

A CONTRIBUTION ON THE HETEROCERA FAUNA
(INSECTA, LEPIDOPTERA) OF THE CENTRAL-
MOUNTAIN PART (RISNJAK & LIČKA PLJEŠEVICA)
OF THE REPUBLIC OF CROATIA

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The Heterocera in the Igalffy Collection of the mountainous areas of Risnjak (Gorski kotar) and Lička Plješevica (Lika) (leg. K. Igalffy) contain 127 taxa. In the Macrolepidoptera (Heterocera) group we have established 118 species, and 9 species in the Microlepidoptera group. We have established 17 families of moths. The greatest number from Geometridae families, 44 species and Noctuidae, 29 species.

Fifty nine species (Heterocera) were recorded in the Risnjak National Park. Seventy eight so far unrecorded species were established in the Lička Plješevica. Together with the number cited in literature this totals 164 registered species of Heterocera fauna for this mountain. According to available literature, in the central-mountain part of Croatia, 22 unrecorded species were established, for Gorski kotar 5 and for Lika 59. According to this data the degree of research of Macrolepidoptera fauna in the central-mountain area of Croatia is 55-65%, for Gorski kotar 65-75%, for area of Lika 35-45%, for mountains Lička Plješevica 25-30% and Risnjak 10-15%, while data about Microlepidoptera is negligible.

To demonstrate the characteristics of Macrolepidoptera fauna we made an analysis of noctuids fauna for the areas of Gorski kotar, Turopolje and southern Dalmatia.

Zoogeographical analysis shows that the domination of Eurosiberien species which is based on the ecological characteristics. The high percentage of the Oriental species is the result of the Mediterranean influence on this region and faunal migration some species of moths.

Key words: Fauna, Heterocera, Risnjak, Lička Plješevica, Croatia.

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Obradom materijala iz zbirke "Igalffy" (Heterocera) prikupljenog na području Risnjaka (Gorski kotar) i Ličke Plješevice (Lika) (leg. K. Igalffy) utvrdili smo 127 vrsta, od kojih 118 pripada skupini Macrolepidoptera, a 9 skupini Microlepidoptera. Registrirano je 17 porodica leptira. Najveći broj vrsta zabilježen je za porodice Geometridae (44) i Noctuidae (29).

Za planinu Risnjak i Nacionalni park na njenom prostoru, utvrđeno je 59 vrsta Heterocera. Za Ličku Plješevicu registrirano je 78 do sada nezabilježenih vrsta, što sa literaturnim podacima čini 164 registrirane vrste u fauni Heterocera toga područja. Prema dostupnoj literaturi za područje centralno-planinskog dijela Hrvatske utvrđene su 22 do sada neregistrirane vrste leptira, 5 za Gorski kotar i 59 za područje Like. Prema ovim podacima stanje istraženosti faune Macrolepidoptera centralno-planinskog područja Hrvatske iznosi 55-65 %, Gorskog kotara 65-75%, Like 35-45 %, Ličke Plješevice 25-30%, Risnjaka 10-15%, dok je poznavanje Microlepidoptera gotovo zanemarivo.

Zbog utvrđivanja karakteristika faune Macrolepidoptera izvršena je analiza faune sovića Gorskog kotara, Turopolja i južne Dalmacije.

Zoogeografska analiza pokazala je da su dominantne vrste eurosibirskog areala što je uvjetovano ekološkim karakteristikama istraživanog područja. Relativno visok postotak orijentalnih zoogeografskih elemenata uvjetovan je utjecajem mediterana na ovo područje i faunističkim migracijama nekih vrsta leptira.

Ključne riječi: Fauna, Heterocera, Risnjak, Lička Plješevica, Hrvatska.

INTRODUCTION

The moth fauna of the central-mountain area of The Republic of Croatia, including the regions of Gorski kotar and Lika, was the subject of lepidoptera research which started at the beginning of the second half of the nineteenth century (MANN, 1867), and has continued, with shorter or longer time intervals until today (ABAFI-AIGNER et al., 1896; ABAFI-AIGNER, 1910; GRUND, 1916; KOČA, 1900, 1901, 1925, 1925a; KUČINIĆ, 1990, 1992; LORKOVIĆ, 1977, 1985; LORKOVIĆ & MLADINOV, 1971; MLADINOV, 1976, 1977, 1978, 1980, 1983; 1985; MLADINOV & LORKOVIĆ, 1979, 1985; LORKOVIĆ, 1993). A great deal of this research was concentrated on studying determined areas of small extent in Gorski kotar and Lika, in the faunistically very interesting and very often inaccessible mountain areas. This applies particularly to Risnjak in Gorski kotar and to Lika where there are a great number of mountain areas which are entomologically almost unexplored. In this paper we present data relating to Lička Plješevica and Risnjak mountains, the result of examinations of working on material, collected on this territory by Konstantin Igalffy. This paper is a continuation of work on Heterocera fauna that started with noctuids of the

same collection, collected in the same area of Lička Plješevica (KUČINIĆ, 1992). We have used data from the literature which is very poor for those areas as well as material collected in field work as a supplement to the Igalffy Collection.

