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CROATIAN ENTOMOFAUNA – Looking Back from the Present and Future Plans

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The development of entomological science in Croatia through the past 250 years can be divided into several periods. From the travel records in the late 18th century, intensive interest in insects and the creation of the first insect collections in Croatia, primarily by foreigners and later by local researchers, to the later establishment of museums and university institutions, until today's current scientific research in various institutes and university faculties.

In the initial period, entomology in Croatia was exclusively studied by foreign researchers, and collected materials were stored in collections in their native countries. When systematics and entomological studies were already in full swing throughout Europe in the 19th century, they were in their beginnings in Croatia. Unfortunately, they have never reached full their development. University educated biologists of the 20th century carried out systematic and faunistic studies, and followed and kept up with the most recent achievements in biological sciences, especially molecular biology and biochemistry. Today we can proudly point to natural historians of world reputation. Despite the progress achieved in other sciences, faunistic studies in general and with respect to entomology have continually developed.

For easier reference, the past 250 years have been divided into six periods, determined by the political and social changes in Europe, our country and in our surroundings and the view in the future. The works of scientists considered important for each period are described, particularly those of Croatian scientists. The remaining works are outlined in tabular form and their pooled numbers are shown in graphical form.

The fact that our museum collections and vary rich library materials remained preserved after the two world wars is encouraging. Unfortunately until this

day, the entomofauna of Croatia has still only been partially studied. Some orders, such as Coleoptera, Lepidoptera and Diptera have been intensively researched, while for many others we have no knowledge at all. We are aware that we must persist in this task, and intensify our efforts. We are following global efforts to protect our environment and biodiversity. Our efforts in those areas are in line with European and global efforts. It has been attempted in this paper to outline the work of many entomologists, to show their focus of study, area of study, representation (families, genera, species), assessed level of threat, endemism, etc. to provide an overview of today's entomology that is clear and accurate. The number of entomologists in individual institutions is given. The launching of scientific journals, scientific and professional associations and significant scientific books are mentioned. In the end, are outlined our plans for the future.

Croatian entomofauna

P. DURBEŠIĆ: Hrvatska entomofauna - iz sadašnjosti pogled unatrag i planovi za budućnost. Entomol. Croat. 2011., Vol. 15. Num. 1-4: 17-101.

Iz povijesti entomološke znanosti u Hrvatskoj kroz minulih 250 godina nekoliko je razdoblja u njezinu uzlaznu razvoju. Od putopisa s kraja 18. stoljeća, preko intenzivnog zanimanja za kukce, pretežno stranaca, a kasnije i domaćih istraživača, izrade prvih zbirki kukaca u Hrvatskoj, do osnivanja muzeja i sveučilišnih ustanova te današnjih znanstvenih istraživanja u institutima i na fakultetima.

U početno su vrijeme našu entomofaunu gotovo isključivo istraživali strani istraživači i entomološki materijal pohranili u svoje domicilne zbirke. I dok su u Europi sistematika i entomofaunistika u 19. stoljeću u punom zamahu, u Hrvatskoj su tek na početku. Na žalost one nikad, ni danas nisu u nas dosegle punu razvijenost. Sveučilišno obrazovani biolozi dvadesetoga stoljeća osim sistematike i faunistike nastoje pratiti novija dostignuća biološke znanosti i ići u korak s njima osobito u molekularnoj biologiji i biokemiji. S ponosom možemo istaknuti naše današnje prirodoslovce svjetskoga glasa Unatoč napretku u drugim znanostima ipak se istraživanje faune općenito pa i entomofaune odvija kontinuirano. Radi preglednosti, tih 250 godina podijelili smo na šest razdoblja koja su određena političkim i društvenim promjenama kako u Europi tako i u nas i u našem okružju. Opisani su radovi znanstvenika važnih za svako razdoblje, a osobito domaćih znanstvenika. Ostali su prikazani tabelarno te skupno grafički brojčano.

Ohrabruje činjenica da su i nakon dva svjetska rata muzejske zbirke i vrlo bogat bibliotečni materijal ostali sačuvani. Na žalost do danas je entomofauna obrađena samo djelomično. Neki redovi, primjerice Coleoptera, Lepidoptera i Diptera istražuju se intenzivnije, ali o mnogima još nemamo nikakvih spoznaja. Svjesni smo da moramo u tom poslu ustrajati, ali i intenzivirati ga. Pratimo svjetska nastojanja u zaštiti prirode i bioraznolikosti. Uхватili smo korak s europskim i svjetskim nastojanjima na tom području. Marom mnogih entomologa nastojalo se u ovom radu prikazati područje istraživanja, prostor, brojčanu zastupljenost (porodica, rodova, vrsta) procjenu ugroženosti, endemizam i dr. da bi uvid u entomofaunu danas bio jasniji i približno točan. Naveden je broj entomologa u pojedinim institucijama. Spomenuto je pokretanje znanstvenih časopisa, znanstveno-stručnih udruga te sve važnije tiskane knjige. Na kraju su naši planovi za budućnost.

Hrvatska entomofauna

Foreword

The article *Croatian entomofauna - looking back from the present and its future plans* is an overview of the period covering more than 250 years, which is divided into six periods for the sake of transparency.

1. The beginnings of entomological research in the late 18th century - the first eight researchers, seven of them foreigners.

2. The first half of the 19th century, the collection period – thirty two foreign and the first eight Croatian researchers.

3. The second half of the 19th century until the First World War (1914) - a period of intensive faunistic, systematic work of local scientists particularly (43), but also foreign researchers (163). The establishment of Croatian scientific institutions, associations and journals.

4. The first half of the 20th century - the time between the two World Wars (1918 - 1941), the development of research in institutions, the establishment of a scientific and professional association of entomologists and the issue of the first entomological scientific journal.

5. The second half of the 20th century - the time from 1945 until 1991, the period of exclusive research by local researchers.

6. Current research into insects in Croatia from 1991 (institutions, scientists, museums, publications and social activities).

Looking to the future.

In each of these periods only the most distinguished researchers are presented in greater detail, and others are given in tables. Both professionals and amateurs are listed as the researchers of Croatian entomofauna, those who investigated or determined insects in laboratories or published some papers about them. Furthermore, foreigners who were employed in Croatia were also classified as domestic researchers.

With its geographic diversity of the Plain Croatia, Mountain Croatia – the Dinarides - with characteristic karst phenomena and the Mediterranean Croatia - Adriatic Sea, coast and islands, Croatia long ago attracted many researchers especially in the time of the early Enlightenment.

The problem in the classification is the state borders; the older researchers divided Croatia according to the borders in the Austro-Hungarian Monarchy so the state borders in their works are shown accordingly. Some researchers in the former state did so intentionally so as to ignore Croatia.

This overview covers data from the travel records of the late 18th century, intensive interest in insects and the creation of the first insect collections in Croatia, done primarily by foreigners and later by local researchers, the establishment of museums and university institutions, and current scientific research in various institutes and university faculties.

While faunistic studies were already in full swing throughout Europe in the 19th century, they were at their beginnings here in Croatia. Unfortunately, they have never reached their full development. Systematic and faunistic studies have been in stagnation in spite of attempts to make up for lost time.

University educated biologists of the 20th century followed and kept up with the most recent achievements of the biological sciences, especially molecular biology and biochemistry. Today we can proudly point to Croatian natural historians of world reputation.

The prominent entomologist and university professor of the first half of the 20th century prof. dr. sc. August Langhoffer*¹ one hundred years ago wrote the following binding words:

It is time to prepare material for a Croatian fauna. It will not come into being at once, and will not be accomplished by one person.

* The degrees are written as it is usually in Central Europe, Croatia and in references.

Unfortunately the dream of Professor Langhoffer has not yet been fully realized.

Still, a lot has been done: collections of huge bibliographic material, research of many insect species, legalized collecting and conservation of insects, collections in museums, etc.

Common history heritage

After the Greek researchers in the field of nature, the Middle Ages was a dark period. A new beginning was shown in by the Enlightenment, a general spiritual movement in Europe in the 18th century in opposition to the dogmatism of the Middle Ages, and for the victory of critical mind and the return to nature that Rousseau favoured. The new beginning starts in late Middle Ages.

It was characterized by Edward Wotton (1492 - 1555) and his work *De Differentiis Animarium* from 1552 and Ulyssis **Aldrovandi** (1522 - 1605) with his first book in the field of entomology *De animalibus Insectis* (1602). The cover page is shown in figure 1. No further real development in the natural sciences, especially in zoology and botany, happened until a hundred years later, in 1735 when Carl Linneaus (1707 - 1778) published his classic work *Systema Naturae per Regno Trio Naturae*. Since then, fauna has intensively been researched throughout Europe (Beier, 1969).

Soon, researchers began to consider Croatia too, although very modestly, because at that time, Croatia was fragmented, divided among the Austrian Monarchy, Venice and Turkey. Only in 1815 were all the Croatian regions united under the Austrian Monarchy.

Beginnings of Entomological Research - Second Half of the 18th Century

The beginnings of entomological research in the second half of the 18th century were marked by four books, seven investigators and a collector of “natural objects”. These are: Giovanni Antonio Scopoli, Alberto Fortis, Matija Piller, Lju-



Figure 1. Cover page of the Aldrovandi work

devit Mittelpacher, Petar Nutrizio Grisogono, Eugenius Johann Christofor Esper, Nicolo Host and Dživo Aletin Natali.



Figure 2. G. A. Scopoli, and the cover page of his important book

Prof. G. A. **Scopoli**, (Tyrol, 1723 – Pavia, 1788) was a naturalist, although he was educated to be a physician (Fig. 2). He worked in Venice, Slovakia, Idrija (Slovenia) and in the end, as a university professor in Pavia. He was engaged in botany and zoology, especially entomology. He published several books in Latin and in 1763 in Vienna the publisher Trattner printed *Entomologia Carniolica exhibens Insecta Carnioliae indigena et distributa in ordines, genera, species, varietates methodo Linnaeana*. This book described his research in Slovenia, and in Croatia (Istria and south-western Croatia). He described 1153 species, which were allocated into 7 orders and 81 species (Coleoptera 27 genera with 258 species, Proboscida 7 genera with 89 species, Lepidoptera 3 genera and 258 species, Aculeata 8 genera and 126 species, Haltera 16 genera with 186 species and Pedestria 14 genera and 129 species). In this systematic list of insects, spiders, scorpions, millipedes and also crustaceans are grouped. Many genera of insects are today separated into separate orders and the mentioned genera have changed. A large part of the text consists of descriptions of species, locations of findings, as well as the host plants of insects (Scopoli, 1763).

A. **Fortis** (Padua, 1741 – Bologna, 1803) was an Italian theologian, naturalist, travel writer and monk, but a true Renaissance man (Fig. 3). He travelled through Europe, but mostly through Croatia: Istria, Kvarner, and the entire Croatian coast - Dalmatia till Dubrovnik including the islands and Zagora (Imotski).

In 26 years he visited different parts of Croatia 11 times. In 1774 in Venice he published travel essays about these trips in the form of letters to his friends named *Viaggio in Dalmazia*. Among other features of nature characteristics of our regions, he described the first data on insects, especially harmful ones. He mentioned mosquitoes and malaria in the valley of the Neretva and the Cetina estuary, but he did not connect them, then fig (probably *Ceroplastes rusci* L.) leaf lice (original - *Lacco*) on the island of Ugljan, a weevil (Magnocoz or Punteruolo) and two spiders (at that time, spiders were counted among insects), tarantula (*Lycos tarentula* Rossi 1790) and the black widow (*Latrodectus tredecimguttatus* Rossi 1790) near the town of Trogir. Fortis also described bees and the silkworm moth (*Bombyx mori* L.) near Opuzen, Brač and Rab, which proves the continued production of silk for centuries in Dalmatia, now lost except in Konavle, kept up as a tourist attraction (Fortis, 1974 reprint, Fortis, 1984 in Croatian).

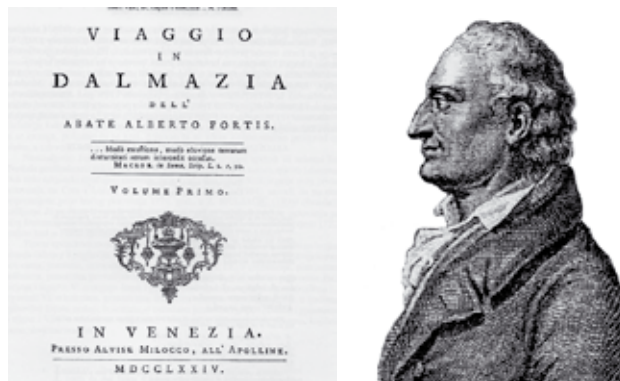


Figure 3. The cover page of the book *Viaggio in Dalmazia* and Alberto Fortis

The book was very popular at that time in Europe and was soon translated into French, German and English. No Croatian translation was published until 1984. It is well known that there was a manuscript and supplemented edition but both were unfortunately lost. There would certainly be more zoological data. This great admirer of our country who wanted to be buried in Dalmatia, has a street named in his honour in Zagreb – Špansko (Bratulić, 1984).

P. N. **Grisogono** (1748 - 1823) printed in Treviso in 1780, at the publisher Trento, a book entitled *Notizie per servire alla Storia Naturale della Dalmazia*



Figure 4. The cover page of the book of P. N. Grisogono with sign of Brusina

(Fig. 4), which gives the first data on our fauna in Dalmatia. Academician Brusina (1886) named this work “The natural geography of Dalmatia”. This book has hardly any record of insects (Grisogono, 1780).

M. Piller (Graz, 1733 – Buda, 1788) and Lj. **Mittelpacher** (Bilje, 1934 - Pest, 1814), professors at the University of Budapest, explored Požega County and in 1781 in Buda printed a book entitled *Iter per Poseganam Sclavoniae provinciam mensibus Junio et Julio anno 1782* (Fig. 5).

The book is illustrated with 16 pictures in engravings. They described the flora and fauna and the economic and health conditions of the County. On their way they visited: Osijek, Čepin, Našice, the swamp Palace, Požega, Kutina, Pakrac, Daruvar, Lipik and many other places. They also went to the mountain of Papuk. Among many insects, they described beetle species of the genera *Scarabeus*, *Cerambyx*, *Leptura*, *Buprestis*, *Tenebrio*. They named new species, two of which are kept up to date in nomenclature priority. These were the first names of insects with Croatian toponyms: *Meloides adamoviciana* (now *Cerocoma adamoviciana*) which was found in Čepin and *Tenebrio velikensis* (now *Enoplopus velikensis*) which was found near the village Velika and *Papilio kolosvarensis*. They described crickets and butterflies (Piller & Mittelpacher 1781, Hirc, 1905, Piller & Mittelpacher 1995).



Figure 5. Mittelpacher bust in Budapest and the book cover (photo: J. Horkowitz)

Prof. E. J. Ch. **Esper** (Wunsiedel, 1742 - Erlangen, 1810) was a German naturalist, entomologist especially interested in Lepidoptera, who worked as a university professor at the University of Erlangen. He was the author of the fundamental systematic work on Lepidoptera in which he described in 1800 the butterfly *Macroglossum croaticum* (Esper, 1800) as a new species from Croatia, found near Karlovac, although it is a Mediterranean species (Esper, 1800).

In 1974 the Croatian Entomological Society choose this butterfly as their logo (Fig. 6). Now the name of the species *Hemaris croatica* (Esper) in the Croatian language is hrvatska golupka.

N. **Host** (Rijeka, 1761 - Vienna, 1834) described a new species of beetles *Otiorrhynchus corruptor* Host. 1789. Otherwise he was a physician and a botanist. He designed and implemented the botanical garden of the castle of Belvedere in Vienna (Depoli, 1924).

The only collector of “natural objects” of that time was **Dž. Aletin Natali** (Dubrovnik, 1670 - 1743). Dubrovnik was in the Age of Enlightenment a significant political, economic, scientific and cultural centre but there was no interest in zoology. The exception was Aletin Natali, the first Secretary of the Dubrovnik Republic. He and his son Anton Aletin Natali (Dubrovnik, 1716 - 1774) were typical representatives of the European “return to nature” in the Rousseau style.

They were nature lovers and they collected, among other things, various “natural things”. They had many acquaintances in Europe so they sent them samples for determination. They had a great private library too. In their house in Dubrovnik they created a private collection, or the first “museum”, and many foreign scientists of that time were interested in fauna. Unfortunately, their collection was damaged by fire, and the rest was donated to the Emperor Joseph II who together with Friedrich II of Saxony and Catherine II belonged to the circle of enlightened despots (Šenoa & Kolumbić, 1983).

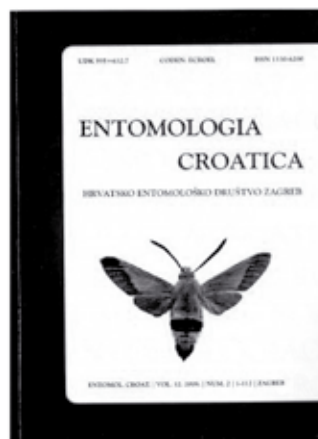


Figure 6. Cover page of the Croatian entomological association journal

The First Half of the 19th Century – a Period of Collectors

In this period 33 foreign and 8 domestic researchers were engaged in entomology in Croatia. They mostly collected entomological material or determined and described it.

By domestic entomologists we imply both Croats and persons of other nationalities of the former Austro-Hungarian Empire who were employed and domiciled in what is today Croatia (Fig. 7).

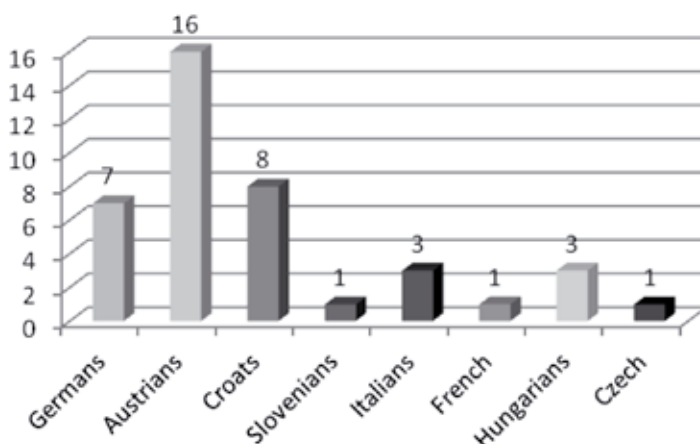


Figure 7. Distribution of the entomologist active in Croatia of the first half of 19th century according to their nationality

Insects in Croatia in this period were collected by seven Germans, the first among whom were **D. Hoppe** and **F. Hornschuch**. In 1818 they published travel articles *Tagesbuch einer Reise nach der Küsten des adriatischen Meeres* in which they described some species from the beetle family (Carabidae). They traded in insects, which was a custom of that time, like collecting postage stamps today (Kurir, 1944).

In this period insects in Croatia were examined and studied mostly by Austrians -16 of them. Thus Carabidae were studied by **Duftschmit**, **Natley** Lepidoptera and **Ulrich** Orthoptera. There were also three Hungarian researchers: **Farkasz**, **Ocskay de Ocskoe** and **Sadler**, three Italians, one French, Czech and Slovenian and eight Croatian researchers.

The researchers of this period are shown in Table 1: their names and the period when they lived, place of residence, nationality, what species of insect were collected and examined, where and when they researched in Croatia, and the title and year of a known work or article and whether they followed an older researcher. In the last column we can see if the work is original or if the data were taken from a secondary proven work (The legend is at the end of the table).

As this period was two hundred years ago, it is clear that not all the data could be found. For example only the initials might be known, or perhaps the time when researcher lived is not known.

The most important are:

Prof. Ernst Friedrich **Germar** (1789 - 1853) was actually the first true scientist and entomologist to collect and research in Croatia (Fig. 8).

He wrote a work called *Reise nach Dalmatien und in das Gebiet von Ragusa* in the year 1817. In the book he described his observations about plants and animals of our coastal areas and islands during his visit to Croatia in 1811. He paid special attention to insects. He collected 500 species: 318 species of beetles, 63 species of Hymenoptera, 48 species of butterflies, etc. (Germar, 1817). He was a university professor in Halle and the director of the museum, especially dealing with beetles. From 1845 he was a member of the Royal Swedish Academy. He published entomological journals, and his masterly work in 24 volumes is *Fauna Europaea insectorum* from 1812 to 1848.

