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Comparative arachnogeographical analysis of Australia, Papuan Area, New Caledonia and New Zealand

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Abstract: Arachnogeographical analysis of all orders of Arachnida in Australia (incl. Tasmania), New Guinea, New Caledonia, Lord Howe Isl. and New Zealand. The purpose of this study was to outline the representation of the different orders in the separate territories and to verify the arachnological proves for the zoogeographical subdivision of Nothogea and the world. The conclusion is that the level of representation of Arachnida in the classical Notogea (including Papuan area, but excluding Patagonia) was much lower as compared to the level in the vertebrates, with their endemic subclasses, orders and suborders. Even in the most isolated area (New Zealand) there were no endemics of very high rank. They included (endemisms above genus):
Australia (cont.): one endemic family of Scorpions (Urodacidae)
Tasmania: only endemic subfamilies of spiders (Plesiothelinae and Hickmanniinae)
New Guinean area: no endemics above genus
New Caledonia: one endemic family of Opiliones (Troglosironidae)
New Zealand: one endemic family of spiders (Huttoniidae) and one of Opiliones (Synthetonychiidae)

Key words: arachnogeographical analysis, Australia, Papuan Area, New Caledonia, New Zealand, Arachnida, endemism

Introduction

The unusual and highly endemic fauna of Australia, New Zealand, New Caledonia and Melanesia has been subject to many analyses, speculations and attempts to explain the presence of animals like Marsupialia, the tuatara, the frog *Leiopelma*, the extinct moa and the still-living kiwi with regard to past connections or isolation of these remote islands. Most of these efforts were (and are) based on vertebrates leading to delimitating an Australian Region, Papuan and Newzealandian areas of changing status. The vertebrate fauna of Australia is highly endemic, to a degree of a separate kingdom Notogea, but the plants and invertebrates, especially in New Guinea and Northern Australia are closer to the flora and fauna of Indo-Malayan Region (Paleotropic). A complex analysis of Arachnida from these territories could help to elucidate the history of this fauna and to give weight to one or another zoogeographical subdivision.

What is Notogea?

Huxley (1868) coined the term “Notogea” (including Australia and South America). In different books it is considered differently (with or without New Zealand or the Papuan Subregion and sometimes including Patagonia).

Notogea is usually regarded as Kingdom.

In the scheme of Sclater (1858) – Australian or Oriental paleotropical region (New Guinea, Australia and Tasmania) Geptner (1936) – Australian Region with five subregions: Papuan, Australian, New Zealandian, Polynesian and Hawaiian Bobrinskij, Zenkevich & Birstein (1949) – Notogean Kingdom (in Russian Susha = dry land), divided into three Regions: New Zealandian, Australian and Polynesian.

New Guinea, Bismarck Archipelago, Solomon Islands and Timor are parts of the Australian Region (Papuan Subregion) Darlington (1957) – Australian Region: Australia and New Guinea De Lattin (1967) Australian Region with three subregions: Continental Australian, New Zealandian and Polynesian. New Guinea is included in the Continental Australian Subregion, the Solomon Islands – in the Polynesian.

Lopatin (1980) – Kingdom Notogea with three Regions: Australian, New Zealandian and Patagonian. According to him, the islands East of the Lombok Strait including New Guinea and ? the Solomon Islands, form the Papuan Subregion of Indo-Malayan Region (Paleotropical Kingdom) Krizhanovskij (1980). New Guinea is part of the Paleotropical Dominion, together with Africa, South Asia and Madagascar.

Krizhanovskij (2002) – Kingdom Notogea with three Regions: Australian, New Zealandian and Chilean-Patagonian. New Guinea is again part of the Paleotropical Kingdom as the Papuan Region.

Recently Holt et al. (2012) proposed a new subdivision of the continents based on amphibians, birds and mammals. Thus the Earth could be divided into 11 "realms", including the Oriental and Australian realms. New Guinea is included in the Oceanian Realm.

Geography

Axelrod & Raven (1982), Brown, Campbell & Crook (1968), Campbell (1943), Chase (1971), Coleman (1970), Craw (1988, 1989), Doutch (1972), Embleton (1973), Fleming (1962, 1963a, 1963b, 1967, 1970, 1975), Grehan (1989), Gressitt (1956, 1958, 1967, 1971, 1974, 1982a, 1982b), Griffiths (1975), Heads (2002, 2008a, 2008b, 2009, 2010), Keast (Ed)(1981), Lillie & Brothers (1970), McElhinny, Embleton & Pozzi (1976), Mitchell & Warden (1971), Page (1989), Paramonov (1958, 1960), Robbins (1971), Sarasin (1925), Sharma & Wheeler (2013), Sloane (1915), Smith (1990), Solem (1958), Taylor, Goodliffe & Martinez (1999), Thompson (1967), Veevers & McElhinny (1976), Voris (2000), Walker (Ed.)(1972), Weissel, Hayes & Herron (1976), Whitmore (Ed.) (1981)

Melanesia consists of the island of New Guinea, the Bismarck Archipelago, d'Entrecasteaux Islands, the Louisiade Archipelago, the Maluku Islands (not included here), Fiji, Norfolk Island, the Solomon Islands, the Schouten Islands, the Torres Strait Islands, the Trobriand Islands, Vanuatu, Woodlark Island and some other islands. Central is the huge island of New Guinea (829 000 km^2, maximal height 4884 m). It is actually a small continent – only the surface of the state of Papua New Guinea is 462 840 km^2. Within this state there are also the „smaller" islands – New Britain (35.600 km^2, bigger than Belgium), New Ireland (8600 km^2, comparable to Corsica), Bougainville (10.500 km^2) and others.

About 25% of New Guinea is situated higher than 1000 m a.s.l. The giant mountain chain, stretching along the entire island, is long more than 2000 km and is higher than the Alps (4884 m a.s.l.). The other islands are also mountaineous (New Britain 2440 m, Bougainville 2740 m). The rivers of the Big Island, which are fed by up to 6500 mm rain annually) are impressive. The Sepik, Fly, Ramu and Baliem Rivers are comparable to the Rhine or Don. In the Papuan phytogeographic Province (of the Malesian Region) are known more than 9000 species and 1400 genera of higher plants, from which 8500 species and 140 genera are endemic.

On the summit of Jaya (Carstensz) the glacial ice covers 6.9 km^2 (16.4 km^2 in the middle of 19 century), and is retreating rapidly. Its thickness is circa 40 m.

Australia

The continent of Australia has an area of 7 692 000 km^2 (without Tasmania, but including the offshore islands). The highest point is Mount Kosciuzko (2228 m).

The continent was detached from the Antarctic some 95-80 Ma (late Cretaceous) and drifted northwards, coming close to the equator and to Sundaland, the present day Indochina and the Greater Sunda islands. Present- day Australia consists of several subregions with very different landscape. Huge areas in Western and Central Australia are deserts and form the so called Eremial.

The northernmost part of the continent, on the Torres Straight, consists of dry savanna in the western part and of rainforests similar to the forests in New Guinea in the eastern part. Udvardy (1975) notes, that Usinger (1963) included Cape York (the northern peninsula of Queensland) to his Papuan subdivision of the Oriental Region, while Gressitt (1961) treated it as a clearly transitional area together with southern New Guinea, and in 1975 in a letter to Udvardy, wrote that „the overlap of Australian and Oriental in southern New Guinea and Northern Australia needs to be shown as an overlap zone with dominance of Oriental elements…". Prof. Gressitt told the same personally to the present author during a visit in Wau in the same 1975. However, this remark concerns mostly to the flora and the invertebrates, especially the insects. Based on vertebrates, the Papuan Subregion is clearly part of the Australian Region (the differences are between kingdoms!).

According to Keast (1959), approximately one-third of the Australian continent lies within the tropics and the rest is either temperate or sub-temperate. Special adaptations to a cold climate are little developed in Australian animals. According to the same author, Australia has not been in direct land contact with Asia since the beginning of the Tertiary, over 50 Ma. Actually, according to the modern concepts, Australia has never been in direct contact with Asia, as it drifted from the south.

If for the final phase of extinction of the giant animals in Australia (*Diprotodon, Palorchestes, Thylacoleo*) could be attributed to the combination of aridity and the arrival of aboriginal man and the dingo, eventual changes in the composition of the arachnofauna are to be explained only with the aridisation.

New Caledonia

New Caledonia is located in the subregion of Melanesia in the South-West Pacific. It comprises the main island (Grande Terre), the Loyalty Islands, and several smaller islands. It has a land area of 18 575.5 km^2.

The Grande Terre is by far the largest of the islands, with an area of 16 372 km^2, and is elongated northwest-southeast, 350 km long and 50 to 70 kilometers wide. A mountain range runs along the length of the island, with five peaks over 1500 m. The highest point is Mont Panié at 1628 m a.s.l.

The detailed analysis of Grandcolas et al. (2008) concerning the formation of the New Caledonian biota comes to the conclusion that it is not a continental, but rather an oceanic island, having its biota formed not earlier than 37 Ma during the Oligocene (confirmed by molecular research).

New Caledonia is extremely interesting from biogeographical point of view and different problems are raised. As a mater of fact, it is archipelago of one big and very varied island, the islands Loyalty, the Pine Island and many other islets and reefs. The total surface is 18 575,5 km^2, the population – 258 000.

The isolation of New Caledonia dates at least from the Miocene (perhaps from the Oligocene) and thus have been preserved many relict animal and plant, also neoendemics have been formed. After the arriving of the first settlers (the Canaques) ca. 3200 – 3300 years ago disappeared many endemic animals and plants, and the Europeans (since 1853 New Caledonia is a French territory) contributed to this process mostly by mining and agrarian activities, forest destruction, planting foreign trees and others. New Caledonia is 1300 km away from Australia, 1500 km from New Zealand and 1200 km from Fiji.

Tasmania

Tasmania is an Australian island and state. It is 240 km^2 south of the continent, separated by Bass Strait. The state includes the island of Tasmania and some smaller islands (state area 68 401 km^2), of which the main island covers 62 409 km^2. The highest point is Mount Ossa (1614 m). Situated at 42°S, Tasmania has a cool temperate climate with four distinct seasons.

The island was joined to the mainland of Australia until the end of the last glacial period approximately 10,000 years ago. Much of Tasmania is still densely forested, with the Southwest National Park and neighbouring areas holding some of the last temperate rain forests in the Southern Hemisphere.

Lord How Is.

The small Lord Howe Island is „The riddle of Pacific" (Paramonov, 1958, 1960). On a surface of 14.55 km^2 (10 km long and up to 2 km wide) many endemic species live, and the island is 600 km away from Australia and 900 km away from Norfolk Island. Its inhabitants (387 permanent and up to 400 tourists) are in the „settled area", in the lowland, because since 1981 70% of the island is a reserve. Fortunately, there are some forest left on the 875 meter high Maunt Gower. The archipelago includes also 28 uninhabited islands.

It is considered that Lord Howe is part of the island chain, having existed along the western edge of the shelf Lord Howe Rise, 3000 km long and 300 km wide. The rise extends from New Zealand to the west of New Caledonia and consists of continental rocks, detached from Australian plate 60-80 Ma ago. The shelf is part of Zealandia microcontinent.

New Zealand

The archipelago, called by the Europeans in 1645 New Zealand, is one of the amazing places on Earth, when discussing zoogeography. It is composed by two bigger islands (North and South Islands), which are separated by the Cook Strait (22 km wide), one less big (Stewart) and many smaller islands with a total surface of 268 000 km^2. New Zealand is 1500 km away from Australia. The relief is very varied with highest point Mount Cook, or Aoraki at 3754 m and 17 other summits above 3000 m. The biota is very altered by humans and the animals they introduced, one way or another. For the invertebrates most important was the change in the environment – the land use, deforestation etc.

Paleogeography

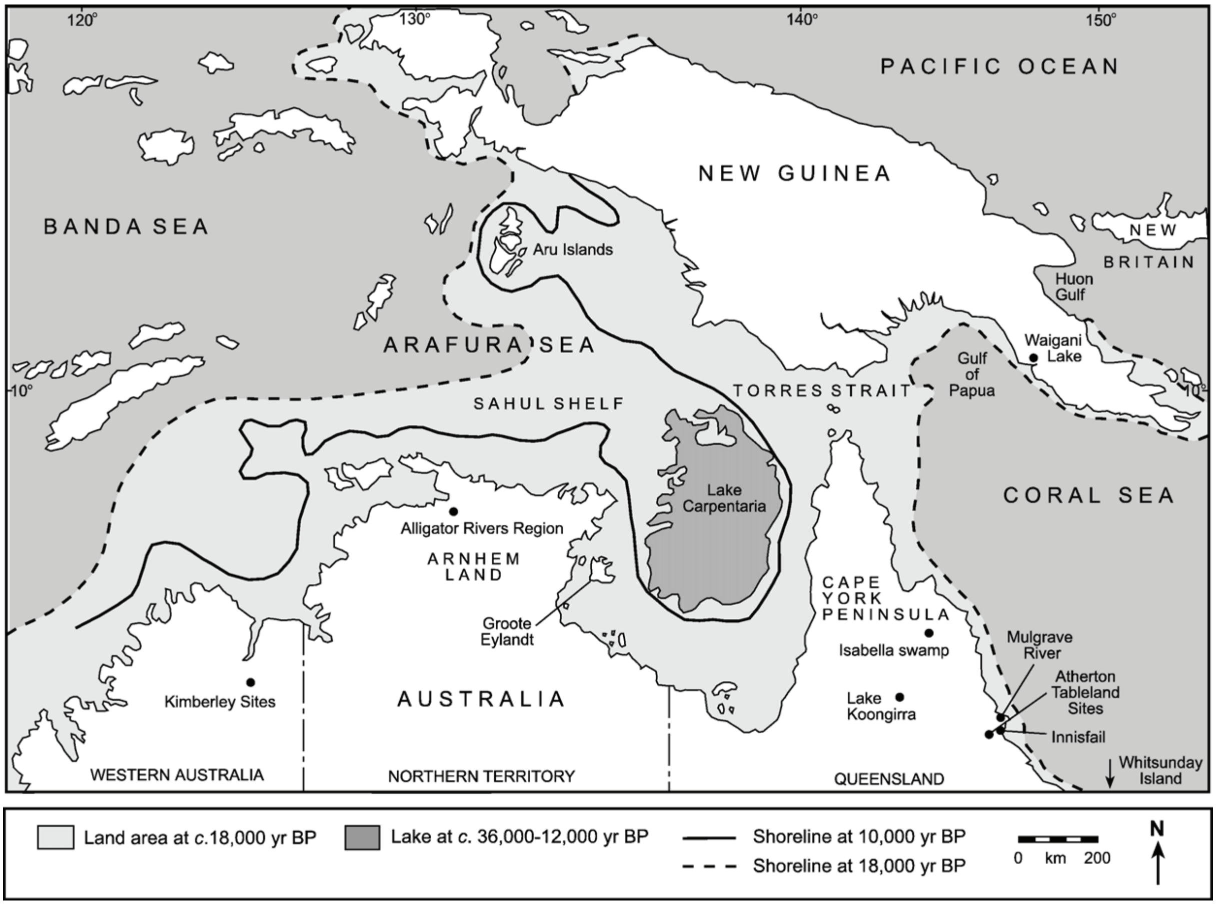
New Guinea. “The consensus of contemporary zoogeographic studies is that though New Guinea and its shelf islands were joined to Australia during several phases of the Pleistocene, New Guinea has a basic, rich biota, much more ancient in origin as well as evolutionary history, and independent of Australian faunal or floral influence” (Udvardy, 1975).

