CONTRIBUTION TO THE BUTTERFLY FAUNA (HESPERIOIDEA & PAPILIONOIDEA) OF THE VELEBIT MOUNTAIN, CROATIA

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During the years 2005 and 2006, 106 butterfly species were identified on Mt. Velebit. The estimated distribution, diversity and biogeographical characteristics of each species are presented in this paper as well as a comparison between recently estimated butterfly fauna and that identified in the past century. Current check-list of 137 butterflies from Mt. Velebit is contained in the Appendix.

Key words: butterflies, fauna, distribution, diversity, protection, Mt. Velebit

INTRODUCTION

With a length of 145 km, Mt. Velebit is the longest mountain of the Dinaric Alps. It spreads from the Vratnik pass above Senj in the north-west to the Zrmanja River in the south-east. Average distance from the coastal area to the Lika continental bed is 14 kilometres. The coastal slope of the mountain is much steeper, distinctly craggy and bare with two distinct longitudinal terraces. The continental slope is much gentler but can be abrupt, mostly forested and overgrown in vegetation, mostly without terraces, but with deeply truncated valleys (Forenbacher, 2001). Of an area of 2274 km² only 41 km² refers to the vertical zone above 1600 m a.s.l. (Poljak, 1974).

In all, the important characteristics of Mt. Velebit are its low indentedness, abrupt slopes, significant daily temperature variations, and mixed continental, Mediter-
ranean and mountainous climate regimes and a combination of central European and Mediterranean vegetation. On Mt. Velebit different ecological and climatic characteristics have conditioned high biotope diversity which has, respectively, ensured high faunistic, and hence butterfly diversity.

According to Kučinić et al. (1995) the butterfly fauna of the Mt. Velebit comprises 115 species. This number is based on the analysis of entomological collections from the Croatian National History Museum (CNHM) in Zagreb and all the existing literature referring to the butterfly fauna of Mt. Velebit.

The goal of this paper is to contribute to the knowledge about the butterfly diversity of Mt. Velebit and to supply a new butterfly check-list for Mt. Velebit.

MATERIAL AND METHODS

Butterflies were collected with an entomological net, observed and photographed in the years 2005 and 2006 at 70 localities on Mt. Velebit (Fig. 1). All collected

![Fig. 1. Researched area – Mt Velebit, Croatia](image-url)
Tab. 1. Alphabetical list of researched locations, belonging to the Sjeverni Velebit National Park (*), the Velebit Nature Park (**) and the Paklenica National Park (***) altitude of each locality and number of found species on each locality (coordinates are given for unprecisely defined localities).

<table>
<thead>
<tr>
<th>Ordinal number</th>
<th>Location</th>
<th>Number of found species</th>
<th>Altitude (m a.s.l.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>above Borisov dom mt. hut ***</td>
<td>7</td>
<td>513</td>
</tr>
<tr>
<td>2.</td>
<td>above Dundović Padež* (5504095/4953163)</td>
<td>14</td>
<td>1328</td>
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<tr>
<td>3.</td>
<td>after Brušane (direction B. Oštarije)**</td>
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<td>6.</td>
<td>Babić Siča*</td>
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<tr>
<td>7.</td>
<td>Babino jezero***</td>
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<td>Babrovača*</td>
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<td>918</td>
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<td>Bačić Duliba**</td>
<td>24</td>
<td>856</td>
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<td>10.</td>
<td>Bakovac**</td>
<td>20</td>
<td>927</td>
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<tr>
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<td>Baške Oštarije**</td>
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<td>Borisov dom mt. hut***</td>
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<td>Brušane**</td>
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<td>Bužim**</td>
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<td>Dabarska kosa**</td>
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<td>Ježera**</td>
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<td>Kubus**</td>
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<td>Ljubica creek (near Baške Oštarije)**</td>
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<td>Malovan (M. stanovi)***</td>
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<td>Malovansko jezero***</td>
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<td>Modrić dolac*</td>
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<td>Parič***</td>
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<td>Položine**</td>
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<td>Raduč**</td>
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<td>Šarinač*</td>
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<td>Štirovača*</td>
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<td>Sunderac**</td>
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<td>Težakovačko vrelo**</td>
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<td>to Bakovac** (5512086 / 4947771)</td>
<td>19</td>
<td>732</td>
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<td>54.</td>
<td>to Bužim** (5523605 / 4934126)</td>
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<td>573</td>
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<td>to Dabarska kosa** (5510043 / 4934381)</td>
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<td>to Klementa** (5508949 / 4946193)</td>
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<td>to Kugina kuća mt. hut* (5507427 / 4939824)</td>
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<td>58.</td>
<td>to Mala Močila*** (5539584 / 4910035)</td>
<td>2</td>
<td>700</td>
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<td>to Malovan (M. stanovi) *** (5542584 / 4913056)</td>
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<td>60.</td>
<td>to Oltari** (5500070 / 4966717)</td>
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<td>933</td>
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<td>to Sijasetska draga **</td>
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<td>62.</td>
<td>Trnovac**</td>
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<td>617</td>
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<td>Tudorevo*</td>
<td>19</td>
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<td>64.</td>
<td>turn to Pandore** (5498757 / 4970426)</td>
<td>18</td>
<td>849</td>
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<td>65.</td>
<td>turn to Zavižan mt. hut* (5500070 / 4966717)</td>
<td>17</td>
<td>999</td>
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<td>66.</td>
<td>Velika Močila***</td>
<td>14</td>
<td>826</td>
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<td>67.</td>
<td>Veliki Javornik***</td>
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<td>68.</td>
<td>Veliki Lubenovac*</td>
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<td>1302</td>
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<td>69.</td>
<td>Vučjak*</td>
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<td>1594</td>
</tr>
<tr>
<td>70.</td>
<td>Žive Vodice*</td>
<td>41</td>
<td>1254</td>
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</tbody>
</table>
specimens are deposited in the butterfly collection of the Department of Zoology, CNHM, in Zagreb. Systematics follows KARSHOLT & RAZOWSKI (1996) and taxonomic determination regarding wing morphology was done according to TOLMAN & LEWINGTON (1997). Biogeographical analysis follows HRUBY (1964) and for species that were not listed there, it follows SJARIĆ et al. (1984) and HIGGINS & RILEY (1993). The analysis of the morphological characteristics of the genitals of specimens from the Leptidea genus was done according to LORKOVIĆ (1993), JAKŠIĆ (1998), LELO (2002) and LELO (2003).

Altitudes were approximately determined using the GPS device Garmin eTrex Summit and geographical sheet maps of Mt. Velebit (1:25000).

RESULTS

In the two year period we counted 106 species belonging to five butterfly families at 70 localities (Tab. 1). Species are listed according to the systematics by KARSHOLT & RAZOWSKI (1996) and the list of localities for each species is given in chronological order of the finding species at a particular finding site.

In parentheses beside the species name, the number of stars indicates the presence of the species in the: * – Northern Velebit National Park, ** – Velebit Nature Park and *** – Paklenica National Park. We have recorded 69 species for the Northern Velebit National Park, 96 species for the Velebit Nature Park and 55 species for the Paklenica National Park.

Hesperioidea

Hesperiidae (6 species)

Pyrginae

Erynnis tages (Linnaeus, 1758) (**):
to Oltari, June 17th, 2005.

Carcharodus floccifera (Zeller, 1847) (*):

Hesperiinae

Thymelicus lineola (Ochsenheimer, 1808) (* / **):

Thymelicus sylvestris (Poda, 1761) (* / ** / ***):

Hesperia comma (Linnaeus, 1758) (* / **):

Papilionoidea

**Papilionidae (4 species)**

**Parnassiinae**

**Parnassius mnemosyne** (Linnaeus, 1758) (* / **): Ljubica, June 18th, 2005; to Dabarska kosa, June 18th, 2005; Dabarska kosa, June 18th, 2005; Štirovača, June 18th, 2005; Jezera, July 26th, 2005; Tudorevo, July 19th, 2006; Vučjak, July 20th, 2006.


**Papilioninae**

**Iphiclides podalirius** (Linnaeus, 1758) (* / ** / ***): to Oltari, June 17th, 2005; turn to Pandore, June 17th, 2005; Ljubica, June 18th, 2005; to Dabarska kosa, June 18th, 2005; Dabarska kosa, June 18th, 2005; Konjsko, June 18th, 2005; Šrica, July 25th, 2005; Dabarska kosa, July 27th, 2005; Kubus, July 28th, 2005; Anača Luka, August 1st, 2005; Babrovača, July 20th, 2006; forest hut Paklenica NP, July 27th, 2006.


**Pieridae (11 species)**

**Dismorphiinae**

Pierinae
Antocharini

*Antocharis cardamines* (Linnaeus, 1758) (* / **):
Borovački Padež, June 18th, 2005; Babić Siča, June 17th, 2005; to Dabarska kosa, June 18th, 2005.