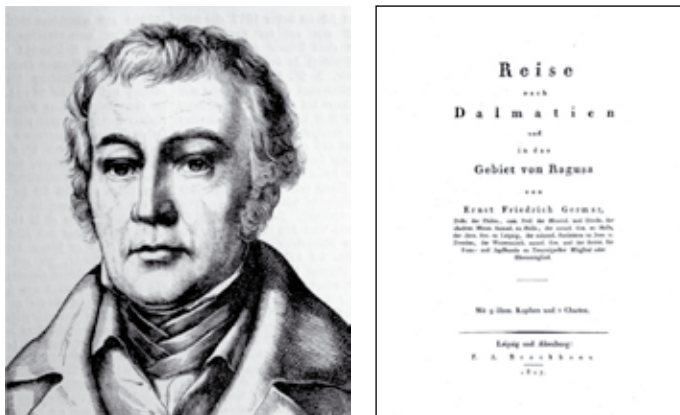


Figure 8. E. F. Germar and cover page of *Raise nach Dalmatien*

Table 1. The first half of 19th century entomologists

No	Name degree	Surname	Lived from to	Speciality, Insects group	Domicile	Researched area	Period	N.	Remarks	S.
	Foreigners									
1		Cupido		Leptidoptera		Rijeka	1825.	T		H
2	T.	Charpentier		Odonata		Radoboj, Croatia	1841, 1843	F	Two articles	O
3	Georg	Dahl	-1832	Insects, trader,	Vienna	Dalmatia	1824.	N	Travel essays	N
4	Pierre F.	Dejean	1780-1845	Coleoptera	France	Whole Dalmatia	1811 - 1812	F	Book 1825	O, N
5		Dufschmidt		Carabidae		Istria , Rijeka,	1825	A	Fauna Austriae 3	B
6	Fr.	Farkasz		Lepidoptera	Hungary	Srijem	1820	M		H
7	Dr. Franz X.	Fieber	1807-1872	Homoptera, Heteroptera , Orthoptera	Chrudin Czech R.	Dalmatia	1853 and 1855	C		N
8	L. H.	Fischer		Orthoptera		Istria	1853	A	Orthoptera Europea	B, H
9	Prof. Ernst F.	Germar	1786-1853	entomologist, mineralogist	Halle	Dalmatia	1811	N	Book Reise ...1817	O
10	Prof. dr. sc. Veit	Graber	1844-1892	Orthoptera	Černovci Bukovina	Slavonia, Srijem	1840, 1880	A		N, H
11	Christian	Handschuh		Trader, insects	Erlangen	Rijeka and Dalmatia				
12	Ernst	Heeger	1783-1866	Insecta		Dalmatia	1828	A		N
13		Held		Botanist, insecta	Vienna	Dalmatia	1818	A		N
14	D.	Hoppe		Carabidae		Dalmatia	1818	N	Taschenbuch	D
15	F	Hornschuch		Carabidae		Dalmatia	1818	N	nach den Kuesten ...	D
16	Prof. dr. sc. Friedrich	Kolenati	1813-1863	Neuroptera	Prague	Dalmatia	1850	C		N, H

Table 1. The first half of 19th century entomologists - continued

17	Akademik. Vincenz	Kollar	1797-1860	Primarily Lepidoptera	Vienna	Dalmatia and Srijem	1846, 1820	A		N, H
18	Dr. Heinrich C.	Küster	1807-1876	Coleoptera	Bamberg	Dalmatia 8 months	1841	N	Die Kaefer... 1844.	N
19	F.	Lanza		malatia	Bologna	Narona	1842	T	Article	B
20	Florian	Macchio		Microlepidoptera	Graz	Dalmatia	1850	A	Followed Mann	N
21	Josef	Mann	1804-1889	Microlepidoptera , others	Vienna	Rijeka 1857	1850- 1868	A		N
						Jospdol 1866				
22	J.	Natley		Lepidoptera		Varaždin	1830	A		H, M
23	Barun F.	Ocskay de Ocskoe		Orthoptera		Rijeka	1840	M		H, B
24		Palliardy		Coleoptera			1825	T		
25	Ludwig	Parreys	1796-1879	Trader, Insecta	Vienna	Many times Dalmatia	Around 1825	A		N
26	Franz	Portenschlag		Botanist, Insecta	Vienna	Dalmatia	1818	A		N
27		Ran		Leptidoptera		Rijeka,	1830	A		H
28	Prof. S.	Sadler		Hemiptera		Rijeka	1840	M		H
29	Prof. C. T. E.	Siebold		Orthoptera	Erlangen	Pula	1842	A		H
30	Ferd. J.	Schmidt	1791-1878	Cave insects		Trieste and Pula	1865	Sl.		H
31	Josef	Ullrich		Coleoptera	Vienna	Trieste and Istria	1820	A		N, B
32	Prof. P. C.	Zeller	1808-1883	Diptera, Orthoptera	Glogau	Trieste and Lastovo	1843	N		N
33	Dr. Friedrich	Zinken		Lepidoptera	Braunschweig	Dalmacija	1818	N	Determined the finds of Germar	N

Table 1. The first half of 19th century entomologists - continued

	Croatians												
1	Jakov	Boglič	1826-1897	Malacologist, Lepidoptera, Coleoptera	Split				H				N, B
2	Matija	Botteri	1808-1878	flora and fauna	Hvar	Hvar			H				N
3	Dr. sc. Francesco	Carrara	1812-1854	archaeologist	Split	Dalmatia			H		Book in 1846		O
4	Dr. sc. Francesco	Danilo	1813-1893	Herpetologist, malacologist, olive parasites				1846	H				N
5	Petar	Niziteo	1774-1866	Insecta	Hvar	Hvar			H				N
6	Franz, prof.	Petter	1798-1853	Botanist, Insecta	Dubrovnik and Split	Dalmatia			H		Number of works		N
7	Gianbattista	Sandri	1799- ?		Zadar			1840	H		Collection of Insecta		N
8	Lujo	Stalio	1799-1882	Naturist, malacologist Insecta	Hvar	Hvar, Vis and Palagruža.			H				N

Legend: In column Name and degrees - degrees as usual in Central Europe, Croatia and in references; in column remarks: p - profession, a - amateur; in column N – nationality: A - Austrians, C - Czechs, F - French, H - Croats, M - Hungarians, N - Germans, SI - Slovenians, T – Italians;

in column S - sources: B - Babić, 1927; D - Durbešić, 1984; H - Hadži, 1929; M - Matonićkin, 1974, N - Nonveller, 1989; O - original work.

One of the Croatian endemic beetles bears his name *Lamprohiza Germar* Küster 1842, from the family Lampyridae.

The book *Reise nach Dalmatien und in das Gebiet von Ragusa* had a significant impact on the scientific circles of Europe, and it stimulated many researchers to come every year to research the Dalmatian coast (Nonveiller, 1974).

The second most important European entomologist of that time was an exiled Napoleonic general, Comte Pierre Francois **Dejean** (Amiens, 1780 - Paris, 1845). He researched for two years in Croatia, from 1816 until 1818, south of the Kupa River to the sea and in Dalmatia (Fig. 9).

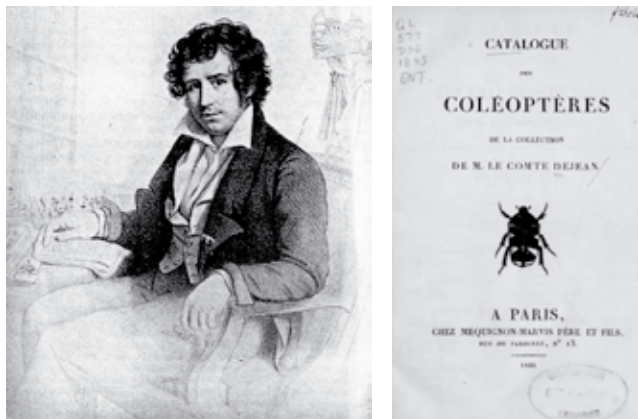


Figure 9. Comte Pierre F. Dejean and cover page of his book

During his stay in Croatia he collected 17000 examples of about 1600 species of insects (1400 beetles with 214 genera, 30 species of grasshoppers, 92 species Hymenoptera and 37 species of butterflies). His main book about beetles, *Species générale de Coléoptères*, was published in Paris in 1831; it described six new species of the family Carabidae with the name and *croaticus* and *dalmatinus* as follows: *Carabus croaticus* 1826, *Trechus croaticus* 1831, *Bembidion dalmatinum* 1831, *Amara dalmatina* 1828, and *Molops dalmatinus* and *Laemostenus dalmatinus* 1828 (Kratz, 1874; Langhoffer, 1918).

At the end of his life he was elected to the Royal Swedish Academy.

An interesting story was that Comte Dejean before he gave the order to attack at the Battle of Alcanizasa dismounted from the horse and picked up a

bug, placed it on a piece of cork under his helmet. The helmet was damaged by bullets, but the bug remained intact. Dejean gave him the name *Cebrio ustulatus* (Kaatz, 1874).

Furthermore, one of the most significant Croatian scientists was the priest dr. sc. Francesco **Carrara** (Split, 1812 - Venice, 1854) who was an archaeologist, historian and curator, writer, director of archaeological museums, high school teacher in Split and the first explorer of Salona (Fig. 10).

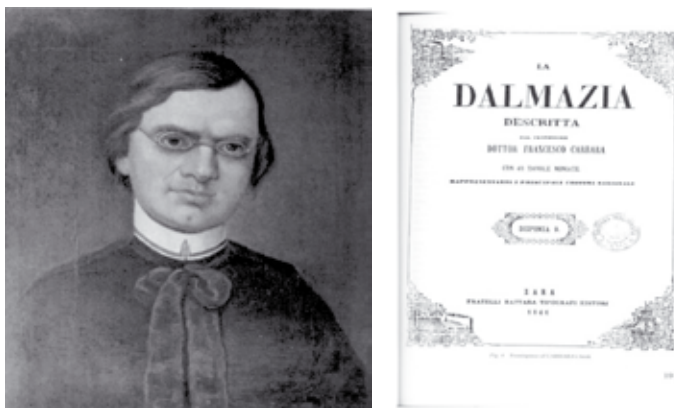


Figure 10. Francesco Carrara and cover page of his book

In 1846 he published in Zadar the encyclopaedic work *La Dalmazia descritta* in two hundred pages, featuring the geographical, geological, climatic, political and social conditions and the basic characteristics of the flora and fauna of Dalmatia. Academy member V. Kollar, the director of the Vienna Museum was his assistant for insects and other Invertebrates, and gave an overview of 224 species for Dalmatia. The material was gathered several domestic enthusiasts of that period (Carrara, 1846).

Of the seven local entomologists Peter **Niziteo** (Brač, 1774 - Stari Grad, 1866) was the oldest naturalist of Dalmatia. He was a descendant of the Croatian poet Petar Hektorović. He lived in Stari Grad on the island Hvar in the poet's fortified villa - Tvrđalj, which he inherited. Like many Dalmatian intellectuals he studied in Padua too. For a short time during the period of Illyrian Provinces he was the director of the gymnasium in Gorizia. He was engaged in entomology,

botany, history, archaeology and agriculture for the purposes of managing his estate. He had a great reputation in scientific circles, particularly in Italy, and was elected an honorary member of the Academy of Turin. He possessed a considerable library of many works especially in the field of entomology. He assembled an entomological collection of over one thousand exemplars. He corresponded with many entomologists of the time, especially when he helped Carrara in the production of the book *La Dalmazia descritta*. Unfortunately only secondary information about his scientific work remained. He was also Mayor of Stari Grad on Hvar, in which there is a street named after him (Gamulin-Brida & Ilijanić, 1977).

Another two researchers from the island Hvar marked this period in entomological science in our country: Lujo **Stalio** (Stari Grad, Hvar, 1799 – Venice, 1882) and Matija **Botteri** (Hvar, 1808 - Orizaba, Mexico 1877). Both were mainly engaged in the field of fish investigation and wrote several works, but in the field of entomology there are only secondary data from individual letters or records by other scientists (Gamulin-Brida & Ilijanić, 1977).

The Second Half of the 19th Century - until 1914

Over two hundred foreign and domestic researchers were engaged in entomology in Croatia in this period. They were mostly just collecting entomological material. At that time another interesting fashion was to make collections of insects, and as with collections of stamps, many stores with entomological material were opened.

In Croatia, some very important events marked this period. These were: the introduction of the Croatian language into schools in the year 1847, the introduction of biology into high schools in 1849, establishment of the National Museum in 1841, establishment of the Academy, starting of the study of biology, as well as the appearance of six great Croatian biology academicians: Spiridion Brusina, Ljudevit Vukotinović, Josip Schlosser-Klekovski, Živko Vukasović, the first university professor of entomology Anton Korlević and later August Langhoffer.

In the middle of the 18th century, western countries replaced the Latin language used in science with national languages; in Croatia that was done a hundred years later.

Therefore, the second half of the 19th century was characterized by the introduction of the Croatian language as the official language in the area of Banska

Croatia, on October 23rd, 1847, thanks to the Croatian National Revival Movement.

Natural subjects were also introduced to all secondary schools in the Austrian Monarchy in 1849. School textbooks were printed in Vienna to pressure schools in Croatia to teach in the German language. Thanks to the Croatian Ban Josip Jelačić, the Croatian Parliament decided that school books should be published in the Croatian language in Croatia. At the same time Croatian researchers made efforts to begin to introduce the Croatian scientific terminology in the framework of a unified international terminology.

Secondary natural science school teachers made contributions in school reports, at the beginning in German, but later on in Croatian as well. These included, for example: J. Tkalec, T. Dimić I. Zech, V. Mihanović, I. Hinterwalder, J. Sapeza, V. Graber and others (Babić, 1927). They also compiled school books for natural history.

In 1829, in his proclamation of the National Revival, Ljudevit Gaj proposed the establishment of a museum for all branches of science, even for natural sciences. The Croatian Parliament accepted Gaj's proposal and founded the National Museum in Zagreb in 1836 (Fig. 11). Since then, many people have donated their collections including many private collections of insects.

The Economic Society was founded in 1841. It organized the first natural science exhibition in 1846.



Figure 11. Museum building in Demetrova which the institution has occupied since 1866 until today.

The entomological material for the exhibition was prepared by Dragutin Račkovac, who was the first curator. That year is considered to be the first year of operation of the National Museum. Just one year later, in 1855, the curator's duty was performed by Antun Praunsperger, who published an entomological article in 1866. His position was succeeded to by Ljudevit Vukotinović, who performed its duties from 1855 to 1862.

Mijat Sabljak took the duty over for next three years and handed it to Josip Schlosser-Klekovski who held the position only for a year. Slavoljub Wormastiny (1816 to 1909) was working there as an assistant conservator for more than fifty years; he laid the groundwork not only for museum collections, but also for entomological collections. In 1861, the Croatian Parliament proposed a declaration of the National Museum as a national institution. The Parliamentary proposal was adopted only five years later. The decision was given the force of law together with the statutes of the Academy of Sciences and Arts of Zagreb. In such a way the Museum became a national institution under the protection of the Croatian Parliament and the administration of the Academy. The Museum was awarded a building in Demetrova Street where it is unfortunately housed, even today, 150 years later, in extremely small and inadequate rooms (Čanadjija, 1974).

A little after that, more precisely in 1874, during the governorship of ban Ivan Mažuranić, the University of Zagreb, comprising three faculties, was founded. Lessons in zoology of the Science Department of the Faculty of Philosophy of the time were held in the building of the Museum for as long as 90 years. The director of the Museum was also the professor of zoology. Spiridion Brusina was the first professor of zoology. Some key courses were taught regularly, while others varied. It is worth noting that Brusina introduced exercises in entomology as early as in the summer semester of the academic year 1880/1881. Lectures of entomology were introduced in 1883 and they have been maintained since then with occasional small interruptions.

Croatian scientists/academicians, primarily Spiridion Brusina and Đuro Pilar, founded the Croatian Natural Society in 1885. It encouraged the gathering of Croatian scientists and the popularization of science. The issuing of a scientific journal *Glasnik* (Herald) (now *Periodicum biologorum*) and in 1911 of the popular science journal *Priroda* (Nature) encouraged the popularization of science in Croatia. The association is still active even today and acts as an umbrella organization for some thirty scientific societies, and journals are published nowadays

as well supported financially by the Ministry of Science, Education and Sport. These magazines enabled Croatian researchers to publish their articles in Croatian (Gamulin-Brida & Lui, 1974).

The establishment of the Museum and other scientific institutions in Zagreb, such as the Academy and the University, gave a significant boost to the development of Croatian science in general, inter alia to the development of entomology as well. It is worth noting that the Academy established a committee to explore the nature of Croatia headed by the prof. dr. sc. Dragutin Gorjanović, in 1912. All scientists were allowed to work in the committee, not only academicians. A program of activities was compiled as well as instructions for contributors, having the title *Nature Researches in Croatia*. By 1924, 15 volumes had been published. The Academy supported individual studies of fauna and flora and issued them in its regular publication *Rad* [Work] too.

It is worth noting that in 1907, Aleksandar Ugrenović (later an academician and a professor of forestry on the University of Zagreb), defended the first PhD dissertation in entomology in Zagreb under the title *O diferencijaciji ekstremiteta za gibanje Coleoptera*.

During this period natural history studies were initiated on the Croatian coast and on the islands, the most interesting parts of Croatia. The studies were logistically supported by ships.

The Zoological Station in Trieste under the guidance of prof. dr. sc. Carl Cori organized twelve trips and zoological and botanical excursions along the coast and islands from the Kvarner islands to the south, especially to the islands of Vis and Palagruža with the ship *Najade* from 1911 to 1914 (Nonveiller, 1989).

The Zoological Station in Trieste had another ship, *Adria*, which was rented to the Academy of Sciences of Vienna twice, in 1906 and in 1912, when they organized zoological and botanical excursions along the Croatian coast. The first trip was led by a botanist, professor dr. sc. Grinzberger and the second by prof. dr. sc. Cori. (Hadži, 1929; Nonveiller, 1989). Academician Spiridion Brusina also organized such a trip with the ship *Margita* in 1893.

A significant portion of fauna research during all of these trips referred to the study of insects. Six prominent scientific workers of the time need especial mention, from a significant number.

Academician Ljudevit **Vukotinović** (Zagreb, 1813 - 1893) was a lawyer, politician, writer and naturalist (Fig. 12). In his natural history work, he mainly



Figure 12. Ljudevit pl Vukotinović and the cover page of first entomological article in Croatian language

dealt with botany. He explored the Croatian flora and published three papers together with Josip Schlosser Klekovski. In addition, he published two papers from the field of entomology: about harmful caterpillars (1856) and butterflies of the surroundings of Zagreb (1879). He listed 234 genera and 445 species of Zagreb and its neighbouring settlement of Samobor. His wish expressed in this work was: "...to eventually increase the number of fans of this profession poorly cultivated until now." (Keglević, 2003, Balabanić, 2005 with references in it).

From 1866, Natural History Museum Departments were managed by Spiridion **Brusina** (Zadar, 1845 - Zagreb, 1908). His specialty was malacology (Fig. 13). From 1874 he was a professor of zoology at the renewed University of Zagreb and two years later he became the head of the department of natural sciences. He held lectures modelled on those given in other European universities and he worked extensively on the organization of scientific collections of the Museum which from beginnings numbe-



Figure 13. The statue of Spiridion Brusina on the quay in Zadar

red almost two thousand species of beetles and four hundred species of butterflies from the beginnings. In addition to numerous scientific articles, he published several from the field of entomology (Hirtz, 1924; Matoničkin, 1974; Balabanić, 1988; Balabanić, 1991 with references in it).

Živko **Vukasović** (Beravci, 1829 – Zagreb, 1874) was a secondary school professor of biology, a zoologist and entomologist (Fig.14). He completed his primary education in Osijek and the study of law and biology in Vienna and Graz. He was employed as a professor at the gymnasium of Vinkovci, at the Border Command in Osijek, in Rijeka and in Križevci. He was a school supervisor later on. He also worked some time as an official of the Croatian Court Office in Vienna. He participated in the opening of the Yugoslav Academy of Science and Art in Zagreb at March, 1866 and he was one of the first of its regular members. He wrote several school textbooks and a dozen zoological articles about beetles. He left two unfinished manuscripts about geography and beetles from all parts of Croatia.