Risnjak (Gorski kotar) and Lička Plješevica (Lika) (Fig. 1) are formed of limestone and dolomite rocks mostly and make up part of the rugged, Dinaric mountains. The climate, is typically mountain with a significant influence of continental and Mediterranean climates (particularly on Risnjak, 20 km from the sea). Beech and fir forests are the dominant associations. Risnjak is located in the middle of Gorski kotar, between Snježnik and Drgomalj; it covers 100 square kilometers. Lička Plješevica is a massif 40 kilometres long located in the north-east part of Lika, bordering on the Republic of Bosnia and Herzegovina. The highest peak is Ozeblin. The highest peak of Risnjak is Veliki Risnjak.

MATERIAL AND METHODS

From Igalffy Collection 261 moth specimens were examined. On the territory of Lička Plješevica Konstantin Igalffy collected material in the Kapela location (800 m). In the Risnjak area moths were collected in the National Park at a height of 900 m. The light of a common mercury bulb was used to catch the moths.

We made preparations of the genital organs of nine species to establish their exact taxonomic status. The determination of material and analysis of genital preparations were done according to the standard literature: BERIO (1985), FORSTER-WOHLFAHRT (1960, 1971, 1981), GOATER (1986) RAZOWSKI (1981, 1987) SKINNER (1986), SPULER (1910). Systematic presentation was made according to HUEMER & TARMANN (1993). In our faunistic analysis we haven't considered data about the family Nolidae (about ten species) which is joined to the family Noctuidae (HUEMER & TARMANN, 1993). For species that are not included in this paper we used FORSTER & WOHLFAHRT (1971) and GOATER (1986).

To include the characteristics of Macrolepidoptera fauna for continental, mountain and mediterranean parts of Croatia we made an analysis of noctuids fauna for the areas of Gorski kotar, Turopolje and southern Dalmatia using the method of SØRENSEN (1948).

The zoogeographical analysis of taxa checked is displayed according to HRUBY (1964).

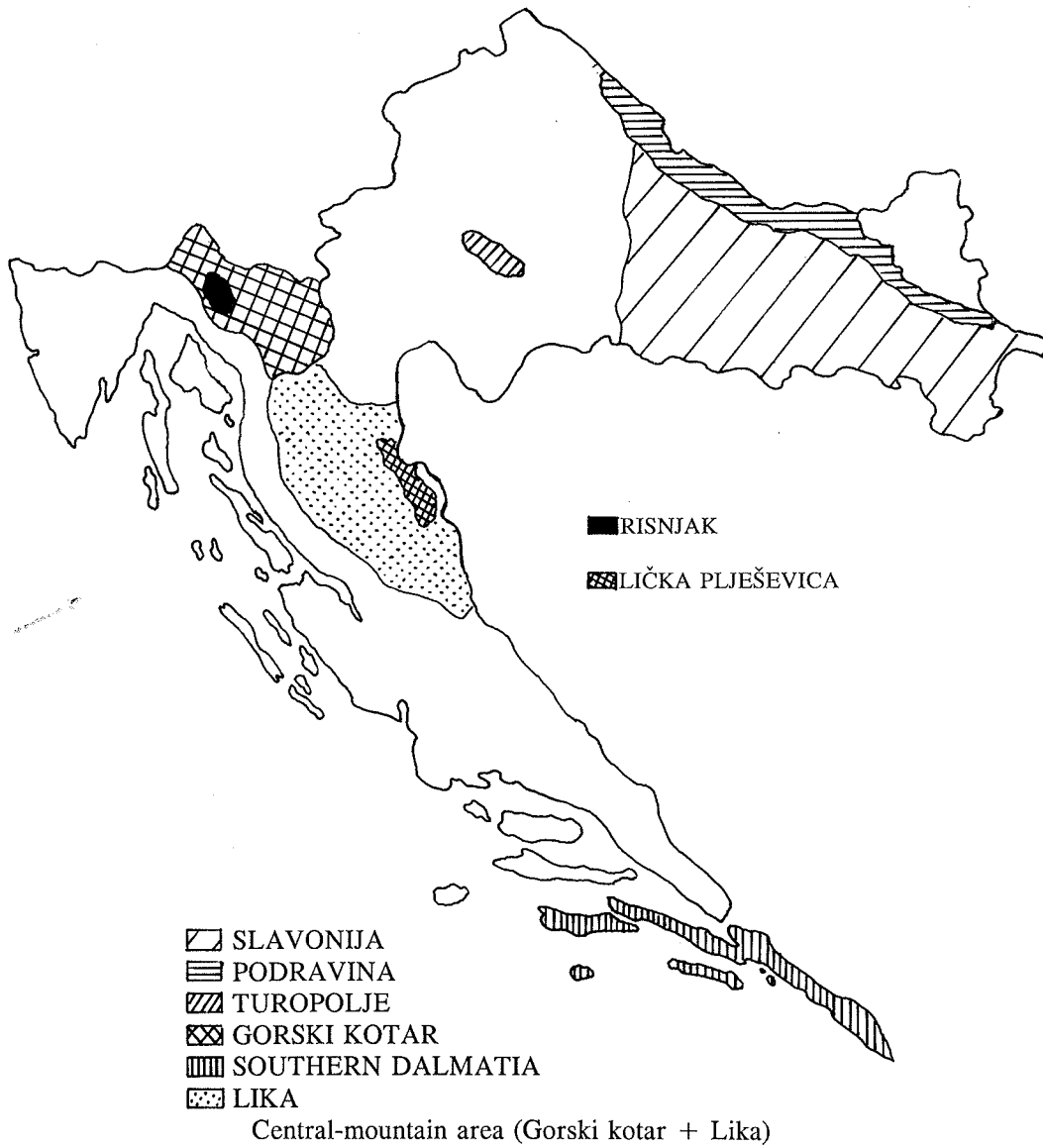


Figure 1. Republic of Croatia with regions: Slavonija, Podravina, Turopolje, Gorski kotar, Lika, southern Dalmatia and mountains Risnjak (Gorski kotar) and Lička Plješevica (Lika).