Pierini

*Aporia crataegi* (Linnaeus, 1758) (* / **):
Švica, June 16th, 2005; turn to Pandore, June 17th, 2005; to Oltari, June 17th, 2005; Ljubica, June 18th, 2005; to Dabarska kosa, June 18th, 2005; Dabarska kosa, June 18th, 2005; Apatišan, July 26th, 2005; Sunđerac, July 28th, 2005; Trnovac, June 20th, 2006; Trnovac, June 23rd, 2006; Jadovno, June 23rd, 2006; Jadovno, July 6th, 2006; to Bužim, July 6th, 2006; Bužim, July 6th, 2006; Ljubica, July 6th, 2006; Bužim, July 7th, 2006; to Bakovac, July 7th, 2006; Bakovac, July 7th, 2006; to Klementa, July 7th, 2006; Petrašića, July 7th, 2006; Štirovača, July 7th, 2006; Veliki Lubenovac, July 19th, 2006; Glamočevoa Duliba, July 20th, 2006; Žive Vodice, July 20th, 2006; Ciganjšte, July 20th, 2006; Bačić Duliba, July 20th, 2006.

*Pieris brassicae* (Linnaeus, 1758) (* / ** / ***):
to Oltari, June 17th, 2005; Ljubica, June 18th, 2005; Sunđerac, July 28th, 2005; to Bakovac, July 7th, 2006; Bakovac, July 7th, 2006; Veliki Lubenovac, July 19th, 2006; Glamočevoa Duliba, July 20th, 2006; to Sijasetska draga, July 26th, 2006; Malovan (M. stanovi), July 26th, 2006.

*Pieris mannii* (Mayer, 1851) (* / ** / ***):

*Pieris rapae* (Linnaeus, 1758) (* / ** / ***):

*Pieris ergane* (Geyer, 1828) (* / ** / ***):
Babić Siča, July 17th, 2005; Dabarska kosa, June 18th, 2005; Anića Luka, August 1st,
2005; Mala Močila, August 2nd, 2005; Ramići, August 26th, 2005, Trnovac, June 20th, 2006; above Dundović Padež, July 19th, 2006; Žive Vodice, July 20th, 2006.

**Pieris napi** (Linnaeus, 1758) (* / ** / ***):

Coliadinae

**Colias croceus** (Fourcroy 1785) (* / ** / ***):
Dabarska kosa, June 18th, 2005; Švica, July 25th, 2005; turn to Pandore, July 26th, 2005; Sunđerac, July 28th, 2005; Parići, August 26th, 2005; Petrašica, July 7th, 2006; above Dundović Padež, July 19th, 2006; Tudorevo, July 19th, 2006; Glamočeva Duliba, July 20th, 2006; Žive Vodice, July 20th, 2006; Šarinac, July 20th, 2006; to Sijasetska draga, July 26th, 2006; Bunovac, July 26th, 2006; Malovan (M. stanovi), July 26th, 2006; Bunovac, July 28th, 2006.

**Gonepteryx rhamni** (Linnaeus, 1758) (* / ** / ***):

**Gonepteryx cleopatra** (Linnaeus, 1767) (**):
Dabarska kosa, June 18th, 2005; Jezera, July 26th, 2005.

Lycaenidae (25 species)

Riodininae

**Hamearis lucina** (Linnaeus, 1758) (* / **):
Babić Sića, June 17th, 2005; to Oltari, June 17th, 2005; Dabarska kosa, June 18th, 2005.

Lycaeninae

**Lycaena virgaureae** (Linnaeus, 1758) (* / **):
Lycaena alciphron (Rottemburg, 1775) (**):  

Lycaena candens (Herrich-Schäffer, 1844) (* / **):  

Eumaeini  
Satyrium w-album (Knoch, 1782) (*):  

Satyrium pruni (Linnaeus, 1758) (**):  
Trnovac, June 20th, 2006.

Satyrium spini (Denis & Schiffermüller, 1775) (* / **):  

Satyrium ilicis (Esper, 1779) (**):  
Baške Oštarije, July 7th, 2006.

Polyommatini  
Cupido minimus (Fuessly 1775) (* / **):  

Cupido alcetas (Hoffmannsegg, 1804) (**):  

Celastrina argiolus (Linnaeus, 1758) (* / ** / ***):  

Scolitantides orion (Pallas, 1771) (** / ***):  
to Dabarska kosa, June 18th, 2005; Parići, August 2nd, 2005.

Glaucopsyche alexis (Poda, 1761) (**):  
Ljubica, June 18th, 2005.

Maculinea arion (Linnaeus, 1758) (* / **):  

Maculinea rebeli (Hirschke, 1904) (**):  
Jadovno, July 6th, 2006; Bakovac, July 7th, 2006.
Plebeius argus (Linnaeus, 1758) (** / ***):

Plebeius idas (Linnaeus, 1761) (**): Šćica, June 16th, 2005; Šćica, July 25th, 2006; Velika Močila, August 2nd, 2005.

Aricia agestis (Denis & Schiffermüller, 1775) (* / ** / ***):

Polyommatus semiargus (Rottemburg, 1775) (* / ** / ***):

Polyommatus dorylas (Denis & Schiffermüller, 1775) (** / ***):

Polyommatus amandus (Schneider, 1792) (* / ** / ***):
Dabarska kosa, June 18th, 2005; Jezera, July 26th, 2005; Jadovno, July 6th, 2006; Ljubica, July 6th, 2006; Petrašica, July 7th, 2006; Štirovača, July 7th, 2006; Tudorevo, July 19th, 2006; Veliki Lubenovac, July 19th, 2006; Glamočeva Duliba, July 20th, 2006; Žive Vodice, July 20th, 2006; Šarinač, July 20th, 2006; Bačić Duliba, July 21st, 2006; Malovan (M. stanovi), July 26th, 2006; Malovansko jezero, July 26th, 2006; Buncovac, July 28th, 2006.

Polyommatus icarus (Rottemburg, 1775) (* / ** / ***):
**Polyommatus daphnis** (Denis & Schiffermüller, 1775) (* / ** / ***):
Mala Močila, August 2\(^{nd}\), 2005; above Dundovič Padež, July 19\(^{th}\), 2006; Žive Vodice, July 20\(^{th}\), 2006; Ciganiste, July 20\(^{th}\), 2006; Šarinci, July 20\(^{th}\), 2006; Babrovača, July 20\(^{th}\), 2006; Duplje, July 20\(^{th}\), 2006; Dabarska kosa, July 21\(^{st}\), 2006; Bačić Duliba, July 21\(^{st}\), 2006; to Kugina kuća mt. hut, July 21\(^{st}\), 2006; Anića Luka, July 27\(^{th}\), 2006; Parići, July 27\(^{th}\), 2006.

**Polyommatus bellargus** (Rottemburg, 1775) (* / ** / ***):
to Oltari, June 17\(^{th}\), 2005; turn to Pandore, June 17\(^{th}\), 2005; Jezera, July 26\(^{th}\), 2005; Apatijan, July 26\(^{th}\), 2005; Parići, August 26\(^{th}\), 2005; Žive Vodice, July 20\(^{th}\), 2006; Parići, July 27\(^{th}\), 2006.

**Polyommatus coridon** (Poda, 1761) (* / ** / ***):
Dabarska kosa, July 27\(^{th}\), 2005; Ljubica, July 27\(^{th}\), 2005; Anića Luka, August 1\(^{st}\), 2005; Mala Močila, August 26\(^{th}\), 2005; Parići, August 26\(^{th}\), 2005; Ramići, August 26\(^{th}\), 2005; Tudorevo, July 19\(^{th}\), 2006; Žive Vodice, July 20\(^{th}\), 2006; Šarinci, July 20\(^{th}\), 2006; Babrovača, July 20\(^{th}\), 2006; Duplje, July 20\(^{th}\), 2006; Jadovno, July 21\(^{st}\), 2006; Malovan (M. stanovi), July 26\(^{th}\), 2006; Veliki Javornik, July 27\(^{th}\), 2006; Buljma (pass), July 27\(^{th}\), 2006; Anića Luka, July 27\(^{th}\), 2006; Jadovno, July 28\(^{th}\), 2006; Raduč, July 28\(^{th}\), 2006; Bunovac, July 28\(^{th}\), 2006.

**Nymphalidae** (60 species)
Libytheinae

**Libythea celtis** (Laicharting, 1782) (** / ***):
Konjško, June 18\(^{th}\), 2005; Ramici, August 26\(^{th}\), 2005; Težakovačko vrelo, July 21\(^{st}\), 2006.