Figure 14. Živko Vukasović

Besides fauna papers, he wrote papers in insects morphology. His great merit was the introduction of Croatian names for the species he investigated (Hirtz, 1924; Spaić, 1983).

Josip Kalasancije **Schlosser - Klekovski** (Jidrichov, 1808 – Zagreb, 1882), a scientist, physician and academician, has a special place among scientists of the time. After studying in Vienna, he came to work in Croatia (Fig. 15). He worked in various public medical positions and he was responsible for improving public health. As a naturalist, he was especially distinguished as a researcher into Croatian flora and fauna. He wrote two major natural history books: *Hrvatska flora* in 1869 and *Fauna kornjašah Trojedne Kraljevine* from 1877 to 1879. (Beetle fauna of the triune kingdom of Croatia). This was the first major piece of zoology in the Croatian language which described over a thousand genera and eleven thousand species of beetles. Croatian names were given before Latin names for each species. L.J. Vukotinovic, J. Torbar and S. Wormastiny helped him.

In addition to the description of the given beetle, he gave the type and the place of discovery and the host plant and habitats. Besides the huge number of



Figure 15. Josip pl. Schlosser
Klekovski

beetles that were collected there he also gave a series of data received from other authors. On the basis of these data it can be noticed that a lot of entomologists were working on the Croatian entomofauna. Some of them are Ullrich, Kolze, Plasson, Sandi, and there are many others.

J. Schlosser put together and edited a collection of beetles comprising some six thousand species, which are now kept at the Croatian Natural History Museum. He published three other entomological books: about water-beetles, littoral fauna and a supplement to the book about beetles.

When a knighthood was conferred on him, he took the attribute Klekovski.

In addition to Lj. Vukasović and S. Brusina, he was also one of the first academicians and head of mathematic and natural science classes. When the Croatian Mountaineering Association was established, he was elected the first president. At that time there were only five such associations existing in the world and the Croatian association was the sixth (Hirtz, 1924, Poljak, 1975).

Prof. Anton **Korlević** (Sv. Ivan od Šterne, Istria, 1851 - Zagreb, 1915) was the first university professor of entomology (Fig. 16). After primary and secondary education at Rijeka and Kastav, he graduated at the Faculty of Natural Sciences in Vienna. He was employed as a high school teacher in Rijeka, Osijek and Zagreb. In 1899 he became the first professor of entomology in Croatia at the Forestry Academy in Zagreb. When retired he was the manager of the entomological sections of the Biological Centre (later the Institute of Plant Protection). During his studies in Vienna, he was a friend of Ludwig Ganglbauer (1856 - 1912), the most important entomologist at that time, who dealt with the beetles of the Central Europe. He motivated him to go in for entomology.



Figure 16. Anton Korlević

During that period Korlević dealt with beetles under Ganglbauer's influence. Later on, he associated with G. Horvath, Friese, Biro and others, and from that time he paid special attention to Cynipidae - gall midges and their gall-nuts. He collected a very rich and valuable collection of about one thousand and three hundred specimens of beetles, about seven thousand specimens with about one thousand species of Hymenoptera and four thousand specimens gall-nuts, that are now stored in the Croatian Natural History Museum. He created a valuable collection of insect pests for teaching purposes. He wrote several science papers, or more specifically, seven entomological papers, some textbooks for schools and the Academy of Forestry. In particular, he tried to introduce a Croatian entomological nomenclature. Four species: *Carabus korlevici* Hoffman 1883 - locus typicus field Lič, *Tenthredopsis korlevici* Konow 1887, *Cynips korlevici* Kieffer 1902 and *Andricus korlevici* Kieffer 1902 were named in his honour.

He participated in the scientific excursion under the leadership of S. Brusina on the ship Margita in 1893 (Langhofer, 1915, Hirtz, 1924).

Professor August **Langhoffer** (Kizacs near Novi Sad, 1861 - Zagreb, 1940) succeeded Academician Brusina at the Faculty and in the Museum (Fig. 17). After primary education in Novi Sad, Zagreb and Sarvaš, he studied biology at Jena, and Zagreb, where he gained his PhD too. He was employed as a high school teacher in Rijeka, Senj, Osijek and Zagreb. In 1885 he became a private lecturer and director of the Zoological Museum in Zagreb in 1901. He was a university professor until his retirement in 1927. He taught general biology at the Faculty of Medicine and economic entomology at the Faculty of Agriculture and Forestry too. He published over eighty scientific and entomological papers.

He became an honorary member of the Croatian Natural History Society in the 1922. He especially studied flies and gave a detailed presentation of these insects in Croatia.

His collection is kept at the Croatian Natural History Museum in Zagreb. He also dealt with cave fauna and harmful insects, especially *Lymantria dispar* L, a pest species of Lepidoptera from the family Lymanthridae. In his honour the name was given to species *Anophthalmus langhofferi* Csiki 1913 (Matoničkin, 1974).

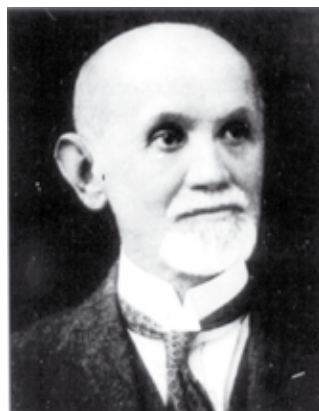


Figure 17. August Langhoffer

Đuro **Koča** Ing. (Osijek, 1853 – Virovitica, 1924) worked in the shadow of the most important entomologist in the second half of the 19th century mentioned above. He attended his primary education in Osijek and Novi Sad, where he graduated. He began his studies in Zagreb and continued at the Agriculture and Forestry School in Križevci where he graduated in 1876. He was employed as a forester in Dalj, Zagreb, and Varaždin County, Slavonski Brod and in Trnina. He was deeply involved in entomology, especially beetles, butterflies, and dragonflies. He bred the wasps Cynipidae. He collected a larger collection of Coleoptera, Lepidoptera, Neuroptera, and Cynipidae with a total number of over ten thousand, which are kept at the Croatian Natural History Museum in Zagreb. His very important work was a complete review of 730 known species of butterflies from the central and eastern Croatia and 1900 beetle species of Vinkovci surroundings and 620 species from the mountains of Dilj and Papuk. He compiled a list of 300 species Microlepidoptera, the first one made in Croatian language. In addition, he published papers on beetles and dragonflies and applied entomology - Cynipidae - more than ten papers. The species: *Lacomis kocae* Gozis 1914, *Aphodius kocae* Reitter 1897, and *Leptura kocae* Bernahauer 1905, a subspecies of *Carabus cancellatus kocae* Born 1910, were named in his honour.

He found and named a new subspecies of *Otriorrhynchus cardinigeroides* Reitter in 1895, as well as local subspecies *Carabus ullrichi* ssp *papukensis* Koca 1898. (Hirtz, 1924).

Dr. h. c. Grgur **Bučić** (Hvar, 1829 - 1911) finished his primary education in Hvar, Split and Dubrovnik (Fig. 18). He studied law, mathematics and physics in Vienna and Padua, but he did not complete his studies due to poor financial conditions. He was employed at the telegraph office in Hvar, where he founded a meteorological and mareometric station and led it for 40 years. He was a naturist and archaeologist. He worked in meteorology, oceanography, zoology, entomology and botany, and especially in the cultivation of sponges. Seven new species of sponges, shrimp and fish were called by his name. His legacy is placed in the natural history cabinet Grgur Bučić in Hanibal Lucić summer house as a



Figure 18 Grgur Bučić
(photo V. Kurelec)

part of the Museum of the town of Hvar. He received several awards and became the Honorary Doctor of the University of Graz in 1886. He was a member of several scientific societies including the very prestigious association of zoologists and botanists in Vienna. He published an entomological work about 63 species of the Orthoptera of the islands of Hvar and Korčula in the associations journal *Verhandlungen Zoologische-Botanische Gesellschaft Wien* published in 1885. He cooperated with several entomologists. Frauenfeld, a kind of Trypetidae family (Diptera)- *Orellia buchichi* Frauenfeld described 1867, was named it after him. Bučić found a type of grasshopper, endemic for the Croatian Middle Islands, on Hvar which was described by Otto Hermann and named *Rhacocleis buchichi* in 1874 (Hirc, 1911, Gamulin-Brida & Ilijanić, 1977, Nonveiller, 1989).

Ivan **Novak** (Hvar, 1848 - Zadar, 1893) was a popular teacher on the island of Hvar, but he dealt with entomology, botany, palaeontology and archaeology as an amateur (Fig. 19). He collaborated with numerous scientists. He collected an extensive collection of insects from Hvar. He published three papers on the species of the orders Demaptera and Orthoptera. Some entomologists named new species of beetles *Kissophagus novaki* Reitter 1889, an endemic species of Hvar from the family Scolytidae, *Pseudocleounus novaki* Penecke 1928 from the family Curculionidae, and two species of families Cantharidae *Maltinus novaki* Reitter 1889 and endemic species of Hvar *Malthodes novaki* Reitter 1894 after Novak. His collections of insects were sold to a dipterologist, G. Strobel, except for the Coleoptera that were kept by his son, Petar Novak. Strobel published several papers on Diptera species from Dalmatia, including some that carry the name of I. Novak: *Tachydromia novaki*, *Hemilea novices* and *Sphonella novaki*, *Usia novaki*, *Chlorops novaki*, *Agromyza novaki* *Psilopus novaki*. Even a single genus bears his name *Novakia scalopsiformis*. I. Novak was interested in pest species and published a paper on the known most important pest species in Dalmatia (Gamulin-Brida & Ilijanić, 1977, Nonveiller, 1989).



Figure 19. Ivan Novak

Eduard **Karaman**, dr. med. (Split, 1849 - 1923) was a physician and entomologist. He finished his primary education in Split, and he studied medicine in

Prague, Vienna and Graz. He graduated in Graz in 1875. He worked as a physician in private and in public practice during a relatively short time. He left the profession early and retired. He devoted himself exclusively to collecting insects, especially beetles. He donated his rather large collection about forty thousand exemplars and of over eight thousand species to the Natural History Museum in Split. He published only one article with Petar Novak. He collaborated with a very large number of entomologists of that time such as: Ganglbauer, Reitter, Winkler and G. Müller. He is definitely the entomologist whose name was given to the largest number of new insect species (twenty). For example, the family Carabidae *Harpalus karamanie* Apfelbeck in 1904 or Curculionidae *Othiorrhynchus karamanie* Apfelbeck in 1918 (Nonveiller, 1989).

A large number, comprising 44 local professional and amateur entomologists, researched in Croatia in the second half of the 19th century and during the early 20th century before the First World War. Data were taken from available original papers of some entomologists of that period using the works: Babić, 1927, Brusina, 1886, Depoli, 1924, Durbešić, 1982, Hadži, 1929, Kurier, 1942, Matoničkin, 1974, Noveiller, 1989 and others (Table 2).

Unfortunately, data on researchers are not uniform since some of them are not available in originals. Tables give name and surname, date of birth and death, information on the group of insects the researcher was involved in, where and when he investigated, nationality and the source of the data. With so many domestic researchers, the number of 163 foreign researchers who came to Croatia to do research shows how great the interest in the study of insects was. At that time, in other countries of Europe, the fauna had been almost completely explored, and Croatian territory was a paradise for naturalists of that time.

By the same principle as for the domestic, foreign researchers are analysed in Table 3.

It could be underlined that there is no significant entomological name of that time that did not explore in Croatia or determine and write about insects from Croatia.

The most important names of entomology in Europe at that time were Georg von Frauenfeld and Edmund Reitter.

Table 2. Domestic entomological researchers in the second half of 19th century until the First World War

No	Name, degree	Surname	Lived from-to	Speciality, Insect group	Domicile	Visited area	Period	Remarks	S.
1	Andro	Alujević		Hymenoptera	Vis		1904	a	N
2	Viktor	Apfelbeck	1859-1934	Coleoptera	Sarajevo	Dalmatia		p	O
3	L.	Bevardi-Lusić			Stari Grad, Hvar	Stari Grad, Hvar	1890	a	N
4	Jakov, prof.	Boglić	1826-1897	Malacologist, Lepidoptera Coleoptera	Zadar		1881	In Schlosser book, p	N
5	Vojtjeh, dr. med	Brida	1875-1954	Insects	Vienna, Brač	Selca, Tiranj , Jelsa	1913	a	N
6	Akad. Spiridion	Brusina	1845-1909	Malacologist and insects	Zagreb	Croatia		Museum director, professor of zoology at PMF	O, H
7	Dr. h. c. Grgur	Bučić	1829-1911	Orthoptera	Hvar	Hvar	1885	p	Hirtz
8	Franjo	Dobias-Padewith	1863-1914	Orthoptera, Coleoptera, trader	Senj	Lika, Senj, Velebit	1891-1898	collection, p	D, H
9	Eugen	Dobias		trader	Gospić	Lika	1886	p	H, N
10	Josip von	Dorotka	1832-1897	Commander of Dubrovnik	Dubrovnik	Driena Cave	1880	a,	N
11	Cupilli Simeone	Ferrari	1834-1922	Lepidoptera	Zadar			Lepidoptera collection, p	N
12	Rikard, prof.	Gasparini	1853-1939	Hymenoptera	Split	Dalmatia	1886, 1887 1889, 1891	In Zagreb, Hymenoptera collection, p	N
			1853-1939	spider	Split	Dalmatia	1891-1892		N
13	Vincenz	Geiger	1819-1892	Lepidoptera	Vis, Split, Zadar	In domicile surrounding	1871, 1879, 1881	Cultivation of Lepidoptera, a	N
14	Arnošt	Grund	1866-1929	Lepidoptera	Zagreb	Surrounding of Zagreb	1903-1918	a	Brit,
15	Acad. Jovan	Haži	1884-1972	Zoologist, Insects	Zagreb-Ljubljana	1907-1 1920 in Zagreb		professor of zoology at PMF, p	K, M, I
16	Andrija, dr. med	Hensch	1857-1930	Insects	Krapina	Croatia		collection 80 000, at F. F. Zagreb, a	Per.
17	Italo, prof.	Hochetlinger		Biospeleologist, cave Coleoptera	Zagreb	Cave Lednica Lokve	1912	Sec. school teacher p	B, H

Table 2. Domestic entomological researchers in the second half of 19th century until the First World War - continued

18	Dr. sc. Adolf	Jurinač	1854-1925	Coleoptera Orthoptera	Krapina Krapina	Ivančica W. Slavonija	1886 1887	Sec. school teacher p	B, M B, M
19	Bogomir	Karakaš		Scolytidae	Križevci			p, teacher at Forest sec. school Križevci,	Sp
20	Eduard, dr. med.	Karaman	1849-1923	Coleoptera	Split	Middle Dalmatia	1885-1920	Collection in Split, p	N
21	Mihovil, prof.	Katurić	1847-1912	Hymenoptera, Lepidoptera	Zadar	3 papers	1887, 1891	director of the first museum in Croatia, p	N, M
22	Prof. Fran	Kesterčanek	1856-1915	Forest science, Scolytidae	Zagreb	Croatia	1881.	Professor. at Forestry Faculty	H, K
23	Vladimir	Kiseljak	1849-1893	Entomological teacher	Križevci	First secondary school book in entomology		Teacher at Forest secondary school in Križevci, p	Sp, I
24	Prof. dr. sc. Mijo	Kišpatić	1851-1926	Minarology, Insecta	Zagreb	Popular book about insects	1886-1887	Director of Mineral. Museum and professor at PMF	Sp, O, H, M
25	Đuro ing.	Koča	1853-1924	Coleoptera, Lepidoptera, Odonata	Vinkovci	County Vinkovci and Požega	1885-1924	Collection in Museum in Zgb., p	Sp, Hirtz
26	Prof. dr. sc. Anton	Korlević	1851-1915	Coleoptera, Curculionidae, Hymenoptera, wespes	Zagreb	Rijeka, Croatia	1887-1906	First professor. of entomology at F.F., collection in Museum, p	Sp, wasps, M
27	Baldo	Kosić	1829-1918	Insects	Dubrovnik	Surroundings of Dubrovnik		Museum manager	N
28	Prof. dr. sc. August	Langhoffer	1861-1940	Diptera and cave Coleoptera	Zagreb	Croatia	1888-1930	Museum director and professor of zoology at PMF, collection	Sp, M
29	E.	Meneghello		Coleoptera	Dubrovnik	Lošinj	1912	Second school teacher	N
30		Metzger		Lepidoptera		Istra	1898		B
31	Krsto	Mussap	1887-1916	Coleoptera	Dubrovnik Kočula	Korčula, Dubrovnik, Pejelšac, Metković	1911-1914	a	N
32	Ivan Krstitejij	Novak	1848-1893	Botanist, archaeologist entomologist	Hvar	Hvar, Split, Zadar	1874 -1893	Teacher, p	N

Table 2. Domestic entomological researchers in the second half of 19th century until the First World War - continued

33	August, dipl. ing	Onsea		Lepidoptera	Zagreb	Zagreb Sijeme Zagreb Sijeme	1892 1896	collection	B
34	prof. dr. sc. Ervin	Rössler	1876-1923	Coleoptera Ornithologist, interested in Odonata	Zagreb	Hrvatska	1900	professor at PMF	M
35	Julijus, prof	Sapetza		Cave Coleoptera	Rakovica	Ozalj – Vrlovka cave	1860	Sec. school teacher, p.	N, B
36	Oskar, dipl. ing	Scheibel	1881-1953	Cave Coleoptera	Zagreb	Dalmatia		a	N
37	Acad. Josip	Schlosser Klekovski	1801-1882	Coleoptera	Zagreb	Croatia	1876-1883	First book, collection in Museum etc.	O, M, N
38	Antonio	Spada	- 1929	Lepidoptera; trader	Zadar	Surroundings of Zadar	1886-1916		N
39	Julija	Stigler Pichler	1827-1901	Coleoptera and cave insects	Zagreb	Ozalj	1870		B, L
40	Gjuro, prof.	Šebišanović	1852-1890	Coleoptera	Rakovac	Varaždin, Karlovac	1888	Sec. school teacher	B
41	Dragutin	Taborski		Lepidoptera	Zagreb			Collection	M
42	Acad. Aleksandar	Ugrenović	1883-1953	Forest science, Coleoptera	Zagreb	First PhD in entomology	1907	Professor at F.F.	H
43	Dr. sc Vatroslav	Vogrín	1886-1956	Insects	Zagreb	Croatia	1913		L
44	Academician Živko	Vukasović	1929-1874	Coleoptera	Zagreb	Croatia	1855-1874	Inspector etc.	T
45	Acad. Ljudevit	Vukotinović	1813-1893	Botanist, Lepidoptera	Zagreb	Surroundings of Zagreb	1879	lawyer, politician, writer and naturalist curator	Bal, M
46	Robert von	Weingärtner	1860-1941	Coleoptera	Zagreb	Dinara		Collection and library in Museum	N
47	Slavoljub	Wormastiny	1816-1909	Insects	Zagreb	Arranged the entomol. collection	1860-1900	Collection in Museum	M

Legend: In column Name and degrees - degrees as usual in Central Europe, Croatia and in references;

in column remarks: p - profession, a - amateur;

in column S - sources: B - Babić, 1927; Bal - Balabanić, 1998; Brit. - Britvec, 1993; D - Durbešić, 1984; H - Hadži, 1929; Hirtz 1924; I - Internet; K - Kurir - 1944;

L - Langhoffer, 1916; M - Matonićkin, 1974; N - Nonveller, 1989; O - original work; Per - Perović, 2005; Sp - Spaić, 1983; T - Torbar, 1875;

F. F. - Forest faculty in Zagreb, PMF - Faculty of natural history in Zagreb

Table 3. Foreign entomological researchers in the second half of 19th century from 1850 – 1914