“When New Guinea, the leading edge of of the Australian plate, was first elevated to form an extensive land area in the late Oligocene, it was colonized largely from the adjacent rich tropical lowlands of Malaysia. Biogeographic affinities with Australia are poorly developed, but there has been a spectacular late Tertiary radiation of many groups…Land connections between Australia and New Guinea are also suggested by the mid-Pliocene appearance of the marsupials…The island as a whole is a region of faunal and floral misxing, survival, and evolution in the middle to late Tertiary”(Raven & Axelrod, 1972).

Some data on the glaciation and climate change in New Guinea we find in Löffler (1982): “The Pleistocene glacial history of New Guinea may date back to about 700000 -+ 100 000 years BP when lava erupted under ice on Mt Giluwe....The last glaciation lasted until about 15 000 years BP when the ice receded rather rapidly to completely disappear by about 9000 years BP…The snowline during the last glaciation was at about 3550 – 3600 m altitude indicating a lowering of the snowline by about 1000 – 1100 m. This would correspond to a temperature depression of about 5-6^{o}C assuming that precipitation was similar to the present”.

Australia.

To partly quote Keast (1959): “New Guinea and Tasmania, lying on the Australian continental shelf, would be brought into contact by a fall in sea-level of about 10 m and 50 m, respectively. They are known to have been joined to Australia during part of the Tertiary and apparently twice during the Pleistocene…This being so, it would seem surprising that the flora of New Guinea bears little resemblance to that of Australia…and much of its invertebrate fauna is likewise Indo-Malayan…In explanation of this it has been suggested that the geologically ancient northern part of New Guinea was once, presumably in the Mesozoic, in direct land contact with



Map 1. Location map of Torres Strait in relation to regional Quaternary shoreline changes (adapted from Rowe, 2007)

Asia … Another proposal is that Australia did not always lie in close proximity to New Guinea but "drifted" into it".

Wallacea

The area, called by Dickerson (1928) "Wallacea" is about 347 000 km^2 between Wallace and Lydekker Lines (between the Makassar and Lombok Straits and some islands near New Guinea) is usually considered part of Indo-Malayan Region (sometimes considered a separate subregion of Notogea – see Buchar, 1983, or part of the Papuan Subregion of Australian Region – see Krzhanovskiy, 2002). Included are the main island Sulawesi, Lombok, Sumbawa, Flores, Sumba, Timor, Halmahera, Buru, Seram, and many smaller islands. Regarding the fauna, some Australian or Papuan elements (Marsupialia, birds) are represented on Sulawesi and some other islands.

Analyzing the Arachnida of Wallacea, we may observe the following (endemics in **bold**):

Palpigradi – fam. Prokoeneniidae (*Prokoenenia* Börner, in Sulawesi)

Amblypygi – fam. Charinidae (*Charon* Karsch – Maluku, Sumbawa); in Flores was found one species of the genus *Phrynus* – the only known member of Phrynidae in the Old World.

Thelyphonida (Uropygi) – fam. Thelyphonidae (*Chajnus* Speijer in Lombok, *Thelyphonus* Latreille s.l. in Maluku)

Schizomida – fam. Hubbardiidae indet. (in Sulawesi)

Solifugae – fam. Melanoblossiidae (*Dinorhax* Simon in Maluku, the easternnmost member of Solifugae)

Opiliones – Cyphophthalmi – Stylocellidae (*Leptopsalis* Thorell in Sulawesi); Eupnoi – Sclerosomatidae (***Gagrellina*** Roewer); Laniatores – Assamiidae, Epedanidae (***Epedanulus*** Roewer, ***Parepedanulus*** Roewer – Sulawesi), Zalmoxidae

Pseudoscorpiones – Chthoniidae, Chernetidae (***Chiridiochernes*** Muchmore – Sulawesi), Cheliferidae (***Aporochelifer*** Beier – Flores), Atemnidae, Garypidae, Garypinidae, Geogarypidae, Hyidae, Olpiidae, Parahyidae, Pseudochiridiidae, Syarinidae, Tridenchthoniidae, Withiidae

Scorpiones – fam. Buthidae, Chaerilidae, Hormuridae, and Scorpionidae.

Araneae – no endemic families.Some endemic genera: Araneidae – ***Plicatiductus*** Millidge et Russell-Smith (in Sulawesi); Linyphiidae – ***Dumoga*** Millidge et Russell-Smith (in Sulawesi); Eutrichuridae – ***Summacanthium*** Deeleman-Reinhold in (in Sulawesi)

Missing from the area are Ricinulei, Palaeoamblypygi, Opilioacarida, Dyspnoi, Holothyrida.

It seems that arachnogeographically Wallacea does not contain elements that are very peculiar or different from the Arachnida of the remaining Indonesia. Sensational exception is the amblypygid *Phrynus* on the Flores island.

Western Sulawesi was connected with East Borneo by late Cretaceous and early Eocene (more than 50 Ma) allowing dispertion of fauna. An island chain was established between east Sulawesi and Australia (late Miocene to late Pliocene).

Collision happened between parts of Gondwanic Outer Banda Arc and Laurasian (volcanic) Inner- Banda Arc (latest Miocene to early Pliocene). Probable land connection(s) existed south, across the Makassar Strait (from late Pliocene).

The Torres Strait as a biogeographical barrier

Discussing the first discovery of Gagrellinae in Australian mainland, Taylor (2009) says: "While Gagrellinae have not previously been reliably recorded from Australia, their discovery in northern Queensland should not represent much of a surprise. Species of Gagrellinae have been described from New Guinea (Roewer 1954a,b, 1955a) and the Solomon Islands (Rainbow 1913; Forster 1949). A land connection between New Guinea and Queensland bridging the Torres Strait would have been present when sea levels were only 10 m lower than the present time, and they have been at least that much lower for 91% of the past 250 000 years (Voris 2000). Closely related or shared taxa are known from both New Guinea and Australia in freshwater fish (…), flowering plants (…), reptiles (…), spiders (Harvey & Waldock 2000) and insects (….), among others. Taylor (1972) concluded that Torres Strait had not been a significant barrier to dispersal for most insect groups. The apparent absence of Gagrellinae from Australia to date has therefore been unusual, though not unique (species of Uropygi (Arachnida) have been described from New Guinea and the Solomon Islands, but the order is currently unknown in Australia – Rowland & Cooke 1973)". According to Szymkowiak (2007), "Despite similar geological history and close vicinity of both areas, the crab spiders show great distinction between New Guinea and Australia. 36 genera on both areas have been recorded, of which only 13 are common (*Amyciaea*, *Cymbacha*, *Diaea*, *Hedana*, *Loxoporetes*, *Mastira*, *Misumena*, *Porropis*, *Runcinia*, *Stephanopis*, *Tharrhalea*, *Tmarus* and *Xysticus*), and 167 species, of which 6 are common…. Thus, similarity of the spider fauna of the family Thomisidae at genera level is near 37%, while at species level it is 3.7%".

Tasmania. The island was joined to mainland Australia until the end of the last glacial period approximately 10,000 years ago. Much of Tasmania is still densely forested, with the South-west National Park and neighbouring areas holding some of the last temperate rain forests in the Southern Hemisphere. The Tarkine, located in the far North-West of the island, is the largest temperate rainforest area in Australia covering approximately 3800 km^2.

According to Darlington (1960), the fauna of Tasmania is depauperate, both in diversity of basic stocks and in total number of species. On the island are (or were) preserved animals that are extinct in mainland Australia.

"Tasmania has long been regarded as a biological treasure trove, supporting an astounding range of species found nowhere else, many of which have survived the perturbations of climate change during the Pleistocene" (Harvey, 1998).

New Caledonia is one of the northernmost parts of the continent Zealandia of which a 93% is submerged. It sank after rifting away from Australia 60–85 million years ago (Ma) and from Antarctica between 130 and 85 Ma. New Caledonia was separated from Australia in the late Cretaceaous (65 – 66 Ma ago), and subsequently drifted in a north-easterly direction, reaching its present position about 50 Ma ago. According to Neall & Trewick (2008), New Caledonia separated from New Zealand 83 Ma. There is also hypothesis that the islands emerged 37 Ma ago (Oligocene) and that its biota started developing by this time. Some geologists insist that New Caledonia has been entirely submerged several times and repopulated after that. However, biologists accept that parts of the land remained above water as refugia for the archaic animals and plants. Many species from the Gondwanian flora in the late Cretaceous and early Tertiary had probably survived in the temperate climate of New Caledonia and died out in Australia during its strong aridisation. This opinion is contested too.

New Zealand. To understand the history of the biota of New Caledonia, New Zealand and Lord Howe Island we have to follow up the hypothetical development of Zealandia, the New Zealand microcontinent, having existed until some 23 million years ago as result of the break away from Australia about 60-85 Ma and from Antarctic 85 – 130 Ma ago.

According to Fleming (1975), the isolation of New Zealand becomes effective for the land vertebrates (and may-be invertebrates) before the end of Cretaceous. According to Cracraft (1973) „Australia separated from Antarctica in the Eocene and with spreading rates approximately twice as fast as those for New Zealand and this differential movement between Australia-New Zealand and Antarctica formed the Tasman See"(see also Griffiths & Varne, 1972). In any case New Zealand was detached from Antarctida more than 80 Ma ago (Cracraft, 1973), together with the ancestors not only of the moa, kiwi, tuatara and other well known cases also with the ancestors of many insects and other invertatbrates. According to Cracraft (1974) "The next portion of Gondwanaland to separate was New Zealand, which was adjacent to West Antarctica and which began drifting in the late Cretaceous at about 40-45 Ma ago".

Analysis and comments

Palpigradi

In Australia, besides *Eukoenenia mirabilis* (imported), was described an indigenous member of Palpigradi: *Eukoenenia guzikae* Barranco et Harvey, 2008

In New Guinea are recorded only two species: *Eukoenenia* cf. *lawrencei* and *Koeneniodes* cf. *frondiger* (fam. Eukoeneniidae: see Condé 1980, 1981).

In New Zealand. Was not recorded

In New Caledonia. Present, non identified.

Ricinulei. Absent in all territories.

Solifugae. Absent in all territories, the closest locality is on Maluku islands (Harvey, 2013b).

Scorpiones

New Zealand: absent

Australia. In his monograph Koch (1977) enumerates for the "Austalo-Papuan Region" 29 species of scorpions of the genera *Cercophonius* (Bothriuridae), *Lychas, Isometroides*, *Isometrus* (Buthidae), *Liocheles* (Hormuridae), *Urodacus* (Urodacidae). **Endemic family** is Urodacidae, **end. genera** – *Urodacus* Peters with 19 species (incl. seven newly described by L.E. Koch), *Aops* Volschenk et Prendini, and *Isometroides* Keyserling. *Cercophonius* Peters with one sp. (Australia and Tasmania) has been recorded also from the Himalaya. As there are no strictly Papuan species (not found in Australia), after this is the final figure (32, adding the new genus and sp. *Aops oncodactylus* Volschenk et Prendini, 2008 and the two new *Urodacus*, described by Volschenk, Smith & Harvey (2000) and Volschenk, Harvey & Prendini (2012) of species of scorpions on the Australian mainland or

Table 1. Presence of Arachnida in the territories of the described area

Group	Australia (Mainland)	Tasmania	Papuan Area	New Caledonia	New Zealand
Order **Palpigradi**	+	-	+	+	-
Fam. Eukoeneniidae	+	-	+	?	-
Order **Ricinulei**	–	–	-	-	-
Order **Solifugae**	-	-	–	-	–
Order **Scorpiones**	+	+	+	+	-
Fam. Buthidae	+	–	+	-	-
Fam. Hormuridae	+	-	+	-	-
Fam. Scorpionidae	+	-	+	+	-
Order **Schizomida**	+	-	+	+	–
Fam. Hubbardiidae	+	–	+	+	-
Order **Uropygi**	-	-	+	-	–
Fam. Hypoctonidae	–	-	+	-	–
Order **Amblypygi**	+	+	+	+	-
Suborder **Neoamblypygi**	+	+	+	+	-
Fam. Charinidae	+	-	+	+	-
Order **Opiliones**	+	+	+	+	+
Suborder **Cyphophthalmi**	+	-	+	+	+
Fam. Stylocellidae	-	-	+	-	-
Fam. Pettalidae	+	-	-	-	+
Fam. Troglosironidae	-	-	-	+	-
Suborder **Eupnoi**	+	+			+
Fam. Acropsopilionidae	+	+	–	-	+
Fam. Sclerosomatidae	+				
Fam. Neopilionidae	+	-	–	-	+
Suborder **Dyspnoi**	-	-	-	-	-
Suborder **Laniatores**	+	+	+	+	+
Fam. Triaenonychidae	+	+	-	+	+
Fam. Synthetonychiidae	-	-	–	+	+
Fam. Assamiidae	+	-	–	-	-
Fam. Samoidae	+	-	–	–	–
Fam. Epedanidae	-	-	+	–	-
Fam. Zalmoxidae	-	-	+	+	-
Order **Pseudoscorpiones**	+	+	+	+	+
Suborder **Epiocheirata**	+	+	+	+	+
Fam. Chthoniidae	+	+	+	+	+
Fam. Tridenchthoniidae	+	-	+	+	-
Fam. Pseudotyrannochthoniidae	+	+	–	-	-
Fam. Feaellidae	+	-	-	–	-
Fam. Pseudogarypidae	-	+	–	–	–
Suborder **Iocheirata**	+	+	+	+	+
Fam. Hyidae	+	-	-	-	-

