



**LACEWINGS (INSECTA: NEUROPTERIDA)  
IN THE ŠTEFAN MICHIELI'S ENTOMOLOGICAL COLLECTION**

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**Abstract** – Štefan Michieli (1933-1968), Slovenian entomologist and physiologist, best known for the study of butterflies and moths (Lepidoptera) in Slovenia and the Balkan countries, was an outstanding lepidopterist. Slovenian Entomological Society is bearing his name. In addition to the Lepidoptera, he also collected small insect orders – Embioptera, Mecoptera and neuropterid orders. In nineties of the 20<sup>th</sup> century, Academician Professor Matija Gogala transferred the Michieli's collection of the Neuropterida to the author of this paper. It is believed that the inspected small neuropterid collection is only a part of formerly larger one, which had been partially destroyed or specimens lost. The remaining collection was restored and specimens identified to species level where possible. The restored collection contains one alderfly (Megaloptera) species, two snakefly (Raphidioptera) species, and 44 lacewing (Neuroptera) species. Collected specimens originate from Slovenia, Croatia and Montenegro. The total species number collected in Slovenia is surprisingly high and represents approx. 37% of the number of the Neuropterida species known nowadays in Slovenia. Štefan Michieli identified 76 individuals and his determinations were mostly made correctly.

**KEY WORDS:** history of entomology, Neuroptera, Megaloptera, Raphidioptera, Slovenia

**Izvleček** – MREŽEKRILCI (INSECTA: NEUROPTERIDA) V ENTOMOLOŠKI ZBIRKI ŠTEFANA MICHIELIJA

Štefana Michielija (1933-1968), slovenskega entomologa in fiziologa, ki ga najbolj poznamo po raziskavah metuljev (Lepidoptera) Slovenije in Balkana, imamo za iz-

jemnega lepidopterologa. Slovensko entomološko društvo nosi v nazivu njegovo ime. Poleg metuljev je zbiral tudi predstavnike manjših redov žuželk – nogoprelcev (Embioptera), kljunavcev (Mecoptera) in mrežekrilcev. V devetdesetih letih 20. stoletja je akademik prof. Matija Gogala prenesel Michielijev zbirko mrežekrilcev avtorju tega prispevka. Prav gotovo je sedanja zbirka le del nekoč večje zbirke, ki je bila deloma uničena ali so bili primerki izgubljeni. Preostanek zbirke smo restavrirali in osebke določili do vrst, kjer je bilo mogoče. Restavrirana zbirka mrežekrilcev vključuje eno vrsto velekrilcev (Megaloptera), dve vrsti kamelovratnic (Raphidioptera) in 44 vrst pravih mrežekrilcev (Neuroptera). Osebki izvirajo iz Slovenije, Hrvaške in Črne gore. 42 vrst mrežekrilcev v širšem smislu (Neuropterida) je iz Slovenije, kar je presenetljivo veliko, saj predstavljajo pribl. 37% vrst vseh, ki jih danes poznamo iz Slovenije. Štefan Michieli je določil 76 osebkov in njegove determinacije so v veliki večini pravilne.