N.	Name, degree	Surname	Lived from to	Speciality, insect group	Domicile	Visited area	Period	N.	Remarks	S
1	Prof. dr. sc. Karel	Absolon	1877-1960	Cave fauna, -Colembola,	Bmo	Mt. Mosor, Cavtat, Mljet, Brač	1913	C	Speleolog, cadastre, p	N
2	St	Basdan		Lepidoptera		Slavonija		A		H
3	Theodor	Becker	1886-1928	Diptera	Slezija	Dubrovnik, cave	1889	N	Catalog publisher, a	N
4	Dr. G.	Bernau			Vienna	Mt. Velebit	1912	A	p	L
5	Dr. Max	Bernhauer	1866-1946	Staphilinidae	Horn	Rijeka, Hrvatsko primorje	1913	A		L
6	Tibor	Blatny	1883-1969	Forester, Coleoptera	B. Bislica	Plitvice	1914	A	Collection, a.	L
7	Franz	Blühweiss	1880-1948	Coleoptera	Vienna	Fuzine	1913			
8	O.	Bohatsch		Lepidoptera		Mt. near Skrad, Fužine, Svrlaja, Dinara, Učka Plješevica	1914	C	p	L
9	P.	Born		Carabidae	Berlin	North Dalmatia, cave Kraljeva pečina	1913	A	Hoffmann follower, a	N
10	Karl, dr. med	Branczik	1842-1915	Hemiptera	Trencin	Slavonija	1892			H
11	Josef	Breit		Coleoptera	Vienna	Middle, South Mt. Velebit, Žumberak, Sijeme, Gospić,	1911	N	p	L
12	Dr. sc. Karl von	Brunner Wattenwyl	1823-1914	Orthoptera	Vienna	Pula, Zadar, Šibenik, Split, Hvar, Gruz	1885, 1904	Sk	a	N
13	Akad. Ivan	Bureš	1885-1980	Lepidoptera	Sofia	Učka, Paklenica	1911	A	p	L
14	Malcolm	Burr		Orthoptera	London	Istria, Primorje, Dalmatia, Hvar	1882	A	Collection	H, N
15		Circovich			Trieste	Whole coast, Dalmatia	1909,1910	B	p	N
16	Carlo, dr. med.	Cori junior		Formicidae	Trieste	Sibenik, Trogir , Mali Lošinj, Korčula, Hvar, Kašela Split	1900	E	officer, a	N
						Cave of island Cres	1914	T	a	N
						Siano, islands, South Dalmatia, Dubrovnik, Ombla	1911, 1912, 1913	T	p	N

Table 3. Foreign entomological researchers in the second half of 19th century from 1850 – 1914 - continued

17	Prof. dr. Carlo I.	Cori senior	1865-1954	Coleoptera	Trieste	Islands, Palagruža, Vis, islands of bay Krvarner	1911-1916	T	12 times with ships Nejade & Adria, p	N
18	Ernoe	Csiki	1875-1954	Carabidae, Chrysomelidae	Budapest	North Dalmatia (Split i Knin)	1907	M	Museum director p	L
						Alančić, Risnjak, Bitoraj, Lokve, Josipdol	1912			
						Rijeka, Vlasčka špijla Kozice -Novi	1913			
19		Curti		Coleoptera	Vienna	Hrvatsko primorje	1912	A		N
20	Karl	Czernohorsky	1857-1942	Cerambycidae cave fauna	Poland	Dubrovnik Sinj, Imotski	1901, 1905	P	Reitter & Müller follower, a	N
21	Paul	Czerny		Insecta, cave fauna	Vienna	islands and Vis	1909, 1912	A	a	N
22	Dr. L. F.	Čelakowsky		galls	Prague	South Dalmatia - Split i Dubrovnik N., S. Dalmatia, Hvar	1910, 1912	C	P	N
23		Diener		Coleoptera	Budapest	Jelenje, Fužine, Risnjak Vinodol	1914	M	a	L
24	Franz	Dirnböck	1810-1873	Coleoptera	Graz	Općina, Zadar, Šibenik, Split Vis	1873	A	a	O
25	Ernst von	Dombrowski	1862-1975	Ornithologist cave fauna	Poland	Cave Vranjača	1907	P		N
26	Prof. dr. Richard	Ebner	1885-1961	Orthoptera	Vienna	South Dalmatia	1911	A	p	N
27	Dr. Johann	Egger	1804-1866	Diptera	Vienna	Dalmatia	1855	A	Collection, p	H, N
28	H.	Eggers		Coleoptera	Vienna	Ludbreg, Dalmatia	1911	A		L
29		Eppelsheim		Coleoptera				N		H
30	Josef	Erber	1824-1882	trader, insecta	Vienna	Whole coast, Hvar.	1861, 1862 1867-1868	A	Three times	N
31	Dr. Josef	Fahringer	1876-1950	Hymenoptera	Vienna	Dalmatia, Dubrovnik	1903-1910	A	Six times, p	N
32	Dr. Curt	Felge	1874-1962	Coleoptera, Heteroptera	Eisleben	Split, Dubrovnik	1912, 1931, 1938	N	a	N
33	Dr. H.	Fischer		Lepidoptera	Austria	Zadar Gruž	1909	A	Hirschka foll., a	N
34	Dr. Anton	Fleischer	1850-1934	Coleoptera	Brno	South Dalmatia - Dubrovnik, Metković	1901	C	Reitter follower, a	N

Table 3. Foreign entomological researchers in the second half of 19th century from 1850 – 1914 – continued

35	Romuald	Formánek	1853-1927	Curculionidae Cave Curculionidae	Brno	South Dalmatia Caves near Zaton	1901, 1913 1913	Collection, p.	N L
36	Zdenek	Frankenberger	1892-1966	Coleoptera	Prague	Carst. of Hrvatsko primorje	1914	P	N
37	Georg von	Frauenfeld	1807-1873	Insecta	Vienna	Whole coast from Trieste until Kotor, Biokovo	1857	Curator, phyloxaera, p	N
						Samobor mountains	1870	With Vukotinović, & Schlosser	N
38		Friese		Hymenoptera		Hrvatsko primorje			H
39	Emeric	Frivaldszky	1799-1870	Coleoptera	Hungary		1865		H
40	Ferdinand	Fuchs		Coleoptera	Vienna	South Dalmatia	1899	Captain, a	N
41	Dr.	Funk		Coleoptera	Bamberg	Dalmatia	1890, 1891	p	N
42	Dr. sc Egon	Galvani	1874-1955	Lepidoptera	Vienna	Rab, Vis, Palagruža, Lastovo, Brsnik	1901		
						Vis, Palagruža	1902, 1904		
						Mljet - Govedari	1906, 1907		
						Gruž	1908	P	N
						Dubrovnik, islands	1909, 1911, 1913		
						Vis	1907, 1908		
						North Dalmatia	1912		
43	Ludwig	Ganglbauer	1856-1912	Coleoptera	Vienna	Istria, Gorski kotar, Senj	1901	curator, p	N
44	Hans	Gebien	1874-1947	Tenebrionidae	Hamburg	Croatia south of Kupa river	1913	a	L, N
						Palagruža	1896		
						Vis, Biševo, Brusnik, Palagruža	1901		
45	Prof. dr. sc. August	Ginzberger	1873-1940	Bolanist insects	Vienna	Islands, Vis,	1905, 1906, 1907, 1910	Leader of the excursion of the Akademie	I, N
						Lošinj, Kornati, Vis, others			
46	Aloiz	Gobanz		Coleoptera	Austria	Mljet	1898, 1901	p	N
47	prof. dr. sc Veit	Grabner	1844-1892	Zoologist Orthoptera	Graz	Vinkovci Srijem	1868 1880	p	N

Table 3. Foreign entomological researchers in the second half of 19th century from 1850 – 1914 - continued

48	Dr. Matjan von	Grabowski	1864-1930	Cave fauna	Poland	Mt. Mosor cave Kraljeva peč Brač	1907 1908	P		N
49	prof. dr. Eduardo	Gridelli		Coleoptera, Trasacridia species	Trieste	Dalmatia,	1911	T	curator, p	L, N
50	Albert	Grunach	1842-1907	Lepidoptera	Germany	Zaton	1902	N	Cultivation	N
51		Hampe		Cave Coleoptera			1861, 1870			M, D
52	Akad. dr. h. c. Anton	Handlirsch	1865-1935	Coleoptera	Vienna	Dubrovnik	1900	A	Museum director, p	N
53		Haury		Coleoptera		Plain Croatia	1855			H
54	Franz	Heikertinger	1876-1953	Alicinae	Vienna	Učka, Dalmatia Velebit, Dalmatia	1912 1913	A	p	N, L
55		Henibusch		Lepidoptera		Slavonija				H
56	O	Herman		Spiders	Vienna	Rijeka	1876-1879	T	p	M
57	Hans	Hirschke		Lepidoptera	Vienna	Dubrovnik Zadar Gruž	1908 1909	A	p	N
58	Adolf	Hoffmann		Coleoptera, trader	Vienna	Rijeka	1879	A	p	D
				Coleoptera, trader		Split, Klis, Knin Zagvozd, Mt. Biokovo	1911		Six time, p	
				Cave fauna, trader		Mt. Biokovo, Mt. Mosor , Cave Kraljeva peč	1912			N
				Cave fauna, trader		Caves near Dugopolje	1914			L, N
				Coleoptera, trader		Split, Biokovo, Makarska, Supetar	1914			p
59	Dr. sc. Karl	Holdhaus	1883-1975	Lepidoptera	Vienna	Metković, Dubrovnik, Konavle	1902	A	Museum director, p	N
						Biokovo, Velebit	1911		L	
						Rab,	1912		L	
60	Baron Georg	Hopfgarten	1825-1904	Coleoptera	Dresden	Slavonija, South Croatia	1879.	N	p	N
						Dalmatia	1880			

Table 3. Foreign entomological researchers in the second half of 19th century from 1850 – 1914 - continued

61	Dr. sc. Geza	De Honvath	1847-1937	Hemiptera	Budapest	Dalmatia	1906	Institute of plant protection, p	N	
						Central Dalmatia	1901			
						Lika	1902			
						Novi	1903			
62	Viečo	ličev	1885-1924	Lepidoptera	Sofia	Dalmatia	1910	Buresch follower, p	N	
						Rijeka, Orehovica, Poovežica, Sušak, Bakar, Novi, Serji, Hvar Gospić, Dalmatia, Volosko,	1911			
63	Dr. Paul	Kammerer		Herpetologist, Insects	Vienna	islands	1911	A	p	N
						Učka Dalmatia	1905, 1906			
64	Dr. ph. med. Henrich	Karny	1886-1939	Pseudoneuroptera, Neuroptera	Graz Graz	Zagreb, Istria, Dalmatia	1911	A	p	N
						Zagreb, Učka, Obrovac	1912	A		
65	Josef	Kaufmann	1836-1913	Coleoptera	Vienna	Fužine, Rijeka, Paklenica, Zadar	1879	Langhoffer and Müller follower, p	N	
						Zadar - Dubrovnik	1885, 1893	Reitter follower, collection,		
66	Dr. Eduard	Kaufmann		Coleoptera	Rijeka	Rijeka mount. of Primorje	1912	T	Collection, p	D, L
						Coast of Istria	1864			L
67	H	Kiesenweter		Coleoptera				C		H
68	Dr. ph.	Klapalek	1883-1907	Zoologist, Cave Heteroptera	Vienna	Mljet - Korita	1906	A	a	N
69	K.	Knauer		Coleoptera	Vienna	Mljet	1906	A	a	N
70	Alfred	Knisch	1885-1926	Hydrophilidae	Vienna	Dalmatia	1911	A	a	N
						Mt. Mala Kapela	1911			
71	Prof. dr. sc. Friedrich	Kolenati	1813-1864	Neuroptera	Prague	Dalmatia	1858	C		H, N

Table 3. Foreign entomological researchers in the second half of 19th century from 1850 – 1914 - continued

73	Walter	Koltze		Coleoptera	Hamburg	Hrvatsko primorje		N	a	D
74	Dr. h. c. August H.	Krauss	1848-1937	Orthoptera	Stuttgart	Istria, Rijeka, Primorje Hvar, Sinj	1874, 1877	N	p two times	B N
75	Dr. Herman	Krauss	1869-1944	Coleoptera Cave insects	Maribor	Istria, Rijeka, Primorje Caves of Brač	1874 -1877	SI	Müller follower, a	N
76	Hans	Krekich Strassoldo	1864-1929	cave fauna Coleoptera		Mt. Prolog Rab,	1912 1911	T		N L
77	Prof. W	Krone		Lepidoptera	Vienna	Gruž	1906	A	p	N
78	Dr. Josef	Kriechbaumer	1819-1902	Hymenoptera	Munich	Rijeka, Krk	1871	N	p	N
79	Walter	Liebman	1885.-1974	Coleoptera	Arnsstadt	Dalmatia	1911, 1912	A	p	N
80	Dr. Fr.	Maidl	1887-1951	Hymenoptera	Vienna	Rijeka, Split	1912	A	p	N
81	Josef	Mann	1804-1889	Lepidoptera	Vienna	Rijeka, Primorje	1849, 1853, 1854, 1857	A	Collection, p	N, L
82	Candido de	Mayer	1874-1924	cave fauna	Trieste	Kvarners islands	1912	T	Müller follower, p	N
83	prof. dr. Gustav	Mayr	1830-1908	Hymenoptera	Vienna	Radoboj - Krapina	1854	A	p	N
84		Meissner		Lepidoptera		Rijeka				H
85	Dr. Leopold	Melichar	1856-1924	Homoptera	Vienna	Dubrovnik	1887	A	p	N
86	Dr. Guisepppe	Messa	1872-1932	cave fauna	Trieste	Mosor	1911	T	Müller follower, p	N
87	Paul	Meyer	1876-1951	Coleoptera	Chernitz	Korčula Rijeka	1913 1900	T	p	N
88	Dr. ph. Karl	Miesinger	1884- ?	Hymenoptera	Vienna	Rijeka, Jablanica, Dubrovnik	1905	A	excursion, p	N
89		Mihok		Coleoptera	Budapest	Jelenje, Fužine, Risnjak Vrnodol	1914	M	p	L
90	Ludwig	Miller	1820-1897	Coleoptera Cave Coleoptera	Vienna	Zadar, Obrovac, Starigrad, Paklenica, Rijeka Fužine	1879	A	p	N
						Dalmatia	1861 1867			M

Table 3. Foreign entomological researchers in the second half of 19th century from 1850 – 1914 – continued

91	Alexaner	Mocsary	1841-1915	Neuroptera, Hymenoptera	Budap.			M	curator	H, I
92	Emil	Moczarski	1879-1945	Coleoptera	Vienna	South Dalmatia	1907	A	excursion	N
						Hrvatsko primorje				
93	Prof. dr. sc. Guiseppe	Müller	1880-1964	Coleoptera Cave fauna	Trieste	Krapina	1912	T	Museum director	N, L
						Sinj, Imotski	1905			
						Mt. Mosor	1910, 1911			
						Mt. Prolog	1912			
						Korčula	1913			
						Šibenik, Brač	1903			
94	prof. dr. Fritz	Netolitzki	1875-1945	Cave fauna Genus Bembidion	Graz	Caves of Mt. Mosor and Sinj	1909	A	p	L, N
						Caves of island Krk	1908			
95	F. Bruno	Neuhaus	1882-?	Coleoptera Cave fauna	Munich	Dubrovnik, Lokrum, Mljet	1912	N	a	N
						Caves surroundings Rijeka, island Krk	1907			
96	Herman F. dipl. ing	Neumann	1866-1925	biospeleologist	Graz.	Mosor, Dubrovnik, spring of river Ombla	1909	A	P	N
						Vis, Hvar	1909			
						Dugopolje, Mosor	1911			
						Dubrovnik - Lokrum	1898			
97	Mary de la Beche	Nicholl		Lepidoptera	London	Dalmatia	1905	A	a	N
98	Josef	Nitsche	1873-1941	Lepidoptera	Vienna	Dalmatia	1905	A	a	N
99	Jan	Obenberger		Coleoptera		Dinara, Bijela Lazica, Otočac, Skrad	1914	N	a	L, H
100	Ludwig	Osthelder	1877-1954	Lepidoptera	Kehlheim	Dubrovnik	1913	N	a	N
101	Gustav	Paganetti- Hummler	1871-1949	Coleoptera, trader	Vienna	South Dalmatia	1898, 1899, 1901, 1902	A	p	N
						Vis, Palagruža	1902			

Table 3. Foreign entomological researchers in the second half of 19th century from 1850 – 1914 - continued

102	Janos	Pavel	1842-1901	Lepidoptera	Budapest	Spitt, Solin, Omiš Lika Novi	1901 1902 1903	M	Horvath follower, p	N
103	Andreas	Pazourek		Coleoptera, trader	Vienna	Mt. Dinara	1911	A	p	N, H
104	prof. dr. ph. Karl	Penecke	1858-1943	Coleoptera	Graz	Mljet, Vrs, Korčula	1901	A	Müller follower, p	N
				Cave fauna		Šibenik, Brač Sinj, Imotski, Biokovo, Makarska	1903 1905	A	Müller follower, p	N
105	Dr. Arnold	Penther	1865-1931	Cave fauna Lepidoptera	Vienna	Dubrovnik Pelješac	1909 1900	A	p	N
106	Dr. ph. Thomas	Pichler		Bolanist insects	Lienz	Dinara, Gnjat, Prolog, Palaguza, Jabuka, Lastovo, Biokovo	1868-1873	A	Three times, p	N
				Cecidomidae		Velebit	1869			
107	Dr. Willy	Ramme		Orthoptera	Berlin	Bakar, Rijek, Orehovica, Opatija, Veprihac	1913	N	p	L, H
108	Father	Ravasini		Coleoptera	Rijeka	Caves of island Cres	1914	T	p	De
109	son	Ravasini		Coleoptera	Rijeka	Caves of island Cres	1914	T		De
110	Prof.dr. Hans	Rebel	1861-1940	Lepidoptera	Vienna	Lokrum	1910	A	Museum director, p	N, H
111	Edmund	Reitter	1845-1920	Coleoptera	Moedling	Kapela, Plitvice lakes, Slavonia	1878	A	p	N, L
						Zadar - Dubrovnik	1879-1912			
						Slavonia, from Kupa till Primorje, Rijeka, Opatija, Učka	1913			
112	Dr. Alois F.	Rogenhofer st.	1831-1897	Lepidoptera	Vienna	analyzed Scopoli and Carrara	1881	A	Curator, p	N
113	Dr. ph. Alois	Rogenhofer ml.	1878- ?	Isopoda, Insects	Vienna	Split, Mljet – Govedari, Pelješac	1906	A	p	N
114	Jan	Roubal				Zagreb	1913	C	p	L
115	N. Ch	Rotschild		Lepidoptera		Sarvaš on Drava river	1911	M	a	L
116	Prof. dr. Uunio	Saalas	1882-1969	Coleoptera	Finland	Dalmatia	1903	Fn	Sahlberg follower, p	N

Table 3. Foreign entomological researchers in the second half of 19th century from 1850 – 1914 - continued

117	Prof. dr. sc. John	Sahlberg	1846-1920	Coleoptera	Finland	Central Dalmatia Split, Šibenik, Dubrovnik, waterfalls of Krka till Knin	1903 1906	Fn	p	N
118	Sidney Smith	Sauders	1809-1884	Coleoptera, Hymenoptera	England	From Istria whole coast	1879	E	a	N
119	Dr. h. c. Ludwig	Schaufuss	1833-1890	Cave Coleoptera,	Dresden	Dalmatia	1861-1864	N	p	M
120	Arturo	Schatzmayer	1880-1950	Cave fauna	Trieste	Mt. Mosor	1910,1911	T	Müller follower, p	N
							1912			
							1914			
121	H.	Schaum		Cave Coleoptera	Berlin		1862	N	a	M, D
122	C.	Scheider		Coleoptera	Vienna	Hvar	1898	A	a	N
123	Dr.	Schima		Lepidoptera		Lokrum	1912			L
124	Dr. Rudolf Ignaz	Schirner	1813-1873	Diptera	Vienna		1879	A	p	N
125	August, prof.	Schletterer	1850-1908	Hymenoptera	Tyrol, Pula	Istria	1885-1901	A	Second school	N, H
126	Ferdinand	Schmidt	1791 -1878	Orthoptera	Ljubljana	Pula	1865	SI		H, N
127	prof. dr. sc Camilo	Schneider		Neuroptera		Hvar	1898	A		H, N
128	Friedrich	Schuhmacher	1888-1934	Hemiptera Chrysomelid.	Germany	Whole coast - Gruž Zadar, Nin, Šibenik, Solin, Klis, Split	1909	N	p	N
							1911			
129	Recher A. von	Schulthess	1855-1941	Hymenoptera	Zurich	Dubrovnik, Hvar	1885	S	a	N
130	Karl	Schwarz	1847-1898	Coleoptera	Liegnitz	Ston, Dubrovnik	1890	N	Becker follower, a	N
131	Ana Marija	Smith		Coleoptera	Rijeka	Hrvatsko primorje	1869	A	p	D
132		Smolik		Coleoptera, trader	Vienna	Mt. Dinara	1911	A	Pauzrek follower, p	N
133	Johannes R.	Spoengerts	1853-1928	Lepidoptera	Chemnitz	Rijeka, Dubrovnik, Jablanica	1905	N	p	N
134		Srnka		Coleoptera	Czech	Metković	1896	C	a	N
135	Hermann	Stauder	1877-1930	Lepidoptera,	Trieste	Split, Brač, Hvar, Mt. Prolog Istria	1907	A	p	N
							1910			
136	prof.dr. Friedrich	Stein		Diptera, Coleoptera	Berlin	Split, Matjan, Dubrovnik	1860	N	Curator, p	N