RESULTS AND DISCUSSION

Through examination of material from the Igalffy Collection we determined 127 taxa for the central-mountain area of the Republic of Croatia (Tab. 1). Data concerning the total number of species per family are shown in Tab. 2. In the Risnjak area we noted 59 and for Lička Plješevica 78 species. Including the literature data (LORKOVIĆ 1977; MLADINOV 1985; MLADINOV & LORKOVIĆ, 1985; KUČINIĆ 1992) of the Lička Plješevica area a total of 164 Heterocera species have until now been noted. For Risnjak and the National Park in that area, 59 species have been noted. We have registered new species not yet recorded in the following regions: Gorski kotar 5, Lika 59 and the central-mountain area of Croatia 22.

The level of exploration of moth fauna performed to date on this territory will be defined if we do the comparison of the determined species number. If we compare the number of determined (for example noctuids) with the number of species in some other, well examined areas of continental part of Croatia. We suppose that the majority of the species has been found in the explorations up to now of the fauna of this area. The appearance of unrecorded species could be caused by expanding area, migration process or human influence. We take noctuids as an example because this group of moths has been best researched in Croatia. The data on noctuids thanks to thorough examination can lead us to reliable conclusions. In order carry out our comparison we must consider human influence and the specificum of certain areas: ecological characteristics, characteristics of vegetation, size of certain areas. Sometimes human influence causes the fauna to become poorer but may cause the number of species to increase (by the development of secondary biotops caused by introduction of new plant species).

According to the data found in the literature (MLADINOV, 1977; KRANJČEV, 1985; KUČINIĆ, 1992; KUČINIĆ & PEROVIĆ, 1992/1993) and entomological collections of the Croatian Natural History Museum in Zagreb, the number of noctuid species from some regions of Croatia is shown in table 3. In Croatia about 540 species of noctuids have been registered (without Nolidae family). Table 3. shows that the smallest number of noctuids were registered in the area of Lika and Turopolje which suggests that those areas are not sufficiently researched. The number of species registered in the fauna of Lika and Turopolje are 21% and 25% of fauna registered in Croatia. For Podravina and Slavonija (Fig. 1) which are the best explored regions in continental Croatia, there are 53% and 50% of all species registered in the fauna of Croatia. Those results imply that the central-mountain part (especially Lika) is the least studied especially when we take into consideration that besides the influence of continental climate on variety and structure of fauna, there is a considerable influence of ecological conditions and biotopes caused by Alpine and Mediterranean climates. About 20 species and subspecies of moths and butterflies were in new research found for the first time in the fauna of Croatia in Gorski kotar (LORKOVIĆ, 1985; LORKOVIĆ & MLADINOV, 1971; MLADINOV 1976, 1977, 1980; MLADINOV & LORKOVIĆ, 1979) and Lika (KUČINIĆ, 1992) are only considering our data and showing some faunistic specificums in this part of country.

According to the data presented on the number of registered noctuids, conclusions can be reached about the completeness of exploration of Macrolepidoptera fauna in Gorski kotar, Lika and the central-mountain part of Croatia. This is possible as a result of the complex researches (ABAFI-AIGNER et al., 1896; KOČA, 1901; LORKOVIĆ & MLADINOV, 1971; MLADINOV, 1976, 1977, 1978, 1980, 1983; KOVAČEVIĆ & FRANJEVIĆ-OŠTRC, 1978) that covered not only the noctuids family, but all the families of the Macrolepidoptera group.

The data on noctuids to a certain extent shows the level of exploration completeness of the whole Macrolepidoptera group. LORKOVIĆ (1985), MLADINOV & LORKOVIĆ (1979, 1985) and MLADINOV (1976, 1977, 1978, 1980, 1983, 1985, 1990) noted 499 Macrolepidoptera species in the upper part of the river Kupa. The same author concluded that Macrolepidoptera fauna was well researched (for Rhoplaocera about 90%), including the noctuids. The situation is similar with the Geometridae family for which MLADINOV (1980, 1983, 1985) noted 161 taxa in the upper part of the river Kupa (about 80-90% potential fauna of Geometridae). For this family in the continental part were registered more than 250 species and in the whole of Croatia about 400 species (KOČA, 1900, 1925; KRANJČEV, 1985; MLADINOV, 1980). For Podravina and Slavonija, which are the best explored regions in continental Croatia, were registered more than 800 species of Macrolepidoptera (KOČA, 1900, 1901, 1925; KOVAČEVIĆ & FRANJEVIĆ-OŠTRC, 1978; KRANJČEV, 1985; LORKOVIĆ et al., 1992, LORKOVIĆ, 1993).