Heliconiinae

**Argynnis paphia** (Linnaeus, 1758) (* / ** / ***):
Gornja Klada, June 17\(^{th}\), 2005; Švica, July 25\(^{th}\), 2005; Babić Siča, July 25\(^{th}\), 2005; turn to Zavižan mt. hut, July 26\(^{th}\), 2005; Oltari, July 26\(^{th}\), 2005; Apatišan, July 26\(^{th}\), 2005; Jezera, July 26\(^{th}\), 2005; Širovača, July 27\(^{th}\), 2005; Polozine, July 27\(^{th}\), 2005; Šprenga, July 27\(^{th}\), 2005; Ljubica, July 27\(^{th}\), 2005; Sunderac, July 28\(^{th}\), 2005; Anića Luka, August 1\(^{st}\), 2005; Borisov dom mt. hut, August 2\(^{nd}\), 2005; Mala Močila, August 2\(^{nd}\), 2005; Velika Močila, August 2\(^{nd}\), 2005; above Borisov dom mt. hut, August 26\(^{th}\), 2005; Parići, August 26\(^{th}\), 2005; Ramici, August 26\(^{th}\), 2005; Brušane, July 6\(^{th}\), 2006; Baške Oštarije, July 7\(^{th}\), 2006; Bužim, July 7\(^{th}\), 2006; Kosinski Bakovac, July 19\(^{th}\), 2006; Križiči, July 20\(^{th}\), 2006; Krivača, July 20\(^{th}\), 2006; Glamočeva Duliba, July 20\(^{th}\), 2006; Žive Vodice, July 20\(^{th}\), 2006; Ciganšte, July 20\(^{th}\), 2006; Duplje, July 20\(^{th}\), 2006; Baške Oštarije, July 21\(^{st}\), 2006; Dabarska kosa, July 21\(^{st}\), 2006; Bačić Duliba, July 21\(^{st}\), 2006; to Kugina kuća mt. hut, July 21\(^{st}\), 2006; Težakovačko vrelo, July 21\(^{st}\), 2006; Jadovno, July 21\(^{st}\), 2006; to Sijasetska draga, July 26\(^{th}\), 2006; forest hut Paklenica NP, July 27\(^{th}\), 2006; Borisov dom mt. hut, July 27\(^{th}\), 2006; Jadovno, July 28\(^{th}\), 2006; Raduč, July 28\(^{th}\), 2006.

**Argynnis pandora** (Denis & Schiffermüller, 1775) (**): turn to Pandore, June 17\(^{th}\), 2005; Šprenga, July 27\(^{th}\), 2005; Jadovno, July 6\(^{th}\), 2006.
Argynnis aglaja (Linnaeus, 1758) (* / ** / ***):

Argynnis adippe (Denis & Schiffermüller, 1775) (* / ** / ***):

Issoria lathonia (Linnaeus, 1758) (* / ** / ***):

Brenthis ino (Rottemburg, 1775) (* / **):

Brenthis daphne (Denis & Schiffermüller, 1775) (* / ** / ***):

Brenthis hecate (Denis & Schiffermüller, 1775) (* / **):
**Boloria euphrosyne** (Linnaeus, 1758) (* / **):  

**Boloria dia** (Linnaeus, 1767) (**):  

Nymphalinae  
Nymphalini

**Vanessa atalanta** (Linnaeus, 1758) (* / ** / ***):  

**Vanessa cardui** (Linnaeus, 1758) (* / ** / ***):  
Dabarska kosa, June 18th, 2005; Borovački Padež, June 18th, 2005; Štiroveča, July 27th, 2005; Kubus, July 25th, 2005; Jadovno, July 6th, 2006; to Bužim, July 6th, 2006; Bužim, July 6th, 2006; Brušane, July 6th, 2006; Ljubica, July 6th, 2006; Baške Oštarije, July 7th, 2006; Bužim, July 7th, 2006; to Bakovac, July 7th, 2006; Bakovac, July 7th, 2006; to Klementa, July 7th, 2006; Petrašica, July 7th, 2006; Štiroveča, July 7th, 2006; from Begovača to Krasišnica, July 7th, 2006; Kosinjski Bakovac, July 19th, 2006; above Dundović Padež, July 19th, 2006; Tudorevo, July 19th, 2006; Vučjak, July 20th, 2006; Križići, July 20th, 2006; Krivača, July 20th, 2006; Glamočeva Duliba, July 20th, 2006; Žive Vodice, July 20th, 2006; Sarinac, July 20th, 2006; Baške Oštarije, July 21st, 2006; Dabarska kosa, July 21st, 2006; Bačić Duliba, July 21st, 2006; to Kugina kuća mt. hut, July 21st, 2006; to Sijasetska draga, July 26th, 2006; Bunovac, July 26th, 2006; Malovan (M. stanovi), July 26th, 2006; Malovansko jezero, July 26th, 2006; forest hut Paklenica NP, July 27th, 2006; Jadovno, July 28th, 2006; Bunovac, July 28th, 2006.

**Inachis io** (Linnaeus, 1758) (* / ** / ***):  

**Aglais urticae** (Linnaeus, 1758) (* / **):  
Babić Sića, June 17th, 2005; turn to Pandore, June 17th, 2005; Vučjak, June 17th, 2005; Štiroveča, June 18th, 2005; Vučjak, July 25th, 2005; Apatišan, July 26th, 2005; to Kugina

**Polygonia c-album** (Linnaeus, 1758) (* / ** / ***):

**Polygonia egea** (Cramer, 1775) (* / ** / ***):

**Araschnia levana** (Linnaeus, 1758) (**):

**Nymphalis antiopa** (Linnaeus, 1758) (**):
Apatišan, July 26th, 2005.

**Nymphalis polychloros** (Linnaeus, 1758) (**):
Ljubica, June 18th, 2005; Dabarska kosa, June 18th, 2005; Konjsko, June 18th, 2005.

Melitaenini

**Euphydryas aurinia** (Rottemburg, 1775) (**):
Ljubica, June 18th, 2005; Trnovac, June 20th, 2006.

**Melitaea cinxia** (Linnaeus, 1758) (**):
Švica, June 16th, 2005; Ljubica, June 18th, 2005.

**Melitaea phoebe** (Denis & Schiffermüller, 1775) (**):

**Melitaea trivia** (Denis & Schiffermüller, 1775) (**):
to Bakovac, July 7th, 2006; Bakovac, July 7th, 2006.

**Melitaea didyma** (Esper, 1778) (**):
Švica, June 16th, 2005; turn to Pandore, June 17th, 2005; Ljubica, June 18th, 2005; Jadovno, July 6th, 2006; to Bakovac, July 7th, 2006.

**Melitaea diamina** (Lang, 1789) (**):
Trnovac, June 20th, 2006; Jadovno, July 6th, 2006.

**Melitaea aurelia** Nickerl, 1850 (**):
Švica, June 16th, 2005; Ljubica, June 18th, 2005; Borovački Padež, June 18th, 2005; Trnovac, June 23rd, 2006; Jadovno, June 23rd, 2006; Jadovno, July 6th, 2006; Petrašica, July 7th, 2006.

Melitaea athalia (Rottemburg, 1775) (* / **):

Limenitinae
Limenitis populi (Linnaeus, 1758) (**):

Limenitis reducta Staudinger, 1901 (* / ** / ***):

Neptis sappho (Pallas, 1771) (**):
to Dabarska kosa, June 18th, 2005.

Apaturinae
Apatura iris (Linnaeus, 1758) (** / ***):

Satyrinae
Elymniiini
Pararge aegeria (Linnaeus, 1758) (* / ***):

Lasioommata megera (Linnaeus, 1767) (** / ***):

Lasioommata maera (Linnaeus, 1758) (* / **):
to Oltari, June 17th, 2005; to Dabarska kosa, June 18th, 2005; Položine, July 27th, 2005; Kubus, July 28th, 2005; Bužim, July 7th, 2006; Bakovac, July 7th, 2006; from Begovača to Krasno, July 7th, 2006; above Dundović Padež, July 19th, 2006; Tudorevo,
Coenonymphini

**Coenonympha rhodopensis** Elwes, 1900 (* / **):
Babići Sića, June 17th, 2005; Dabarska kosa, June 18th, 2005; Borovački Padež, June 18th, 2005.

**Coenonympha arcania** (Linnaeus, 1761) (* / ** / ***):

**Coenonympha glycerion** (Borkhausen, 1788) (* / **):
Apatišan, July 26th, 2005; Sunderac, July 28th, 2005; Trnovac, June 23rd, 2006; Jadovno, June 23rd, 2006; Jadovno, July 6th, 2006; to Bužim, July 6th, 2006; Ljubica, July 6th, 2006; Baške Oštarije, July 7th, 2006; Bužim, July 7th, 2006; to Bakovac, July 7th, 2006; Bakovac, July 7th, 2006; Petrašica, July 7th, 2006.

**Coenonympha pamphilus** (Linnaeus, 1758) (* / ** / ***):
Štica, June 16th, 2005; Babići Sića, June 17th, 2005; to Oltari, June 17th, 2005; turn to Pandore, June 17th, 2005; Gornja Klada, June 17th, 2005; Ljubica, June 18th, 2005; Dabarska kosa, June 18th, 2005; Borovački Padež, June 18th, 2005; Parići, August 26th, 2005; Trnovac, June 20th, 2006; Bakovac, July 7th, 2006; Križići, July 20th, 2006; Čiganiste, July 20th, 2006; Duplje, July 20th, 2006; Dabarska kosa, July 21st, 2006; Malovan (M. stanovi), July 26th, 2006.

Maniolini

**Aphantopus hyperantus** (Linnaeus, 1758) (**):

**Maniola jurtina** (Linnaeus, 1758) (* / ** / ***):
Hyponephele lycaon (Rottemburg, 1775) (*):
Šarinac, July 20th, 2006; Babrovača, July 20th, 2006.