**KLJUČNE BESEDE:** zgodovina entomologije, mrežekrilci, blatnice, kamelovratnice, Slovenija

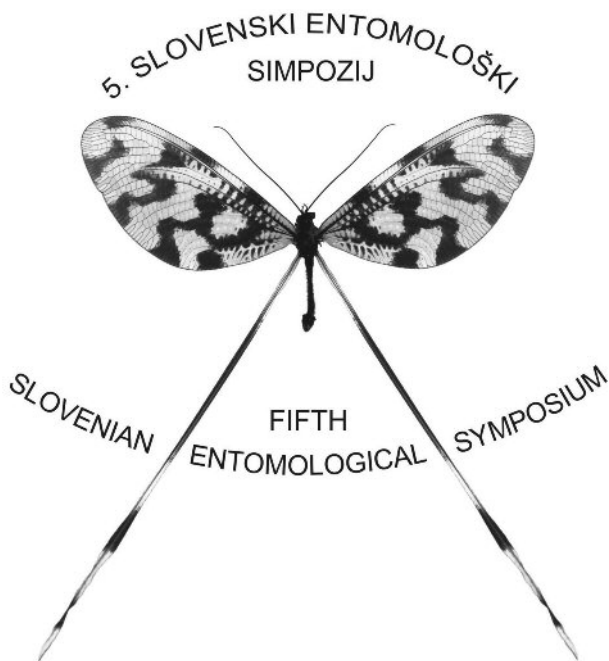
### Introduction

Neuropterological investigations in Slovenia have a rich tradition. The oldest documented record of any lacewing in the country dates back to the year 1685 when Janez Vajkard Valvasor (1641-1693) prepared an unpublished collection of aquarelles



**Fig. 1.** Štefan Michieli (1933-1968).

**Fig. 2.** Logo of the 5<sup>th</sup> Slovenian Entomological Symposium (5SES) with International Attendance. The Symposium was dedicated to Profs. M. Gogala and Š. Michieli. The logo contained a figure of the spoonwing species *Nemoptera sinuata*.



of Slovenian plants and animals, among them also an excellent illustration of one lacewing species (Valvasor 1685; Wraber et al. 1990). Research of the neuropterology in Slovenia started in 1763 with the Scopoli's famous *Entomologia carniolica* containing a description of three new neuropteran species (Scopoli 1763).

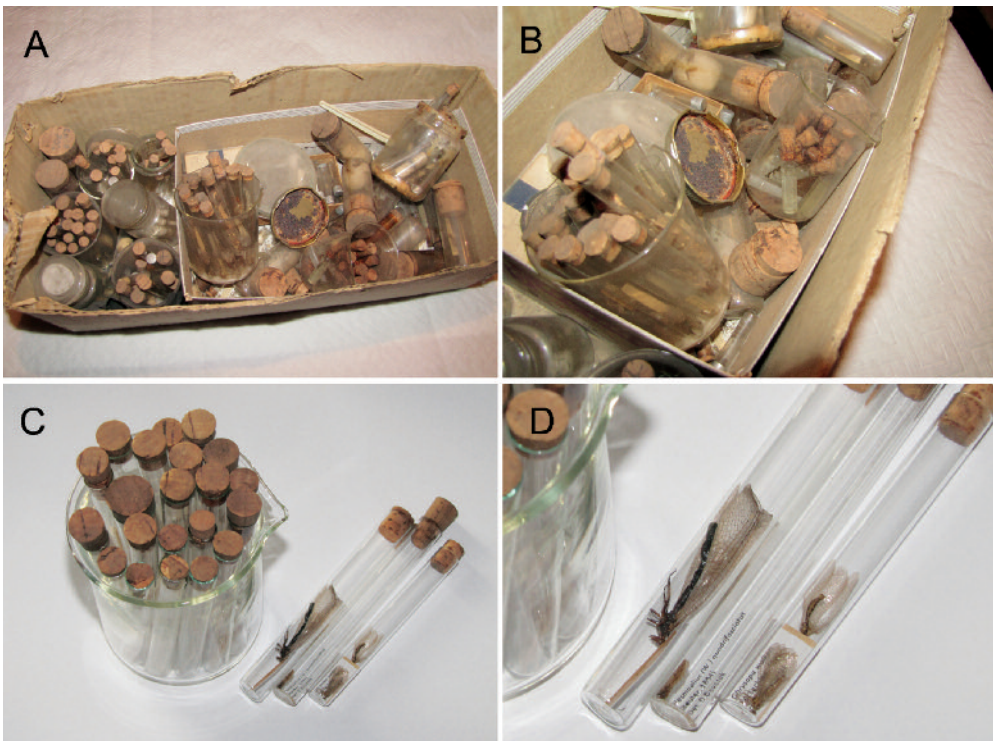
In 20<sup>th</sup> century, in the period after the WWII, a new era of the study of Slovenian insects begun. In 1952, the Slovenian Entomological Society was founded and an outstanding zoologist Štefan Michieli (1933-1968) (Fig. 1) promoted progress in entomology as a mentor of young students and a brilliant researcher. Professor Michieli who was well known as a lepidopterologist was also a founder of Animal Physiology at the University of Ljubljana (Gogala 2018). His lepidopterological collection is now deposited in the Natural History Museum of Slovenia in Ljubljana. His focus in the field of entomology was – besides butterflies and moths – small insect orders, such as Embioptera, Mecoptera and neuropterid orders (Raphidioptera, Megaloptera, Neuroptera). While Michieli studied biology of two western Balkan embiopteran species thoroughly (Michieli 1956, 1958; Michieli & Bole 1956; Bole 1978), unfortunately, he did not publish any paper on faunistics of Neuropterida in Slovenia. First comprehensive lists of Neuropterida and Mecoptera in Slovenia were published only three decades later, in 1984 and 1988 (Devetak 1984, 1988).