Considering the number of registered noctuid species in Croatia and in different parts of Croatia (Tab. 3) as well as faunistic data of the Geometridae family, it can be concluded that the families mentioned families and the other families belonging to the Macrolepidoptera group are 65-75% researched for the Gorski kotar area. Since considerably less is known about Macrolepidoptera of Lika the level of exploration completeness is 35-45% and for the central-mountain area 55-65%. It should be pointed out that there is no single part in Lika so well explored as Gorski kotar is (MLADINOV, 1976, 1977, 1978, 1980, 1983, 1985, 1990). For Risnjak we registered 10-15 potential species of Macrolepidoptera, and for Lička Plješevica, including the literature data 25-30 potential species. Including the ecological characteristics, size of areas and number of registered species in Podravina and Slavonija we must expect 750-850 species of Macrolepidoptera fauna for areas of Gorski kotar and Lika and 500-600 for Risnjak and Lička Plješevica.

For the continental part of Croatia, knowledge of Microlepidoptera fauna is considerably smaller compared to Macrolepidoptera fauna. The first scientific data for this region were given by MANN (1867) who explored the surrounding of Josipdol. The first significant data were given by ABAFI-AIGNER et al. (1896) and KOČA (1925a) who presented the entomological data for the continental part of Croatia. ABAFI-AIGNER et al. (1896) in the "Fauna of Hungaria" which includes out a lot of data Micro and Macrolepidoptera registered by the end of the nineteenth century in the fauna of the Croatian area (which at that time was part of Hungary). We can consider that this is the first Croatian fauna of moths and butterflies. KOČA (1925a) registered 320 Microlepidoptera species for continental

Croatia. After that there were no complex explorations for this group of moths in the last 70 years. Those are the first data on Microlepidoptera fauna for the mountains of Lička Plješevica and Risnjak. We must expect several hundred species of Microlepidoptera fauna for areas of Risnjak, Lička Plješevica and the central-mountain area of Croatia.

Table 1. A survey of established moths on Risnjak (Gorski kotar) and Lička Plješevica (Lika) and their zoogeographical characteristics.

1-Risnjak	Z.P.-Zoogeographical dependence
2-Lička Plješevica	EU-European species
3-Gorski kotar	ES-Eurosiberian species
4-Lika	OR-Oriental species
*- literature data for Lička Plješevica, Gorski kotar and Lika	HO-Holarctic species
+ new data for Risnjak and Lička Plješevica	AT-Atlantic species
	ME-Mediterranean species
	TR-Tropic species
	CO-Cosmopolite species
	EU-OR-Eurooriental species

SPECIES	1	2	3	4	Z.D.
GEOMETRIDAE					
1. <i>Geometra papilionaria</i> L.	-	+	*	+	ES
2. <i>Chlorissa viridata</i> L.	-	+	*	+	ES
3. <i>Thetidia smaragdaria</i> Fab.	-	+	-	+	ES
4. <i>Idaea aversata</i> L.	+	-	*	-	OR
5. <i>Timandra griseata</i> Peter.	+	-	*	-	EU-OR
6. <i>Larentia clavaria</i> Haw.	-	+	-	+	ME
7. <i>Scotopteryx chenopodiata</i> L.	+	-	*	-	ES
8. <i>Scotopteryx moeniata</i> Scop.	+	-	*	-	OR
9. <i>Scotopteryx bipunctaria</i> D.&S.	+	+	*	*	OR
10. <i>Aplocera plagiata</i> L.	-	+	*	*	ES
11. <i>Aplocera praeformata</i> Hbn.	+	+	*	*	OR
12. <i>Triphosa dubitata</i> L.	-	+	*	+	ES
13. <i>Eulithis pyraliata</i> D.&S.	+	+	*	+	ES
14. <i>Cidaria fulvata</i> Forst.	+	-	*	-	ES
15. <i>Thera variata</i> D.&S.	-	+	*	+	ES
16. <i>Chlorochysta siterata</i> Hufn.	-	+	*	+	OR
17. <i>Chlorochysta citrata</i> L.	-	+	*	+	ES
18. <i>Colostygia olivata</i> D.&S.	+	+	-	*	ES
19. <i>Pareulype berberata</i> D.&S.	+	-	*	-	ES
20. <i>Catarhoe cuculata</i> Hufn.	+	-	*	-	ES
21. <i>Epirrhoe tristata</i> L.	+	+	*	+	ES
22. <i>Epirrhoe alternata</i> Müll.	+	-	*	-	ES
23. <i>Cabera pusaria</i> L.	+	+	*	+	ES

24.	<i>Puengeleria capreolaria</i> D.&S.	+	+	*	+	EU
25.	<i>Campaea margaritata</i> L.	+	+	*	+	OR
26.	<i>Ennomos quercinaria</i> Hufn.	+	+	*	+	OR
27.	<i>Colotois pennaria</i> L.	+	-	*	-	OR
28.	<i>Crocallis tusciaria</i> Bkh.	+	-	+	-	OR
29.	<i>Crocalis elinguaris</i> L.	+	-	*	-	ES
30.	<i>Opisthograptis luteolata</i> L.	-	+	*	*	ES
31.	<i>Epione repandaria</i> Hufn.	+	-	*	-	ES
32.	<i>Pseudopanthera macularia</i> L.	-	+	*	+	ES
33.	<i>Semiothisa clathrata</i> L.	+	-	*	-	ES
34.	<i>Agriopis aurantiaria</i> Hbn.	-	+	-	+	OR
35.	<i>Erannis defoliaria</i> Cl.	-	+	-	+	OR
36.	<i>Biston betularius</i> L.	-	+	*	+	ES
37.	<i>Peribatodes secundarius</i> D.&S.	-	+	-	+	EU
38.	<i>Alcis repandatus</i> L.	-	+	*	+	ES
39.	<i>Hypomecis roboraria</i> D.&S.	-	+	*	*	ES
40.	<i>Ascotis selenaria</i> D.&S.	-	+	*	+	ES
41.	<i>Gnophos furvatus</i> D.&S.	-	+	*	*	EU
42.	<i>Charissa obscurata</i> D.&S.	+	-	-	-	OR
43.	<i>Siona lineata</i> Scop.	-	+	-	+	ES
44.	<i>Aspitates gilvaria</i> D.&S.	-	+	-	+	ES