Table 1. Continued

Group	**Australia (Mainland)**	**Tasmania**	**Papuan Area**	**New Caledonia**	**New Zealand**
Fam. Syarinidae	-	-	+	–	-
Fam. Garypidae	+	+	-	-	+
Fam. Geogarypidae	+	-	–	–	–
Fam. Cheiridiidae	+	-	+	-	+
Fam. Pseudochiridiidae	–	–	+	-	-
Fam. Olpiidae	+	-	+	+	-
Fam. Garypinidae	+	-	+	-	+
Fam. Menthidae	+	-	-	-	–
Fam. Sternophoridae	+	-	+	-	–
Fam. Withiidae	+	-	+	-	+
Fam. Cheliferidae	+	-	+	-	+
Fam. Atemnidae	-	–	+	+	-
Fam. Chernetidae	-	–	+	-	-
Order **Araneae**	+	+	+	+	+
Suborder **Mesothelae**	–	–	–	–	–
Suborder **Orthothelae**	+	+	+	+	+
Infraorder **Mygalomorphae**	+	+	+	+	+
Fam. Barychelidae	+	-	+	+	-
Fam. Hexathelidae	+	-	–	-	+
Fam. Dipluridae	+	-	-	+	-
Fam. Nemesiidae	+	-	-	-	+
Fam. Theraphosidae	+	-	+	-	-
Fam. Cyrtaucheniidae	+	-	-	-	-
Fam. Idiopidae	+	-	–	-	+
Fam. Ctenizidae	+	-	+	-	-
Fam. Migidae	+	-	-	-	+
Infraorder **Araneomorphae**	+	+	+	+	+
Fam. Austrochilidae	-	+	–	-	-
Fam. Gradungulidae	+	-	-	-	+
Fam. Filistatidae	+	-	+	-	–
Fam. Periogopidae	+	-	-	-	+
Fam. Stenochilidae	-	-	+	-	-
Fam. Malkaridae	+	–	-	-	-
Fam. Scytodidae	+	-	+	-	+
Fam. Sicariidae	+	–	–	-	+
Fam. Ochyroceratidae	-	-	+	-	-
Fam. Telemidae	-	-	+	+	-
Fam. Pholcidae	+	+	+	+	+
Fam. Tetrablemmidae	+	-	+	+	-
Fam. Dysderidae	+	–	-	-	-
Fam. Oonopidae	+	+	-	+	+

Table 1. Continued

Group	**Australia (Mainland)**	**Tasmania**	**Papuan Area**	**New Caledonia**	**New Zealand**
Fam. Orsolabidae	+	+	-	–	+
Fam. Segestriidae	+	-	-	-	+
Fam. Hersiliidae	+	–	-	-	+
Fam. Oecobiidae	+				+
Fam. Huttoniidae	-	-	–	–	+
Fam. Mimetidae	+	+	-	–	+
Fam. Deinopidae	+	+	+	+	+
Fam. Uloboridae	+	-	+	-	+
Fam. Anapidae	+	+	+	+	+
Fam. Araneidae	+	+	+	+	+
Fam. Cyatholipidae	+	-	-	-	–
Fam. Linyphiidae	+	+	+	+	+
Fam. Nesticidae	+	-	+	–	-
Fam. Mysmetidae	-	+	–	+	–
Fam. Symphytognathidae	+	+	+	-	-
Fam. Synotaxidae	+	+	-	-	-
Fam. Tetragnathidae	+	+	+	+	+
Fam. Theridiidae	+	+	+	+	+
Fam. Theridiosomatidae	+	-	-	-	-
Fam. Ctenidae	+	–	+	-	–
Fam. Lycosidae	+	+	+	+	+
Fam. Oxyopidae	+	+	+	+	+
Fam. Gnaphosidae	+	+	+	+	+
Fam. Pisauridae	+	-	+	+	-
Fam. Psechridae	+	-	–	-	-
Fam. Stiphidiidae	+	+	+	+	+
Fam. Zoridae	+	+	-	-	+
Fam. Zoropsidae	+	-	-	-	+
Fam. Agelenidae	/	/	/	/	+
Fam. Amphinectidae	+	+	-	-	+
Fam. Amaurobiidae	+	-	-	-	+
Fam. Anyphaenidae	+	+	+	-	-
Fam. Desidae	+	+	-	+	+
Fam. Dictynidae	+	+	–	-	+
Fam. Hahniidae	+	+	-	–	+
Fam. Nicodamidae	+	+	+	-	+
Fam. Sparassidae	+	+	+	+	+
Fam. Selenopidae	+	-	+	-	-
Fam. Zodariidae	+	+	+	-	+
Fam. Tengellidae	-	-	–	-	+
Fam. Clubionidae	+	-	-	-	-

Table 1. Continued

Group	Australia (Mainland)	Tasmania	Papuan Area	New Caledonia	New Zealand
Fam. Miturgidae	+	-	+	-	+
Fam. Titanoecidae	-	-	+	-	-
Fam. Lamponidae	+	-	-	+	+
Fam. Prodidomidae	+	–	-	-	-
Fam. Trochanteriidae	+	-	-	+	-
Fam. Philodromidae	+	-	+	-	-
Fam. Thomisidae	+	+	+	+	+
Fam. Salticidae	+	+	+	+	+
Fam. Corinnidae	+	+	+	+	+
Fam. Liocranidae	+	-	+	-	–
Order **Opilioacarida**	+	-	-	-	-
Fam. Opilioacaridae	+	-	-	-	-
Order **Holothyrida**	+	-	+	+	+
Fam. Allothyridae	+	-	-	–	+
Fam. Holothyridae	-	-	+	+	-
Order **Ixodida**	+	+	+	+	+
Fam. Argasidae	+	+			+
Fam. Ixodidae	+	+	+	+	+
Order **Mesostigmata**	+	+	+	+	+
Order **Sarcoptiformes**	+	+	+	+	+
Order **Trombidiformes**	+	+	+	+	+

in Tasmania (the last has no endemic scorpions and shares with the mainland *Cercophonius squama*). We should extract from the 32 sp. *Lychas variatus* (also in Fiji), and the widespread *Isometrus maculatus, I. melanodactylus, Liocheles australasiae, L. waigiensis,* and *L. karschii.* Thus the endemic species for Australia (*Cercophonius squama* also in Tasmania) are 26. Australia and New Guinea share only the six widespread species of *Isometrus, Lychas* and *Liocheles.*

To quote Koch (1977): "The highly speciated urodacine scorpionid genus *Urodacus* is widespread in Australia but absent from both New Guinea and Tasmania. Because of the time required for the evolution of a genus, there are two possibilities: either the genus *Urodacus* has always been confined to inland Australia, or there have been species outside Australia and these became extinct. The exclusion from Tasmania of the genera *Urodacus* and *Lychas*… could be due to cold. There is however an absence of factors…which might exclude *Urodacus* from New Guinea. I consider therefore that either its species in the more peripheral northern areas of the Australian mainland have reached there relatively recently (since the last major transgression of the sea) or that species in New Guinea have been eliminated ".

In his article on the zoogeography of Australian scorpions Koch (1981) distributed the scorpion taxa in three "levels of endemism":

1. Cosmopolitan species or non-endemic species shared with Asia: *Isometrus* one species, *Liocheles* three species.
2. Species that have arisen in the Australo-Papuan area from non-endemic genera: *Lychas* three species, *Isometrus* one species.
3. Species that have arisen in Australo-Papua: *Isometroides* one species, *Cercophonius* one species, *Urodacus* 20 species.

He also classified the genera regarding the continental drift:

1. Genera derived from an ancient stock with related genera only in South America: *Cercophonius*
2. Australian genus with less certain relationships and probably ultimately derived from Asia: *Urodacus*
3. Genera in common with Asia: *Isometrus, Lychas, Liocheles*

4. Genus clearly derived from *Lychas* in Australia: *Isometroides*

Further, the scorpions are distributed into three groups: Southern, Central and Northern species.

The family **Urodacidae** is endemic.

From **Tasmania** has been recorded only *Cercophonius squama* (Bothriuridae), shared with mainland Australia. Also on Flinders I. and King I. (Koch, 1977).

New Guinea. According the monograph of Koch (1977) and the older papers of Takashima (1948, 1950) in New Guinea (incl. the islands Aru and Bougainville) live only six widespread species of the genera *Isometrus, Lychas* (Buthidae), and *Liocheles* (Hormuridae). They are shared with Australia. From the Rennell Island (the Solomon Isls) have been found three sp., including the newly described (endemic sp.) *Liocheles penta* Francke et Lourenço, 1991.

New Caledonia. Only three species (Kraepelin, 1914, Simon, 1877, Vachon, 1976).

Fam. Hormuridae

Liocheles australasiae (Fabricius)

L. neocaledonicus Simon

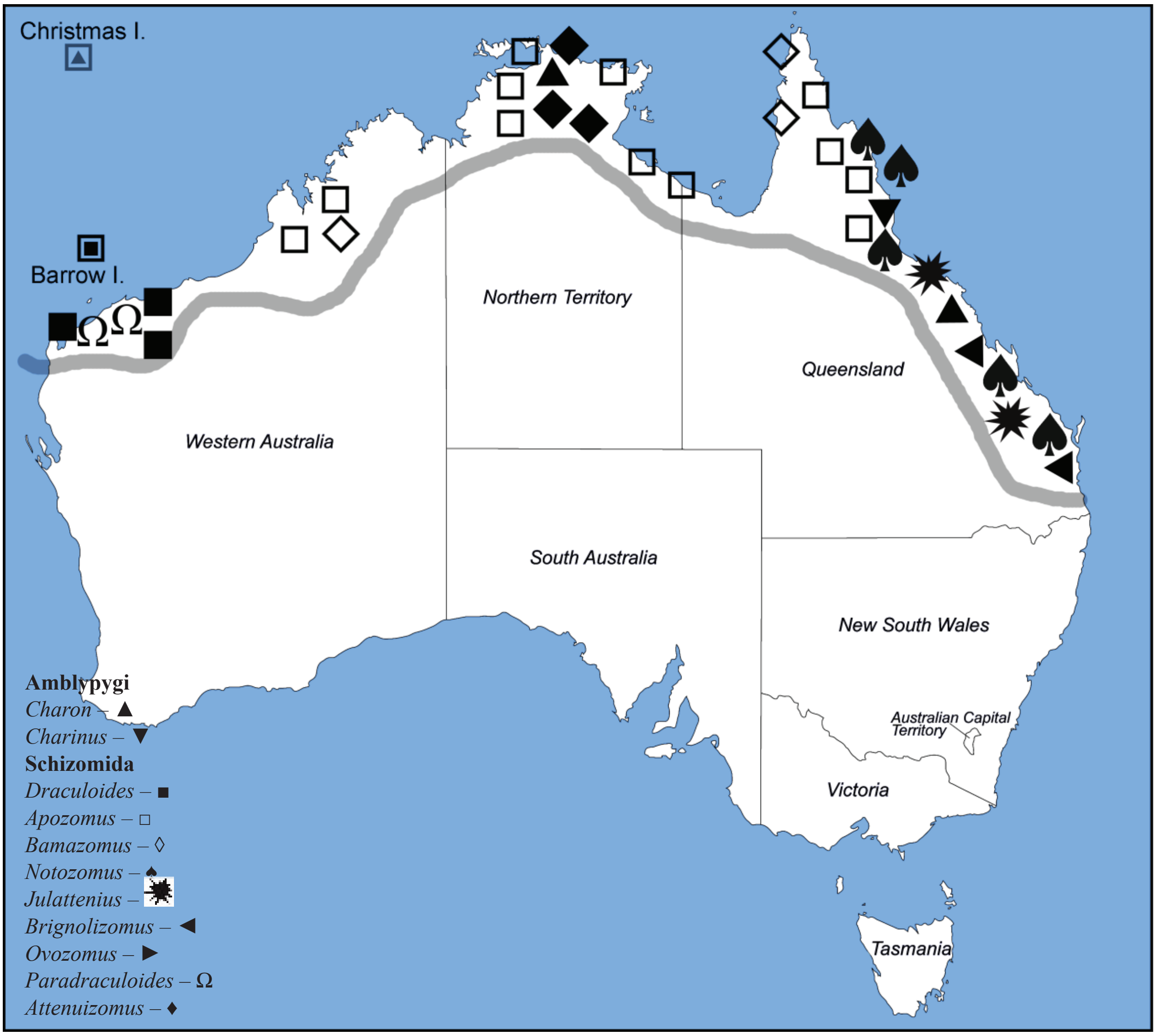
Fam. Buthidae

Isometreus (*Reddyanus*) *heimi* Vachon

Schizomida. Present in Australia and New Guinea, indet. in New Caledonia, absent in New Zealand.

Australia. See Harvey (1992, 2000a, 2000b, 2001b), Harvey, Berry, Edward & Humphreys (2008); for **Melanesia** see Hansen & Srensen (1905)

The first member of the order Schizomida from **Australia** (a troglobitic one) was described by Harvey (1988), despite the fact that the order was recorded from this continent as early as 1963. In his impor-



Map 2. Distribution of Amblypygi and Schizomida in Australia

tant paper of 1992 Harvey described five new genera (*Draculoides, Apozomus, Bamazomus, Notozomus* and *Julattenius*) and 24 new species of Schizomida. From the map 2 is clear, that all these species are known from the periphery of the continent: the far west, far north and the easternmost parts of Australia. Later Harvey (2000) added two more genera *Brignolizomus* and *Attenuizomus*, with three new species, in 2008 was added *Paradraculoides* Harvey, Berry, Edward et Humphreys. Currently (2017) in Australia are known 53 sp. of the genera ***Draculoides*** (6), *Apozomus* (11), *Bamazomus* (5), ***Notozomus*** **(17),** ***Julattenius*** (2), ***Brignolizomus*** (3), ***Paradraculoides*** (4), [*Ovozomus*] and ***Attenuizomus*** (4) (end. genera in **bold**). This is the highest number of genera and species in one country and is due mostly to the research of M. Harvey.