During his lepidopterological field trips in the Balkan countries, Michieli collected Neuroptera occasionally. Well known is his interest for spoonwings (Nemopteridae) and after his death, the distribution of a species *Nemoptera sinuata* Olivier, 1811 (Fig. 2) in North Macedonia also based on his collection was presented by Popov (1970).

Štefan Michieli collected lacewings and identified most of the specimens. After his premature death, nobody took care of his lacewing collection and a part of it was crumbling. In nineties of the 20<sup>th</sup> century, Academician Professor Matija Gogala left the Michieli's collection of the Neuropterida to the author of this paper. Now, this collection is deposited in the Entomological Collections of the Natural History Museum of Slovenia in Ljubljana. In the present paper, a revision of Michieli's collection and a list of species with localities are provided.

### Material and methods

Insects were originally preserved in glass vials, filled with 70% ethanol. Later, the medium evaporated and some of the specimens were more or less damaged or even destroyed by pests (Fig. 3 A, B). After restoration, dried specimens are preserved in original glass vials (Fig. 3 C, D). Specimens were identified to species level where possible. For identification we used Aspöck et al. (1980). Reliable identification of *Wesmaelius*-females was only possible by means of examination of their genitalia. Genital preparations were made by clearing the apex of the ab-



**Fig. 3.** A part of the Michieli's neuropterid collection before (A, B) and after (C, D) the reconstruction.

domen in saturated KOH solution. Nomenclature has been used in accordance with Oswald (2017).

## Results and discussion

We believe that the investigated small collection is only a part of formerly larger one, which had been partially destroyed or specimens lost. The collection after restoration (Fig. 3) contains 184 specimens belonging to 47 neuropterid species – one alderfly (Megaloptera) species, two snakefly (Raphidioptera) species, and 44 lacewing (Neuroptera) species (Table 1). Collected specimens originate from Slovenia, Croatia and Montenegro. The total species number is surprisingly high. Forty-two neuropterid species originating from Slovenia represents 37% of the Slovenian fauna (Devetak 2018). Štefan Michieli identified 76 individuals and most of his determinations were made correctly. Collected lacewings are common species, wide spread in Slovenia (Devetak 2018). In the period after WWII, in Michieli's times, any similar collection of the neuropterid orders did not exist in Slovenia.

Neuropterids were, besides other taxa, also a subject for the study of visual properties of insect eyes. Professor Michieli and his colleague professor Matija Gogala studied the structure and function of owlfly compound eyes in a context of UV-vision (Gogala and Michieli 1965). Later, after Michieli's death, the research initiated by the both scientists lead to the discovery and isolation of the first known UV-phopigment in invertebrates (Gogala et al. 1970; Hamdorf et al. 1971).

Štefan Michieli died very young, in the age of 35. He was the first Slovenian entomologist studying Neuropterida in the country. If he had lived longer, he would have a greater impact on the world neuropterology.

## Acknowledgement

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**Table 1:** A list of species of the Neuropterida in the Michieli's collection. Legend: Carn – J. Carnelutti leg.; Mich – Š. Michieli leg.