Hyponephele lupinus (O. Costa, 1836) (**):
Oltari, July 26th, 2005.

Erebiini

Erebia ligea (Linnaeus, 1758) (* / ** / ***):
Babići Sića, July 25th, 2005; turn to Zavižan mt. hut, July 26th, 2005; Apatišan, July 26th, 2005; Položine, July 27th, 2005; Sunderac, July 28th, 2005; to Bakovac, July 7th, 2006; Bakovac, July 7th, 2006; to Klementa, July 7th, 2006; from Begovača to Krasno, July 7th, 2006; above Dundović Padž, July 19th, 2006; Veliki Lubenovac, July 29th, 2006; Krizići, July 20th, 2006; Krivača, July 20th, 2006; Glamočeva Duliba, July 20th, 2006; Žive Vodice, July 20th, 2006; Čiganište, July 20th, 2006; Duplje, July 20th, 2006; to Kugina kuća mt. hut, July 21st, 2006; Težakovačko vrelo, July 21st, 2006; Malovan (M. stanovi), July 26th, 2006; Vunovac, July 28th, 2006.

Erebia euryale (Esper, 1805) (* / **):

Erebia epiphron (Knoch, 1783) (* / **):

Erebia aethiops (Esper, 1777) (** / ***):

Erebia medusa (Denis & Schiffermüller, 1775) (* / ** / ***):
Švica, June 16th, 2005; Babići Sića, June 17th, 2005; to Oltari, June 17th, 2005; turn to Pandore, June 17th, 2005; Ljubica, June 18th, 2005; Dabarska kosa, June 18th, 2005; Borovački Padež, June 18th, 2005; Ljubica, July 6th, 2006; Petrašica, July 7th, 2006; Štiroveča, July 7th, 2006; Tudorevo, July 19th, 2006; Krivača, July 20th, 2006; Malovan (M. stanovi), July 26th, 2006.

Erebia ottomana Herrich-Schäffer, 1847 (**/ ***):
Bunovac, July 26th, 2006; to Malovan (M. stanovi), July 26th, 2006; Malovan (M. stanovi), July 26th, 2006; Malovansko jezero, July 26th, 2006; Struge, July 27th, 2006; Bunovac, July 28th, 2006.

Erebia melas (Herbst, 1796) (* / ***):
above Dundović Padež, July 19th, 2006; Glamočeva Duliba, July 20th, 2006; Žive Vodice, July 20th, 2006; Malovan (M. stanovi), July 26th, 2006; Malovansko jezero, July 26th, 2006; Babino jezero, July 28th, 2006.

Erebia oeme (Hübner, 1804) (* / ** / ***):
Jezera, July 26th, 2005; Štiroveča, July 27th, 2005; Sunderac, July 28th, 2005; Ljubica,
July 6th, 2006; Petrašica, July 7th, 2006; Štirovača, July 7th, 2006; Malovan (M. stanoovi), July 26th, 2006.

Melanargiini

Melanargia galathea (Linnaeus, 1758) (* / ** / ***):

Satyrini

Satyrus ferula (Fabricius, 1793) (*):

Hipparchia fagi (Scopoli, 1763) (* / ** / ***):

Hipparchia syriaca (Staudinger, 1871) (* / ** / ***):
- Štica, July 25th, 2005; turn to Zavižan mt. hut, July 26th, 2005; Oltari, July 26th, 2005; to Mala Močila, August 2nd, 2005; Mala Močila, August 2nd, 2005; Velika Močila, August 2nd, 2005; Parići, August 26th, 2005; Ramići, August 26th, 2005; to Bakovac, July 7th, 2006; Babrovača, July 20th, 2006; Dabarska kosa, July 21st, 2006; Borisov dom mt. hut, July 27th, 2006.

Hipparchia semele (Linnaeus, 1758) (* / ** / ***):
Arethusa arethusa (Denis & Schiffermüller, 1775) (**): Parići, August 2nd, 2005; Ramići, August 26th, 2005.


Biogeographical characteristics of species determined on Mt. Velebit are given in Table 2 and Table 3. Biogeographical analysis has revealed the dominance of the Eurosibirean (62.26%), Oriental (14.15%) and Mediterranean (13.21%) biogeographical elements.

DISCUSSION

Faunistic analysis

The total of 106 butterfly species found on Mt. Velebit in 2005 and 2006 represents 55.80% of the Croatian butterfly fauna, which has altogether 190 species (MIHOCI et al., 2005, 2006; PERKOVIĆ, 2006) or 72.10% of all detected species in the Velebit area until now (Appendix 1, KUČINIĆ et al., 1995; JUTZELER et al., 2001, 2002).

According to the KUČINIĆ et al. (1995) only Zerynthia polyxena from the Papilionidae family found in Krasno in the past century was not detected in our research, probably because our first fieldtrip was done in June and the species had already emerged.

From the Pieridae family we have not detected Pontia daplidice and Colias hyale. Specimens of the species Leptidea morsei ssp. major from the Central Butterfly Collection (CNHM) mentioned in KUČINIĆ et al. (1995) was misidentified with the species Leptidea sinapis, as confirmed by analysis of the following genitalia parameters: length of the aedeagus, saccus, uncus and tegumen (LELO, 2003) (redet. M. Kučinić). According to LELO (2003), data on the metrical values of tegument are best in proving the existence of the explicit differences in genitalia of the L. sinapis and L. morsei ssp. major taxa. It is supposed that the main limiting factor for distribution of L. morsei in Europe is a cooler and rainier summer climate (LORKOVIĆ, 1975). Also, L. morsei inhabits oak forests with the food plants spring vetch Lathyrus verna or black pea L. niger (LORKOVIĆ, 1975). Although both plants are known from Mt. Velebit (FORENBACHER, 2001), verna from Vratnik, Oštarije, Medačka staza, Malovan, Debeli kuk and Crnopac and niger from Vratnik, Budakovo brdo, Kiza and Takalice they were not noticed during our fieldtrips.
Tab. 2. Biogeographical characteristics of species identified on Mt. Velebit, according to HRUBY (1964), SÍJARIĆ et al. (1984) and HIGGINS & RILEY (1993).