NOCTUIDAE

45.	<i>Agrotis segetum</i> D.&S.	+	-	*	-	HO
46.	<i>Agrotis exclamationis</i> L.	+	*	*	*	ES
47.	<i>Peridroma saucia</i> Hbn.	+	*	*	*	AT
48.	<i>Xestia baja</i> D.&S.	+	*	*	*	HO
49.	<i>Xestia rhomboidea</i> Esp.	+	-	*	*	EU
50.	<i>Xestia c-nigrum</i> L.	+	*	*	*	HO
51.	<i>Anaplectoides prasina</i> D.&S.	+	*	*	*	HO
52.	<i>Lacanobia w-latinum</i> Hufn.	+	*	*	*	HO
53.	<i>Lacanobia oleracea</i> L.	+	-	*	-	ES
54.	<i>Melanchra persicariae</i> L.	+	*	*	*	ES
55.	<i>Aneda rivularis</i> Fab.	+	-	*	-	ES
56.	<i>Mythimna ferrago</i> Fab.	+	*	*	*	ES
57.	<i>Mythimna conigera</i> D.&S.	+	*	*	*	ES
58.	<i>Acronicta rumicis</i> L.	+	*	*	*	ES
59.	<i>Tetramphipyra tetra</i> Fab.	+	-	*	-	ES
60.	<i>Phlogophora meticulosa</i> L.	+	*	*	*	OR
61.	<i>Actinotia polyodon</i> Cl.	+	*	*	*	ES
62.	<i>Apamea monoglypha</i> Hufn.	+	*	*	*	ES
63.	<i>Amphipoea oculea</i> L.	+	-	*	*	HO
64.	<i>Hoplodrina blanda</i> D.&S.	+	-	*	-	OR
65.	<i>Platyperigea kadenii</i> Frey.	+	-	+	-	ES
66.	<i>Panemeria tenebrata</i> Scop.	-	+	*	-	EU
67.	<i>Abrostola triplasia</i> L.	+	-	*	-	ES
68.	<i>Diachrysia chrysitis</i> L.	+	*	*	*	ES

69. <i>Macdunnoughia confusa</i> Steph.	+	-	*	-	ES
70. <i>Autographa gamma</i> L.	+	*	*	*	HO
71. <i>Scoliopteryx libatrix</i> L.	+	*	*	*	HO
72. <i>Laspeyria flexula</i> D.&S.	+	-	*	-	ES
73. <i>Phytometra viridaria</i> Cl.	+	-	*	-	ES
SPHINGIDAE					
74. <i>Agrius convolvuli</i> L.	-	+	-	+	TR
75. <i>Sphinx ligustri</i> L.	-	+	*	+	ES
76. <i>Hyloicus pinastri</i> L.	-	+	*	+	ES
77. <i>Smerinthus ocellatus</i> L.	-	+	*	+	ES
78. <i>Deilephila porcellus</i> L.	-	+	*	*	ES
79. <i>Laothoe populi</i> L.	-	+	*	+	ES
80. <i>Macroglossum stellatarum</i> L.	+	+	*	+	ES
ZYGAENIDAE					
81. <i>Zygaena filipendulae</i> L.	-	+	*	*	OR
82. <i>Zygaena purpuralis</i> Brunn.	-	+	*	*	ES
83. <i>Zygaena transalpina</i> Esp.	+	-	*	*	EU
84. <i>Zygaena ephialtes</i> L.	-	+	-	+	ES
SATURNIDAE					
85. <i>Perisomena caecigena</i> Kup.	-	+	-	+	OR
DREPANIDAE					
86. <i>Habrosyne pyritoides</i> Hufn.	-	+	*	+	ES
87. <i>Tethea</i> or F.	-	+	*	+	ES
88. <i>Cilix glaucata</i> Scop.	-	+	-	+	HO
ARCTIIDA					
89. <i>Lithosia quadra</i> L.	-	+	*	+	ES
90. <i>Eilema complana</i> L.	+	-	*	-	OR
91. <i>Eilema sororcula</i> Hufn.	-	+	*	+	ES
92. <i>Chelis maculosa</i> Gern.	-	+	-	+	ES
93. <i>Diacrisia sannio</i> L.	-	+	*	*	ES
94. <i>Spilosoma lubricipedium</i> L.	-	+	*	+	ES
NOTODONTIDAE					
95. <i>Notodonta ziczac</i> L.	-	+	*	+	ES
96. <i>Ptilodon capucina</i> L.	-	+	*	+	ES
97. <i>Phalera bucephala</i> L.	-	+	-	+	ES
98. <i>Pterostoma palpinum</i> Cl.	-	+	*	+	ES
99. <i>Stauropus fagi</i> L.	-	+	*	*	ES
100. <i>Clostera curtula</i> L.	-	+	*	+	ES
101. <i>Clostera pigra</i> Hufn.	-	+	*	+	ES
102. <i>Cerura vinula</i> L.	+	-	*	*	ES
103. <i>Drymonia ruficornis</i> Hufn.	-	+	*	+	ES
LASIOCAMPIDAE					
104. <i>Malacosoma neustrium</i> L.	-	+	*	*	ES
105. <i>Malacosoma castrensis</i> L.	-	+	*	+	ES
106. <i>Poecilocampa populi</i> L.	-	+	*	*	EU
107. <i>Macrothylacia rubi</i> L.	-	+	*	*	ES