Current valid name	Collecting place, date	Original label (identification); remarks	Number of individuals	Identification: corr-correct; incorr-incorrect
R A P H I D I O P T E R A				
RAPHIDIIDAE				
<i>Dichrostigma flavipes</i> (Stein, 1863)	Nanos 4.-6. VII. 1959	-	1 female	-
<i>Venustoraphidia nigricollis</i> (Albarda, 1891)	Ljubljana 10.V.1959	Raph.	1 ind	-
M E G A L O P T E R A				
SIALIDAE				
<i>Sialis</i> sp.	Posavje	<i>Sialis flavilatera</i> /no abdomen/	1 ind	-
<i>Sialis</i> sp.	Slovenija, Ljubljana	<i>Sialis fuliginosa</i> - unidentified	2 ind	-
N E U R O P T E R A				
OSMYLIDAE				
<i>Osmylus fulvicephalus</i> (Scopoli, 1763)	Gornji Grad VI. 55	<i>Osmylus chrysops</i> L.	4 ind	corr
<i>Osmylus fulvicephalus</i> (Scopoli, 1763)	Bistričica pod Krvavcem VII.1955 Carn. leg	<i>Osmylus chrysops</i> L.	2 ind	corr
CHRYSOPIDAE				
<i>Hypochrysa elegans</i> (Burmeister, 1839)	Bohinj V.1956 Mich. leg.	<i>Hypochrysa nobilis</i> Schneid.	2 ind	corr
<i>Nineta flava</i> (Scopoli, 1763)	Ljubljana 30. VIII. 1957	<i>C. flava</i>	2 ind	corr
<i>Nineta flava</i> (Scopoli, 1763)	Bohinj 7.-10. VIII. 1959	-	1 ind	-
<i>Nineta flava</i> (Scopoli, 1763)	Dolina Triglavskih jezer 7.-10. VIII. 1959	-	1 female	-
<i>Nineta vittata</i> (Wesmael, 1841)	Bohinj, Savica	<i>Chrysopa vittata</i> Wesm.	1 ind	corr
<i>Nineta vittata</i> (Wesmael, 1841)	Gornji Grad VI.1955	<i>Chrysopa vittata</i> Wesm.?	1 ind	corr
<i>Nineta vittata</i> (Wesmael, 1841)	Bohinj-Savica 26/27.VIII.1957	-	3 female	-
<i>Nineta pallida</i> (Schneider, 1846)	Dolina Triglavskih jezer 7.-10. VIII. 1959	-	1 ind	-
<i>Chrysopidia ciliata</i> (Wesmael, 1841)	Krvavec 21.VIII.	<i>C. alba</i> L.?	1 male	corr