<table>
<thead>
<tr>
<th>Ord. No.</th>
<th>Species and author</th>
<th>Biogeog. character</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Erynnis tages (Linnaeus, 1758)</td>
<td>ES</td>
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<tr>
<td>2.</td>
<td>Carcharodus floccifera (Zeller, 1847)</td>
<td>ME</td>
</tr>
<tr>
<td>3.</td>
<td>Thymelicus lineola (Ochsenheimer, 1808)</td>
<td>ES</td>
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<tr>
<td>4.</td>
<td>Thymelicus sylvestris (Poda, 1761)</td>
<td>ES</td>
</tr>
<tr>
<td>5.</td>
<td>Hesperia comma (Linnaeus, 1758)</td>
<td>ES</td>
</tr>
<tr>
<td>6.</td>
<td>Ochloides venata (Bremer &amp; Grey, 1853)</td>
<td>ES</td>
</tr>
<tr>
<td>7.</td>
<td>Parnassius mnemosyne (Linnaeus, 1758)</td>
<td>OR</td>
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<tr>
<td>8.</td>
<td>Parnassius apollo (Linnaeus, 1758)</td>
<td>ES</td>
</tr>
<tr>
<td>9.</td>
<td>Iphiclides podalirius (Linnaeus, 1758)</td>
<td>ES</td>
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<tr>
<td>10.</td>
<td>Papilio machaon Linnaeus, 1758</td>
<td>ES</td>
</tr>
<tr>
<td>11.</td>
<td>Leptidea sinapis (Linnaeus, 1758)</td>
<td>ES</td>
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<tr>
<td>12.</td>
<td>Antocharis cardamines (Linnaeus, 1758)</td>
<td>ES</td>
</tr>
<tr>
<td>13.</td>
<td>Aporia crataegi (Linnaeus, 1758)</td>
<td>ES</td>
</tr>
<tr>
<td>14.</td>
<td>Pieris brassicae (Linnaeus, 1758)</td>
<td>ES</td>
</tr>
<tr>
<td>15.</td>
<td>Pieris mannii (Mayer, 1851)</td>
<td>OR</td>
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<tr>
<td>16.</td>
<td>Pieris rapae (Linnaeus, 1758)</td>
<td>ES</td>
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<tr>
<td>17.</td>
<td>Pieris ergane (Geyer, 1828)</td>
<td>OR</td>
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<tr>
<td>18.</td>
<td>Pieris napi (Linnaeus, 1758)</td>
<td>HA</td>
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<tr>
<td>19.</td>
<td>Colias croceus (Fourcroy, 1785)</td>
<td>TR</td>
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<tr>
<td>20.</td>
<td>Gonepteryx rhamni (Linnaeus, 1758)</td>
<td>ES</td>
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<tr>
<td>21.</td>
<td>Gonepteryx cleopatra (Linnaeus, 1767)</td>
<td>ME</td>
</tr>
<tr>
<td>22.</td>
<td>Hamearis lucina (Linnaeus, 1758)</td>
<td>ME</td>
</tr>
<tr>
<td>23.</td>
<td>Lycaena virgaureae (Linnaeus, 1758)</td>
<td>ES</td>
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<tr>
<td>24.</td>
<td>Lycaena alciphron (Rottemburg, 1775)</td>
<td>ES</td>
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<tr>
<td>25.</td>
<td>Lycaena candens (Herrick-Schäffer, 1844)</td>
<td>OR</td>
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<tr>
<td>26.</td>
<td>Satyrium w-album (Knoch, 1782)</td>
<td>ME</td>
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<tr>
<td>27.</td>
<td>Satyrium pruni (Linnaeus, 1758)</td>
<td>ME</td>
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<tr>
<td>28.</td>
<td>Satyrium spini (Denis &amp; Schiffermüller, 1775)</td>
<td>ES</td>
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<tr>
<td>29.</td>
<td>Satyrium ilicis (Esper, 1779)</td>
<td>ME</td>
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<tr>
<td>30.</td>
<td>Cupido minimus (Fuessly, 1775)</td>
<td>ES</td>
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<tr>
<td>31.</td>
<td>Cupido alcetas (Hoffmannsegg, 1804)</td>
<td>ES</td>
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<tr>
<td>32.</td>
<td>Celastrina argiolus (Linnaeus, 1758)</td>
<td>ES</td>
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<tr>
<td>33.</td>
<td>Scolitantides orion (Pallas, 1771)</td>
<td>ES</td>
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<tr>
<td>34.</td>
<td>Glaucopsyche alexis (Poda, 1761)</td>
<td>ES</td>
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<tr>
<td>35.</td>
<td>Maculinea arion (Linnaeus, 1758)</td>
<td>ES</td>
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<tr>
<td>Ord. No.</td>
<td>Species and author</td>
<td>Biogeog. character</td>
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<tr>
<td>36.</td>
<td><em>Maculinea rebeli</em> (Hirschke, 1904)</td>
<td>ES</td>
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<tr>
<td>37.</td>
<td><em>Plebeius argus</em> (Linnaeus, 1758)</td>
<td>ES</td>
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<tr>
<td>38.</td>
<td><em>Plebeius idas</em> (Linnaeus, 1761)</td>
<td>EU</td>
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<tr>
<td>39.</td>
<td><em>Aricia agestis</em> (Denis &amp; Schiffermüller, 1775)</td>
<td>ES</td>
</tr>
<tr>
<td>40.</td>
<td><em>Polyommatus semiargus</em> (Rottemburg, 1775)</td>
<td>ES</td>
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<tr>
<td>41.</td>
<td><em>Polyommatus dorylas</em> (Denis &amp; Schiffermüller, 1775)</td>
<td>OR</td>
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<tr>
<td>42.</td>
<td><em>Polyommatus amandus</em> (Schneider, 1792)</td>
<td>ES</td>
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<tr>
<td>43.</td>
<td><em>Polyommatus icarus</em> (Rottemburg, 1775)</td>
<td>ES</td>
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<tr>
<td>44.</td>
<td><em>Polyommatus daphnis</em> (Denis &amp; Schiffermüller, 1775)</td>
<td>OR</td>
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<tr>
<td>45.</td>
<td><em>Polyommatus bellargus</em> (Rottemburg, 1775)</td>
<td>OR</td>
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<td>46.</td>
<td><em>Polyommatus coridon</em> (Poda, 1761)</td>
<td>OR</td>
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<td>47.</td>
<td><em>Libythea celtis</em> (Laicharting, 1782)</td>
<td>ME</td>
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<td>48.</td>
<td><em>Argynnis paphia</em> (Linnaeus, 1758)</td>
<td>ES</td>
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<tr>
<td>49.</td>
<td><em>Argynnis pandora</em> (Denis &amp; Schiffermüller, 1775)</td>
<td>ME</td>
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<tr>
<td>50.</td>
<td><em>Argynnis aglaja</em> (Linnaeus, 1758)</td>
<td>ES</td>
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<tr>
<td>51.</td>
<td><em>Argynnis adippe</em> (Denis &amp; Schiffermüller, 1775)</td>
<td>ES</td>
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<td>52.</td>
<td><em>Issoria lathonia</em> (Linnaeus, 1758)</td>
<td>ES</td>
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<tr>
<td>53.</td>
<td><em>Brenthis ino</em> (Rottemburg, 1775)</td>
<td>ES</td>
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<td>54.</td>
<td><em>Brenthis daphne</em> (Denis &amp; Schiffermüller, 1775)</td>
<td>ES</td>
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<tr>
<td>55.</td>
<td><em>Brenthis hecate</em> (Denis &amp; Schiffermüller, 1775)</td>
<td>ME</td>
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<td>56.</td>
<td><em>Boloria euphrosyne</em> (Linnaeus, 1758)</td>
<td>ES</td>
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<td>57.</td>
<td><em>Boloria dia</em> (Linnaeus, 1767)</td>
<td>ES</td>
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<td>58.</td>
<td><em>Vanessa atalanta</em> (Linnaeus, 1758)</td>
<td>ES</td>
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<tr>
<td>59.</td>
<td><em>Vanessa cardui</em> (Linnaeus, 1758)</td>
<td>KO</td>
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<tr>
<td>60.</td>
<td><em>Inachis io</em> (Linnaeus, 1758)</td>
<td>ES</td>
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<tr>
<td>61.</td>
<td><em>Aglais urticae</em> (Linnaeus, 1758)</td>
<td>ES</td>
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<tr>
<td>62.</td>
<td><em>Polygonia c-album</em> (Linnaeus, 1758)</td>
<td>ES</td>
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<tr>
<td>63.</td>
<td><em>Polygonia egea</em> (Cramer, 1775)</td>
<td>OR</td>
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<tr>
<td>64.</td>
<td><em>Araschnia levana</em> (Linnaeus, 1758)</td>
<td>ES</td>
</tr>
<tr>
<td>65.</td>
<td><em>Nymphalis antiopa</em> (Linnaeus, 1758)</td>
<td>HA</td>
</tr>
<tr>
<td>66.</td>
<td><em>Nymphalis polychloros</em> (Linnaeus, 1758)</td>
<td>ES</td>
</tr>
<tr>
<td>67.</td>
<td><em>Euphydryas aurinia</em> (Rottemburg, 1775)</td>
<td>ES</td>
</tr>
<tr>
<td>68.</td>
<td><em>Melitaea cinxia</em> (Linnaeus, 1758)</td>
<td>ES</td>
</tr>
<tr>
<td>69.</td>
<td><em>Melitaea phoebe</em> (Denis &amp; Schiffermüller, 1775)</td>
<td>ES</td>
</tr>
<tr>
<td>70.</td>
<td><em>Melitaea trivia</em> (Denis &amp; Schiffermüller, 1775)</td>
<td>ES</td>
</tr>
<tr>
<td>71.</td>
<td><em>Melitaea didyma</em> (Esper, 1778)</td>
<td>ES</td>
</tr>
<tr>
<td>72.</td>
<td><em>Melitaea diamina</em> (Lang, 1789)</td>
<td>ES</td>
</tr>
<tr>
<td>Ord. No.</td>
<td>Species and author</td>
<td>Biogeog. character</td>
</tr>
<tr>
<td>---------</td>
<td>-------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>73.</td>
<td>Melitaea aurelia</td>
<td>ES</td>
</tr>
<tr>
<td>74.</td>
<td>Melitaea britomartis</td>
<td>ES</td>
</tr>
<tr>
<td>75.</td>
<td>Melitaea athalia</td>
<td>ES</td>
</tr>
<tr>
<td>76.</td>
<td>Limenitis populi</td>
<td>ES</td>
</tr>
<tr>
<td>77.</td>
<td>Limenitis reducta</td>
<td>ES</td>
</tr>
<tr>
<td>78.</td>
<td>Neptis sappho</td>
<td>OR</td>
</tr>
<tr>
<td>79.</td>
<td>Apatura iris</td>
<td>ES</td>
</tr>
<tr>
<td>80.</td>
<td>Pararge aegeria</td>
<td>EU</td>
</tr>
<tr>
<td>81.</td>
<td>Lasiommata megera</td>
<td>OR</td>
</tr>
<tr>
<td>82.</td>
<td>Lasiommata maera</td>
<td>OR</td>
</tr>
<tr>
<td>83.</td>
<td>Coenonympha rhodopenisa</td>
<td>ES</td>
</tr>
<tr>
<td>84.</td>
<td>Coenonympha arcania</td>
<td>ME</td>
</tr>
<tr>
<td>85.</td>
<td>Coenonympha glycerion</td>
<td>ES</td>
</tr>
<tr>
<td>86.</td>
<td>Coenonympha pamphilus</td>
<td>ES</td>
</tr>
<tr>
<td>87.</td>
<td>Aphantopus hyperantus</td>
<td>ES</td>
</tr>
<tr>
<td>88.</td>
<td>Maniola jurtina</td>
<td>OR</td>
</tr>
<tr>
<td>89.</td>
<td>Hyponephele lycaon</td>
<td>ES</td>
</tr>
<tr>
<td>90.</td>
<td>Hyponephele lupinus</td>
<td>ES</td>
</tr>
<tr>
<td>91.</td>
<td>Erebia ligea</td>
<td>ES</td>
</tr>
<tr>
<td>92.</td>
<td>Erebia euryale</td>
<td>BA</td>
</tr>
<tr>
<td>93.</td>
<td>Erebia epiphron</td>
<td>AL</td>
</tr>
<tr>
<td>94.</td>
<td>Erebia aethiops</td>
<td>ES</td>
</tr>
<tr>
<td>95.</td>
<td>Erebia medusa</td>
<td>ES</td>
</tr>
<tr>
<td>96.</td>
<td>Erebia ottomana</td>
<td>ES</td>
</tr>
<tr>
<td>97.</td>
<td>Erebia melas</td>
<td>EU</td>
</tr>
<tr>
<td>98.</td>
<td>Erebia oeme</td>
<td>AL</td>
</tr>
<tr>
<td>99.</td>
<td>Melanargia galathea</td>
<td>OR</td>
</tr>
<tr>
<td>100.</td>
<td>Satyrus ferula</td>
<td>OR</td>
</tr>
<tr>
<td>101.</td>
<td>Hipparchia fagi</td>
<td>EU</td>
</tr>
<tr>
<td>102.</td>
<td>Hipparchia syriaca</td>
<td>ME</td>
</tr>
<tr>
<td>103.</td>
<td>Hipparchia semele</td>
<td>ME</td>
</tr>
<tr>
<td>104.</td>
<td>Arethusaana arethusa</td>
<td>ES</td>
</tr>
<tr>
<td>105.</td>
<td>Brintesia circe</td>
<td>ME</td>
</tr>
<tr>
<td>106.</td>
<td>Chazara briseis</td>
<td>ME</td>
</tr>
</tbody>
</table>