"Schizomus" modestus Hansen, 1905 is described from **New Guinea** and recorded also in New Britain and W. Malaysia (unverified record of Buxton, 1917). In the collection of P. Beron in Sofia there are Schizomids, collected by me in New Ireland in 1975 (Beron, 1975).

Only Hubbardiidae indet. are mentioned from **New Caledonia** (Reddell & Cokendolpher, 1995).

Amblypygi

For **Australia** see Dunn (1949), Harvey (1985), Harvey & West (1998), Monteith (1965); for **New Guinea** see Dunn (1949), Gravely (1915), Rahmadi & Kojima (2010), Thorell (1888); for **New Caledonia** see Kraepelin (1914), Simon (1895)

In **Australia** (the Northern Territory, Queensland and the Australian Christmas Island) are known six sp. of Amblypygi of the genera *Charon* Karsch (three sp.) and *Charinus* Simon (three sp.) (Charinidae). They are known only from the tropical part of the continent. All species are (so far) endemic for the areas of description. From Western Australia has been recorded another species (Harvey, Rahmadi & Aland, 2012).

In **Melanesia** are present four genera of Amblypygi:

Fam. **Charinidae**

Charinus Simon, 1892 – *Ch. australianus* (L. Koch)(Samoa, Fiji), *Ch. pescotti* Dunn (Solomon Isl.)

Sarax Simon, 1892 – *S. monodenticulatus* Rahmadi et Kojima (Papua, Waigeo), *S. newbritainensis* Rahmadi et Kojima (New Britain, New Ireland), *S. sarawakensis* (Thorell) (New Guinea, Solomon Isl.), *S. willeyi* Gravely (New Britain), *S. subterraneus* Thorell (= *papuanus*)(New Guinea, Maluku)

Fam. **Charontidae**

Charon Karsch – *Ch. grayi* (Gervais)(? = *papuanus* Thorell)(New Guinea)

Stygophrynus Kraepelin – *S. (Neocharon) forsteri* Dunn (Solomon Isl., endemic for Guadalcanal)

Members of Amblypygi recorded from **New Caledonia** include *Charinus neocaledonicus* Simon, 1895 (Charinidae), endemic species of a widespread genus.Other members of the same genus (all of them known from caves) are three subspecies of *Ch. australianus* and the endemic *Charinus pecki* Weigoldt, 2006.

Thelyphonida (Uropygi). Present in the Papuan area, absent in Australia, New Zealand and New Caledonia.

On the island of New Guinea and the nearby islands of Fergusson, New Ireland and New Britain live three species of "*Abaliella*" Strand (Pocock, 1898). One *Thelyphonus* was described by Rowland (1973a) from Guadalcanal (Solomon Islands), added to the other species from the Solomons *Thelyphonus leucurus* Pocock, 1898. The widespread *Minbosius manilanus* (C.L. Koch) lives on the Mollucas, in New Guinea and the Philippines. All they belong to Thelyphonidae, Thelyphoninae, typical for the Papuan area, Samoa, the Philippines and SE Asia. Haupt (2009a) synonymise *Abaliella* Strand, *Minbosius* Speijer and *Tetrabalius* Thorell with *Thelyphonus* Latreille.

Pseudoscorpiones.

New Guinea: see Beier (1940, 1965, 1971, 1982), Morikawa (1963). In Papua New Guinea are known Pseudoscorpions of 12 families, 35 genera and 65 specis (Harvey, 2013).

Endemic genera of pseudoscorpions in New Guinea are:

Fam. Cheliferidae – *Papuchelifer* Beier, 1965 (three species)

There are also genera (*Cacoxylus, Acanthicochernes, Gelachernes*) known only from New Guinea and the nearby Solomon Islands (Melanesian endemics)

Australia (Tasmania excluded) – 150 registered species of Pseudoscorpions of 17 families (for the whole of Australia 181 sp.)(Harvey, 2009, 2011, 2013, actualized). Other sources: Beier, 1948, 1954, 1975, Edwards & Harvey, 2008, Harvey, 1992, 2006, Harvey & Edward, 2007, Harvey & Mei Chen Leng, 2008a, 2008b, Hoff, 1947).

Endemic genera of pseudoscorpions in Australia (without Tasmania) are:

Fam. Olpiidae: ***Austrohorus*** Beier, 1966 (one sp.); ***Linnaeolpium*** Harvey et Leng (one sp.)

Fam. Cheliferidae: ***Australochelifer*** Beier, 1975 (one species)

Fam. Chernetidae: ***Conicochernes*** Beier, 1948 (four species), ***Marachernes*** Harvey, 1992 (three species)

In **Tasmania** are registered Pseudoscorpiones from the families Chthoniidae, Pseudogarypidae, Pseudotyrannochthoniidae, Garypidae, Syarinidae, Garypinidae, and others (Benedict & Malcolm, 1978, Dartnall, 1970, Harvey, 1998, Morris, 1948).

Endemic genera for Tasmania are ***Neopseudogarypus*** Morris, 1948 and ***Oreolpium*** Harvey et Šťáhlavský (Garypinidae)

New Guinea. Beier (1965, 1967, 1971, 1975, 1982) raised the Pseudoscorpions from Papua New Guinea (incl. Bismarck Islands to 65 species of 36 genera and 12 families (Chthoniidae, Tridenchthoniidae, Syarinidae, Cheiridiidae, Garypinidae, Geogarypidae, Atemnidae, Olpiidae, Sternophoridae, Cheliferidae, Chernetidae, Withiidae). Beier (1966) listed 24 genera and eight families of Pseudoscorpions from the Solomon Islands (incl. Bougenville and Buka Isls, which belong to Papua New Guinea), mostly from Guadalcanal (26 sp.). Now the known species of Pseudoscorpiones in the islands are 38, including some endemic. Species living on both Solomon Islands and New Guinea and the Bismarcks are *Acanthicochernes biseriatus* Beier, 1964 and common genus of both is *Gelachernes* Beier, 1940 – four sp. (Chernetidae).

Endemic genus for New Guinea and the Bismarck Archipelago:

Fam. **Cheliferidae**

Papuchelifer Beier, 1965 – Indonesia (Papua), Papua New Guinea (three sp.)

Endemic genus for the Solomon Islands:

Fam. **Chernetidae**

Cyclochernes Beier, 1970 – Guadalcanal (one sp.)

The known pseudoscorpions from Vanuatu (New Hebrides) are only four species belonging to four genera and the families Atemnidae, Cheliferidae, Chernetidae. *Lissochelifer insularis* (Beier) is common with New Guinea, *Paratemnoides salomonis* and *Haplochernes hebridicus* – with the Solomon Islands. Only *Hebridochernes paradoxus* is endemic species to Vanuatu.

On Fiji are registered three species of the genera *Geogarypus* (Geogarypidae) and *Haplochernes* (Chernetidae). *Geogarypus longidigitatus* (Rainbow, 1897) and *Haplochernes funafutensis* (With, 1907) were described from Funafuti (Tuvalu), *Haplochernes ellenae* Chamberlin, 1938 – from Viti Levu (Fiji).

In **New Caledonia** and the Loyalty Isls are known 14 species of Pseudoscorpiones from 10 genera of seven families: Chthoniidae, Tridenchthoniidae, Parahyidae, Syarinidae, Garypinidae, Atemnidae, and Chernetidae. Among them are the endemic species *Hebridochernes caledonicus, H. gressitti, H. maximus, Nesidiochernes caledonicus, Paraldabrinus* (**end. genus**) *novaecaledoniae, Amblyolpium ruficeps, Ideobisium antipodum, Anaulacodithella novacaledonica, A. reticulata, Sathrochthonius kaltenbachi, Tyrannochthonius troglophilus, T. zonatus* – 12 sp., or 86% endemism (Beier, 1940, 1964, 1966, 1966d, 1968, 1976, 1979; Simon, 1880).

For the **Lord Howe Island** Beier (1976) has published data on eight species of pseudoscorpions (four **endemics** for the island), seven genera, six families (Chthoniidae, Dithidae, Olpiidae, Atemnidae, Chernetidae, Cheliferidae). One **endemic** subgenus *Pholeochthonius* – troglobite. Notogean genera are *Anaulacodithella, Philomaoria.*

New Zealand. The pseudoscorpion fauna of New Zealand and the subantarctic islands in the area consists now of 70 species of 28 genera and nine families: Chthoniidae, Syarinidae, Garypidae, Garypinidae, Olpiidae, Cheiridiidae, Cheriferidae, Chernetidae, Withiidae, including six **endemic genera**. One genus (*Philomaoria*) is shared with Lord Howe Is., 11 genera – with Australia (Beier, 1966, 1967, 1969, 1973, 1976, Chamberlin, 1925, Harvey, 2009 (Pseudoscorpions of the World, version 1.2.).

Endemic genera:

Fam. **Chthoniidae**

Maorichthonius Chamberlin, 1925 (one sp.), ***Sathrochthoniella*** Beier, 1967 (one sp.),

Tyrannochthoniella Beier, 1966 (one sp.)

Fam. **Olpiidae**

Nelsoninus Beier, 1967 – New Zealand (South Isl.)(one sp.)

Fam. **Chernetidae**

Apatochernes Beier, 1948 – New Zealand (Campbell Isls, Snares Isls, Auckland Isls, Chatam Isls, Norfolk Isl. (17 sp.)

Heterochernes Beier, 1966 – New Zealand (one sp.)

Opiliones

In **Australia** (without Tasmania) are known ten indigenous families of Opiliones.

Cyphophthalmi

In Australia have been registered nine sp. of Cyphophthalmi of two genera of the family Pettalidae (Boyer & Giribet, 2007, Clouse & Giribet, 2007, Giribet, 2003, Juberthie, 1988b,). The genera are endemic in Queensland (***Austropurcellia*** Juberthie, 1988, six sp.) and Western Australia (***Karripurcellia*** Giribet, 2003, three sp.).

Eupnoi (Forster, 1949a, 1952b, 1955, Hunt, 1971, 1985, 1992, Hunt & Cokendolpher, 1991, Hunt & Hickman, 1993, Kauri, 1954, Roewer, 1914-1949, Shear, 1996, 2001, Taylor, 2009, 2011, Hickman, 1957, 1958, Hogg, 1909, Hunt, 1990, 1995)

Fam. **Neopilionidae** – ***Arrallaba*** Hunt et Cokendolpher (one sp.), ***Ballarra*** Hunt et Cokendolpher (six sp.), ***Plesioballarra*** Hunt et Cokendolpher (one sp.), ***Hypomegalopsalis*** Taylor (one sp.)

Hesperopilio Shear (WA, one sp.). Unclear family withion Phalangioidea.

Fam. Sclerosomatidae – *Gagrella* Stoliczka (one sp.)

Dyspnoi – Fam. Acropsopilionidae – *Acropsopilio* Silvestri, 1905 – Queensland (one sp.), *Austropsopilio* Forster, 1955 (=*Tasmanopilio* Hickman, 1957) – NSW, Queensland (two endemic sp., the genus known also from Tasmania and Chile)]

Laniatores

In Australia (without Tasmania) are known Laniatores of 54 genera (39 genera in Triaenonychidae) and six families (Assamiidae, Phalangodidae, Podoctidae, Samoidae, Zalmoxidae, Triaenonychidae).

Endemic genera of Opiliones Laniatores for Australia (Tasmania excluded) are:

Fam. Triaenonychidae – ***Breviacantha*** Kauri, 1954 (one sp.), ***Callihamina*** Roewer, 1942 (one sp.), ***Callihamus*** Roewer, 1931 (one sp.), ***Cluniella*** Forster, 1955 (three sp.), ***Heteronuncia*** Roewer, 1920 (one sp., Queensland), ***Holonuncia*** Forster, 1955 (13 sp., ACT, NSW, Victoria), ***Perthacantha*** Roewer, 1931 (one sp.), ***Yatala*** Roewer, 1942 (SA, one sp.), ***Conoculus*** Forster, 1949 (one sp.), ***Dingupa*** Forster, 1952 (one sp., WA), ***Dipristes*** Roewer, 1931 (one sp.)

Fam. Assamiidae – ***Octobunus*** Roewer, 1923, ***Metamermerus*** Roewer, 1920, ***Dampetrus*** Karsch, 1880, ***Wintonia*** Roewer, 1923

Fam. Samoidae – ***Badessania*** Roewer, 1915

Dyspnoi

Fam. **Acropsopilionidae**

Austropsopilio Forster, 1955 (= *Tasmanopilio* Hickman, 1957) –three sp.

Laniatores

In Tasmania are registered Laniatores of family Triaenonychidae (Hickman, 1957, 1958, Hogg, 1909, Hunt, 1990, 1995, Roewer, 1914)

Endemic genera are:

Fam. **Triaeninychidae**

Allonuncia Hickman, 1958 (one sp.), ***Ankylonuncia*** Hickman, 1958 (three sp.), ***Bryonuncia*** Hickman, 1958 (one sp.), ***Calliuncus*** Roewer, 1931 (five sp.), ***Cluniella*** Forster, 1955 (three sp.), ***Hickmanoxyomma*** Hunt, 1990 (seven sp.), ***Leionuncia*** Hickman, 1958 (one sp.), ***Notonuncia*** Hickman, 1958 (three sp.), ***Nucina*** Hickman, 1958 (two sp.), ***Nuncioides*** Hickman, 1958 (two sp.), ***Odontonuncia*** Hickman, 1958 (one sp.), ***Parattahia*** Roewer, 1914 (one sp.), ***Rhynchobunus*** Hickman, 1958 (one sp.), ***Stylonuncia*** Hickman, 1958 (one sp.), ***Tasmanonyx*** Hickman, 1958 (one sp.), ***Pyenganella*** Hickman, 1958 (one sp.), ***Tasmanonuncia*** Hickman, 1958 (one sp.), ***Thelbunus*** Hickman, 1958 (one sp.), ***Allobunus*** Hickman, 1958 (one sp.), ***Chilobunus*** Hickman, 1958 (one sp.), ***Chrestobunus*** Roewer, 1914 (three sp.), ***Eubunus*** Hickman, 1958 (one sp.), ***Glyptobunus*** Roewer, 1914 (two sp.), ***Mestonia*** Hickman, 1958 (two sp.), ***Miobunus*** Roewer, 1915 (six sp.), ***Phanerobunus*** Roewer, 1915 (four sp.), ***Phoxobunus*** Hickman, 1958 (two sp.)