<i>Chrysopa perla</i> (Linnaeus, 1758)	Posavje, Mich. leg.	<i>C. perla</i> L.	5 ind	corr
<i>Chrysopa perla</i> (Linnaeus, 1758)	Bohinj Komna Mich. leg.	<i>C. perla</i>	1 ind	corr
<i>Chrysopa perla</i> (Linnaeus, 1758)	Komarča, 1300 m, 2.VII.1956	<i>Chrysopa perla</i>	2 ind	corr
<i>Chrysopa perla</i> (Linnaeus, 1758)	Rakovnik 26. V. 1959	-	2 ind	-
<i>Chrysopa perla</i> (Linnaeus, 1758)	Ljubljana VII. 1957	<i>C. perla</i>	1 ind	corr
<i>Chrysopa perla</i> (Linnaeus, 1758)	Kamniška Bistrica V.1955	<i>C. perla</i>	1 ind	corr
<i>Chrysopa perla</i> (Linnaeus, 1758)	Ljubelj 2.VI.1958		2 ind	
<i>Chrysopa walkeri</i> McLachlan, 1893	Solkan 22.V.1959	-	2 ind	-
<i>Chrysopa abbreviata</i> Curtis, 1834	Ljubljana 30.VIII.1957	<i>C. abbreviata</i> Curt.	1 ind	corr
<i>Chrysopa formosa</i> Brauer, 1851	Ljubljana 15. VI. 1955	-	1 ind	-
<i>Chrysopa formosa</i> Brauer, 1851	[Montenegro] Rijeka Crnojevića V.1957	<i>C. abbreviata</i> Curt.	1 ind	incorr
<i>Chrysopa</i> cf. <i>nigricostata</i> Brauer, 1851	[Croatia] Rovinj 4.- 15.IX.1956	<i>C. (tenella) nigrocostata</i>	1 ind	-
<i>Chrysopa pallens</i> (Rambur, 1838)	Ljubljana VII. 1957	<i>C. septempunctata</i>	1 ind	corr
<i>Chrysopa pallens</i> (Rambur, 1838)	Ljubljana VII.1955	<i>C. septempunctata</i> Wesm.	1 ind	corr
<i>Chrysopa pallens</i> (Rambur, 1838)	Ljubljana 1956	<i>C. septempunctata</i>	2 ind	corr
<i>Chrysopa pallens</i> (Rambur, 1838)	Ljubljana 30.VIII.1957	<i>C. septempunctata</i>	1 ind	corr
<i>Chrysopa pallens</i> (Rambur, 1838)	Ankaran 20- 30.VI.1957	-	3 ind	-
<i>Chrysopa pallens</i> (Rambur, 1838)	Ankaran 1.-7- IX. 1958	-	1 ind	-
<i>Chrysopa pallens</i> (Rambur, 1838)	[Croatia] Rovinj 4.- 12.IX.1955	<i>C. septempunct?</i>	1 ind	corr
<i>Chrysopa gibeauxi</i> (Leraut, 1989)	Trenta 28. VII.-1. VIII.	-	1 ind	-
<i>Chrysopa</i> sp.	Trenta 28.VII.- 1.VIII.???? 1956?	- unidentified	6 ind	-
<i>Pseudomallada</i> <i>prasinus</i> (Burmeister, 1839)	Bohinj 7.-10. VIII. 1959	-	1 ind	-
<i>Pseudomallada</i> <i>zelleri</i> (Schneider, 1851)	Nanos 4.-6.VII.1959	-	1 ind	-
<i>Pseudomallada</i> <i>zelleri</i> (Schneider, 1851)	[Croatia] Dubrovnik V.1957	<i>C. aspersa</i> Wesm.	3 ind	incorr



<i>Pseudomallada zelleri</i> (Schneider, 1851)	[Montenegro] Kotor V.1957	<i>C. aspersa</i> Wesm	1 ind	incorr
<i>Pseudomallada</i> sp.	Ankaran 1.-7- IX. 1958	- unidentified	3 ind	-
<i>Pseudomallada</i> sp.	Ankaran 20-30.VI.1957	- unidentified	3 ind	-
<i>Pseudomallada</i> sp.	Trenta 28.VII.-1.VIII.???? 1956?	- unidentified	4 ind	-
<i>Chrysoperla carnea</i> (Stephens, 1836) s.l.	Ankaran 20-30.VI.1957	-	1 ind	-
<i>Chrysoperla carnea</i> (Stephens, 1836) s.l.	Bohinj 2.-4.VII.1956	<i>C. vulgaris</i>	2 ind	corr
<i>Chrysoperla carnea</i> (Stephens, 1836) s.l.	Bohinj – Savica 11. VII. 1957	<i>C. microcephala</i> Br.	1 ind	corr
<i>Chrysoperla carnea</i> (Stephens, 1836) s.l.	Dolina Triglavskih jezer [Dol. trigl. j.] 1.-10- VII. 1958	-	5 ind	-
<i>Chrysoperla carnea</i> (Stephens, 1836) s.l.	Dolina Triglavskih jezer /date missing/	<i>C. vulgaris</i>	1 ind	corr
<i>Chrysoperla carnea</i> (Stephens, 1836) s.l.	Ljubljana 1855	<i>C. vulgaris</i>	7 ind	corr
<i>Chrysoperla carnea</i> (Stephens, 1836) s.l.	Ljubljana 15. VI. 1955	-	3 ind	-
<i>Chrysoperla carnea</i> (Stephens, 1836) s.l.	[Croatia] Rovinj 4.-12.IX.????	<i>C. vulgaris</i>	3 ind	corr
<i>Chrysoperla carnea</i> (Stephens, 1836) s.l.	Trenta 28.VII.-1.VIII.???? 1956?	-	5 ind	-
<i>Chrysoperla lucasina</i> (Lacroix, 1912)	Ljubljana 15.VI.1955	-	1 ind	-
<i>Cunctochrysa albolineata</i> (Killington, 1935)	Bohinj 7.-10. VIII. 1959	-	1 ind	-
<b>HEMEROBIIDAE</b>				
<i>Hemerobius humulinus</i> Linnaeus, 1758	Dolina Triglavskih jezer 7.-10.VIII.1959	-	1 ind	-
<i>Hemerobius humulinus</i> Linnaeus, 1758	Trenta 28.VII.-1.VIII.???? 1956?	-	1 male 2 females	-
<i>Hemerobius simulans</i> Walker, 1853	Ljubljana VII. 1955	<i>Hem. simulans</i>	1 ind	corr
<i>Hemerobius stigma</i> Stephens, 1836	Trenta 28. VII.-1. VIII.	-	2 ind	-
<i>Hemerobius pini</i> Stephens, 1836	Dolina Triglavskih jezer 7.-10. VIII. 1959	-	3 ind	-
<i>Hemerobius nitidulus</i> Fabricius, 1777	Trenta 28.VII.-1.VIII.???? 1956?	- (now in coll Devetak)	1 female	-