Explanations: AL, Alpine species; BA, Boreo-alpine species; KO, Cosmopolitan species; ES, Eurosibirean species; EU, European species; HA, Holarctic species; ME, Mediterranean species; OR, Oriental species; TR, Tropic species.
For Mt. Velebit from the Lycaenidae family we have recorded for the first time the following species: Lycaena alciphron, Satyrium w-album, Satyrium pruni, Cupido alcetas, Celastrina argiolus, Polyommatus dorylas and Polyommatus amandus; on the other hand Lycaena phleas, Lampides boeticus, Leptotes pirithous, Iolana iolas, Tarucus balkanica, Plebeius argyrognomon, Aricia eumedon, Aricia anteros, Aricia artaxerxes and Polyommatus eros were not confirmed during the field trips in the years 2005 and 2006. Failures to record some characteristic Mediterranean species like Leptotes pirithous, Iolana iolas or Tarucus balkanicus are due to the fact that the probable finding localities of these species were not examined during 2005 and 2006. These species, with a few exceptions, are usually restricted to the narrow coastal area.

Several species from the Lycaenidae family should be discussed here. The species Lycaena candens was just mistyped from MLADINOV & LORKOVIC (1985) in KUCINIC et al. (1995) as Lycaena hippothoe. In 2006 L. candens was found in Jadovno and Veliki Lubenovac, but in very low numbers. In Croatia both species are present and widely distributed, the palearctic L. hippothoe in the lowlands, and the oriental L. candens in the mountainous part. L. candens and L. hippothoe are sibling species that are most closely related. On the Balkan Peninsula, according to LORKOVIC & MIHLEVIC (1988), L. candens and L. hippothoe populations can be easily divided according to the altitude of the finding site. L. hippothoe is usually found from 100 to the 500 meters above sea level and L. candens usually above 900 m a.s.l. Apart from the altitudinal difference there is no significant ecological distinctions between them, although L. hippothoe inhabits somewhat wetter meadows and L. candens dry and sloping glades (LORKOVIC & MIHLEVIC, 1988).

Also, the presence of two myrmecophilous species from the genus Maculinea on Mt. Velebit is very interesting: Maculinea arion and Maculinea rebeli. Imago phase of M. arion was found at five localities (Svica, Stirovac, to Bakovac, Bakovac and Jadovno). The larval host plant of M. rebeli, Gentiana cruciata was found at Jadovno, on the meadows along the road to Bakovac and near Bakovac with eggs and larvae, which undoubtedly confirms the presence of the species, and the imago was also

<table>
<thead>
<tr>
<th>Biogeographical characteristic</th>
<th>Percentage portion (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alpine</td>
<td>1.87</td>
</tr>
<tr>
<td>Boreo-alpine</td>
<td>0.94</td>
</tr>
<tr>
<td>Cosmopolitan</td>
<td>0.94</td>
</tr>
<tr>
<td>Eurosibirean</td>
<td>62.26</td>
</tr>
<tr>
<td>European</td>
<td>3.77</td>
</tr>
<tr>
<td>Holartic</td>
<td>1.87</td>
</tr>
<tr>
<td>Mediterranean</td>
<td>13.21</td>
</tr>
<tr>
<td>Oriental</td>
<td>14.15</td>
</tr>
<tr>
<td>Tropic</td>
<td>0.94</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100</td>
</tr>
</tbody>
</table>

Tab. 3. Percentage portions of the particular biogeographical characteristic.
found in Jadovno and Bakovac. Kučinić et al. (1995) mentions a specimen of M. alcon from the past century, from the Gušić collection, at the locality above Kozjak. In the paper, Kučinić states that according to the foodplant G. cruciata, which is common on Mt. Velebit, this specimen could be the species M. rebeli. In addition, G. pneumonanthe, the larval host plant of M. alcon, has never been found on Mt. Velebit (Kučinić et al., 1995; Forenbacher, 2001; Topić & Palković, 2005). In all studied localities, we also did not find Gentiana pneumonanthe. G. pneumonanthe prefers marshy and humid meadows, while M. rebeli and G. cruciata prefer dry swards and mountain pastures (Bereczki et al., 2005), which dominate the investigated area. The former subspecies Maculinea alcon alcon and Maculinea alcon rebeli were separated in two sibling species (Lepidopterologen-Arbeitsgruppe, 1987) whose differences are based on different foodplants and host ant species (Thomas et al., 1989). The present taxonomic status of both is quite confusing, even if accepted as separate species, for genetic differentiation has shown little or no difference (Als et al. 2004; Pech et al. 2004; Bereczki et al., 2005), so in the current literature they are considered differently, as one species, two species or even ecological forms.

Specimens determined as Pseudophilotes baton (Bergsträsser, 1779) (Kučinić et al., 1995) due to acceptance of systematics according to Higgins & Riley (1993) have to be redetermined as Pseudophilotes vicrama. Both sexes of P. vicrama resemble P. baton, but their area of distribution in Europe differs. P. baton spreads from northern Portugal to south-western Poland and western Austria, and P. vicrama from southern Finland, north-eastern Italy to Greece and the European part of Turkey (Tolman & Lewington, 1997).

For the first time for Mt. Velebit, in the research in 2005 and 2006 we found species from the Nymphalidae family, Araschnia levana, Euphydryas aurinia, Melitaea diamina, Melitaea aurelia, Melitaea britomartis, Neptis sappho, Apatura iris, Limenitis populi, Pararge aegeria, Aphantopus hyperantus and Arethusana arathusa. On the other hand, some previously recorded species (Kučinić et al., 1995; Jutzeler et al., 2001, 2002) were not found at any recently studied localities, like Argynnis niobe, Limenitis camilla, Nymphalis vaualbum, Melanargia larissa, Pyronia tithonus, Erebia stirius, Erebia pronoe, Erebia gorge, Minois dryas and Hipparchia statilinus.

Several nymphaeid species are hereafter emphasized. For Araschnia levana the finding locality in Jadovno is the most southern finding site of the species in Croatia (Jakišić, 1988).

From the most interesting and for the mountainous area the most specific genus Erebia we have recorded eight species (E. ligea, E. euryale, E. epiphron, E. aethiops, E. medusa, E. ottomana, E. oeme and E. melas). The most interesting Erebia gorge vagana has not been found recently, but was found in the past century. It inhabits only the north-eastern slopes of Mt. Velebit at an altitude from 1600 to 1660 m a.s.l. in the area between Babin vrh and Vaganski vrh (southern Velebit – Paklenica NP). These exact microlocalities have not been visited in this research. Imago flight period dates from July 14th to August 14th. According to Lorković (1955) Mt. Velebit is the area with the lowest altitude at which gorge is still preserved/maintained. This one and only finding locality of gorge in Croatia is even 400 meters lower than that on Mt. Prenj (2155 m a.s.l., Herzegovina, BH) which is the second lowest in the entire
area of the species distributional range. As a result of altitudinal presence LORKOVIĆ (1955) concluded that from the end of the last glacial period there were no warmer climatic periods than the present one, because otherwise gorge would have withdrawn to higher altitudes and these do not exist on Mt Velebit.