Table 3. Foreign entomological researchers in the second half of 19th century from 1850 – 1914 - continued

137	Franz	Steindachner	1834-1919	Ichthyologist, Insects	Vienna	Hvar	1861	A	Museum director, p	N
138	Dr. Robert von	Sterneck		Geographer, Insects	Vienna	Vis, Palagruža, Hvar, Korčula, islands	1885	A	a	N
139	Dr. A	Steur		Formicidae		Dalmatia	1994	A	Ship Najada, p	N
140		Sterl		Coleoptera						H
141	V	Stiller		Cave Coleoptera		Cave of Croatian carst	1911-1913	N	p	L, H
142	Michele	Stossich	1857-1906	Helminthologist, Insects	Trieste	Vis, Palagruža	1879	T	Ship Palegosa, p	N
143	Palter dr. Gabriel	Strobl	1846-1925	Diptera	Admond	Šibenik, Spili, Solin	1897	N		N
						Kvarner, Kvarners islands	1871	N	p	D
						Zadar- Dubrovnik	1879	N		N
144	Dr. Rudolf	Sturany	1867-1935	Malacologist, Coleoptera	Vienna	Brač, Omiš, Makarska Imotski	1902	A	Curator, p	N
						Metković, Korčula	1903			
145	Josef	Stussiner	1850-1917	Coleoptera	Ljubljana	Škurinje, Opatija, Jordani, cave near Novigrad	1878	SI	p	N
146	dr. Zoltan	Szilady		Neuroptera	Budapest	Serj	1912	M	p	L
147	Dr. Karel	Šulc		Hemiptera		Crkvenica, Ledence, Breze, Serj		C	p	L
148	V	Taborski		Lepidoptera	Prague	Dubrovnik	1909	C	a	N
						Metković, Vis	1902			
150	Franz	Tax	1854-1921	Cave fauna	Graz	Cave Vranjača	1903	A	a	N
						Brač, Obrovac	1904			
						Metković, Mljet	1908			
151		Thalhammer		Hymenoptera		Siavonija				H
152		Thorell		Cave fauna	Vienna	Rijeka	1870-1873	T	p	M
						Dubrovnik, Gruž, Ombla	1907	C	a	
153	Franz	Toegl	1877-1917	Diptera	Vienna	Dalmatia	1913		Heikeriger follower, a	N
154	Dr. Jenoe	Vangel		Lepidoptera	Budapest	Dalmatia	1905	M	p	N

Table 3. Foreign entomological researchers in the second half of 19th century from 1850 – 1914 – continued

155	Dr. Vaclav	Vavra		Orthoptera	Prague	South Dalmatia	1911	C	Curator, p	N
156	Fritz	Wagner	1873-1938	Lepidoptera	Vienna	Gruž, Lepod	1905	A	p	N
							1907			
							1909			
157	Adolf	Walter		Coleoptera	Brno	Central Dalmatia, Kaštel Stari	1913	C	p	N
158	Dr. h. c. Georg	Warnecke	1883-1962	Lepidoptera	Hamburg	Rijeka, Zadar, Dubrovnik, Split	1913	N	p	N
159	Eugen, prof.	Weber		Cave fauna	Graz	Cave of Mt. Mosor	1910	A	Müller follower	N
160	Prof. dr. sc. Franz	Werner	1867-1939	Orthoptera	Vienna	Central Dalmatia, islands	1889	A	p	N
							1897			
							1893, 1903			
							1906			
161	Prof. dr. Carlo	Wolf		Formicidae	Trieste	Dubrovnik, Solin, Peješac, Korčula, Brač	1912	T	p	N
							1913			
							1859			
162	G.	Zebe	? - 1867	Formicidae	Neumarkt	Dalmatia	1859	N	p	N
163	Dr. Hans	Zerny	1887-1945	Lepidoptera Diptera	Vienna	Dalmatia, Vienna University excursion	1912	A	Curator, p	N

Legend: : In column Name and degrees - degrees as usual in Central Europe, Croatia and in references;

in column remarks: p - profession, a - amateur;

in column N – nationality: A - Austrians, B – Bulgarians, C - Czechs, E - British, Fr – Finns, M - Hungarians, N - Germans,

P - Poles, S - Swiss, Sl - Slovenians, Sk – Slovaks, T – Italians;

in column S - sources: B - Babić, 1927; D - Durbešić, 1984; De – Depoli, 1924; H - Hadži, 1929; I – Internet; L - Langhoffer, 1916;

M - Matonićkin, 1974; N - Nonveiller, 1989; O - original work.

Georg von **Frauenfeld** (Vienna, 1808 - 1873) was one of the most prominent entomologists second half of the 19th century and the curator of the Royal Zoological Cabinet, today the Natural History Museum in Vienna (Fig. 20). He was a naturalist, and his specialties were entomology and malacology. He was among the founders of the Zoological-Botanical Society in 1851, which still is active. He was a life-long secretary of the association. In the field of entomology he preferred the order Diptera, but was interested in other orders of insects too. It is significant that he was the first to describe the incidence of phylloxera in the Austro-Hungarian Monarchy. In particular he explored Dalmatia, where he travelled over two months in 1854. It is interesting that he was in Zagreb where he met with Lj. Vukotinović and J. Schlosser-Klekovski and with them visited the Samobor mountains in 1870. Besides collecting in Dalmatia he also collaborated with M. Botteri and G. Bučić from Hvar, who sent him material. Frauenfeld named a species of family Trypetidae *Orellia buchichi* in honour of G. Bučić. J. Schlosser in his book *Fauna kornjašah Trojedne Kraljevine* mentioned several places from Dalmatia where Frauenfeld investigated.



Figure 20 Georg von Frauenfeld



Figure 21 Edmund Reitter

An eminent entomologist of that time who wrote tables for determination which are still in use today, was Edmund **Reitter** (Mueglitz, 1845 - Paskau, 1920). He frequently visited Croatia and all parts of Croatia (Fig. 21). Like many scientists and entomologists in Central Europe he was affected by Ganglbauer, who said of him "Edmund is unique example of brilliant man who educated himself." Ganglbauer and Reitter were friends also. As son of a forester, after secondary education, he continued a his father's footsteps, but changed his mind and focused on insects - especially beetles. He was extremely talented in systematics with a huge energy for work.

He published over a thousand articles on beetles and made a collection with 250 thousand with about 30 thousand species. The museum in Budapest bought his collection. His most famous book is *Fauna Germanica* in five volumes, with many tables in colour, printed during his lifetime in about thirty thousand copies. Many generations of entomologists have used it. A reprint was recently published in spite of other recent releases.

It is particularly interesting that Reitter supported the trade in insects, entomological supplies and entomological literature too. Even his successor had shop in Munich. In the 1980s, I bought entomological literature and accessories in that shop too.

He visited Croatia, more frequently than all other foreign researchers. The first time it was in 1878 (Kapela, Plitvice and Slavonia), and mostly Dalmatia and the islands along the coast to Dubrovnik. The last time he was there was in 1913.

The relationship of certain nationalities of foreign and domestic researchers in Croatia in the second half of the 19th century is shown graphically in Figure 22.

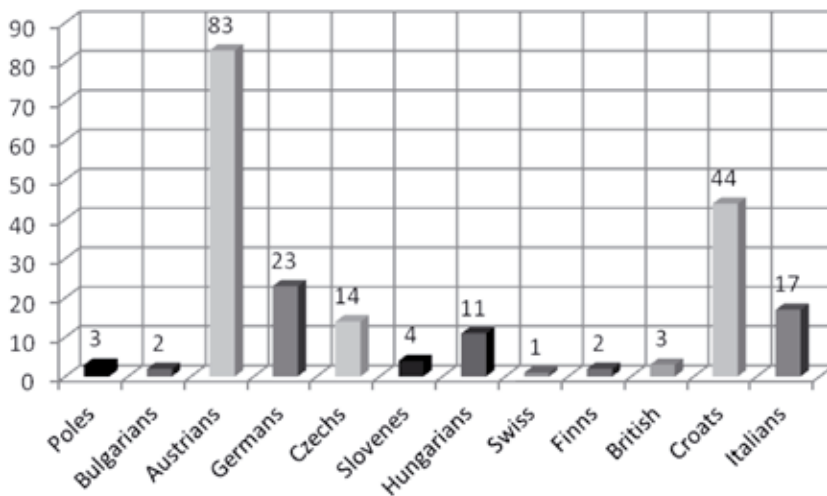


Figure 22. The relationship of certain nationalities of foreign and domestic researchers in Croatia in the second half of the 19th century

The First Half of the 20th Century - the Interval between the Two World Wars

After a pause in activity during the First World War and immediately after it, a number of entomologists continued to study in Croatia as before. They particularly concentrated on the coastal area, although in comparison to the previous period the number of researchers decreased. The Austro-Hungarian Empire had been divided into a number of smaller countries. Not only did the state borders of those new countries represent problems, but their economies were also troublesome. Those problems significantly reduced the interest in the development of private collections. Many amateur collectors disappeared. Faunistic studies were conducted by research institutions.

The entomology in Croatia during the period between the two World Wars was marked by three significant entomologists: Petar Novak, ing. prof.dr.sc. Josip (Josef, Guiseppe) Müller and Guido Depoli.

P. Novak researched in Dalmatia, the coast, the islands and Dalmatian Zagora - mountains and caves. He lived mostly in Split.

Professor J. Müller investigated Dalmatia on the coast and islands and in the mountains and caves of Dalmatian Zagora, in addition to research in Venezia Giulia in Italy and Slovenia. He lived in Trieste. He researched in Croatia mostly with P. Novak, with whom he was on friendly terms.

G. Depoli researched in Istria, Kvarner and Gorski Kotar and lived in Rijeka. All three mainly investigated beetles.

P. **Novak** ing. (Hvar, 1879 - Split, 1968). Somebody wrote of him "A man who dedicated his life and all his spiritual, material and physical forces to entomology" (Fig. 23). A son of the already mentioned entomologist Ivan Novak, he began working in entomology from his 5th birthday. P. Novak finished the Higher School of Economy and Agriculture in Križevci. He was employed as an inspector for vineyards from 1923, helping grape farmers to introduce American rootstocks. In 1924 he was appointed state entomologist. From 1946 he was the director of the Natural History Museum in Split. He published 36 papers and compiled a book about the beetles of Dalmatia.



Figure 23. Petar Novak

His beetle collection, including over 500 thousand exemplars, is kept in the Croatian Natural History Museum in Zagreb. Unfortunately, it is not complete because one cabinet was sold to the Faculty of Agriculture in Zemun. He collected mainly in Dalmatia along the coast, on the islands and the Dinarides, although he also travelled in Africa, Spain and Asia. He particularly explored the cave fauna of the Dinaric Mountains and travelled during eight decades, walking thousands and thousands of kilometres on foot. Entomologists, particularly Müller, named 18 new species of beetles in his honour. He was awarded the first Lifetime Achievement of the town of Split (Cvitanić, 1964; Nonveiller 1989).

He and professor Müller were friends from their schooldays.

The mother of prof. dr. sc. Josip **Müller** (Zadar, 1880 - Trieste 1964) was a Croat (Fig. 24). After primary education he studied in Graz. Even as a student he was engaged in scientific work, for which he won a prize. He was 18 when he published his first scientific paper, and when he received his doctoral degree at the age of 22, he had already published 5 papers. His first working position was the position of a high school teacher and after that he was a curator, later on director in the Museo di Storia Naturale di Trieste until his retirement.

After his retirement he was director of the Phytopathology station in Trieste.

In the same manner as Korlević, he was also influenced by Ganglbauer and had his own ideas for his scientific entomological researches. He developed a research program named: Research into the beetles of the Adriatic and Balkan zoological region. He published more than two hundred papers. He published more papers about Croatian fauna than any other foreign researchers - even eighty. All these were related to entomofauna of our coastline, the islands, Dinaric Mountains and Dalmatian Zagora and the Croatian caves. His most important works were books: *Coleotteri della Venezia Giulia I, Adepaga* (300 pages) and *Phytopaga* (685 pages).

In the Trieste Museum there are more unpublished works as well as a significant scientific entomological collection (Pilleri 1955; Nonveiller, 1989).

The third significant entomologist at that time was really an amateur - G. **Depoli** (Rijeka, 1879 -



Figure 24. Josip Müller

Belluno, Italy 1948). He was the brother of the far better known historian and politician Attilio Depoli, who was a leader of the Italian irredentist movement. G. Depoli was a director of customs in Rijeka, but also a geographer, historian, caver, climber, and entomologist. In each of these areas he had significant results, especially in the field of entomology. He dealt exclusively with the order Coleoptera, and the particular family Carabidae of, as he said, Liburnia. At the time when he explored, Istria, Rijeka and the islands of Cres and Lošinj were under Italian rule. He published 65 mainly entomological papers about the surroundings of Rijeka. He left a large collection of beetles to the Natural History Museum in Rijeka. Nowadays it constitutes the major part of the museum collection consisting of 50 thousand species of insects, too. There are some of his unpublished manuscripts as well. His scientific entomological work is especially significant because he was a pioneer of ecological - entomological research in Croatia (Bičanić, 1993 and Durbešić, 1984).

Two entomologists from inland Croatia cannot be omitted from the list of significant and indispensable naturalists of that period. These are Prof. dr. sc. Nikola **Fink** and Doc. dr. sc. Božidar **Hergula**.

Prof. dr. sc. Nikola **Fink** was born in 1894 in Zagreb, where he died in 1968. (Fig. 25). He graduated from the Faculty of Philosophy in Zagreb in 1916, and received his doctoral degree from the same faculty in 1917. From 1915 he was an assistant professor, and he was curator from 1927, and a professor of the Faculty of Science from 1946. He was the head of the zoological department and the director of the Croatian Natural History Museum. He prepared scientific museum catalogues for many species of animals, including insects. From 1945 and during the next twenty years, he taught the basic subjects of zoology. He was particularly engaged in the translation of foreign works (Brehm: How animals live and Ognjev: Vertebrates), and textbooks for secondary schools.

He wrote several sets of study materials for students of biology. He published 60 articles in encyclopaedias and more than three hundred popular scientific papers.



Figure 25. Nikola Fink

His articles on the effect of temperature on beetles, studies about wasps (Tenthredinidae) and the booklet – *Kratka uputa u sabiranju kukaca / Short instructions for the collection of insects* from 1930 were his most important works for entomological science.

He received two national awards for his work (Matoničkin, 1974; Durbešić, 1984).

Doc. dr. sc. Božidar **Hergula** was born in 1899 in Zagreb, where he suddenly died in 1939. He graduated at the Faculty of Philosophy in Zagreb in 1925 and received a doctorate in 1931. While studying he worked at the Museum in Zagreb and at the Faculty of Agriculture and Forestry in Zagreb. After graduation he worked briefly as a high school teacher, and in 1933 he was elected assistant professor of the Agricultural and Forestry Faculty. He taught agricultural and forest entomology, general and special zoology, apiculture and sericulture.

From the scientific point of view he specifically dealt with the protection of plants. He studied the European corn borer *Ostrinia nubilalis* Hübner, 1796. It should be noted that he was a pioneer of biological pest control and he led the first Croatian experiments in aerial spraying against forest pests.

He published 23 papers in several domestic and foreign scientific journals. He was a member of the Yugoslav Entomological society.

Establishment of Entomological Society

The Entomological Society was founded in the Kingdom of Slovenes, Croats and Serbs in 1926. In the Croatia of that time, some twenty entomologists were at work. A roughly similar number worked in other parts of the country as well. A group of entomologists initiated the establishment of the association and after many years of preparation, the Entomological Society was founded and by 1931 the society's journal was in existence. The membership of the Society coming from Croatia comprised: M. Barbulović, A. Biskontini, I. Čadek, B. Hergula, M. Kaman, A. Kauders, Z. Kovačević, A. Langhofer, Z. Lorkovic, F. Operman, D. Poljungan, B. Tucijan, B. Turina, Z. Ugrenović, A. Turković, D. Valjavec, R. Weingartner and B. Zarnik.

It is known that some scientists who were active at that time were not members: F. Košćec, V. Vogrin, I. Igalfy, U. Girometa, V. Redenšek, M. Fink, P. Novak, B. Gušić and S. Svirčev.

Table 4 Domestic entomological researchers between two World Wars

Nr.	Name and degree	Surname	Lived from to	Speciality, Group of Insects	Domicile	Visited area, others	Period	Remarks	Source
1	Zvonimir dipl. ing.	Badovinac	1905 -1976	Lepidoptera	Zagreb	Zagreb surrounding, Mt. Samoborsko, Velebit, Lička Plješevica	1916 - 1926	Collection at F.F.	Lork.
2	Antun	Čadek	/	Cave fauna	Zagreb	Dnara	1933 -1935	With Weingartner	N
3	Prof. dr. sc. Nikola	Fink	1894 -1968	Museum catalogs	Zagreb	Entomological lecture		Museum director Professor of zoology at PMF	M
4	Umberto, prof.	Girometa	1883 -1939	Cave fauna	Split	Split, Dugopolje, Mosor, Sinj, Hvar	1913 - 1939	Museum director	N
5	Academician Branislav	Gušić	1901 -1975	Otolaryngologist, Lepidoptera	Zagreb	Zagreb, Velebit, Gorški Kotar, Slavonija Dubrovnik, Split, Vis	1917 - 1921	Collection of 2500 mountain examples	Lork.
6	Doc. dr. sc. Božidar	Hergula	1899 -1939	Plant and forest protec. Ostrinia nubilalis	Zagreb		1919 -1939	Professor at F. F.	I
7	Imbre, dr.med.	Igalfy	1882 -1963	Insects	Krapina			Collection	M
8	Milan, prof.	Kaman	1888 - 1962		Varaždin, Zagreb			Museum director, Member of JED	M
9	dr. h. c. Anton	Kauders	1878 - 1966	Forester	Senj			Member of JED	I
10	Prof. dr. sc. Željko	Kovačević	1893 -1984	Agro and forest insects	Zagreb			First book of applied entomol. Professor at A. F. Member of JED	Brit
11	Academician Antun	Kurir	1909 -1988	Forester	Vienna		1942	Entomol. bibliography	O
12		Kozulich						Collection	Č
13	Franjo pl., prof.	Košćec	1882-1968	Hymenoptera	Varaždin	Surroundings Varaždin		Curator	Bal.

Table 4 Domestic entomological researchers between two World Wars - continued

14	Prof.dr.sc. August	Langhoffer	1861-1940	Diptera	Zagreb			Museum director, professor of zoology at PMF Member of JED	M
15	Akademik Zdravko	Lorković	1900 -1998	Genetics, Lepidoptera	Zagreb			Professor on M. F. Member of JED	Brit. 1
16	Petar, ing	Novak	1879 -1968	Coleoptera, cave fauna	Split	Dalmatia, Islands, Zagora caves	1885 -1960	Collection in Zgb. Museum	N, D
17	Franjo, prof	Operman	1885 -1965	Agro and forest pests	Zagreb			Secondary school teacher, inspector.	M
18	Dr. sc. Dragutin.	Poljugan	1881 -1950	Spiders				Secondary school director	M
19	Josip	Redenšek	1887-1972	Cave fauna	Zagreb			Collection	N
20	Oskar, dipl. ing	Scheibel	1881-1953	Insects, trader	Zagreb			a	N
21	Sjjepan	Svirčev	1889 -1949	Coleoptera, cave fauna	Siverić	Caves in surroundings	1922	a	N
22	Akademician Aleksandar	Ugrenović	1883 -1958	Forester	Zagreb	First entomological PHD	1907	Professor at F.F.	S. E.
23		Vajjavec						Collection	Č
24	Dr. sc. Vatroslav	Vogrin	1886 -1956	Hymenoptera	Zagreb		1910, 1947	Secondary school teacher, curator	M
25	Robert	Weingartner	1860-1941	Coleoptera, cave fauna	Zagreb			Coleoptera collection	M
26	Academician Boris	Zarnik	1883-	Biologist, Foraminifera	Zagreb			Professor at M. F.	Hirtz

Legend:

In column Name and degrees - degrees as usual in Central Europe, Croatia and in references; in column remarks: p - profession, a - amateur;

In column S – sources: Bal - Balabanić, 1998; Brit. - Britvec 1993; Brit. 1. – 1999; Č- Čanadija 1971; D - Durbešić, 1984; Hirtz, 1924; I – Internet; K- Kurir – 1944; Lork- Lorković, 1929; M - Matonićkin, 1974; N - Nonveiller, 1989; O - original work; Sp- Spaić, 1983; S. E. – Forest. Cycloptidia.