From **Melanesia** have been recorded Opiliones of at least 29 genera and the families Stylocellidae, Sclerosomatidae, Assamiidae, Podoctidae, Epedanidae, Samoidae, Zalmoxidae (Forster, 1949b, Goodnight & Goodnight, 1947, Loman, 1906, Roewer, 1911, 1912, 1913, 1915b, 1935-36, 1949, 1963, Suzuki, 1982).

The collection of P. Beron from New Guinea, New Britain and New Ireland is still under study.

Cyphophthalmi

Until recently, Cyphophthalmi were not registered east of the Lyddeker Line. However, two sp. of *Stylocellus* Westwood,1874, genus known from Malaysia, Indonesia, Singapore, and Palawan (Philippines), have been found in Papua (Indonesian New Guinea)(Clouse & Giribet, 2007). These animals don't cross salt water areas, so a problem arises about their establishment in New Guinea.

Eupnoi

Fam. **Sclerosomatidae** – *Gagrella* Stoliczka

Dyspnoi – not recorded from Melanesia

Laniatores

In Melanesia are recorded Laniatores of 27 genera and the families Assamiidae, Podoctidae, Epedanidae, Samoidae, Zalmoxidae.

Endemic genera in New Guinea are:

Fam. **Assamiidae**

Granobunus Roewer, 1912 (one sp.), *Euwintonius* Roewer (two sp.), ***Heteropygoplus*** Roewer, 1915 (one sp.), ***Apygoplus*** Roewer, 1912 (three sp.), ***Macrodampetrus*** Roewer, 1915 (two sp.), ***Metadampetrus*** Roewer, 1915 (two sp.), ***Metamosoia*** Roewer, 1915 (one sp.), ***Mosoia*** Roewer, 1912 (one sp.), ***Neonothippus*** Roewer, 1912 (one sp.), *Dukkeriana* Roewer (one sp.), ***Sermowaius*** Roewer

Fam. **Podoctidae** (incl. Erecananinae and Ibaloniinae)

Asproleria Roewer, 1949 (one sp.), ***Heteroibalonius*** C.J. Goodnight et M.L.Goodnight, 1947 (one sp.), ***Heteropodoctis*** Roewer, 1912 (one sp.), ***Orobunus*** Goodnight et Goodnight, 1947 (one sp.), ***Paramesoceras*** Roewer, 1915 (one sp.), ***Podoctinus*** Roewer, 1923 (one sp.), ***Proholozoster*** Roewer, 1915 (one sp.)

Santobius Roewer, 1949 (= *Mesoceras* Soerensen, 1886, preoccup., =

Mesoceratula Roewer, 1949) – Vanuatu, Fiji (two sp.)

Fam. **Samoidae**

Badessa Sørensen, in L. Koch 1886 – Fiji (one sp.)

Fijicolana Roewer, 1963 – Melanesia (one sp.)

Fam. Zalmoxidae – in New Guinea and the nearby islands live 26 sp. of the genus *Zalmoxis* Sorensen (the only Zalmoxid in the Eastern Hemisphere)

New Caledonia (Juberthie, 1979, Kury & Machado, 2009, Shear, 1993)**;**). Most interesting is the endemic family of **Cyphophthalmi Troglosironidae** with one genus ***Troglosiro*** Juberthie, 1979 and 13 sp.

Dyspnoi – missing

Laniatores

From New Caledonia and the Loyalty Isls are known Laniatores from the families Triaenonychidae, Zalmoxidae (eight endemic sp. of genus *Zalmoxis*)(Simon, 1881, Roewer, 1912, 1914, 1949, Goodnight & Goodnight, 1948, Sharma et al., 2012).

Endemic Laniatores in New Caledonia are the following genera:

Fam. **Triaenonychidae**

Diaenobunus Roewer, 1914 (one sp.), ***Triconobunus*** Roewer, 1914 (one sp.), ***Santobius*** Roewer, 1949 (= *Mesoceras* Soerensen, 1886, preoccup., = *Meso ceratula* Roewer, 1949) – Vanuatu, Fiji (two sp.)

In **New Zealand** (s. str.) live 111 species of Opiliones (Forster, 1975, actualized), from the families Pettalidae, Acropsopilionidae, Neopilionidae (incl. Monoscutidae), **Synthetonychiidae**, Triaenonychidae, (Boyer & Giribet, 2009, Crawford, 1992, Forster, 1947, 1948, 1952, 1954, 1964, 1975, 16 papers from 1943 to 1975, Hirst, 1925, Roewer, 1931, Taylor, 2004, 2009, 2011, 2013).

Cyphophthalmi

In New Zealand have been recorded 23 sp. of the fam. Pettalidae:

Rakaia Hirst, 1925 – 12 species (**endemic genus**)

Aoraki Boyer et Giribet, 2007 – eight specis (**endemic genus**)

Neopurcellia Forster, 1948 – South Island (three species)(**endemic genus**)

Eupnoi

Fam. **Neopilionidae** (incl. Monoscutidae) – ***Forsteropsalis*** Taylor (nine sp.), ***Mangatangi*** Taylor (one sp.), *Pantopsalis* Simon (nine sp.); **Monoscutinae** (end. subfamily): ***Acihasta*** Forster, ***Monoscutum*** Forster, ***Templar*** Taylor

Dyspnoi

Fam. **Acropsopilionidae** – *Acropsopilio* Silvestri, 1904 (one sp.)

Laniatores

In New Zealand are registered 68 sp. of Laniatores of 15 genera and two families. **Endemic** supraspecific taxa:

Fam. **Synthetonychiidae – end. family**

Synthetonychia Forster, 1954 (14 sp.)

Fam. **Triaenonychidae**

Hedwiga Roewer, 1931 (one sp.), ***Hendea*** Roewer, 1931 (14 sp.), ***Hendeola*** Forster, 1954 (two sp.), ***Metanuncia*** Roewer, 1914 (one sp., Stewart Island), ***Neonuncia*** Roewer, 1914 (five sp.), ***Prasma*** Roewer, 1931 (three sp.), ***Prasmiola***

Forster, 1954 (one sp.), ***Psalenoba*** Roewer, 1931 (one sp.), ***Triregia*** Forster, 1948 (three sp.), ***Algidia*** Hogg, 1920 (eight sp.), ***Cenefia*** Roewer, 1931 (four sp.), ***Muscicola*** Forster, 1954 (one sp.), ***Pristobunus*** Roewer, 1931 (two sp.)

Subfam. **Sørensenellinae – end. subfamily** (eight sp.)

Karamea Forster, 1954 (four sp.), ***Sørensenella*** Pocock, 1903 (four sp.)

Araneae. For Australia (cont.) see Baehr & Baehr (1987), Crews & Harvey (2011), Dunn (1951), Harms & Harvey (2009, 2013), L. Koch (1873), Main (1969, 1976, 1981a, 1981b, 1987), Platnick (2000, 2004), Platnick & Forster (1989), Raven (1978, 1980, 1984, 1985, 1991), Rix (2006), Rix & Harvey (2010, 2011, 2012a, 2012b), Thorell (1881), Zabka (1993); **Tasmania**. Gertsch (1958), Hickman (1957, 1958, 1969), Platnick & Forster

(1989), Raven (1978);

New Guinea. Balogh (1936), Baehr & Baehr (1993), Baert (1979, 1980, 1982, 1984), Bourne (1980), Brignoli (1981), Chrysanthos (several papers), Lehtinen & Saaristo (1980), Main (1982), Robinson (1982), Thorell (1881), Versteirt, Baert & Jocqué (2010), York (1982); **New Caledonia**. Berland (1924, 1929), Platnick (1993), Platnick & Forster (1993), Rainbow (1920), Raven (1994), Raven & Churchill (1991), Rix & Harvey (2010), Simon (1889, 1892)

Following the table of Main (1981) in **Australia** are registered 46 families of spiders. Without Salticidae, they contained 276 indigenous genera, of which 77 (27.9%) are endemic; including the Salticidae they are 338 genera of which 88 (26%) are endemic. The family Salticidae contained 62 genera, of which 11 endemic. Other families with many genera are Araneidae (33, six endemic), Lycosidae (25, two endemic) and Thomisidae (23, five endemic).

Since 1981 many new records of spiders in Australia have changed these numbers. Now (2017) in Australia are registered at least 73 families. The families Gradungulidae, Periogopidae, Holarchaeidae (Tasmania), Pararchaeidae (also New Caledonia), Nicodamidae (also New Guinea) are shared only (or almost only) with New Zealand, the families Hexathelidae (Hexathelinae), Migidae (Calathotarsinidae), Malkaridae, Amphinectidae are shared with southern South America (Argentina and Chile).

Endemic genera of spiders in Australia (Tasmania excluded) are:

Fam. **Hexathelidae**

Hexathelinae

Atrax O. P-Cambridge, 1877 (three sp.), ***Bymainiella*** Raven, 1978 (four sp.),

Hadronyche L. Koch, 1873 (31 sp., incl. one from Tasmania), ***Paraembolides*** Raven, 1980 (eight sp.), ***Teranodes*** Raven, 1985 (two sp.)

Fam. **Dipluridae**

Subfam. Euagrinae

Australothele Raven, 1984 (seven sp.), ***Caledothele*** Raven, 1991 (seven sp., one is from New Caledonia), ***Carrai*** Raven, 1984 (one sp., New South Wales), ***Cethegus*** Thorell, 1881 (12 sp.), ***Namirea*** Raven, 1984 (seven sp.) incertae sedis

Troglodiplura Main, 1969 (one sp.)

Fam. Anapidae

Chasmocephalon O. P-Cambridge, 1889 (eight sp.), ***Maxanapis*** Platnick et Forster, 1989 (nine sp.), ***Nortanapis*** Platnick et Forster, 1989 (one sp.), ***Octanapis*** Platnick et Forster, 1989 (two sp.), ***Queenslanapis*** Platnick et Forster, 1989 (one sp.), ***Risdonius*** Hickman, 1939 (three sp.), ***Spinanapis*** Platnick et Forster, 1989 (nine sp.), ***Victanapis*** Platnick et Forster, 1989 (one sp.)

Fam. **Pararchaeidae**

Westrarchaea Rix, 2006 – Western Australia (three sp.)

Fam. **Gallienelliidae**

Meedo Main, 1987 (13 sp.), ***Neato*** Platnick, 2002 (seven sp.), ***Oreo*** Platnick, 2002 (five sp.), ***Peeto*** Platnick, 2002 (one sp., Queensland), ***Questo*** Platnick, 2002 (one sp., Australia, Victoria)

Fam. **Lamponidae**

Asadipus Simon, 1897 (20 sp.), ***Bigenditia*** Platnick, 2000 (two sp.), ***Centroina*** Platnick, 2002 (11 sp.), ***Centrothele*** L. Koch, 1873 (10 sp.), ***Centsymplia*** Platnick, 2000 (one sp.), ***Graycassis*** Platnick, 2000 (10 sp.), ***Lampona*** Thorell, 1869 (56 sp., five of them shared with Tasmania, two with New Zealand, one in New Guinea), ***Lamponata*** Platnick, 2000 (one sp.), ***Lamponega*** Platnick, 2000 (three sp.), ***Lamponella*** Platnick, 2000 (10 sp., one shared with Tasmania), ***Lamponicta*** Platnick, 2000 (one sp.), ***Lamponina*** Strand, 1913 (six sp.), ***Lamponoides*** Platnick, 2000 (one sp.), ***Lamponova*** Platnick, 2000 (one sp., shared with New Guinea), *Lamponusa* Platnick, 2000 (one sp.), ***Longepi*** Platnick, 2000 (eight sp.), ***Notsodipus*** Platnick, 2000 (18 sp.), ***Paralampona*** Platnick, 2000 (eight sp.), ***Platylampona*** Platnick, 2004 (one sp.), ***Prionosternum*** Dunn, 1951 (three sp., one shared with Tasmania), ***Pseudolampona*** Platnick, 2000 (12 sp.), ***Queenvic*** Platnick, 2000 (four sp.)

In **Tasmania** have been recorded two **endemic** subfamilies (Plesiothelinae and Hickmanniinae) and some **endemic genera** of spiders:

Fam. **Hexathelidae**

Plesiothelinae – Tasmania (end.)

Plesiothele Raven, 1978 – one sp.

Fam. **Anapidae**

Acrobleps Hickman, 1979 – (one sp.), ***Hickmanapis*** Platnick et Forster, 1989 (two sp.), ***Tasmanapis*** Platnick et Forster, 1989 (one sp.)

Fam. **Austrochilidae** – Chile, Argentina, Tasmania (nine sp.)

Hickmaniinae (as family Hickmaniidae)

Hickmania Gertsch, 1958 – one sp. – *Hickmania troglodytes* (Higgins et Petterd, 1883), Cave

Fam. **Orsolabidae**

Cornifalx Hickman, 1979 (one sp.), ***Hickmanolobus*** Forster et Platnick, 1985, ***Olgania*** Hickman, 1979, ***Carathea*** Moran, 1986, ***Tupua*** Platnick *in* Forster, Platnick et Coddington, 1990, ***Cicirra*** Simon, 1876, ***Namandia*** Lehtinen, 1967, ***Ommatauxesis*** Simon, 1903, ***Toxops*** Hickman, 1940, ***Lithodamus*** Harvey

Fam. **Malkaridae**

Carathea Moran, 1986 (two sp.)

Fam. **Micropholcommatidae**

Epigastrina Rix et Harvey, 2010 (three sp.)

Fam. **Synotaxidae**

Tupua Platnick, 1990 (four sp.)