108. <i>Gastropache quercifolia</i> L.	-	+	*	+	ES
109. <i>Odonestis pruni</i> L.	-	+	-	+	ES
110. <i>Dendrolimus pini</i> L.	-	+	*	+	ES
111. <i>Trichiura crataegi</i> L.	-	+	*	+	OR
112. <i>Lasiocampa trifolii</i> D.&S.	+	-	*	*	OR
LYMANTRIIDAE					
113. <i>Arctornis l-nigrum</i> Müll.	-	+	*	+	ES
114. <i>Lymantria dispar</i> L.	-	+	*	*	ES
115. <i>Lymantria monacha</i> L.	+	-	*	-	ES
116. <i>Calliteara pudibunda</i> L.	-	+	*	+	ES
LEMONIIDAE					
117. <i>Lemonia taraxaci</i> D.&S.	-	+	*	+	EU
HEPIALIDAE					
118. <i>Triodia sylvina</i> L.	-	+	*	+	OR
CRAMBIDAE					
119. <i>Scoparia basistrigalis</i> Knag.	-	+	-	+	EU
120. <i>Ostrinia nubilalis</i> Hub.	-	+	*	*	ES
121. <i>Pleuroptya ruralis</i> Scop..	-	+	-	+	ES
PYRALIDAE					
122. <i>Pyralis farinalis</i> Zeller.	+	-	+	*	CO
123. <i>Dioryctria abietella</i> D.&S.	-	+	-	+	HO
TORTRICIDAE					
124. <i>Agapeta zoegana</i> L.	+	-	*	*	OR
125. <i>Epiblema foenella</i> L.	-	+	-	+	OR
OECOPHORIDAE					
126. <i>Harpella forcicella</i> Scop.	-	+	*	+	OR
ELACHISTIDAE					
127. <i>Ethmia pusiella</i> L.	-	+	-	+	OR

A comparison between noctuids fauna and computed quotient of similarity (SØRENSEN, 1948) between ecologically different regions: Gorski kotar with predominant mountain climate, Turopolje with predominant continental climate and southern Dalmatia with predominant Mediterranean climate. According to number of registered species of noctuids (Tab. 3) and area (Fig. 1) they live in, noctuids fauna of those regions are approximately equally explored. Table 4 shows the number of species of those regions, the number of common species between those regions and the quotient of similarity (SØRENSEN, 1948) of noctuids fauna between those regions. As can be seen, each of the regions compared has a certain specific characteristic of fauna (number of species for that region only), but there is a much greater degree of fauna similarity between Gorski kotar and Turopolje (large number of common species and quotient of similarity), while the degrees of similarity between those regions and southern Dalmatia is very small (small number of common species and quotient of similarity) (Tab. 4). Characteristics of climate, vegetation, and soil are of essential influence on composition and structure of fauna of a certain region. Those

characteristics are much more similar for Turopolje and Gorski kotar than they are for those regions compared to southern Dalmatia.

Table 2. Families and established species.

Families	Total number	Risnjak	Lička Plje.
Geometridae	44	23	30
Noctuidae	29	28	1
Sphingidae	7	1	7
Zygaenidae	4	1	3
Saturnidae	1	-	1
Drepanidae	3	-	3
Arctiidae	6	1	5
Notodontidae	9	1	8
Lasiocampidae	9	1	8
Lymantridae	4	1	3
Lemonidae	1	-	1
Hepialidae	1	-	1
Crambidae	3	-	3
Pyralidae	2	1	1
Tortricidae	2	1	1
Oecophoridae	1	-	1
Elachistidae	1	-	1
Total number	127	59	78

Conclusions about the characteristics of noctuids fauna in those regions may perhaps be applied for complete butterfly and moth fauna of those regions as well as the wider geographical regions to which they belong, Turopolje for the lowland continental part of Croatia, Gorski kotar for the central-mountain part and southern Dalmatia for the Mediterranean part of Croatia, which may be confirmed by future research.

Table 3. Number of registered noctuids (N) in parts of Croatia.

Area	N	Area	N
Gorski kotar	179	S. Dalmatia	175
Lika	114	Slavonia	270
Turopolje	140	Podravina	289

Table 4. Number of common species and quotient of similarity between areas of Gorski kotar, Turopolje and southern Dalmatia.