F. F. - Forest faculty in Zagreb, PMF - Faculty of Natural History in Zagreb, M. F. - Medicine Faculty Zagreb, A. F. - Agriculture Faculty Zagreb

Table 5. Foreign entomological researchers between two World Wars

No.	Name, degree	Surname	Lived from-to	Speciality Insect group	Domicile	Visited area	Period	N.	Remarks	Sour.
1	Prof. dr. sc. Karel	Absolon	1877-1960	cave fauna	Brno	Mijet, Brač	1917	C	Speleological cadastre, p	K, N
2	Dr. Hans Georg	Amsel	1905	Lepidoptera	Germany	Dubrovnik	1930	N	p	K, N
3	Dr. Wolfgang	Bath	1882-1932	Coleoptera	Halle	Central Dalmatia	1929	N	p	N
4	S.	Breuning		Cerambycidae, Laminae	Vienna	Makarska	1938	A	p	
5	Dr. Carlo	Cori junior		Formicidae	Trieste	islands	1914	T	p	N
6	Prof. dr. sc. Carlo Isidore	Cori senior	1865-1954	Coleoptera	Trieste	islands - Palagnuža, Vis, Kvarner islands, other islands	1911-1916	T	12 times leading ships Najade & Adria p	N
7	Jaroslav	Čejka		Coleoptera	Prague	Vis, Hvar	1935	C	p	N
8	Dr. Curt	Feige	1874-1962	Coleoptera, Heteroptera	Eisleben	Split, Dubrovnik	1931, 1938	N	a	N
9	Hans	Feigl		Coleoptera	Vienna	Central Dalmatia - Dugopolje	1925	A	Hoffmann follower	N
10	A	Fuchs		Formicidae	Vienna	Krk	1927	A	a	N
						Brač	1930			
						Vis, Korčula, Mijet	1932			
						Hvar	1933			
11	Prof. dr. sc. Leopold	Fulmek	1883-1969	Hymenoptera wasps	Vienna	Čibuča Dubrovnik Dalmatia	1914 1917	A	agro. entomol., p	N
12	Dr. sc. Egon	Galvani	1874-1955	Lepidoptera	Vienna	North Dalmatia Central Dalmatia	1912 1915 1934	A	p	K, N
13	Hans	Gebien	1874-1947	Tenebrionidae	Hamburg	Dalmatia	1939	N	a	N
14	Prof. dr. sc August	Ginzberger	1873-1940	Botanist, insecta	Vienna	Islands, Vis	1914	A	Leader of the expedition, p	I, N

Table 5. Foreign entomological researchers between two World Wars - continued

15	Albert	Gylek	1864-1923	Coleoptera		Vienna	Kirk	1914, 1917		A	Madera follower, a	
				caves				1914			Hoffmann follower a,	N
16	Dr. phil. R Ludwig	Heberdey Hofbauer		Coleoptera	Graz	Caves Dugopolje, Split, Mosor	Mosor	1928		A	a	N
17				Lepidoptera			Zadar	1916		A	a	N
18	Adolf	Hoffmann		Coleoptera, Irader	Vienna	Central Dalmatia	Central Dalmatia Mosor, Biokovo, Brač	1914, 1925, 1928		A	a	N
19	Dr. sc. Geza de	Horvath	1847-1937	Hemiptera	Budapest	Central Dalmatia	Central Dalmatia	1914.		M	Inst. for plant protection p	N
20	Otto	Jaap	1864-1922	galls	Germany		Lošinj, Rab, Opatija	1912.		N	p	K, N
							Sibenik, Trogir, Split, Hvar, Dubrovnik	1914.				
							Istria, Dalmatia	1919				
21	Stepan dr. med	Jureček	1877-1940	Coleoptera	Prague	Biokovo, Makarska Orebić	Biokovo	1933. 1934.		C	Collection Coleoptera, p	N
22	Franz	Käufel	1892-1956	Formicidae	Vienna	Kirk and neighbour islands	Kirk and neighbour islands	1927.		A	p	N
23	Walter	Klemm		Formicidae	Vienna	Goli, Lopar -Rab	Goli, Lopar -Rab	1928.		A	a	N
24	Alfred	Knirsch	1885-1926	Coleoptera	Vienna	Central Dalmatia, Mala Kapela	Central Dalmatia, Mala Kapela	1928.		A	Hoffmann follower, a	N
25	Prof. Ernst	Kohlmeyer		cave fauna	Bratislava		Dubrovnik	1928.		Sk	a	N
							Kupari	1925, 1929				
							Kvarner, Plitvice lakes	1929				
							Dubrovnik	1928				
							Orebić, Metković, Istra	1931				
26	Walter	Liebman	1885-1974	Coleoptera	Arnstätt	Makarska, Orebić, Biokovo Plitvice lakes	Biokovo Plitvice lakes	1935		N	p	K, N
27	Dr. Franz	Maidl	1887-1951	Hymenoptera	Vienna	Rijeka, Split	Orebić	1921		A	p	N
	Prof. dr. sc Giusseppe	Müller	1880-1964	Coleoptera	Trieste	Whole coast, islands, Zagora, caves		1900-1931.		T	80 articles for Croatia, p	K, N

Table 5. Foreign entomological researchers between two World Wars - continued

28	Dr. H	Müller		Lepidoptera	Neuhaus	Brač	1921	N	a	N
29	Hans	Nadbyl		Lepidoptera	Thüringen	Zadar	1930	N	a	N
30	Josef	Nitsche	1873-1941	Lepidoptera	Vienna	Orebić	1933	A	a	N
31	akademik Jan	Obenberger	1892-1964	Coleoptera	Prague	Dinara, Mosor, Dugopolje, Kraljeva peć, Knin	1914	C	Museum director, p	L, H
						Konavljje	1914			
32	prof. dr. sc. Hermann	Priesner	1891-1974	Thysanoptera	Linz	Opatija, Dubrovnik	1918	A	p	N
33	Franz	Pugel	Lepidoptera, trader	Vienna	Vienna	Dalmatia	1931	A	a	N
							1910			
34	Dr. phil. František	Rambousek	1886-1931	Staphylinidae, sugar beet pests	Prague	Zadar, Solin	1922	C	p Institute for sugar beet pests	N
						Mosor	1927			
						Dubrovnik				
35	Jan	Roubal	1880-1971	Coleoptera	Prague	Split, Solin, Makarska Tucepi, Gruz	1922, 1924	C	p	D, N
						Biokovo	1927			
36	Dr. Franz	Rückert	1882-1942	Lepidoptera	Austria	Sibenik	1915	A	a	N
37	Dr. Franz	Ruschka	1882-1942	Chalcidoidea	Austria	Central & South Dalmatia	1914	A	Maidl follower, a	N
38	Karl, dr.med.	Schawerda	1869-1943	Lepidoptera	Vienna	Gruž, Lapad	1914	A	a	N
39	Dr. Anton	Schmidt		Lepidoptera	Budapest	Biokovo	1929	M	Museum director, p	N
40	Otto	Schönfeld		Lepidoptera, trader	Eger	South Dalmatia	1926	C		
41	Leo	Schwingenschuss	1878-1954	Lepidoptera	Vienna	Gruž	1923-1927	A	Wagner follower	N
42	Anthony von	Siegenfeld		Lepidoptera	Vienna	Gruž	1914	A	Schawerda follower	N
43	K.	Sorner		Coleoptera	Čzech	Central Dalmatia	1924	C	Roubal follower	N
44	prof. dr. sc. Stepan	Soudek	1889-1936	Formicidae	Brno	Split, Metković, Dubrovnik	1922-1923	C	p	N
						Split, Dubrovnik	1923			
45	A	Spaney		Coprophaga	Berlin	Split	1939	N	Laboratory assistant, p	N

Table 5. Foreign entomological researchers between two World Wars - continued

46	Franz	Steindachner	1834-1919	Ichthyolog, Insecta	Vienna	Hvar Split	1917 1929	A	Museum director, p	N
47	Franz	Stocklein	1879-1956	Coleoptera	Munich	Split, Mosor, Brač Sibenik, Krk Briokovo, Hvar	1936 1938 1939	N	a	N
48	Ferdinand	Stoklas		Lepidoptera, Irader	Češka	Dalmatia	1926	C	a	
49	Egone	Stolfa	1911-1943	cave fauna	Trieste	Lastovo	1929	T	a	N
50		Thunder		Tenebrionidae	Austria	Ston	1918	A	a	N
51	Dr. Karel	Všetečka	1898-	Coleoptera	Prague	Dalmatia Dinara Biokovo	1920 1927 1928	C	a	N
52	Fritz	Wagner	1873-1938	Lepidoptera	Vienna	Gruž	1923, 1924, 1937	A	p	K, N
53	Leo	Weirather	1887	Cave fauna, Irader	Insruck	Central Dalmatia Svileja Mosor Dinara, Zrmanja Vigorac Sibenik	1925 1926, 1927 1937 1939 1939	A	a	N
54	Prof. dr. sc. Franz	Werner	1867-1939	Orthoptera	Vienna	Central & South Dalmatia	1927, 1931	A	p	K, N
55	Albert	Winkler	1881-1945.	Formicidae cave fauna Coleoptera	Vienna	Split, islands Dinara, Svileja Rijeka	1933 1914 1921	A	p Coleoptera catalog, p collection of million examples, p	N K, N
56	Stephan dr. med.	Zimmermann	1896-1980	Formicidae	Vienna	Kvarner islands Krk, Trogli, Split, Dubrovnik	1928 1931	A	a	N

Legend:

In column Name and degrees, degrees as usual in Central Europe, Croatia and in references;

In column remarks: p - profession, a - amateur;

In column N – nationality: A - Austrians, C - Czechs, M - Hungarians, N - Germans, Sk – Slovaks, T – Italians;

In column S - sources: D - Durbešić, 1984; H - Hadži, 1929; I – Internet; K - Kurir – 1944; L - Langhoffer, 1916; M - Matoničkin, 1974; N - Nonveiller, 1989; O - original work,

The Second Half of the 20th Century- Since 1945 until Today

Two very important Croatian entomologists marked this period: Academician Zdravko Lorković, and prof. dr. sc. dr. h. c. Željko Kovačević. They have been both the Nestors of entomological and biological science in Croatia.

Professor Z. **Lorković** (Zagreb, 1900 – 1998) was a biologist, geneticist, zoologist, ecologist and entomologist (Fig. 26). He graduated in 1924 at the Natural Sciences and Mathematics Department, the Faculty of Philosophy in Zagreb, and immediately after graduation he became an assistant to Academician Boris Zarnik, a professor at the Department of Biology, the Faculty of Medicine. He took a doctorate in 1928 defending a thesis on the variability of butterflies. Dr Jovan Hadži from Ljubljana was his mentor. Lorković was an associate professor at the Faculty of Veterinary in 1940. He became a professor at the Faculty of Medicine in 1943, where he worked until his retirement in 1970. He had a fruitful scientific and teaching career.

He published 91 scientific papers. A list of papers was published in the journal *Acta entomologica Jugoslavica* in 1980. The Croatian Natural History Museum in Zagreb keeps his collection of 50 thousand Lepidoptera and four thousand microscopic slides of butterfly genital organs. He presented a large number of butterfly karyotypes for more than 70 taxa especially dealing with genetic research. He was a leader in this field of research in the world. He made chromosome preparations alone and found great number of multiple chromosomes in butterflies.

He was a chief editor of *Acta entomologica Jugoslavica* (1969 to 1989) and *Entomologia Croatica* from 1995 to 1998. He received numerous awards for his important scientific work: the Medal of the Order of Croatian Danica with the image of R. Bošković, a National Award for lifetime achievement, the R. Bošković Annual Award, the Charter of the University of Zagreb and many others. He was a globally respected scientist. A room in the Natural



Figure 26. Z. Lorković as a young researcher

History Museum of London is named in his honour (Britvec, 1999).

Professor **Ž. Kovačević** (Varaždin, 1893 - Zagreb, 1984) was another great Croatian professor of entomology of that period. He graduated at the University of Zagreb in 1917 and gained a PhD in 1922 (Arthropoda, Myriapoda, Glomeriadae), at the Natural Science and Mathematics Department, the Faculty of Philosophy in Zagreb.

From 1922 to 1947 he was an assistant in the Museum in Zagreb in the entomological section, afterwards he became a secondary school teacher, a head of section, a head of department, director of various institutions for plant protection and entomology. From 1947 until 1964 he was a university professor, head of the department of zoology and a dean of the Faculty of Agriculture and Forestry. After retirement he continued to work vigorously, taking postgraduate studies and research projects.

After J. Schlosser-Klekovski, he wrote the first book of entomology – a textbook of general entomology, agricultural and forest pests. He also published 120 scientific and professional publications, 220 popular professional articles, 23 books and 10 scripts (Durbešić, 1984). He dealt with insects during the whole of his working life and applied scientific research in agriculture and forestry.

He is the founder of the first post-graduate study in plant protection. He was a mentor to many graduate and master theses and PhD dissertations. It is my pleasure to be able to state that I successfully worked with him for years. He received a Lifetime Achievement Award and was awarded an honorary doctorate (Britvec, 2004).

In addition to these two Nestors of entomology, Milan Maceljiski, Lea Schmidt, Inoslava Balarin and Ivan Ciglar, teachers from the Faculty of Agriculture, and Milan Androić and Ivan Spaić, teachers from the Faculty of Forestry were also active during that period.

Academician Milan **Maceljiski** (Zagreb, 1925 - 2005). He finished elementary school, secondary school and the Faculty of Agriculture in 1950 (Fig. 28).



Figure 27. Željko Kovačević

He worked as an engineer agronomist in Orahovica for ten years. After that, he was employed at the Faculty of Agriculture. Soon after his PhD, he became an assistant professor and afterwards went through all the grades until he became a full professor. He was constantly at work on modern plant protection and he was a founder of modern phytopharmacy. He led international projects, collaborated on projects led by the governments or ministries of Italy, Germany and Austria.

He was director of the Institute of Plant Protection and Head of the Department of Zoology, Faculty of Agriculture, President of the Croatian Entomological Society, and lifelong honorary president of the Croatian Society for Plant Protection for many years.

He was a chief editor of *Entomologia Croatica*, and the *Journal of Plant Protection*. He was a regular member of the Croatian Academy of Arts and Sciences and the Italian and Slovenian Academy of Arts and Sciences. He wrote hundreds of scientific papers, publications, nearly a thousand popular publications, 28 books, 14 of which were textbooks. He dealt especially with research into environmentally friendly plant protection. He was mentor of many masters' and doctoral theses. He received an Annual Award for the Popularization of Science and a Lifetime Achievement Award 2007 (Cvjetković, 2007 with references in it).



Figure 29. Lea Schmidt

Prof. dr. sc. Lea **Schmidt** (Varaždin, 1921 - Zagreb, 1982) finished primary and secondary school in Zagreb (Fig.29). During high school education she showed her interest in natural sciences. She studied at the Faculty of Agriculture and Forestry and at the Biology Department of the Faculty of Philosophy from 1940 to 1945. She led exercises in entomology while she was still a student. She graduated in 1948, becoming in the same year assistant professor of entomology at the Agricultural Faculty. She gained her PhD in 1953 and habilitation in 1960, when she became assistant professor of agricultural entomology. In 1964 she became an associate professor, and full professor in 1969.



Figure 28. Milan Maceljiski

She taught comparative zoology, apiculture and sericulture. At the graduate level she taught general biology, general and special entomology, biological methods of combating pests and other subjects and wrote course materials for all of them. She was an accomplished educator during her 40 years of teaching. She successfully inducted younger generations into scientific and professional work and supervised a number of graduate and PhD dissertations. Entomology was the focus of the whole of her scientific work. Tables used for identification of insects represented one of her most original works. She worked with numerous companies and research institutions. She participated in many national and international scientific meetings and in expeditionary research in Nigeria.

She was a head of the Department of Zoology, founder of the Yugoslav Entomological Society, the first president of the Croatian Entomological Society and a member of several scientific organizations.

She also received several awards as a member of the Academy of New York, the Croatian Natural History Society Plaque, etc. She published seventy scientific - technical and popular publications and a number of sets of course materials for students (Britvec, 1983 with references in it).

Prof. dr. sc. Inoslava **Ballarin** (Zagreb, 1927 - 1987) was employed at the Department of Entomology at the Faculty of Agriculture (Fig. 30) from 1951 when she graduated at the Agricultural and Forestry Faculty of Zagreb to her untimely death in 1987. Her particular field of interest was the fauna of Heteroptera. She was engaged with cereal bugs in her master's thesis (1966) and she gained her PhD on forage legumes and natural meadows in 1975. Her scientific work was very fruitful. She published some fifty scientific papers that contributed to the knowledge of Croatian Heteroptera fauna and plant protection and more popular works.

She was a much-loved teacher, because she knew how to approach students and younger colleagues and was a prime example of a selfless helper. She taught phytopharmacy, entomology and general zoology. She supervised several graduate degrees and two master's theses (Igrc Barčić, 2007 with references in it).



Figure 30. Inoslava Ballarin

Prof. dr. sc. Ivan **Ciglar** (Mala Subotica, 1933 - 2003) finished primary and secondary education in Međimurje and Križevci, and graduated at the Faculty of Agriculture in Zagreb in 1961 (Fig. 31). He gained his master's degree in 1971 and PhD in 1975. First, he was employed at the Institute for Fruit Growing, and then at the Faculty of Agriculture. He especially dealt with the study of economically important pests of fruit trees and vines and with the problems of disturbed natural equilibrium. He taught two courses to graduate and two to postgraduate students. He supervised about 50 graduation theses, eight master's degrees and one PhD.



Figure 31. Ivan Ciglar

He published over 50 scientific and 100 technical papers and two books. He also held a patent.

Two eminent professors worked at the Faculty of Forestry University of Zagreb.

Prof. dr. sc. Milan **Androić** (Gračac, 1913 - Zagreb, 1999) finished primary and secondary education in Gospić, and graduated at the Agriculture and Forestry Faculty in 1939 (Fig. 32). He worked several years in the forestry sector. He became assistant professor at the Agriculture and Forestry Faculty in 1949. He gained his PhD in Paris in 1954. He became an assistant professor in 1956, an associate professor in 1960 and a full professor of forest entomology and forest protection 1964. He was the first scientist who started studying some fundamental methods in forest protection and he was specialist in the pest species of Mediterranean pine forests.



Figure 32. Milan Androić

He wrote 95 scientific papers, and an especially important book: *Osnovi zooekologije s osobitim osvrtom na entomofaunu* in 1970.

He received the Ruder Bošković Merit Award. ([http:// imenik . sumari.hr](http://imenik.sumari.hr) 2012 and bibliography).

Prof. dr. sc. Ivan **Spaić** (Vinkovci, 1919 - Zagreb, 1987) graduated in 1947 and gained a PhD in 1961 (Fig. 33) He worked at the Institute for Forestry Rese-



Figure 33. Ivan Spajić

arch from 1947 until 1956. Subsequently, he was a full professor at the Faculty of Forestry. He taught forest protection, forest entomology and wildlife management. He was also a dean of the Faculty of Forestry and president of the Croatian Entomological Society. He was involved in pathology and protection of forests especially oak lowland forest in the area of entomology with species of family Scolytidae. He published over 120 scientific papers ([http:// imenik . sumari.hr](http://imenik.sumari.hr) 2012 and bibliography).