<i>Hemerobius handschini</i> Tjeder, 1957	Bohinj 7.-10. VIII. 1959	-	1 ind	-
<i>Hemerobius handschini</i> Tjeder, 1957	Dolina Triglavskih jezer 7.-10.VIII.1959	-	1 ind	-
<i>Hemerobius handschini</i> Tjeder, 1957	Trenta 28.VII.-1.VIII.???? 1956?	-	3 males	-
<i>Hemerobius micans</i> Olivier, 1793	Bohinjsko jezero 22.IV.1957	<i>Hemer. micans</i> Oliv.	1 male	corr
<i>Hemerobius micans</i> Olivier, 1793	Bohinj-Savica 11.VIII.1056	<i>Hemerobius micans</i> Oliv.	1 ind	corr
<i>Hemerobius micans</i> Olivier, 1793	[Julian Alps] Črno jez. 1300-1500 m	<i>Hemerobius nitidulus</i>	2 ind	incorr
<i>Hemerobius micans</i> Olivier, 1793	Ljubljana X.1959	-	1 ind	-
<i>Hemerobius micans</i> Olivier, 1793	Trenta 28.VII.-1.VIII.???? 1956?	-	1 ind	-
<i>Hemerobius lutescens</i> Fabricius, 1793	Dolina Triglavskih jezer 7.-10.VIII.1959	-	1 male 1 female	-
<i>Hemerobius</i> sp.	Dolina Triglavskih jezer 2.VI.1957	<i>Hemerobius stigma</i> - unidentified	1 ind	-
<i>Wesmaelius concinnus</i> (Stephens, 1836)	Dolina Triglavskih jezer [Dol. Trigl. j.] 1500-1700 m	-	1 ind	-
<i>Wesmaelius quadrifasciatus</i> (Reuter, 1894)	Krvavec VII.1957	<i>Boriomyia quadrifasc.</i>	1 ind	corr
<i>Wesmaelius quadrifasciatus</i> (Reuter, 1894)	Krvavec 5. VII. 1957	-	4 ind	-
<i>Wesmaelius quadrifasciatus</i> (Reuter, 1894)	Vršič – Kr. Gora 16. VII. 1957	<i>Boriomyia quadrifasciata</i>	1 ind	corr
<i>Wesmaelius fassnidgei</i> (Killington, 1933)	Dolina Triglavskih jezer 7.-10.VIII.1959	- [genital preparation in coll Devetak]	1 female	-
<i>Wesmaelius nervosus</i> (Fabricius, 1793)	Krvavec 21.VIII.1955 Carn. leg.	<i>Boriomyia subnebulosa</i> [genital preparation in coll Devetak]	1 f	incorr
<i>Wesmaelius malladai</i> (Navás, 1925)	Krvavec VII. 1957 1300 m	<i>Boriomyia nervosa</i>	4 ind	incorr
<i>Wesmaelius tjederi</i> (Kimmins, 1963)	Bohinj-Savica 26.VIII.1959	[genital preparation in coll Devetak]	2 females	-
<i>Wesmaelius tjederi</i> (Kimmins, 1963)	Dolina Triglavskih jezer 7.-10.VIII.1959	-	2 males 1 female	-
<i>Wesmaelius subnebulosus</i> (Stephens, 1836)	Log-Trenta 7.VII.1956 Mich.	<i>Boriomyia subnebulosa</i> Steph.	1 female	corr
<i>Wesmaelius</i> sp.	Krvavec 5. VII. 1957	- unidentified	2 ind	-