Areas	1	2
G.K. - T.	100	62%
G.K. - S.D.	45	25,4%
T. - S.D.	39	24,7%

1 = number of common species

2 = quotient of similarity

(SØRENSEN, 1848)

G.K.= Gorski kotar

T = Turopolje

S.D.= southern Dalmatia

Zoogeographical analysis of moths of those regions also indicates a substantial degree of zoogeographical elements of similarity that are predominant in Turopolje and Gorski kotar as compared with southern Dalmatia. Euroasiberian zoogeographical elements predominate in Gorski kotar and Turopolje (MLADINOV, 1977, 1980; KUČINIĆ & PEROVIĆ, 1992/1993), while Oriental elements are predominant in Dalmatia (KUČINIĆ et al., 1993; MLADINOV & KUČINIĆ, 1993). These results also show that the fauna of Macrolepidoptera is more similar between Gorski kotar and Turopolje, while the similarity between those regions and southern Dalmatia is smaller. These results are in accordance with zoogeographical analysis of species registered in this paper for the central-mountain area, Risnjak and Lička Plješevica (Tab. 5) and in papers MLADINOV (1977, 1980) for the area of Gorski kotar and for Lika (KUČINIĆ, 1992). A high percentage of Oriental species (Tab. 5) is the result of the Mediterranean influence on this central-mountain region and of faunal migration of some species from southern Europe, Asia, north Africa to central and north Europe (MLADINOV, 1977, 1980; KUČINIĆ, 1992).

Table 5. Zoogeographical analysis registered species

Z. P.	TOTAL	RISNJAK	LIČKA PLJEŠEVICA
E S	79(62,0%)	32(54,1%)	53(67,9%)
O R	24(19,4)	13(23,0%)	14(17,9%)
E U	9(6,9%)	3(4,9%)	7(9,0%)
H O	10(7,7%)	8(13,2%)	2(2,6%)
M E	1(0,8%)	-	1(1,3%)
T R	1(0,8%)	-	1(1,3%)
A T	1(0,8%)	1(1,6%)	-
C O	1(0,8%)	1(1,6%)	-
EU - OR	1(0,8%)	1(1,6%)	-
TOTAL	127(100%)	59(100%)	78(100%)

EU-European species

HO-Holoartic species

AT-Atlantic species

ES-Eurosiberien

TR-Tropic species

ME-Mediterranean species

OR-Oriental species

CO-Cosmopolite species

EU-OR-Eurooriental species

CONCLUSION

1. Analysing moths from the Igalffy Collection from the area of Risnjak (Gorski kotar) and Lička Plješevica (Lika), we found 127 species from 17 families, for the central-mountain area of Croatia. For area of Risnjak we established 59 unrecorded species, for Lička Plješevica 78 unrecorded species, for Gorski kotar 5 unrecorded species, for Lika 59 unrecorded species and for the central-mountain area of Croatia 22 unrecorded species (Tab. 1).

2. We presuppose that our results cover 55-65% for the central-mountain area of Croatia, 65-75% for Gorski kotar, 35-45% for Lika, 25-30% for mounts Lička Plješevica and 10-15% for Risnjak from the potential number of species for the fauna of Macrolepidoptera. This is the first information concerning the fauna of Microlepidoptera in Risnjak and Lička Plješevica.

3. Comparison between noctuids fauna, using the SØRENSEN, (1948) methods between ecologically different regions (Gorski kotar-mountain area, Turopolje lowland of continental area and southern Dalmatia-Mediterranean area) shows that the fauna of Turopolje and Gorski kotar have many more mutual similarities then they do with southern Dalmatia.

4. Because of very interesting results (LORKOVIĆ & MLADINOV, 1971, MLADINOV, 1976, 1977, 1980) further entomological research is necessary in the central-mountain area of Croatia. Special consideration has to be given to the group of Microlepidoptera and to areas with relatively unknown fauna (Risnjak, Lička Plješevica, Snježnik, Kapela, Velebit).

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CORRIGENDA

Tab.1.

18. <i>Colostygia olivata</i> D.&S.	+	+	+	*	ES
42. <i>Charissa obscurata</i> D.&S.	+	-	+	-	OR
80. <i>Macroglossum stellatarum</i> L.	+	+	*	*	ES

ARCTIIDAE

SAŽETAK

Prilog fauni Heterocera (Insecta, Lepidoptera) centralno-planinskog područja (Risnjak i Lička Plješevica) Republike Hrvatske

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Nastavkom obrade leptira iz zbirke "Igalffy" prikazali smo rezultate koji se odnose na skupinu Heterocera prikupljenih na području Nacionalnog parka "Risnjak" (Gorski kotar) i Ličke Plješevice (Lika). Oba područja smještena su u centralno-planinskom dijelu Republike Hrvatske (Sl. 1).

Determinacijom leptira (261 primjerak) utvrdili smo 127 vrsta (Tab. 1), iz 17 porodica (Tab. 2). Najveći broj vrsta (Tab. 2) zabilježili smo za porodice Geometridae (44) i Noctuidae (29). Za Nacionalni park Risnjak registrirali smo 59, a Ličku Plješevicu 78 vrsta Heterocera. Sa literaturnim podacima koji se također temelje na obradi materijala iz zbirke "Igalffy" (LORKOVIĆ, 1977; MLADINOV 1985; MLADINOV & LORKOVIĆ, 1985; KUČINIĆ, 1992) za područje Ličke Plješevice zabilježene su do sada 164 vrste Heterocera, što su jedini podaci o fauni noćnih leptira te planine. Za područje Gorskog kotara registrirali smo 5 nezabilježenih vrsta leptira, Like 59, a centralno-planinskog dijela Hrvatske 22.

