i> ([Denis & Schiffermüller], 1775) | 2, 3, 5, 6, 9, 10, 11, 12, 14, 15, 19, 23      | Galvagni (1935), Reinhardt (1990), Withrington (2008)                 |
| 50. <i>Polyommatus bellargus</i> (Rottemburg, 1775)**      | 4, 6, 19                                       | /   |
| 51. <i>Polyommatus icarus</i> (Rottemburg, 1775)           | 2, 3, 4, 6, 9, 11, 14, 19, 23, 24              | Stauder (1923), Galvagni (1935), Reinhardt (1990), Withrington (2008) |
| 52. <i>Polyommatus theristes</i> (Cantener, 1835)          |  | Lorković (2009)   |
| <b>Hesperiidae</b>   |  |   |
| 53. <i>Pygus malvae</i> (Linnaeus, 1758)**                 | 5  | /   |
| 54. <i>Spialia orbifer</i> (Hübner, 1823)                  | 4, 8, 11, 14, 15, 21, 22, 23                   | Galvagni (1935), Reinhardt (1990), Lorković (2009)                    |
| 55. <i>Carcharodus alceae</i> (Esper, 1780)                | 6, 19, 26                                      | Galvagni (1990), Wermers (1982), Reinhardt (1990), Withrington (2008) |
| 56. <i>Gegenes nostradamus</i> (Fabricius, 1793)           |  | Stauder (1911)  |
| 57. <i>Gegenes pumilio</i> (Hofmannsegg, 1804)             |  | Lorković (1971)   |
| Number of recorded species:                                | 49   |   |

\*The locality number corresponds to the localities given in the Materials and methods section.

\*\*Newly recorded for the island.