<i>Symphorobius pygmaeus</i> (Rambur, 1842)	Ljubljana 3.VIII.1957	<i>Symphorobius elegans</i> Steph.	1 ind	incorr
<i>Megalomus tortricoides</i> Rambur, 1842	Bohinj 7.-10. VIII. 1959	-	7 ind	-
<i>Megalomus tortricoides</i> Rambur, 1842	Dolina Triglavskih jezer 7.- 10.VIII.1959	-	1 m	-
<i>Megalomus tortricoides</i> Rambur, 1842	Trenta 28.VII.- 1.VIII.???? 1956?	-	1 male 1 female	-
<i>Megalomus</i> sp.	Log v Trenti 25.VII.1954	<i>Megalomus hirtus</i> - unidentified	1 ind	-
<i>Drepanopteryx phalaenoides</i> (Linnaeus, 1758)	Ljubljana 18.VII.1955	<i>Drepanopteryx phalaenoides</i>	1 ind	corr
<i>Micromus variegatus</i> (Fabricius, 1793)	Trenta 28. VII.-1. VIII.	-	1 ind	-
<i>Micromus paganus</i> (Linnaeus, 1767)	Bohinj 7.-10. VIII. 1959	-	1 ind	-
<i>Micromus paganus</i> (Linnaeus, 1767)	Bohinj 2.-4.VII.1956	<i>Micromus paganus</i> L.	1 ind	corr
<i>Micromus paganus</i> (Linnaeus, 1767)	Krvavec VII.1957 1300 m	<i>Boriomya coccina</i> Steph	1 ind	incorr
<i>Micromus paganus</i> (Linnaeus, 1767)	Krvavec 5. VII. 1957	-	2 ind	-
MANTISPIDAE				
<i>Mantispa styriaca</i> (Poda, 1761)	Bled 11.-30. VII. 1957 Hadži leg.	<i>Mantispa styriaca</i> Poda	1 ind	corr
MYRMELEONTIDAE				
<i>Palpares libelluloides</i> (Linnaeus, 1764)	[Montenegro] Črna gora Bar VII.1955	-	1 ind	-
<i>Myrmeleon formicarius</i> Linnaeus, 1767	Bohinj 7.- 10.VIII.1959	-	1 ind	-
<i>Myrmeleon formicarius</i> Linnaeus, 1767	Ljubljana 1956 Mich. leg.	<i>Myrmeleon formicarius</i>	1 ind	corr
<i>Myrmeleon formicarius</i> Linnaeus, 1767	Ljubljana ?	-	1 ind	-
<i>Myrmeleon formicarius</i> Linnaeus, 1767	Nanos 4.-6. VII. 1959	-	1 ind	-
<i>Myrmeleon formicarius</i> Linnaeus, 1767	Trenta, 28.VII.- 1.VIII.????	- [wings only]	1 ind	-
<i>Distoleon tetragrammicus</i> (Fabricius, 1798)	[Croatia] Crikvenica 1-4. VII. 1957 Carnelutti J. leg.	<i>Formicaleo tetragrammicus</i> F.	1 ind	corr

<i>Distoleon tetragrammicus</i> (Fabricius, 1798)	[Croatia] Rovinj 25.VII/3.VIII.	-	2 ind	-
<i>Creoleon plumbeus</i> (Olivier, 1811)	[Croatia] Rovinj 4.- 18. IX. 1955	Acanthaclisis sp.	1 ind	incorr
<i>Gymnocnemia variegata</i> (Schneider, 1845)	[Croatia] Rovinj date?	-	1 ind	-
		Total number of individuals:	184 ind	