Za određivanje stupnja istraženosti faune Macrolepidoptera kao pokazatelj istraženosti koristili smo podatke koji se odnose na porodicu sovice (KUČINIĆ, 1992; KUČINIĆ & PEROVIĆ, 1992/1993). Prema tim podacima istraženost faune leptira Gorskog kotara iznosi 65-75%, Like 35-45%, centralno-planinskog područja Hrvatske 55-65%, Ličke Plješevice 25-30%, a Risnjaka 10-15%. Kod tih komparacija vodili smo računa ne samo o broju registriranih vrsta, nego i o veličini uspoređivanih područja i njihovim ekološkim karakteristikama. Prema tim podacima kao i prema podacima koji se odnose na faunistički najbolje istražena područja kontinentalnog dijela Hrvatske, Podravine i Slavonije, za koje je registrirano više od 800 vrsta Macrolepidoptera (KOČA, 1900, 1901, 1925; KOVAČEVIĆ & FRANJEVIĆ-OŠTRC, 1978; KRANJČEV, 1985, LORKOVIĆ et al., 1992, LORKOVIĆ 1993), za područje Gorskog kotara i Like u fauni Macrolepidoptera možemo očekivati između 750 i 850, a Risnjaka i Ličke Plješevice između 500 i 600 vrsta leptira.

Poznavanje faune Microlepidoptera na ovim prostorima daleko je manje nego faune Macrolepidoptera. Za područja Risnjaka i Ličke Plješevice pregledom dostupne literature nismo naišli ni na jedan faunistički podatak.

Radi utvrđivanja određenih karakteristika faune leptira centralno-planinskog dijela Hrvatske, metodom po SØRENSENU (1948) usporedili smo faune sovice Gorskog kotara (centralno-planinski dio Hrvatske), Turopolja (nizinski-kontinentalni dio) i južne Dalmacije (mediteranski dio Hrvatske). Rezultati te analize prikazani su na tabeli 4. Oni pokazuju relativno velik broj zajedničkih vrsta i relativno visoki stupanj sličnosti fauna Gorskog kotara i Turopolja, za razliku od malog broja zajedničkih vrsta i kvocijenata sličnosti

faune tih područja i južne Dalmacije. Iz toga možemo zaključiti da i kod leptira, insekata koji su veoma pokretljivi, najčešće s velikim područjem rasprostranjenja, postoje značajne razlike u strukturi i sastavu faune na određenim područjima koja su pod utjecajem karakterističnih i za njih specifičnih ekoloških uvjeta. U ovome slučaju to se prvenstveno odnosi na klimu (Gorski kotar – dominantni utjecaj planinske klime, Turopolje – kontinentalne i južna Dalmacija – mediteranske) vegetaciju i pedološke karakteristike, koji djeluju na sastav faunističkih elemenata koji dolaze na tim prostorima. Sa porastom njihove sličnosti, raste i sličnost faune.

Zaključci o karakteristikama faune sovica tih područja možda se mogu primjeniti i za cjelokupnu faunu leptira tih regija, kao i većih geografskih prostora kojima pripadaju (kontinentalni nizinski dio-Turopolje, centralno-planinsko područje-Gorski kotar i mediteransko područje-južna Dalmacija), što će moći potvrditi tek rezultati idućih entomoloških istraživanja različitih skupina i porodica leptira na tim područjima.

Zoogeografska analiza (Tab. 5) pokazala je da u fauni Macrolepidoptera Risnjaka i Ličke Plješevice prevladavaju eurosibirski zoogeografski elementi, što je uvjetovano ekološkim karakteristikama koji vladaju na tim planinskim prostorima. Relativno visoki udio orijentalnih elemenata uvjetovan je znatnim utjecajem mediterana na ta područja, kao i migracijskim letovima nekih vrsta leptira iz južnih dijelova Europe, sjeverne Afrike i Azije u hladnija područja srednje i sjeverne Europe. Ti rezultati podudaraju se sa rezultatima sličnih zoogeografskih analiza provedenih za područje centralno-planinskog dijela Republike Hrvatske (KUČINIĆ, 1992; MLADINOV, 1977, 1980). U fauni sovica Turopolja dominantni su također eurosibirski faunistički elementi (KUČINIĆ & PEROVIĆ, 1992/1993), za razliku od područja Dalmacije u kojoj prevladavaju orijentalne, vrste (KUČINIĆ et al., 1993; MLADINOV & KUČINIĆ, 1993). I ti podaci ukazuju na veći stupanj sličnosti faune Macrolepidoptera Turopolja i Gorskog kotara, u odnosu na područje južne Dalmacije.

Rezultati ovih kao i istraživanja ostalih autora koji su obrađivali faunu leptira centralno-planinskog područja Hrvatske (ABAFI-AIGNER et al., 1896, LORKOVIĆ, 1977, 1985; LORKOVIĆ & MLADINOV, 1981; MANN, 1867; MLADINOV, 1977, 1980, 1983, 1985, 1986; MLADINOV & LORKOVIĆ, 1985) ukazuju na značajne faunističke specifičnosti toga područja Hrvatske. Buduća entomološka istraživanja (u slučaju leptira posebno skupine Microlepidoptera) trebala bi prvenstveno usmjeriti na područje NP "Risnjak" kao i na neke druge do sada nedovoljno istražene planinske dijelove (Snježnik, Lička Plješevica, Velika i Mala Kapela, Velebit).