Fam. **Lycosidae**

Tasmanicosa Roewer, 1959 (one sp.)

Fam. **Psechridae**

Tjurunga Lehtinen, 1967 (one sp.)

Fam. **Miturgidae** (Zorinae)

Odomasta Simon, 1909 (one sp.)

Fam. **Araneidae**

Collina Urquhart, 1891 (one sp.)

Fam. **Amphinectidae**

Tanganoides Davies, 2005 (six sp., incl. one in Victoria), ***Tasmabrochus*** Davies, 2002 (three sp.), ***Tasmarubrius*** Davies, 1998 (five sp.), ***Teeatta*** Davies, 2005 (three sp.)

Fam. **Amaurobiidae** – only endemic species

Fam. **Desidae**

Cicirra Simon, 1886 (one sp.), ***Namandia*** Lehtinen, 1967 (one sp.), ***Ommatauxesis*** Simon, 1903 (one sp.), ***Toxops*** Hickman, 1940 (one sp.)

Fam. **Hahniidae**

Neoaviola Butler, 1929 (one sp.)

The spiders of **New Guinea**

In New Guinea and the Bismarck Archipelago (incl. Buka and Bougainville) have been recorded spiders of at least 54 families (BALOGH, 1936, BAERT, 1980, 1984, BRIGNOLI, 1981). The collection, brought by me (43 sp. of 15 families), was identified only partially by BRIGNOLI (1981), but his untimely death did not allow him to describe the many new taxa in this collection. It as noted that some species related to groups believed "typical" of New Zealand (Stiphidiidae). The preliminary conclusion of BRIGNOLI (1981) is: "It is still too early to appreciate the value of the proposal of LEHTINEN (1980), of abandoning the traditional Oriental and Austral regions in favour of an Indo-Pacific and a South Gonwanian region, but I would like to observe that, if it is probably possible to accept the limited value of Wallace's and Weber's lines for spiders, I do not see every definite border between the two new regions proposed by Lehtinen".

Some endemic genera of spiders in the "Papuan area" are:

Fam. **Telemidae**

Jocquella Baert, 1980 – New Guinea (two sp.)

Fam. **Theridiidae** (Hadrotarsinae)

Yoroa Baert, 1984 – New Guinea (two sp.)

Fam. **Philodromidae**

Pseudopsellonus Balogh, 1936 (one sp.), ***Senoculifer*** Balogh, 1936 (three sp.)

Fam. **Sparassidae**

Exopalistes Hogg, 1914 – New Guinea

Strandiellum Kolosváry, 1934 – New Guinea

Fam. **Lycosidae**

Satta Lehtinen et Hippa, 1979 – New Guinea

Fam. **Salticidae**

Allococalodes Wanless, 1982 – New Guinea

Aruana Strand, 1911 – New Guinea, Aru

Bulolia Zabka, 1996 – New Guinea

Chalcolemia Zhang et Maddison, 2012 – New Guinea

[***Coccorchestes*** Thorell, 1881 – 38 sp. from New Guinea, one from New Britain, one from Queensland]

Cucudeta Maddison, 2009 – New Guinea

Diolemus Thorell, 1870 – 16 sp. in New Guinea, 2 in Moluccas

Furculattus Balogh, 1980 – New Guinea, New Britain (one sp.)

Leptathamas Balogh, 1980 – New Guinea

Opistoncana Strand, 1913 – New Ireland

Papuaneon Maddison, 2016 – New Guinea

Paraharmochirus Szombathy, 1915 – New Guinea

Porius Thorell, 1892 – New Guinea (two sp.)

Saitissus Roewer, 1938 – New Guinea

Tabuina Maddison, 2009 – New Guinea (three sp.)

Tarodus Pocock, 1899 – New Britain

Variratina Zhang et Maddison, 2012 – New Guinea

Viribestus Zhang et Maddison, 2012 – New Guinea

Zabkattus Zhang et Maddison, 2012 – New Guinea

It is to notice, that many families of spiders, known from Northern Australia, are not (yet?) registered in New Guinea.

The list of Araneae of **Fiji** contains 122 sp. of spiders (part of them indet.), of 35 families (EVENHUIS, 2006). ***Lakarobius*** Berry et al.(Salticidae) is endemic genus.

In **New Caledonia** have been recorded spiders of Anapidae, Dipluridae, Desidae, Pararchaeidae. Nearly 200 spider species have been recognized thus far (until 1993 have been 112 genera and 194 sp., after Platnick, 1993). Platnick & Forster (1993) synonymized the "endemic family" Bradystichidae Simon, 1884 with Pisauridae. Raven (1994) explored the Mygalomorphae of New Caledonia.

Endemic genera of spiders are:
Fam. **Dipluridae**
Stenygrocercus Simon, 1892 (six sp.)
Fam. **Anapidae**
Caledanapis Platnick et Forster, 1989 (six sp.), ***Mandanapis*** Platnick et Forster, 1989 (one sp.), ***Montanapis*** Platnick et Forster, 1989 (one sp.)
Fam. **Barychelidae**
Barychelinae
Barycheloides Raven, 1994 (five sp.), ***Barychelus*** Simon, 1889 (two sp.), ***Encyocrypta*** Simon, 1889 (32 sp.), ***Natgeogia*** Raven, 1994 (one sp.), ***Orstom*** Raven, 1994 (four sp.), ***Questocrypta*** Raven, 1994 (one sp.)
Fam. **Desidae**
Canala Gray, 1992 (two sp.)
Fam. **Lamponidae**
Centrocalia Platnick, 2000 (three sp.)
Fam. **Theridiidae**
Anatea Berland, 1927 (one sp.)
Fam. **Pisauridae**
Bradystichus Simon, 1884 (five sp.)
Pseudohostus Rainbow, 1915 (five sp.)
Fam. **Miturgidae** (Zorinae)
Zoroides Berland, 1924 (one sp.)
Fam. **Salticidae**
Corambis Simon, 1901 (two sp.), ***Lystrocteisa*** Simon, 1884 (one sp.), ***Rhondes*** Simon, 1901 (one sp.),

New Zealand.

It would be hardly possible to assess the entire endemism and richness of New Zealand arachnofauna some 40 years ago. Forster (1949c, 1973, 1975) analysed the particularities of this amazing fauna, but since (mostly with the efforts of Forster himself and his co-laborators) new data have been accumulated. The orders Scorpiones, Ricinulei, Uropygi, Amblypygi, Schizomida, Opilioacarida are completly missing (naturally) from New Zealand and the surrounding islands. Some other sources: Blest (1979), Forster (1955, 1959, 1964, 1970), Forster & Blest (1979), Forster & Platnick (1977, 1984), Forster & Wilton (1968, 1973), Paquin, Vink & Dupérré (2010), Parrott (1942), Platnick & Forster (1989), Rix (2006), Vink & Dupérré (2010), Zabka, Pollard & Anstey (2002) and others.

From **New Zealand** have been recorded one endemic family (Huttoniidae), one subfamily (Pahorinae), 93 end. genera and at least 93% of the species of spiders are endemic:

Fam. **Huttoniidae: *Huttonia*** Pickard-Cambridge),

Fam. **Hexathelidae**: ***Hexathele*** Ausserer, ***Porrhothele*** Simon)

Fam. **Anapidae**: ***Novanapis*** Platnick et Forster, ***Paranapis*** Platnick et Forster, ***Zealanapis*** Platnick et Forster

Fam. **Pararcheidae**: ***Forstrarchaea*** Rix, ***Pararchaea*** Forster

Fam. **Cycloctenidae**: ***Plectophanes*** Bryant, ***Toxopsiella*** Forster, ***Uzakia*** Koçak et Kemal, ***Cantuarea*** Hogg

Fam. **Gradungulidae**: ***Gradungula*** Forster, ***Pianoa*** Forster, ***Spelungula*** Forster Fam. Orsolabidae: ***Anopsolobus*** Forster et Platnick, ***Ascuta*** Forster, ***Bealeyia*** Forster et Platnick, ***Dugdalea*** Forster et Platnick, ***Duripelta*** Forster, ***Maoriata*** Forster et Platnick, ***Orongia*** Forster et Platnick, ***Paralobus*** Forster et Platnick, ***Pounamuella*** Forster et Platnick, ***Subantarctia*** Forster,***Tangata*** Forster et Platnick, ***Tautukua*** Forster et Platnick, ***Turretia*** Forster et Platnick, ***Waiporia*** Forster et Platnick, ***Wiltonia*** Forster et Platnick

Fam. **Mecysmauchenidae**: ***Aotearoa*** Forster et Platnick, ***Zearchaea*** Wilton, ***Parapua*** Forster, ***Pua*** Forster, ***Forstarchaea*** Rix, ***Tekelloides*** Forster, ***Waitkerra*** Opell, ***Nomana*** Forster, ***Pahora*** Forster, ***Pahoroides*** Forster, ***Runga*** Forster, ***Wairua*** Forster, ***Meringa*** Forster, ***Mangua*** Forster, ***Ahua*** Forster et Wilton, ***Huka*** Forster et Wilton, ***Mahura*** Forster et Wilton, ***Neoramia*** Forster et Wilton, ***Oramia*** Forster et Wilton, ***Oramiella*** Forster et Wilton, ***Orepukia*** Forster et Wilton, ***Paramyro*** Forster et Wilton, ***Porotaka*** Forster et Wilton, ***Tararua*** Forster et Wilton, ***Tuapoka*** Forster et Wilton, ***Anhunga*** Forster et Wilton, ***Maloides*** Forster et Wilton, ***Muritaia*** Forster et Wilton, ***Pakeha*** Forster et Wilton, ***Paravoka*** Forster et Wilton, ***Poaka*** Forster et Wilton, ***Gasparia*** Forster et Wilton, ***Gohia*** Forster et Wilton, ***Goyenia*** Forster et Wilton, ***Hapona*** Forster, ***Helsinia*** Forster, ***Hulua*** Forster et Wilton, ***Lamina*** Forster, ***Mangareia*** Forster, ***Matachia*** Dalmas, ***Mesudus*** Özdikmen, ***Neomyro*** Forster et Wilton, ***Notomatachia*** Forster, ***Nuisiana*** Forster et Wilton, ***Otagoa*** Forster, ***Panoa*** Forster, ***Rapua*** Forster, ***Toxopsoides*** Forster et Wilton, ***Tuakana*** Forster

Fam. **Dictynidae**: ***Paradictyna*** Forster, ***Viridictyna*** Forster, ***Karanga*** Forster, ***Poroides*** Forster, ***Forstertyna*** Harvey, ***Megadictyna*** Dahl, ***Haurokoa*** Koçak et Kemal, ***Zealoctenus*** Forster et Wilton, ***Pacificana*** Hogg, ***Kaitawa*** Forster, ***Matua***

Forster, ***Nauhea*** Forster, ***Notiodrassus*** Bruyant, ***Zelanda*** Özdikmen.

Recently an overview of **New Zealand** spiders has been published by Paquin, Vink & Dupérré (2010). Best characterized is the spider fauna of New Zealand by the book review of Duffey (2010, Newsl. Br. Arachnol. Soc., 119): "Britain and New Zealand are comparable in area but the former has 658 species while the latter has 1126 described and another 536 awaiting description, making a present total of about 1662 species in 236 genera and 57 families. As new species are still being found the authors think the true total could be about 2000. One can't help feeling this is a conservative estimate because even the well-worked fauna in Britain, which recorded a total of 584 in 1958, has since added another 74 species. The best known New Zealand arachnologist, R.R. Forster, though the New Zealand total could be as much as 2500 species. Whether 2000 or 2500, the fascinating question is why New Zealand has such a rich fauna when no country in Europe reaches even the lower figure. France, one of the largest, is two and half times the area [of NZ], but has a total of 1569 sp. (Le Peru 2007). The family Linyphiidae is the largest in New Zealand but only 12% of the total and they are all in the subfamily Linyphiinae. Endemic Erigoninae apparently do not exist as all known species are introduced. In Britain about 40% of the spider fauna are Linyphiidae, of which over 70% are Erigoninae".

The endemism of New Zealand spiders is amazing: one family, one subfamily and at least 93 genera and 93% of species. In total, in New Zealand are recorded 57 families of spiders.

Opilioacarida

In **Australia** are found unidentified Opilioacarida (Walter & Proctor, 1998).

Holothyrida (Beron, 2014).

Australia. Domrow (1955), Van der Hammen (1961, 1983), Womersley (1935);

New Guinea. Thorell (1882), Beron (2014), Canestrini (1897), Lehtinen (1981, 1995), Van der Hammen (1983);

New Zealand. Womersley (1935)

Endemic family (Allothyridae) for **Australia** and **New Zealand** (?! the same species *Allothyrus* (?) *australasiae* (Womersley).

In Australia also the endemic species *Allothyrus constrictus* Domrow, 1955.

In **New Guinea** are found 11 sp. of another family (Holothyridae), out of all 29 species in the order Holothyrida (New Guinea looks like the center of speciation of these strange Arachnids). All species are endemic, so are the genera *Hammenius* Lehtinen and *Thonius* Lehtinen. *Hammenius niger* (Thon) lives on Silhouette Isl. (the Seychelles), a highly interesting distribution for these conservative animals.

In **New Caledonia** live two genera of Holothyridae, one of them endemic (*Haplothyrus* Lehtinen – two sp.), another one (*Lindothyrus* Lehtinen) is shared with Lord Howe Is. (Berlese, 1923, Lehtinen, 1995). On New Caledonia endemic sp. is *Lindothyrus rubellus* Lehtinen, 1995. Both genera belong to the family Holothyridae and not to the Allothyridae, known from Australia and New Zealand. The New Guinean genera also are not represented in New Caledonia. The same observation is valid for the Holothyrida of Lord Howe Island (*Lindothyrus elongatus* Lehtinen, 1995).