During our field trips on Mt. Velebit in the last two years the Styrian Ringlet Erebia stiriус (GODART, 1824) was not detected. WARREN (1936) mentioned the presence of the Styrian Ringlet (Erebia stiriус f. nerine (Freyer, 1831) on Mt. Velika Kapela and Mt. Velebit. Also according to WARREN (1936), in the mentioned area the form of the nominal species (typical race) is very abundant and it is possible that it may even be found in the Dinaric Alps. Therefore and according to specimens collected by M. Hilf in 1906, for many years Lorković tried to confirm the species in the southern part of Gorski Kotar, on Bjelolasica peak and on the Bijele Stijene peak (Mt. Velika Kapela), near Baške Oštarije (Mt. Velebit) as well as in the entire area of Mt. Velebit, but did not succeed (LORKOVIĆ, 1952; 1955). On the other hand, according to JUTZELER et al. (2001, 2002), in 1983 and never after, Ortner succeeded in finding one male specimen of E. stiriус near Baške Oštarije at 1000 m a.s.l. Without a clear documentation or re-finding, we believe the presence of E. stiriус on Mt. Velebit is highly questionable.

From the Hipparchia genus we have detected three species out of four known in Croatian fauna: Hipparchia semele, H. syriaca and H. fagi. According to LORKOVIĆ (1976) the ranges of two similar species H. fagi and H. syriaca in south-eastern Europe overlap in the coastal region but are usually isolated in the near vicinity in spite of their ecological similarity. Conspecific H. fagi and H. syriaca are easily distinguished by the Jullien organ in males and by the sculpture of sclerotized postvaginal and antevaginal lamella in females (LORKOVIĆ, 1976). H. fagi has 2–4 hair-like scales in the Jullien organ and H. syriaca has 9 or more hair-like scales in the Jullien organ. Difference in the postvaginal lamella structure between H. fagi and H. syriaca is reflected in the scaly cover of lobes vaginales so each specimen of H. fagi or H. syriaca can be easily distinguished in the field, even without genitalia preparation. According to LORKOVIĆ (1976) in the investigated area there are no intermediar genitalia between these two taxa, hence no hibridization. This means that H. fagi and H. syriaca are completely reproductively separate species.

From the Coenonympha genus two species must be additionally discussed: Coenonympha rhodopensis found at Babić Sića, Dabarska kosa and Borovački Padež in 2005 and 2006 and Coenonympha tullia mentioned in KUČINIĆ et al. (1995). The presence of the species Coenonympha tullia has so far never been recorded for Croatia. All specimens mentioned in KUČINIĆ et al. (1995) cited from the Central Butterfly Collection of the CNHM and Coll. Gušić refer to the original description of this species as a variety, and later as a mountain subspecies of the C. tullia syn. tiphon (SIJARIĆ, 1984). Those taxonomic statuses were accepted in the scientific and review literature for more than 75 years (SIJARIĆ, 1984). The nominal form of the species Coenonympha rhodopensis is linked to the eastern part of the Balkan Peninsula and its subspecies occupata Rebel to the western part (SIJARIĆ, 1979; 1984). Subspecies occupata is typical of the Dinaric Alps while border areas (habitats close to the Adriatic Sea) are characterized by a higher percentage of intermediate forms if compared to the nominal
forms. On Mt. Velebit *Coenonympha rhodopensis* was found at localities above 1000 m a.s.l., usually on dry and sunny mountainous meadows.

Localities with the highest number of the registered species are Žive Vodice* (41 species), Ljubica** (43), Jadovno** (45) and Dabarska kosa** (46). Of the mentioned localities only the Žive Vodice locality was visited just once. At all the mentioned localities habitat types are very diverse (FORENBACHER, 2001), contributing to the highest number of established species.

In addition, the highest number of species was established for the area of the Velebit Nature Park (96) because of the frequency of field trips and diversity of habitat types.


*Maculinea arion* is an endangered European butterfly (EN-SPEC 3) (VAN SWAAY & WARREN, 1999) listed in the Appendix II of the Bern Convention (ANON., 1996), Annex IV of the Habitats Directive (ANON., 1992) and the IUCN Red List of the Threatened Species (IUCN, 2006). It was found on sunny and flowery grasslands at Štica, Štirovača, Bakovac and Jadovno localities. Conservation measures that should be carried out for this species maintenance, as well for others like *M. rebeli*, *G. alexis*, *P. vicrama* and *S. orion* on Mt. Velebit are extensive grazing and mowing of grasslands and regular future monitoring.

Moreover, *Parnassius apollo* is protected in many European countries and listed in the Appendix II of the Bern Convention (ANON., 1996), the Annex IV of the Habitats Directive (ANON., 1992), IUCN Red List of the Threatened Species (IUCN, 2006) and the Red Data Book of European Butterflies (VU-SPEC 3) (VAN SWAAY & WARREN, 1999). The species was found in several localities in 2005 and 2006: Polužine, Dabarska kosa, from Begovača to Krasno, along the road to Kugina kuća mt. hut, in Jadovno and Struge. The species was also observed at the localities Sadikovac, Jadičevac, pool to Kiza peak and Alaginac (pers. comm. V. Prpić), above Vlaški grad to the Šveto brdo peak (pers. comm. G. Lukać) and on Struge near the Buljma pass (pers. comm. Z. Marasović). The major threats to species maintenance in the researched localities are the loss, fragmentation and isolation of Velebit’s grassland habitats (especially those with its larval host plant *Sedum album*) as well as uncontrolled collecting because of the species attractiveness.

Further, *Melitaea aurelia* and *Melitaea britomartis* have vulnerable threat status in Europe (VU-SPEC 3) (VAN SWAAY & WARREN, 1999) due to habitat fragmentation and loss. They were found on moist, grassy and flowery meadows in several localities (Štica, Ljubica, Trnovac, Jadovno, Petrašica and Borovački Padež). The preservation of those meadows should also be priority.

*Euphydryas aurinia* is present in the Red Data Book of European Butterflies (VU-SPEC 3), in Appendix II of the Bern Convention (ANON., 1996) and Annex II of the Habitats Directive (ANON., 1992). It was found in two localities: the wetland habitat
Baške Oštarije (near Ljubica creek) and marshy parts of the meadows in Trnovac. The major threats could occur at the Trnovac locality due to agricultural improvements, chemical pollution and land drainage. Locality in Baške Oštarije is endangered by possible urbanisation.

Furthermore, the protection of meadows, humid woodland clearings as well as grassy alpine slopes amongst sparse coniferous trees is necessary in preservation of habitats of the Woodland Ringlet. *Erebia medusa* is a generally widespread but locally very rare butterfly.

We should mention that the main factors influencing butterfly diversity on Mt. Velebit include habitat structure, quality, fragmentation as well as habitat suitability. Altogether, grasslands maintained by traditional means of grazing or mowing as well as the prevention of habitat destruction are necessary as butterflies have very specific habitat requirements and occupy very specific and narrow ecological niches.

**Biogeographical analysis**

Biogeographical analysis shows the dominance of Eurosibirean (62.26%), Oriental (14.15%) and Mediterranean (13.21%) species. According to geographical position, climatic characteristics and the size of Velebit, this can be easily explained. Climatic characteristics greatly depend on the geographical position, length, the lie of the mountain and on relief which causes microclimatic features (POLJAK, 1974; FORENBACKER, 2001). Dominance of the Eurosibirean species is due to the expressed influence of the continental and mountainous climate, and the high percentage of the Oriental and Mediterranean species to the high Mediterranean influence affecting Velebit.

In all, this paper is a contribution to the knowledge of butterfly fauna of Mt. Velebit. No further considerable increase in species number can be expected. Future activities should be continued with more detailed study of the butterfly vertical (altitudinal) and horizontal distribution and confirmation of the past data.

**ACKNOWLEDGEMENTS**

The research was supported by the grant of the KEC project and project 0183007 of the Ministry of Science, Education and Sports of the Republic of Croatia. We extend our thanks to expert managers Svetlana Lupret-Obrađović (Sjeverni Velebit National Park), Ivan Tomljenović (Velebit Nature Park) and Dr. Gordan Lukač (Paklenica National Park) for supporting the field research and providing the legal permission for collecting specimens. We express our deepest thanks to Dr. Nikola Tvrtković (CNHM) for organising all field trips, as well as to Mladen Vajdcić (CNHM) and Zlatko Marasović (Paklenica NP) for considerable help during the field work. Also, we are grateful to Dr. Mladen Kučinić (University of Zagreb, Faculty of Science) for determination of specimens from the *Leptidea* genus (genitalia preparation) and useful suggestions in preparing the manuscript.

*Received November 7, 2006*
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Na lokalitetima Žive Vodice (41), Ljubica (43), Jadovno (45) i Dabarska kosa (46) zabilježen je najveći broj vrsta čemu u velikoj mjeri pridonosi različitost stanišnih tipova na navedenim lokacijama.

Zoogeografska analiza utvrđenih vrsta ukazuje na dominaciju eurosibirskih, orientalnih i mediteranskih vrsta, što se može objasniti geografskim položajem, smjerom pružanja, mikroreljefom i klimatskim obilježjima Velebita.

S obzirom na objavljene podatke u KUČIĆ et al. (1995), navode se ispravci za vrste Leptidea morsei, Lycaena hippothoe, Pseudophilotes baton, Maculinea alcon i Coenonympha tullia u fauni Velebita.