Prof. dr. sc. Stjepan **Čanadjija** (Zagreb, 1912 - 1996) was a biologist and a director of the Croatian Natural History Museum for many years. He taught as titular professor at several faculties of the University of Zagreb.

His work *Entomološke zbirke hrvatskog narodnog zoološkog muzeja* (Čanadjija, 1971) is significant piece of work for entomological science in Croatia.

Prof. dr. sc. Guido **Nonveiller** (Rijeka, 1913 - Beograd, 2002) was professor of entomology at the Agricultural Faculty in Zemun (Serbia). He dealt with entomology from an early age and was a friend of P. Novak and G. Müller. They named a new species *Trechus nonveilleri* Müller in his honour when he followed them in their investigations on the mountain of Biokovo in 1929. He was also important because he wrote a book about all the entomological research in Dalmatia in 1989. The title of the book is *Pioniri proučavanja insekata Dalmacije* or *Pioneers of the study of insects of Dalmatia* and the publisher was the Yugoslav Entomological Society, Zagreb, with 390 pages.

Prof. dr. sc. Ljerka **Oštrec** (Zagreb, 1942 - 2009) was a biologist and professor at the Faculty of Agriculture. She dealt scientifically with nematoda and established a nematoda laboratory at the Faculty of Agriculture. She wrote fifty scientific papers and five textbooks. (Barić, 2009 with references in it).

Lidija **Mladinov** (Ogulin, 1922 - Zagreb, 2009) was a daughter of professor Ž. Kovačević. By education she was a biologist. She worked as a high school teacher, and then as a curator at the Natural History Museum in Zagreb. She investigated Lepidoptera, mostly on the island of Pag and along the Kupa River (Britvec, 2009 with references in it).

Rene **Mikšić** (Zagreb 1920 - Sarajevo, 1990) dealt with the order Coleoptera. He was employed at the Natural History Museum in Rijeka by 1952, and then at several scientific institutions in Sarajevo until his death. He published 162 scien-

tific papers and several books about Cetoniinae, Cerambycidae and Lucanidae, etc.). He was a prominent specialist in the family Cetoniidae. Ten species have a scientific name in his honour. He donated a valuable collection to the Croatian Natural History Museum in Zagreb.

Our two distinguished entomologists, Stjepan **Keglević**, BSc. (Varaždin, 1925) and Bogoslav **Milošević** BSc. (Zagreb, 1926), have also contributed to the development of entomology in Croatia, and although they are no longer active they have to be mentioned here. Both of them have been mostly engaged in quarantine service and plant protection. In addition, Keglević has successfully organized the inventory of insect pests in the border areas of Croatia, and Milošević has arranged a bibliography, taken care of the library of the Croatian Entomological Society and introduced its website.

Another entomologist who also worked in the quarantine service of Croatia has to be mentioned: Branko **Britvec** BSc (Brckovljani, 1926 - Zagreb, 2011). He published several articles in the editions of the Krleža Lexicographic Institute (Encyclopaedia of Agriculture and Croatian Biographical Lexicon). He was especially active in the journals *Acta entomologica Jugoslavica* and *Entomologia Croatica*. He participated in teaching at the Agricultural Faculty in Zagreb for a short time.

In the period from 1945 until present time it has successfully started many projects, such as:

- The study of soil entomofauna in the early seventies, led by professor Ž. Kovačević
- This was the start of research into Apterygota, but it has unfortunately not been continued.
- Making inventories of entomofauna in border areas under the leadership of S. Keglević, B.Sc.
- Collected entomofauna was determined, analysed and the data were published.
- Multidisciplinary research of 100 permanent plots by the University of Zagreb and Croatian Ecological Society - led by professor Đ. Rauš.
- Entomofauna was also investigated.
- Ecological researches into watercourses headed by professor Matoničkin.
- Entomofauna of waters and coastal areas was investigated.

- There are several projects especially concentrating on applied entomology and forestry.

Current Researches into Insects in Croatia

After the establishment of Croatia as an independent state in 1991, seventy scientists divided into ten thematic working groups worked on the development of the National Strategy and Action Plan for the Protection of Biological and Landscape Diversity (NSAP).

One group worked on the exploration of the Croatian fauna of Vertebrates and Invertebrates. A tabular overview of a number of species of freshwater and land Invertebrates was made (Radović, 1999). A part of it, referring to insects, was processed by a dozen entomologists; results of this work are shown in Table 6 of this work.

The analysis of data from Table 6 leads to the conclusion that there has been a satisfactory exploration of the higher systematic categories of insects, up to the genera. The number of 119 species belonging to 17 families and four orders of Apterygota are described in Croatia. The number of 15 512 species of 468 families from 24 Orders of Pterygota are processed. These are data that were created over the last two and a half centuries, but unfortunately they have never become a whole that could be called the Croatian fauna. Although the data are encouraging, they are not satisfying. Croatia has taken on the obligation to implement the protection of biodiversity in the whole of its territory. The first condition for such an implementation is planned, systematic and intensive research.

Currently active Croatian entomologist have been interviewed for the purpose of this study. The aim has been to find out into which group of insects they are researching and what the state of the fauna within it is, without going into the projects from which these results were derived from.

The questionnaire contained the following entries:

QUESTIONNAIRE

- ▶ *Name and Surname*
- ▶ *Title*
- ▶ *Institution*
- ▶ *Address*
- ▶ *E-mail*
- ▶ *Which group of insects are you working with*

- ▶ *Which field*
 - *Systematics*
 - *Faunistics*
 - *Ecology*
 - *Physiology*
 - *Genetics*
 - *Molecular Biology*
 - *Applied Entomology*
 - *Agronomy*
 - *Forestry*
 - *Medicine*
 - *Veterinary*
- ▶ *Other*
- ▶ *According to your opinion- from the group which you are working with-- how many of the following are there in Croatia*
 - *Families*
 - *Genera*
 - *Species*
 - *Endemic*
 - *Condition of endangerment*

Date:

Signature:

Table 7 was created on the basis of data collected from questionnaires. The survey was extended to cave Arachnida. If we compare the results from table 6 and 7, it is evident that there are not many systematic and faunistic researchers in Croatia. Scientific papers in the field of nature conservation (e.g. Belančić et al., 2008), ecological research (e.g. Durbešić, 1984; Merdić et al., 2008; Šerić Jelaska, 2010); and applied research in agrocoenoses and forests (e.g. Pernek et al., 2008; Matošević et al., 2009; Raspudić et al., 2009 as well as studies of insects in aquatic habitats(e. g. Previšić, et al., 2010; Turić, et al., 2008) are the most common.

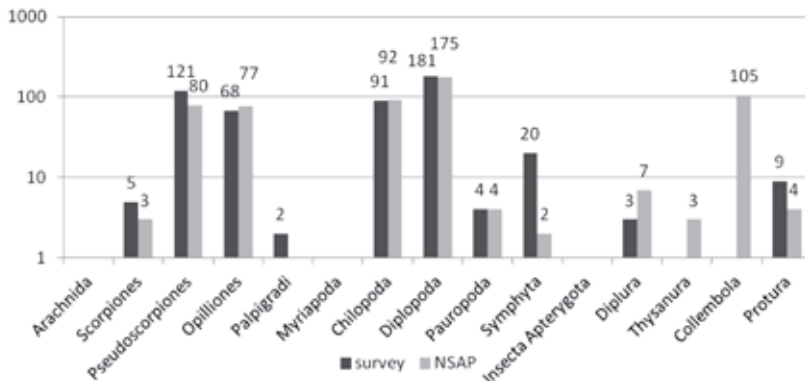


Figure 34. Comparison of researched figures of species Arachnida, Myriapoda and Apterygota according to NSAP and the survey

Table 6: Number of Orders, Families and Species of Croatian entomofauna according to NSAP According to: Biological and Landscape Diversity of Croatia

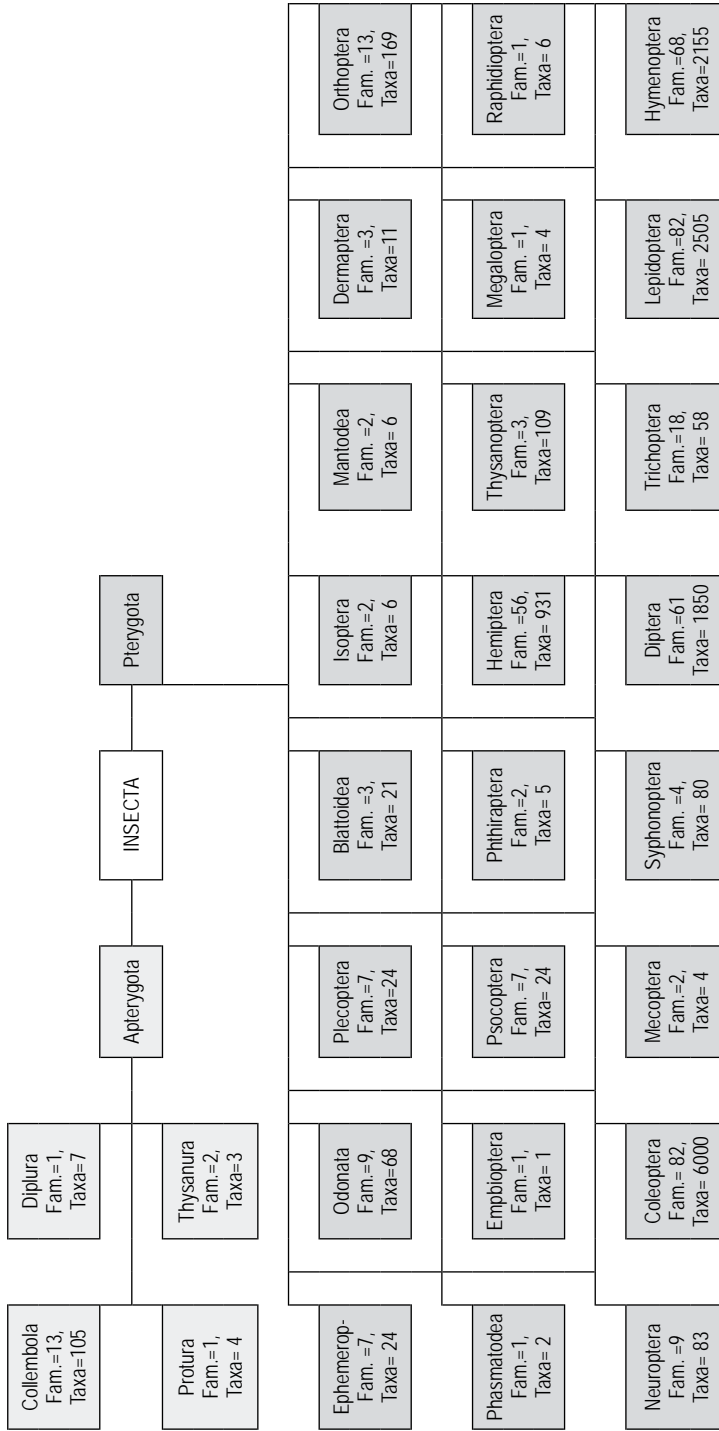


Table 7 The Croatian entomofauna - degree of exploration- results of the survey

No	Class/Order Family	Number											Reaserchers	
		Family		Genus		Species, Sub. Variety		Endemic	IUCN status	Field		Name		
		Found	Assess	Found	Assess	Found	Assess							
	ARACHNIDA													
1	Scorpiones	1	1			5	10					S, F, E, Pea, biosp.	R. Ozimec	
2	Pseudoscorpiones	10	26	35	121	220	49					S, F, E, Pea, biosp.	R. Ozimec	
3	Opliones	9	37	40	68	100	14					S, F, E, Pea, biosp.	R. Ozimec	
4	Paligradi	1	1		2	10	2					S, F, E, Pea, biosp.	R. Ozimec	
	MYRIAPODA													
1	Chilopoda	10	20	25	91	120	7					S, F, E, Pea, biosp.	R. Ozimec	
2	Diplopoda	22	59	70	181	280	47					S, F, E, Pea, biosp.	R. Ozimec	
3	Pauropoda	2	3		4	100						S, F, E, Pea, biosp.	R. Ozimec	
4	Symphyla	2	6	12	20							S, F, E, Pea, biosp.	R. Ozimec	
	INSECTA													
	APTERYGOTA													
1	Prolura	2	2		3	90						S, F, E, Pea, biosp.	R. Ozimec	
2	Diplura	2	3		9	100	1					S, F, E, Pea, biosp.	R. Ozimec	
	PTERYGOTA													
1	Odonata	9	33		70							S, F, E,	T. Bogdanović	
	Odonata	9	34		71							S, F, E,	M. Franković	

Table 7 The Croatian entomofauna - degree of exploration- results of the survey - continued

2	Plecoptera														
	Plecoptera	7	20	90			4 Dinar. 3 Balcan. 7 Alp.	RE: 2, CR: 1, EN: 3, VU: 11, NT: 4, LC: 26, DD: 35 (50 strictly protected 23 protected)	S, F, E	A. Popijač					
3	Psocoidae	12	3	62					F, Pea, Fiz	I. Kalinović					
4	Hemiptera porodice														
	Aleyrodidae	1	19	31					S, F, Pea	M. Šimala					
	Aphidoidea			199					S, F, E, Pea	T. Gotlin-Čujjak					
	Anthcoridae, Nobidae Miridae, Corcidae, Lygaeidae		118	300					F, Pea	B. Barić, I. Pajač					
	Heteroptera Miridae			276					F, E, G, Pea	I. Pajač					
	Heteroptera water	7	18	64					F, E.	N. Turić					
5	Thysanoptera														
	Thysanoptera	3		119					S, F, Pea	E. Raspudić					
6	Neuroptera Families														
	Osmyidae, Neuronthidae, Sisyridae	3		5		2			F, E	M. Ivković					
7	Coleoptera Families														
	Carabidae		118	557				136 (CR: 38, EN: 35, VU: 63)	F, E, MB	L. Šerić Jelaska					

Table 7 The Croatian entomofauna - degree of exploration- results of the survey - continued

	Staphylinidae Psepheninae		42	60	169	300	41	CR: 38, EN: 35, VU: 63, caves	S, F, E, Pea, biosp.	R. Ozimec
	Elatridae	10	59		170				Pea, E, F	R. Bažok
	Hydradephaga		45		226				F, E	N. Turčić
	Polyphaga, Hydrophaga, Dryopoidea	9	34		520				F, Pea	V. Mičetić Stanković
	Tenebrionidae								MB	M. Plohl
	Chrysomelidae								F, E, G, Pea	M. Ivezić
									F, E, G, Pea	R. Bažok
									Pea,	T. Kos
									S, E, Pea	D. Lemić
	Scolytidae		37		112				F, E, Pef	B. Hrašovec
	Curculionidae								Pea	I. Juran
	Coleoptera cave	5	51			97		18 Genera	S, F, E	B. Jalžić
	Coleoptera varia	2						(Cerambycidae, Buprestidae)	F, E, Pef	B. Hrašovec
	Coleoptera varia							Carabidae, Chrysomelidae, Dermestidae		P. Durbešić
	Coleoptera varia		13						Pea	T. Kos
8	Diptera Families									
	Culicidae		8			50			S, F, E	E. Merdić
	Culicidae		8			51			F, E	I. Vručina
	Culicidae		8			51			F, E, S, Fiz	M. Sudarić Bogojević
	Culicidae		8			51			F, MB	G. Vignjević
	Culicidae		8			51			Pea; E, Pe,	Ž. Jeličić-Marinković
	Tabanidae		10			78			S, F, E, Pe	S. Krčmar

Table 7 The Croatian entomofauna - degree of exploration- results of the survey - continued

	Syrphidae		62		230				E, Pea	Ž. Jeličić -Marinković
	Simuliidae		1		7				S, F, E, Pe med, PEV	M. Sudarić Bogojević
	Simuliidae		2		20	50			F, E,	M. Ivković
	Tephritidae		79		79				S, F, E, Pea	M. Bjeliš
	Empididae, Mnocerinae, Hemerodromiinae Climocerinae		8		51	10	4		S, F, E, M	M. Ivković
9	Trichoptera									
	Trichoptera	17	60		155	20	2		S, F, E,	A. Previšić
	Trichoptera				171	270	4		S, F, E,	M. Kučinić
	Trichoptera varia				200				F, E	I. Vručina
10	Lepidoptera families									
	Lepidoptera				2800	3800			S, F, E	M. Kučinić
	Rhopalocera	6	70		194				S, F, E	M. Šašić
	Rhopalocera				193		6		S, F, E	M. Kučinić
	Lepidoptera varia								Pea	M. Ivezić
	Lepidoptera varia								Pef	D. Matošević
11	Hymenoptera									
	Apoidea, Synohyta	11	105		432				S, F, Pe	F. Perović
	Hymenoptera varia								Pef	D. Matošević

Legend:

RE- regionally endangered, CR - critically endangered, EN - endangered, VU - vulnerable NT - nearly threatened, LC – least concern, DD - data deficient, biosp – biospeleologist, E - ecologist, F –faunist, Fiz - physiologist, G - geneticist, MB - molecular biologist, S – systematist, a -Agronomy, f - Forestry, Pe - applied entomology

There are neither many faunistic papers, nor investigated groups. Some territories are explored more than others.

Data from Tables 6 and 7 are compared and the obtained data are shown graphically in logarithmic scale (Fig. 34 and 35) for easier transparency. A comparison of figures shows large differences. The number of taxa in the data from NSAP is higher than the number from the survey for almost all orders with some exceptions, Psedosporpiones, Symphyta, Protura, Plecoptera, Psocoptera and Trichoptera. These Ordo are intensively researched in recent years and show significant positive changes in relation to NSAP.

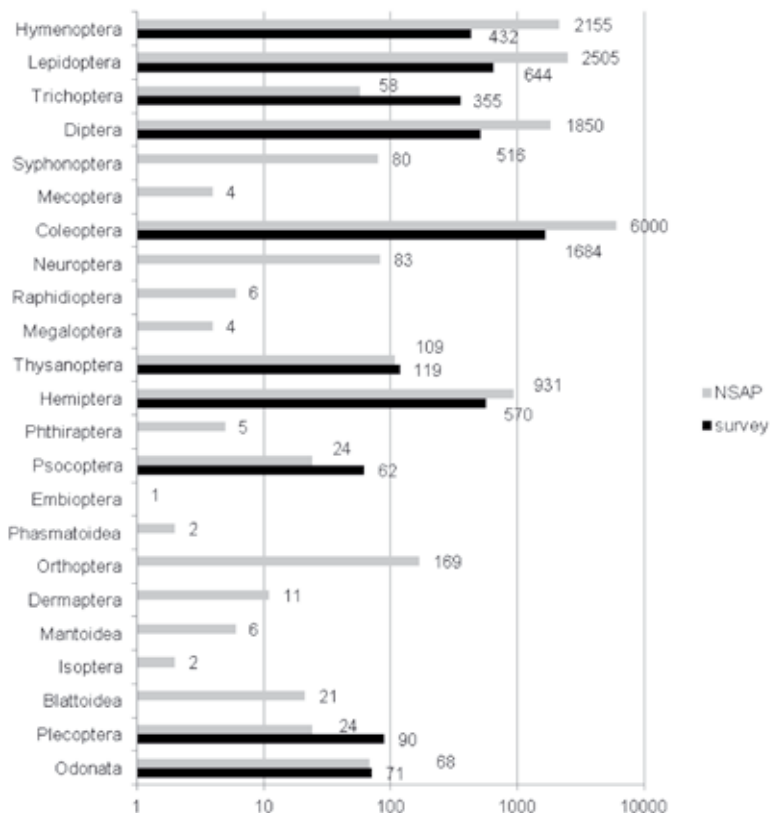


Figure 35. Comparison of researched figures of Pterygota according to NSAP and the survey

The number of entomologist in institutions varies (Fig. 36); ten entomologists operate at the Institute of Zoology, Department of Biology, J. J. Strossmayer University of Osijek, and six entomologists operate at the Department of Zoology at the Faculty of Science in Zagreb. Six entomologists are working in the Croatian Natural History Museum in Zagreb and one or two in other Museums. These data also indicate that the number of entomologists working in institutions is insufficient. A few more employees work at the applied faculties. The Faculty of Agriculture, University of Zagreb: the Department of Zoology has ten entomologists, like the Faculty of Agriculture of Osijek. The Faculty of Forestry has only two entomologists, and the Institute of Forestry in Jastrebarsko four. The situation in the forestry profession is better because each forestry office employs an entomologist and a phytopathologist (save guard) who monitor forest health conditions in their areas. Several entomologists are employed in the Institute for agronomy, forestry and village.