Parasitiformes (some Ixodida and Mesostigmata)

Ixodida

New Zealand has eleven named species of ticks, four of which **endemic:** *Aponomma sphenodonti* (Dumbleton, 1953)(on tuatara), *Ixodes anatis* Chilton, 1904 (on kiwi and Anatidae), *I. jacksoni* Hoogstraal, 1967 (from nest of *Stictocarbo* = *Phalacrocorax punctatus*) and *Carios quadridentatus* Heath, 2012 (from the endemic bat *Mystacina tuberculata*). Six are known also from Australia (Dumbleton, 1953, 1963, Heath, 1977, 2012, Heath et al., 2011, Hoogstraal, 1967, Spain & Luxton, 1971)

Acariformes: Haliday (1998), Spain & Luxton (1971)

Sarcoptiformes

Oribatida: Hammer (1966, 1967, 1968), Coloff & Cameron (2014). Thanks to the research of M. Hammer, from New Zealand have been listed at least 50 families of Oribatida (Spain & Luxton,1971)

Trombidiformes (some).

Australia. Beron (2008), Domrow & Lester (1985), Haliday (1998); **New Caledonia.** Southcott (1966);

New Zealand. Hirst (1926), Southcott (1988), Zhang (2000)

Prostigmata

Fam. **Smarididae – end. genus *Sphaerotarsus*** Womersley, 1936

Fam. **Erythraeidae**

Endemic genera in Australia: ***Erythrellus*** Southcott, 1946, ***Erythrites*** Southcott, 1946, ***Erythroides*** Southcott, 1946, ***Rainbowia*** Southcott, 1961, ***Pussardia*** Southcott, 1961, ***Mypongia*** Southcott, 1961, ***Wartookia*** Southcott, 1961

End. species in New Caledonia: *Charletonia rageaui* Southcott, 1966

Endemic genera in New Zealand: ***Neosmaris*** Hirst, 1926, ***Taranakia*** Southcott, 1988, ***Ramsayella*** Zhang, 2000

Charcteristics of the areas analysed in this article

Kingdom Notogaea – no endemic orders or suborders among Arachnida

Region Australia

Palpigradi – some brought from Europe, one local (endemic?) sp.

Solifugae – missing

Amblypygi – fam. Charinidae (*Charinus* Simon)

Uropygi – not found in Australia

Schizomida – fam. Hubbardiidae (*Apozomus* Harvey, ***Attenuizomus*** Harvey, *Bamazomus* Harvey, ***Brignolizomus*** Harvey, ***Draculoides*** Harvey, *Ovozomus* Harvey, ***Jullatenius*** Harvey, ***Notozomus*** Harvey, ***Paradraculoides*** Harvey et al.

Scorpiones – Endemic family is **Urodacidae**, end. genera – ***Urodacus*** Peters with 19 species, ***Aops*** Volschenk et Prendini, ***Isometroides*** Keyserling and ***Cercophonius*** Peters (Australia and Tasmania).

Pseudoscorpiones – no endemic families; 150 sp., 17 fam. Endemic genera of pseudoscorpions in Australia (without Tasmania) are: fam. Olpiidae – ***Austrohorus*** Beier (one sp.), ***Linnaeolpium*** Harvey et Leng (one sp.), fam. Cheliferidae – ***Australochelifer*** Beier (one sp.), fam. Chernetidae – ***Conicochernes*** Beier (four sp.), ***Marachernes*** Harvey (three sp.); in Tasmania: ***Neopseudogarypus*** Morris.

Opiliones – no endemic families

Cyphophthalmi – fam. Pettalidae (two genera, **endemic** in Queensland (***Austropurcellia*** Juberthie) and Western Australia (***Karripurcellia*** Giribet).

Laniatores – fam. Triaenonychidae (endemic: ***Breviacantha*** Kauri, ***Callihamina*** Roewer, ***Callihamus*** Roewer, ***Cluniella*** Forster, ***Heteronuncia*** Roewer, ***Holonuncia*** Forster, ***Perthacantha*** Roewer, ***Yatala*** Roewer, ***Conoculus*** Forster, ***Dingupa*** Forster, ***Dipristes*** Roewer, Assamiidae, Samoidae, Zalmoxidae (= Stygnoleptinae)

Eupnoi – fam. Neopilionidae (incl. Monoscutidae), Ballarriinae (***Arrallaba*** Hunt et Cokendolpher, ***Ballarra*** Hunt et Cokendolpher, ***Plesioballarra*** Hunt et Cokendolpher, ***Vibone*** Kauri). ***Hesperopilio*** Shear – unclear fam. within Phalangioidea.

Dyspnoi – fam. Acropsopilionidae (*Acropsopilio* Silvestri)

Araneae – in Australia 73 fam. with 237 end. genera; in Tasmania two endemic subfamilies (**Hickmaniinae, Plesiothelinae**)

Opilioacarida – one indeterm. recorded

Holothyrida – fam. Allothyridae (*Allothyrus* van der Hammen, ***Australothyrus*** van der Hammen)

Other Acari – many endemic genera

Region New Zealand

Very unbalances fauna. Seven orders of Arachnida are missing, the remaining are Pseudoscorpiones (67 sp.), Opiliones (111 sp.), Araneae (1662 sp.), Holothyrida (one sp.), Ixodida (11 sp.), Mesostigmata, Sarcoptiformes and Trombidiformes. Particularly well is represented the order Araneae.

Palpigradi – missing

Solifugae – missing

Amblypygi – missing

Uropygi – missing

Schizomida – missing

Scorpiones – missing

Pseudoscorpiones – no endemic families; 67 sp. of 27 genera and eight

families. Endemic genera: ***Maorichthonius*** Chamberlin, ***Sathrochthoniella*** Beier, ***Tyrannochthoniella*** Beier, ***Nelsoninus*** Beier, ***Apatochernes*** Beier (together with Campbell Isls, Snares Isls, Auckland Isls, Chatam Isls, Norfolk Isl.), ***Heterochernes*** Beier.

Opiliones – one endemic family

Cyphophthalmi – three endemic genera (***Rakaia*** Hirst, ***Aoraki*** Boyer et Giribet, ***Neopurcellia*** Foster) from the family Pettalidae (in total 21 sp.)

Laniatores – endemic family: Synthetonychiidae (***Synthetonychia*** Forster), Triaenonychidae (***Hedwiga*** Roewer, ***Hendea*** Roewer, ***Hendeola*** Forster, ***Metanuncia*** Roewer (Stewart Island), ***Neonuncia*** Roewer, ***Prasma*** Roewer, ***Prasmiola*** Forster, ***Psalenoba*** Roewer, ***Triregia*** Forster, ***Algidia*** Hogg, ***Cenefia*** Roewer, ***Muscicola*** Forster, ***Pristobunus*** Roewer, **subfam. Sørensenellinae** (***Karamea*** Forster, ***Sørensenella*** Pocock);

Eupnoi – fam. Neopilionidae (incl. Monoscutidae) (***Forsteropsalis*** Taylor (nine sp.), ***Mangatangi*** Taylor (nine sp.), *Pantopsalis* Simon (nine sp.); **Monoscutinae** (end. subfamily): ***Acihasta*** Forster, ***Monoscutum*** Forster, ***Templar*** Taylor) (New Zealand, Auckland, Snares, Campbell Islands)

Dyspnoi – fam. Caddidae (*Acropsopilio* Silvestri)

Araneae: one endemic family (Huttoniidae),

one subfamily (**Pahorinae**), and at least 93 **endemic genera** of spiders.

Opilioacarida – missing

Holothyrida – no endemic families or genera: *Allothyrus* van der Hammen (one sp., in common with Australia)

Ixodida – no endemic genera. Fam. Ixodidae and Argasidae (11 sp., four endemic)

Other Acari: no endemic families.

Trombidiformes

Prostigmata – fam. Erythraeidae (***Neosmaris*** Hirst, ***Taranakia*** Southcott, ***Ramsayella*** Zhang)

Papuan Area (New Guinea, Bismarcks, Salomon Islands)

Arachnida: no endemic families

Palpigradi – fam. Eukoeneniidae (*Eukoenenia* cf. *lawrencei* and *Koeneniodes* cf. *frondiger*)

Solifugae – missing

Amblypygi – fam. Charinidae (*Charinus* Simon, *Sarax* Simon – New Guinea), Charontidae (*Charon* Karsch – New Guinea)

Uropygi (Thelyphonida) – fam. Thelyphonidae (Thelyphoninae). Genera: *Abaliella*, *Thelyphonus* and *Minbosius* (New Guinea, Fergusson, New Ireland, New Britain, Guadalcanal). Haupt (2009a) synonymized *Abaliella* Strand, *Minbosius* Speijer and *Tetrabalius* Thorell with *Thelyphonus* Latreille. **Only endemic species**.

Schizomida – fam. Hubbardiidae (*Apozomus* Harvey, *Bamazomus* Harvey – New Guinea)

Scorpiones – In New Guinea (incl. Aru and Bougainville) are known six widespread species of the genera *Isometrus, Lychas* (Buthidae), and *Liocheles* (Hormuridae).

Pseudoscorpiones – fam. Chthoniidae, Tridenchthoniidae, Syarinidae, Cheiridiidae, Garypinidae, Geogarypidae, Atemnidae, Olpiidae, Sternophoridae, Cheliferidae, Chernetidae, Withiidae. **Endemic genera*:* *Papuchelifer*** Beier, ***Cyclochernes*** Beier

Opiliones

Cyphophthalmi – fam. Stylocellidae (two sp. of *Stylocellus* on Bird's Head of New Guinea)

Laniatores – fam. Assamiidae, Epedanidae, Podoctidae (incl. Erecananinae and Ibaloniinae), Zalmoxidae (= Stygnoleptinae)

Dyspnoi – missing

Araneae – ca. 200 sp.**, no endemic families**

Holothyrida – fam. Holothyridae (***Hammenius*** Lehtinen, ***Leiothyrus*** van der Hammen)(all from New Guinea)

Opilioacarida – missing

New Caledonia

Palpigradi – present, unidentified

Solifugae – missing

Amblypygi – fam. Charinidae (*Charinus*), only endemic species and subspecies

Uropygi – **missing**

Schizomida – Hubbardiidae indet.

Scorpiones – two species of *Liocheles* (Hormuridae)

Pseudoscorpiones – families Chthoniidae, Tridenchthoniidae, Syarinidae, Cheiridiidae, Garypinidae, Geogarypidae, Atemnidae, Olpiidae, Sternophoridae, Cheliferidae, Chernetidae, Withiidae

Opiliones

Cyphophthalmi – one endemic fam. **Troglosironidae** (13 sp.)

Laniatores – fam. Assamiidae, Epedanidae, Podoctidae (incl. Erecananinae and Ibaloniinae), Zalmoxidae (= Stygnoleptinae)

Dyspnoi – missing

Araneae – 33 families: Anapidae, Barychelidae, Dipluridae, Desidae, Pararchaeidae, Lamponidae, Theridiidae, Pisauridae, Zoridae, Salticidae, Scytodidae, Tetrablemmidae, Telemidae, Segestriidae, Oonopidae, Mimetidae, Deinopidae, Uloboridae, Mysmenidae, Linyphiidae, Tetragnathidae, Araneidae. Until 1993 have been recorded spiders of 112 genera and 194 sp. Endemic genera: ***Stenygrocercus*** Simon (Dipluridae), ***Caledanapis*** Platnick et Forster, ***Mandanapis*** Platnick et Forster, ***Montanapis*** Platnick et Forster, ***Caledothele*** Raven (Anapidae), ***Barycheloides*** Raven, ***Barychelus*** Simon, ***Encyocrypta*** Simon (32 sp.), ***Natgeogia*** Raven, ***Orstom*** Raven, ***Questocrypta*** Raven (Barychelidae), ***Canala*** Gray (Desidae),***Centrocalia*** Platnick (Lamponidae), ***Anatea*** Berland (Theridiidae), ***Pseudohostus*** Rainbow (Pisauridae), ***Zoroides*** Berland, 1924 (Zoridae), ***Corambis*** Simon, ***Lystrocteisa*** Simon, ***Rhondes*** Simon (Salticidae)

Holothyrida – fam. Holothyridae (two genera, one of them endemic

(***Haplothyrus*** Lehtinen – two species), the other (*Lindothyrus* Lehtinen) is shared with Lord Howe Is.

Opilioacarida – **missing**

Conclusion

The level of representation of Arachnida in the classical Notogea (with Papuan area, but excluding Patagonia) is much lower than the level in the vertebrates, with their endemic subclasses, orders and suborders. Even in the most isolated area (New Zealand) there are **no endemics of very high rank**. Here are the endemisms above genus:

Australia (cont.): one endemic family of Scorpions (Urodacidae)

Tasmania: only endemic subfamilies of spiders (Plesiothelinae and Hickmanniinae)

New Guinean area: no endemics above genus

New Caledonia: one endemic family of Opiliones (Troglosironidae)

New Zealand: one endemic family of spiders (Huttoniidae) and one of Opiliones (Synthetonychiidae)

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Сравнителен арахногеографски анализ на фауните на Австралия, Папуаския подрайон, Нова Каледония и Нова Зеландия

Петър Берон

(Резюме)

Арахногеографски анализ на всички разреди от клас Arachnida в Австралия (вкл. Тасмания), Нова Гвинея, Нова Каледония, о. Лорд Хоу и Нова Зеландия. Целта е да се очертае представянето на различните разреди в отделните територии и да се види арахногеографската подкрепа на едно или друго ниво на ситуирането на териториите в зоогеографското поделяне на Нотогея и на света. Заключението е, че нивото на отделните групи Arachnida в класическата Нотогея (с Папуаския район, но без Патагония) е много по-ниско от нивото на гръбначните, с тяхните ендемични подкласове, разреди и подразреди. Даже в най-изолираната част няма ендемични арахниди от много висок ранг. Ето нивото на ендемизъм, по-високо от род:

Австралия (континентална част): едно ендемично семейство скорпиони (Urodacidae)

Тасмания: само ендемични подсемейства паяци (Plesiothelinae и Hickmanniinae)

Новогвинейския район: няма ендемични арахниди по-високо от род.

Нова Каледония: едно ендемично семейство опилиони (Troglosironidae)

Нова Зеландия: едно ендемично семейство паяци (Huttoniidae) и едно ендемично подсемейство (Pahorinae). При опилионите (енд. сем. Synthetonychiidae), както и едно ендемично подсемейство (Monoscutinae).

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Comparative arachnogeographical analysis between the faunas of Central America and the Antilleans (Caribbeans)

Petar Beron

Abstract: The distribution of all orders of Arachnida in Central America and the Antilleans is analysed and compared, together with analysis of the paleogeographical history of the area and the various attempts of zoogeographers to situate the continental and the insular parts on the zoogeographical map of Western Hemisphere.