Ovaj rad prilog je poznavanju faune danjih leptira Velebita. Daljnjim faunističkim istraživanjima ne očekuje se značajan porast broja vrsta na Velebitu. Buduća faunistička istraživanja danjih leptira Velebita trebalo bi usmjeriti na proučavanje horizontalne i vertikalne distribucije vrsta, visinskog raspona koji pojedina vrsta zauzima, kao i na potvrdu nalaza vrsta zabilježenih u prošlom stoljeću.
APPENDIX

Check-list of butterflies (Hesperioidea & Papilionoidea) from Mt. Velebit

1. *Erynnis tages* (Linnaeus, 1758)
2. *Carcharodus alceae* (Esper, 1780)
3. *Carcharodus lavatherae* (Esper, 1783)
4. *Carcharodus floccifera* (Zeller, 1847)
5. *Pyrgus carthami* (Hübner, 1813)
6. *Pyrgus malvae* (Linnaeus, 1758)
7. *Pyrgus serratulae* (Rambur, 1839)
8. *Pyrgus alveus* (Hübner, 1803)
9. *Thymelicus lineola* (Ochsenheimer, 1808)
10. *Thymelicus sylvestris* (Poda, 1761)
11. *Thymelicus acteon* (Rottemburg, 1775)
12. *Hesperia comma* (Linnaeus, 1758)
13. *Ochlodes venata* (Bremer & Grey, 1853)
14. *Zerynthia polyxena* (Denis & Schiffermüller, 1775)
15. *Parnassius mnemosyne* (Linnaeus, 1758)
16. *Parnassius apollo* (Linnaeus, 1758)
17. *Iphiclides podalirius* (Linnaeus, 1758)
18. *Papilio machaon* Linnaeus, 1758
19. *Leptidea sinapis* (Linnaeus, 1758)
20. *Antocharis cardamines* (Linnaeus, 1758)
21. *Aporia crataegi* (Linnaeus, 1758)
22. *Pieris brassicae* (Linnaeus, 1758)
23. *Pieris manni* (Mayer, 1851)
24. *Pieris rapae* (Linnaeus, 1758)
25. *Pieris ergane* (Geyer, 1828)
26. *Pieris napi* (Linnaeus, 1758)
27. *Pontia daplidice* (Linnaeus, 1758)
28. *Colias croceus* (Fourcroy, 1785)
29. *Colias hyale* (Linnaeus, 1758)
30. *Gonepteryx rhamni* (Linnaeus, 1758)
31. *Gonepteryx cleopatra* (Linnaeus, 1767)
32. *Hamearis lucina* (Linnaeus, 1758)
33. *Lycaena phleas* Linnaeus, 1761
34. *Lycaena virgaureae* (Linnaeus, 1758)
35. *Lycaena alciphrön* (Rottemburg, 1775)
36. *Lycaena candens* (Herrich-Schäffer, 1844)
37. *Satyrium w-album* (Knoch, 1782)
38. *Satyrium pruni* (Linnaeus, 1758)
39. *Satyrium spini* (Denis & Schiffermüller, 1775)
40. *Satyrium ilicis* (Esper, 1779)
41. *Lampides boeticus* (Linnaeus, 1767)
42. *Leptotes piritthous* (Linnaeus, 1767)
43. *Tarucus balkanica* (Freyer, 1844)
44. *Cupido minimus* (Fuessly, 1775)
45. *Cupido alcetas* (Hoffmannsegg, 1804)
46. *Celastrina argiolus* (Linnaeus, 1758)
47. *Pseudophilotes vicrama* (Moore, 1865)
48. *Scolitantides orion* (Pallas, 1771)
49. *Glacopsycha alexis* (Poda, 1761)
50. *Iolana iolas* (Ochsenheimer, 1816)
51. *Maculinea arion* (Linnaeus, 1758)
52. *Maculinea rebeli* (Hirschke, 1904)
53. *Plebeius argus* (Linnaeus, 1758)
54. *Plebeius idas* (Linnaeus, 1761)
55. *Plebeius argyrognomon* (Bergsträsser, 1779)
56. *Aricia eumedon* (Esper, 1780)
57. *Aricia agestis* (Denis & Schiffermüller, 1775)
58. *Aricia artaxerxes* (Fabricius, 1793)
59. *Aricia anteros* (Freyer, 1838)
60. *Polyommatus semiargus* (Rottemburg, 1775)
61. *Polyommatus dorylas* (Denis & Schiffermüller, 1775)
62. *Polyommatus amandus* (Schneider, 1792)
63. *Polyommatus icarus* (Rottemburg, 1775)
64. *Polyommatus eros* (Ochsenheimer, 1808)
65. *Polyommatus daphnis* (Denis & Schiffermüller, 1775)
66. *Polyommatus bellargus* (Rottemburg, 1775)
67. *Polyommatus coridon* (Poda, 1761)
68. *Libythea celtis* (Laicharting, 1782)
69. *Argynnis paphia* (Linnaeus, 1758)
70. *Argynnis pandora* (Denis & Schiffermüller, 1775)
71. *Argynnis aglaja* (Linnaeus, 1758)
72. *Argynnis adippe* (Denis & Schiffermüller, 1775)
73. *Argynnis niobe* (Linnaeus, 1758)
74. *Issoria lathonia* (Linnaeus, 1758)
75. *Brenthis ino* (Rottemburg, 1775)
76. *Brenthis daphne* (Denis & Schiffermüller, 1775)
77. *Brenthis hecate* (Denis & Schiffermüller, 1775)
78. *Boloria euphrosyne* (Linnaeus, 1758)
79. *Boloria dia* (Linnaeus, 1767)
80. *Vanessa atalanta* (Linnaeus, 1758)
81. *Vanessa cardui* (Linnaeus, 1758)
82. *Inachis io* (Linnaeus, 1758)
83. *Aglais urticae* (Linnaeus, 1758)
84. *Polygonia c-album* (Linnaeus, 1758)
85. *Polygonia egea* (Cramer, 1775)
86. *Araschnia levana* (Linnaeus, 1758)
87. *Nymphalis antiopa* (Linnaeus, 1758)
88. *Nymphalis polychloros* (Linnaeus, 1758)
89. *Nymphalis vaualbum* (Denis & Schiffermüller, 1775)
90. *Euphydryas aurinia* (Rottemburg, 1775)
91. *Melitaea cinxia* (Linnaeus, 1758)
92. *Melitaea phoebe* (Denis & Schiffermüller, 1775)
93. *Melitaea trivia* (Denis & Schiffermüller, 1775)
94. *Melitaea didyma* (Esper, 1778)
95. *Melitaea diamina* (Lang, 1789)
96. *Melitaea aurelia* Nickerl, 1850
97. *Melitaea britomartis* Assmann, 1847
98. *Melitaea athalia* (Rottemburg, 1775)
99. *Limenitis populi* (Linnaeus, 1758)
100. *Limenitis camilla* (Linnaeus, 1964)
101. *Limenitis reducta* Staudinger, 1901
102. *Neptis sappho* (Pallas, 1771)
103. *Apatura iris* (Linnaeus, 1758)
104. *Pararge aegeria* (Linnaeus, 1758)
105. *Lasiommata megera* (Linnaeus, 1767)
106. *Lasiommata maera* (Linnaeus, 1758)
107. *Coenonympha rhodopensis* Elwes, 1900
108. *Coenonympha arcania* (Linnaeus, 1761)
109. *Coenonympha glycerion* (Borkhausen, 1788)
110. *Coenonympha pamphilus* (Linnaeus, 1758)
111. *Pyronia tithonus* (Linnaeus, 1767)
112. *Aphantopus hyperantus* (Linnaeus, 1758)
113. *Maniola jurtina* (Linnaeus, 1758)
114. *Hyponephele lycaon* (Rottemburg, 1775)
115. Hyponephele lupinus (O. Costa, 1836)
116. Erebia ligea (Linnaeus, 1758)
117. Erebia stirius (Godart, 1824)
118. Erebia euryale (Esper, 1805)
119. Erebia epiphron (Knoch, 1783)
120. Erebia aethiops (Esper, 1777)
121. Erebia medusa (Denis & Schiffermüller, 1775)
122. Erebia gorge (Hübner, 1804)
123. Erebia ottomana Herrich-Schäffer, 1847
124. Erebia pronoe (Esper, 1780)
125. Erebia melas (Herbst, 1796)
126. Erebia oeme (Hübner, 1804)
127. Melanargia galathea (Linnaeus, 1758)
128. Melanargia larissa (Geyer, 1828)
129. Satyrus ferula (Fabricius, 1793)
130. Minois dryas (Scopoli, 1763)
131. Hipparchia fagi (Scopoli, 1763)
132. Hipparchia syriaca (Staudinger, 1871)
133. Hipparchia semele (Linnaeus, 1758)
134. Hipparchia statilinus (Hufnagel, 1766)
135. Arethusa arethusa (Denis & Schiffermüller, 1775)
136. Brontesia circe (Fabricius, 1775)
137. Chazara briseis (Linnaeus, 1764)