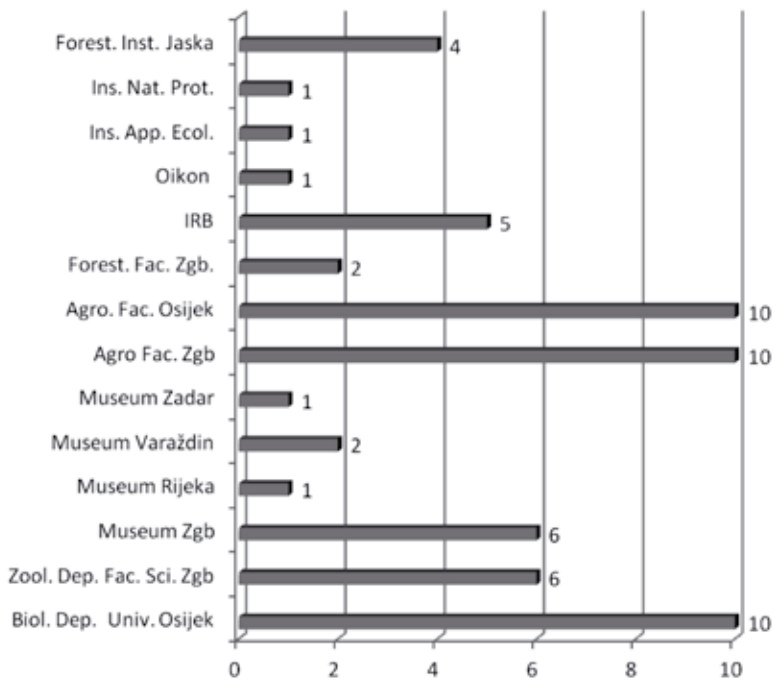


Figure 36. Number of employed entomologists in institutions

The development of molecular biology led to insects, particularly of the family Tenebrionidae, becoming models for genetic, cytogenetic, toxicological, evolutionary and taxonomic studies at Ruder Bošković Institute. This research is being conducted by a team of molecular biologists: Đurđica Ugarković, Miroslav Plohl, Branka Bruvo Mađarić and others. The significance of this research lies in the knowledge about the organizational structure of the eukaryotic genome, about the function and significance of satellite DNA within the genome, the preservation of the gene pool, in resolving phylogenetic relationships, the position of individual species within higher taxonomic categories, especially the control of the size of the population of economic pests.

Several younger entomologists in other institutions are engaged in molecular biology, indicated in Table 6 with MB.

Entomologists are also employed at the Oikon Ltd., at the Institute for Applied Ecology, Institute for Research and Development of Sustainable Eco-systems and in the State Institute for Nature Protection.

The different intensities in each research group shows that entomofaunistic studies have never been planned in order to complete Croatian fauna while many orders are completely unknown. Personal interests still prevail in general and therefore, for example, Macrolepidoptera - Rhopalocera are researched up to the level of 99 % (Šašić & Mihoci, 2011) of the expected species for Croatia. However, the intensity of research differs between studies of diurnal and nocturnal Lepidoptera. Although more than 90 % of Lepidoptera are active by night.

The environmental conditions in Slavonia, especially the abundance of aquatic habitats, have influenced the redundancy of some species such as mosquitoes (Culicidae). Therefore a significantly higher number of Osijek entomologists deal with this group. The situation is the same with the emergence of the newly identified species *Diabrotica virgifera virgifera*, a dangerous corn pest, which is being explored by a number of entomologists from the Faculty of Agriculture in Osijek.

Regarding orders with a large number of species as Orthoptera, Diptera, Coleoptera, the most vigorous research has been directed to a few families, and even those are not thoroughly explored. There are few Croatian entomologist and these are very numerous groups of insects of which some are very difficult to determine.

Systematics and faunistics represent foundation studies for all other research, particularly ecological, and they have to be carried out over a longer period of time to be accurate. The entomological material collected with the help of methods: catcher, malaise traps, "Steiner" and other, is various and its processing requires collaboration of numerous experts. These studies have been quite successfully and continually conducted in our country in the forests, watercourses and agrocoenoses (e.g. Durbešić, 1984; Merdić et al., 2008; Šerić Jelaska, 2010; Pernek et al., 2008; Matošević et al., 2009; Raspudić et al., 2009; Previšić, et al., 2010; Turić, et al., 2008)

Because of its geological past, Croatia has numerous endemic species, especially cave species and relics hosted as refugees during glaciation such as *Hennedyia annulitarsis* Cameron, 1871 (Hymenoptera). In fauna of cave Arachnida, there are many endemic species: Pseudoscorpiones 49, Palpigradi two, Opiliones 14. Four endemic species of insects belong to the order Plecoptera, and four to the order Trichoptera. Regarding orders with a large number of species as Orthoptera, Diptera, Coleoptera, the most vigorous research

In the nineteenth and the first half of the twentieth century, the interest of entomologists was directed to the continental and Mediterranean parts of Croatia. Selection of areas for study was most often associated with the possibility of getting to these areas and being accommodated. For that reason, the mountain parts of Croatia, Gorski Kotar, Velebit, Lika and mountains along the coast: Mosor, Biokovo and Snježnica are poorly researched. Difficult transportation conditions and sometimes heavy and necessary equipment represent an additional reason for that, but today the conditions have changed. So we now have lack of researching in non carstic region (e. g. Vujčić-Karlo & Durbešić, 2002; Mihoci, 2011.)

In all above mentioned scientific institutions, a lot of entomological projects are in progress as well as a number of master theses and doctoral dissertations.

The fundamental indicators of the degree of exploration of entomofauna, its richness, diversity and the representation of certain groups are the entomological collections in Croatian museums. Many of them are very old and therefore they do not reflect the present state. Therefore the entomofauna should be systematically investigated and the collections regularly amended.

In Croatia, there are departments of natural history museums and museums in Zagreb, Osijek, Varaždin, Rijeka and Zadar. Each of them has collections of insects.

For example, the collection of insects from the Croatian Natural History Museum in Zagreb has 226 thousand specimens of Coleoptera, and consists of the collections of Schlosser, Weingartner, Redenšek, Onsea, Novak, Mikšić, Kozulić, Korlević, Koča, Igalffy and Geiger. There are over 3 thousand specimens of cave beetles with numbers of types of endemic taxa (Jalžić collection). The Lepidoptera collection has over 86 thousand specimens and consists of the Lorković, Lako, Koča, Gušić, Grund, Taborsky, Novak, Geiger, Kozulić, Igalffy, Redenšek, Maretić, Rucner, Mladinov and Vajdić collections. The Hymenoptera collection has nearly 43 thousand specimens from the Korlević and Perović collections, Diptera over 17 thousand from the Langhoffer collection, Heteroptera over 10 thousand specimens, Orthoptera 4 thousand specimens, Trichoptera 16 thousand specimens from the Kučinić and Perović collections. There are 69 thousand specimens of other groups created by various authors, and the still not organized collection of Petar Novak with over 500 thousand specimens (Čanadjija, 1971).

The Natural History Department of the National Museum in Zadar has valuable collections of Lepidoptera, Homoptera, Hymenoptera, Diptera, Mecoptera, Ephemeroptera, Odonata, Plecoptera, Trichoptera, Orthoptera, Dictyoptera, Mantodea and Neuroptera.

The Specialized Entomological Department of the City Museum Varaždin with tens of thousands of insect specimens was opened in 1954 and it is still operating in Varaždin. It is the only specialised museum of the kind in Croatia, and, which is a rarity, even in Europe.

The founder and the first curator of the Department was Franjo pl. **Košćec** (Fig. 36), a secondary school teacher and a prominent naturalist. His valuable collection of insects of inland Croatia numbers tens of thousands of specimens. It is presented in a permanent exhibition entitled "The World of Insects" and it is one of the most beautiful in Europe (Balabanić, 1998).

Many collections are stored in the Natural History Department of the Museum in Rijeka. Some of them are the collection of Beszedes over 6 thousand exemplars and 16 thousand specimens, the collection of Depoli and others. Valuable collections of insects are found in Split, Zadar and Osijek. There are also collections of insects at universities. Thus, the Faculty of Forestry keeps the Hensch collection of more than 80 thousand exemplars and 15 thousand species and 11 holotypes and eight lectotypes and the collection of Badovinac with some thousand exemplars, of which only Noctuida (Lepidoptera) consists of over thousand exemplars and 164 species.



Figure 36. Franjo pl. Koščec in his laboratory in Varaždin

There are collections of insects at the Agricultural Faculty in Zagreb and Osijek, the Faculty of Science in Zagreb, which are used for teaching purposes. Private collections are rare but valuable. One of them is the collection of R. Kranjčar, which has several thousand exemplars of Lepidoptera with more than 8 hundred species from the area of Posavina.

One of the priority tasks in museums would be making inventories. The very limited number of entomologists working in museums are making efforts directed to managing a large-scale work, but without a sufficient number of experts and sufficient financial resources, things are going very slowly. For instance, the Croatian Natural History Museum inventoried only over 12 thousand Coleoptera, 49 thousand Lepidoptera and 14 thousand Hymenoptera out of the entire collection.

Social activities of Croatian entomologists

The history of gatherings of Croatian entomologist reaches one hundred years back when Professor A. Korlević sent the draft of the Statutes together with a proposal for establishment of the entomological section of the Croatian Society of Natural Sciences to the High Royal Government. The Government approved the Statutes on 4th May, 1909 and granted funds for the start of the entomological section.

Professor A. Korlević was the first head of the section. The faculty assembly of the Royal Forestry Academy gave working space for the entomological section in the Forestry Centre. Members of sections dealt with studies of the degradation of grape vines and fig trees, providing a lot of professional advice and the work of Croatian entomologists branched out from these activities.

Entomologists such as A. Langhoffer and F. Operman were active in the section. During the First World War the section ceased existing.

The Entomological Society was founded in the Kingdom of Serbs, Croats and Slovenes (SHS) in Belgrade in 1926. The Society started the journal *Acta entomologica Jugoslavica* (AEJ) too but the journal expired in 1931.

After World War II, the Yugoslav Entomological Association (JED) was founded in Zagreb on 14th November 1969. I personally attended the meeting at which Professor Željko Kovačević was elected president. The Association started *Acta entomologica Jugoslavica* (AEJ) under the editorship of Academician Zdravko Lorković.

Four years later, on 9th April 1974, the Croatian Section of the Yugoslav Entomological Society was founded in Zagreb at the Department of Agricultural Zoology, Faculty of Agriculture, and the Croatian Entomological Society (HED) 29 July the same year. The first president was Professor Lea Schmidt, after that, Professor Ivan Spajić, Bogomir Milošević B.Sc., Professor Miroslav Harapin and Academician Milan Maceljki. The current president is Professor Božena Barić. *Entomologia croatica* is the official journal of the Croatian Entomological Society, the successor of the journal *Acta entomologica Jugoslavica*. Academicians Zdravko Lorković and Milan Maceljki were editors earlier, and Professor Paula Durbešić is currently carrying out these duties. Two issues of the journal used to be published per year but today four issues yearly are published. The works comprise an international review and articles from the journal are referenced in several databases such as: BIOSIS Preview, Zoological Abstract, Entomological Abstract and Hrčak. The journal is exchanged with more than a hundred foreign and domestic publications. The Society maintains its own website.

Croatian entomologists organized four entomological conferences in the former Yugoslavia: on the island of Korčula in 1976, in Zadar in 1983, in Zagreb in 1989 and in Pula in 1990. Croatian conferences with international participation were organised in Zagreb in 1992 and in 1994 (Soil fauna). The first entomological symposium was organized within the framework of the Congress of Croatian

Biologists in Osijek in 2010 and another is planned, also within the framework of Congress of Croatian Biologists, for Šibenik in 2012.

The Croatian Entomological Society is a member of the Croatian Society of Natural Sciences. The Society maintains good cooperation with other societies in Croatia, and has especially very good cooperation with the Štefan Michaeli Slovenian Entomological Society from Ljubljana.

Student- entomologists gathered in associations have made significant contributions with their activities, successfully dealing with entomological research. There are active societies and associations such as: the Croatian Myrmecological Society (member of HPD), Croatian Biospeleological Society (HBSD), the Society for Biological Research, (BIOM), the Association of Students of Biology at the Faculty of Science, the University of Zagreb (BIUS).

Publication of books

One of important activities of entomologists in Croatia is the publication of books

The first work to be published was:

- Schlosser-Klekovski, J., 1877. -1879. Fauna kornjašah Trojedne kraljevine, I.,II. & III., JAZU Zagreb, 995 pp.
- Several books with entomological content were published in the second half of the 20th century:
- Kovačević, Ž., 1950. Primijenjena entomologija – Opći dio. Nakladni zavod Zagreb, 217 pp.
- Novak, P., 1952. Kornjaši Jadranskog primorja. JAZU Zagreb, 521 pp.
- Kovačević, Ž., 1956. Primijenjena entomologija - Šumski štetnici. Poljoprivredni nakladni zavod Zagreb, 535 pp.
- Kovačević, Ž. et al., 1956. Bolesti i štetnici ratarskog bilja. Nakladni zavod znanje Zagreb, 516 pp.
- Androić, M., 1970. Osnovi zoekologije s osobitim osvrtom na entomofaunu. A. G. Matoš Samobor, 152 pp.
- Schmidt, L., 1970. Tablica za determiniranje insekata. Sveučilište u Zagrebu Zagreb, 258 pp
- Vajda, Z., 1974 Nauka o zaštiti šuma. Školska knjiga Zagreb, 482 pp.
- Maceljčki, M., 1983. Entomologija, specijalni dio – štetnici voćaka i vinove loze. II. izd., Sveučilište u Zagrebu Zagreb, 258 pp.

- Ciglar, I., 1988., Integralna zaštita voćnjaka i vinograda. Zrinski Čakovec, 236 pp.
- Durbešić, P., 1988. Upoznavanje i istraživanje kopnenih člankonožaca. Mala ekološka biblioteka, Hrvatsko ekološko društvo Zagreb, 78 pp.
- Maceljki, M. & Igrc, J., 1991. Entomologija – štetne i korisne životinje u ratarskim usjevima. Fakultet poljoprivrednih znanosti Zagreb, 210 pp.
- Maceljki, M., 1999. Poljoprivredna entomologija. Zrinski Čakovec, 464 pp.
- Radović, J., 1999. Biološka i krajobrazna raznolikost Hrvatske. Državna uprava za zaštitu prirode i okoliša Zagreb, 152 pp.
- Igrc Barčić, J. i Maceljki, M., 2001. Ekološki prihvatljiva zaštita bilja od štetnika. Zrinski Čakovec, 517 pp.
- Maceljki, M. et al., 2004., Štetočinke povrća. Zrinski Čakovec, 517 pp.
- Oštrc, Lj. i Čuljak Gotlin, T., 2005. Opća entomologija. Zrinski Čakovec, 222 pp.
- Maceljki, M., Cvjetković B., Ostojić, Z. i Barić, B., 2006. Štetočinke vinove loze. Zrinski Čakovec, 319 pp.
- Purger, J. J., (ur.) 2007. Priručnik za istraživanje bioraznolikosti duž rijeke Drave. Sveučilište u Pečuhu Pečuh, 248 pp.
- Belančić, A., Bogdanović T., Franković, M., Ljuština M., Mihoković, N. i Vitas B., 2008 Crvena knjiga vretenca. Ministarstvo kulture, Državni zavod za zaštitu prirode Republike Hrvatske Zagreb, 132 pp.
- Ivezić, M., 2008. Entomologija – kukci i ostali štetnici u ratarstvu. Grafika Osijek, 202 pp.
- Kranjčev, R. 2009. Leptiri Hrvatske. Veda d.o.o. Zagreb, 256 pp.
- Martinčić, I., 2010. Upravljanje zaštićenim područjima prirode. Sveučilište u Zagrebu. Šumarski fakultet Zagreb, 368 pp.

It is specially to point out many years of work and the valuable book about our cave fauna - Jalžić et al. 2010. *Atlas špiljskih tipskih lokaliteta faune Republike Hrvatske* and the work on protection of endangered species - red book about Odonata (Belančić, et al., 2008).

Croatian entomological researchers published their investigated results in various foreign journals and in Croatia beside *Entomologia Croatica* occasionally in *Natura Croatica* - Journal of the Croatian Natural History Museum in Zagreb, *Periodicum biologorum* - Journal of the Croatian Natural History Soci-

ety - successor of the *Glasnik*, and popular articles on insects are common in the journal *Priroda*.

Croatian Entomofauna – Looking into Future

Croatia is among rare European countries which does not have its fauna processed. Our country has recently been through difficult times, since achieving independence, but it seems that in all areas, plans are focused on the future yet our wishes to fulfil the ancient Langhoffer's dream, as mentioned in the introduction, seems for many like looking back. Nevertheless, people who understand natural processes well know that without preserving the natural resources and beauties of our homeland, there can be no correct view of the future. Carrying out the environmental protection is possible only with the knowledge of our ecosystems: woods, fields, rivers, the sea, and so on, and to achieve that we must know the flora and the fauna.

Natural processes go their own way so that many species disappear or, due to our activities, some species that once threatened us are now in danger. It seems absurd, but according to our expert entomologists, E. Merdić and M. Kučinić the species *Anopheles maculipennis* complex Meigen 1818 (Culicidae) and *Pieris brassicae* L. (Lepidoptera) are already endangered in Croatia.

Those well informed know that in biology now we are going through the period of a renaissance of the oldest biological science – systematics. Today, systematics, by including genetics and molecular biology into its research, reveals that the well defined old species according to the Linnaeus system have proved to be complexes of reproductively isolated individuals. Because of that the fauna must be systematically researched, while the knowledge of fauna is crucial for solving numerous questions in the functioning of the eco-system, and it also contributes to environmental protection.

Croatia has through the implementation of the National Strategy and Action Plan for the Protection of Biological and Environmental Diversity (NSAP), made a step forward by moving in the direction of monitoring biological diversity.

The National Institute for the Protection of Nature (DZZP) has taken over the task of organizing, coordinating, making an inventory and monitoring the conditions for biological diversity. But who are the actual people who carry out the tasks? They are highly educated people who moved to administration in order to carry out the set task of the Institute, as they did for the NSAP, by collecting

data from the rare faunists and entering them into programmes that were rather expensive. Is it not the high time to start systematic research of fauna and flora? The survey carried out and shown in table 7. shows that only a few groups actually carry out research and that there are few faunists. Therefore, as a solution for those problems it would be necessary to employ young people in the institutions who would continue the way of making fauna which started long time ago, according to scientific principles and a well designed plan.

Still, we must be proud of the results achieved in the past times, by not only foreign researchers but also our local pioneers who followed them. We must still be open to cooperation with foreign experts from Europe and the world, but it is our responsibility to research into fauna by creating a plan and a strategy. We have the knowledge and the will, our young people are proud of their own country, and also we older ones still have the strength to achieve Langhoffer's dream.

Conclusion

The current conditions in Croatian entomology have been achieved by the care, love and enthusiasm of a large number of researchers, entomologists, professional scientists as well as amateurs. We must also point out the role of insect traders in completing entomological collections.

All these results were achieved without any planned strategy, mostly with only minimum financial means and the relatively late introduction of insect research to the work of institutions. Despite that we must be satisfied with all that was done up to the point and aware that it is impossible to get to know all natural values. Considering that in Croatia there is still no established systematic research of biodiversity and that we are one of the rare countries in Europe which does not have processed fauna, or entomofauna, it is high time to start doing planned research and not base it on processing already collected data.

This idea has been alive for centuries in Croatia. It is time to set sails and finish by all means what our ancestors started a long time ago. We must make an effort to consider taxonomy, the basic science in biology without which these great plans cannot be achieved. There are young people interested in fauna research, but there is a lack of knowledge and understanding among decision-makers. Fauna research should be given more support and importance. A well considered fauna research strategy would not only help in its introduction but international obligations would be able to be fulfilled more reliably and correctly. The preser-

vation of biodiversity is a priority because the quality of our lives depends on the richness and diversity of other living beings.

In 1886 the Academy member Spiridion Brusina wrote

FAUNA RESEARCH INTO THE HOMELAND IS A PATRIOTIC AND PRIMARY OBLIGATION OF EACH PATRIOT.

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