Conclusions:

Palpigradi are known only from the Antilleans.

In the seven countries of Central America (without counting Yucatan) are recorded 18 species of **Ricinulei** belonging to the two American genera. From the Antilleans (Cuba) are known only two (endemic?) species. The genus *Cryptocellus* Westwood is common for both regions.

In the seven countries of Central America (without South Mexico) are recorded **Solifugae** of five genera, all belonging to Ammotrechidae (Ammotrechinae). Two of them seem endemic. Four genera have been recorded from the Antilleans (all of them from the same family Ammotrechidae), three of them are endemic. Only one genus (*Ammotrechella*) is in common for both regions, the species are endemic.

The Amblypygids (**Amblypygi**) of the Antilleans are more numerous and diverse (29 species of four genera), than in the seven countries of Central America (nine species of two genera, the families are the same). Again difference at the level of research?

Both regions have different fauna of **Thelyphonida** (**Uropygi**) – three endemic genera in Central America, one endemic genus plus several end. species of *Mastigoproctus* in the Caribbean Islands). The Schizomids (**Schizomida)** in both areas belong to the same family, but the genera are different (seven genera, one endemic in Central America, eight genera, six of them endemic in the Antilleans). There are three genera in common for both areas. Again difference at the level of research?

Opiliones. Cyphophthami – unknown in both regions. **Eupnoi**: Sclerosomatidae (in both areas the same genera *Geaia* and *Prionostemma*); **Dyspnoi** – in Honduras is known the genus *Trilasma* Goodnight et Goodnight (Nemastomatidae, Ortholasmatinae); in the Antilleans the suborder Dyspnoi is not known. **Laniatores.** The Catalogue of Kury (2003) enumerates 56 genera and nine families of Laniatores, living in the seven countries of Central America. From the Antilleans in the same Catalogue are listed 117 species Opiliones Laniatores, belonging to 65 genera and 11 families. From this list five families are in common (underlined). The endemic genera on the islands are 13 (from Biantidae and Kimulidae). **There are no endemic families.**

The faune of **pseudoscorpions** in the Antilleans seems richer (39 genera, 15 families), than the one of the seven families of Central America (33 genera, 13 families). Both areas have 13 genera in common. Among the eight genera of **scorpions** in Central America and 11 genera in the Antilleans there are four genera in common. Three families in Central America (Chactidae, Euscorpiidae and Vaejovidae) are not recorded about Antilleans. Interesting fact is that the scorpions on the islands are more species and genera, than the scorpions in Central America, with land connection with such areas, rich in scorpions, as Mexico and the northern part of South America. One of the explanations is the very active speciation, especially in Cuba (55 species) and the Dominican Republic (40 species). Another explanation is that in Cuba live such specialists like Armas and Teruel.

Araneae. The spiders recorded from Cuba are 567 sp. of 52 families, including 247 endemic de Antilleans (43.56%) with eight endemic genera (Ochyroceratidae – ***Fageicera*** Dumitrescu et Georgescu, Barychelidae – ***Troglothele*** Fage, Pholcidae – ***Bryantina*** Brignoli, Oonopidae – ***Brignolia*** Dumitresco et Georgesco, Prodidomidae – ***Caudalia*** Alayón, ***Cubanopillus*** Alayón et Platnick, Sparassidae – ***Decaphora*** Franganillo, Salticidae ***Paraplexippus*** Franganillo). **Opilioacarida.** Two genera from the same family (*Neocarus* Chamberlin et Mulaik and *Caribeacarus* Vasquez et Klompen) occure in both areas. The species are (for the time being) endemic. **Holothyrida** are unknown in Central America. From the Dominican Republic has been described the endemic *Caribothyrus barbatus* Kontchán et Mahunka, 2004.

As a whole, there is considerable difference (artificial ?) between the arachnofauna of both areas, but Orly at a low level (genus or species). The Antilleans seem to be richer (or better explored). **In both areas are lacking endemic families**.

Key words: Antilleans, Central America, Arachnida, zoogeography

Introduction

Central America (sensu stricto between Mexico and Colombia, but including Yucatan) is one of the areas with the highest biodiversity on Earth. The role of this narrow stripe of land for the Great Exchange of fauna and flora between the Neotropical and the Holarctic areas (belonging to different kingdoms!) has been analysed many times, but never through comparing the distribution of all orders of Arachnida within South and North America, and with the nearby Antillean (Caribbean) islands which are important centres of speciation.

Central America

Geography, General Zoogeography and Paleogeography

Central America is extending from the Isthmus of Tehuantepec in southern Mexico southeastward to the Isthmus of Panama where it connects to the Colombian Pacific Lowlands in northwestern South America. Alternatively, the Transmexican Volcanic Belt delimits the region on the north. Central America has an area of some 592,000 km2, shared between seven states: Belize, Guatemala, Honduras, Costa Rica, Nicaragua, El Salvador and Panama. Most of Central America rests atop the Caribbean Plate (Halffter, 1976, 1987, Kraus, 1962, Morrone, 2001, Khudoley & Meyerhoff, 1971, Ryan, 1963, Weyl, 1964, 1966a, 1966b, 1970a, 1970b, 1973, Woodring, 1966).

According to Morrone (2005), Central America is included in the Caribbean Subregion of the Neotropical Region (Mesoamerican Dominion with five provinces).

Central America is part of the Mesoamerican Biodiversity hotspot, containing 7% of the world‘s biodiversity. As a bridge between North and South America, Central America has many species from the Nearctic and the Neotropic ecozones.

Halffter (1978) says that his “Patron Mesoamericano de Montaña” (Mountain Mesoamerican Pattern) is composed of elements having evolved in the Centroamerican Nucleus (determined by Halffter, 1978, as “La mesa Central y las dos cordilleras de Chiapas, asi como las tierras altas y sus declives de Guatemala, Honduras, El Salvador y norte de Nicaragua”).

In Central America (from the Isthmus of Tehuantepec to Panama) we can distinguish clearly two mountain massifs: north of the Centroamerican Nucleus, including 80% of the high grounds (above 600 m a.s.l.) of Central America; in the south la Sierra de Talamanca in Costa Rica and the west of Panama (Halffter, 1978).

Arachnogeography

Central America, being a bridge between North and South America and facing the Caribbeans, is zoogeographically important and is with rich and varied nature (Armas, 2004). In the seven countries between Mexico and Colombia are represented 14 orders: Ricinulei (18 specis of two genera), Solifugae (12 species of five genera, all Ammotrechidae), Scorpiones (six families, 11 genera – non is endemic), Pseudoscorpiones (13 families, 33 genera, one endemic), Opiliones (one genus of Eupnoi, 56 genera of eight families of Laniatores, mostly Cosmetidae), Amblypygi (three genera of the families Phrynidae and Charinidae, four endemic species), Thelyphonida (Uropygi)(five species of three endemic genera), Araneae (many), Opilioacarida (two genera), the superfamilies Acariformes and Parasitiformes (Banks, 1909a, Kury, 2003, Roewer, 1954).

Palpigradi, Holothyrida and the suborders Palaeoamblypygi, Cyphophthalmi, Dyspnoi, Mesothelae have not been recorded from Central America . If we consider the entire area of Central America (incl. Yucatan) and the Caribbean, we may say that this is the most varied area in Arachnida in the world – all orders and almost all suborders are present (except of Palaeoamblypygi and Mesothelae).

Palpigradi – not recorded from Central America.

Ricinulei

In the seven countries of Central America (without S. Mexico) are registered 18 species of Ricinulei (Cooke & Shadab, 1973, Fage, 1921, 1938, Merret, 1960, Platnick & Pass, 1982, Platnick & Shadab, 1981, Chamberlin & Ivie, 1938).

Cryptocellus Westwood, 1874 – Panama, Costa Rica, Honduras, Nicaragua (12 species)

Pseudocellus Platnick, 1980 – Guatemala, Honduras, El Salvador, Panama (six species)

These are the two genera of Ricinulei (Ricinoididae), known in the New World. They are represented also in Mexico and the Caribbean (Cuba). In Yucatan, which is part of Central America geographically, are known five more Ricinuleid species.

Solifugae

From the seven countries of Central America (without S. Mexico) are known 12 species of

Table 1

Country	Belize	Guatemala	Honduras	Salvador	Nicaragua	Costa Rica	Panama
	4	16	9	2	4	15	17
Fam. **Buthidae**	+	+	+	+	+	+	+
Ananteris Thorell	-	-	-	-	-	1	1
Centruroides Marx	1	6	5	1	3	4	4
Isometrus Ehrenberg	-	-	-	-	-	1	1
Tityus C.L. Koch	-	-	-	-	-	6	10
Fam. **Chactidae**	-	-	-	-	-	+	+
Neochactas Sol. et Fet	-	-	-	-	-	-	1
Chactas Gervais	-	-	-	-	-	1	2
Fam. **Euscorpiidae**	-	+	+	-	-	-	-
Plesiochactas Pocock	-	-	-	-	-	-	-
Fam. **Hormuridae**	-	+	-	-	-	+	+
Opisthocanthus Peters	-	1	-	-	-	1	1
Fam. **Scorpionidae**	+	+	+	+	+	+	-
Diplocentrus Peters	4	6	3	-	-	-	-
Didymocentrus Kraep.	-	-	1	1	2	1	-
Fam. **Vaejovidae**	-	+	-	-	-	-	+
Vaejovis C.L. Koch	-	1	-	-	-	-	1

Solifugae of five genera, all belonging to the family of Ammotrechidae (Armas, 1993, 1996, 2000, 2004, Muma, 1970, 1976, 1986, Pocock, 1902, Roewer, 1934). Highest diversity has been recorded in Nicaragua (six species) and Guatemala (five species). According to Armas (1996), this is only half of the presumed number of species in Centroamerica (23).

Ammotrechinae

Ammotrecha Banks, 1900

Ammotrecha limbata (Lucas, 1835) — Guatemala

A. nigrescens Roewer, 1934 — Costa Rica, Guatemala

A. picta Pocock, 1902 — Guatemala

A. stollii (Pocock, 1895) — Costa Rica, Guatemala, USA

Ammotrechella Roewer, 1934

Ammotrechella pseustes (Chamberlin, 1925) — Panama, California, Puerto Rico

A. tabogana Chamberlin, 1919 — Panama

Ammotrechesta Roewer, 1934

Ammotrechesta garcetei Armas, 1993 — Nicaragua

A. maesi Armas, 1993 — Nicaragua

A. schlueteri Roewer, 1934 — Honduras

A. brunnea Roewer, 1934 – Costa Rica

A. tuzi Armas, 2000 – Mexico

Innesa Roewer, 1934

Innesa vittata (Pocock, 1902) — Guatemala

Scorpiones

The list of scorpions in Central America (Mexico excluded) of Armas & Maes (1998) contains data on 38 species of 11 genera and five families. From them 24 species are Central American endemics. Meanwhile, some changes occurred in the names of families, the place of the genera, etc. Now there are 11 accepted genera, but of six families (Francke, 1978, Francke & Stockwell, 1987, Stockwell, 1988, Lourenço, 1996c, Lourenço & Méndez, 1984, Viquez, 1999).

Scorpiones in Central America (without Mexico)

Pseudoscorpiones

In the seven countries of Central America are recorded Pseudoscorpions of 33 genera and 13 families (Chthoniidae, Tridenchthoniidae, Bochicidae, Neobisiidae, Syarinidae, Ideoroncidae, Sternophoridae, Garypinidae, Atemnidae, Olpiidae, Cheliferidae, Chernetidae, Withiidae)(Beier, 1931, 1932, 1953, 1955, 1976, Heurtault, 1998, Hoff, 1944, Mahnert, 1987, Muchmore, 1973).

In six countries of Central America (no data for Honduras) the number of the pseudoscorpion species is as follows (Harvey, 2003, 2011):

Belize – 10; Guatemala – 17; Costa Rica – 23; El Salvador – 10; Nicaragua – one; Panama – 15

Endemic genus for Central America:

Fam. Chernetidae

Coprochernes Beier, 1976 – Costa Rica

Opiliones

Cokendolpher & Cokendolpher (1984), Goodnight & Goodnight (1942, 1983), Cruz-López, Proud & Pérez-Gonzalez (2016), Kury (2003), Pickard-Cambridge (1904 -1905), Roewer (1943, 1949), Shear (2010a), Šilhavý (1979), Townsend, Viquez, VanZandt & Proud (2010)

Cyphophthami – Unknown

Eupnoi

Fam. Sclerosomatidae

Geaya Roewer – Belize, Costa Rica

Prionostemma Pocock – Guatemala, El Salvador, Panama, Costa Rica

Dyspnoi

Fam. Nemastomatidae

Ortholasmatinae

Trilasma Goodnight et Goodnight – Honduras (one sp.)

Laniatores

The Catalogue of Kury (2003) enumerates from the seven countries of Central America 56 genera and nine families of Laniatores as follows:

Fam. Cosmetidae

Acromares Goodnight et Goodnight – Belize (one sp.)

Bokwina G.et G. – Belize (one sp.)

Boneta G. et G.- Guatemala (one sp.)

Cosmetus Perty – Panama (one sp.)

Cynorta C.L. Koch – Belize, Costa Rica, Panama, Honduras, Guatemala, El Salvador (20 sp.)

Cynortellana Roewer – Costa Rica (one sp.)

Cynortoperna Roewer – Costa Rica (one sp.)

Cynortula Roewer – Costa Rica, El Salvador, Nicaragua, Guatemala (nine sp.)

Erginoides Pickard – Cambridge – Panama, Costa Rica (two sp.)

Erginulus Roewer – Guatemala, Honduras, Belize, Costa Rica, El Salvador (21 sp.)

Eucynorta Roewer – Costa Rica, Panama, El Savador, Guatemala (24 sp.)

Eucynortella Roewer – Guatemala, Panama (five sp.)

Eucynortoides Roewer – Costa Rica (one sp.)

Eucynortula Roewer – Costa Rica, Nicaragua, Guatemala, Belize, Panama (seven sp.)

Eugnidia Roewer – Costa Rica (one sp.)

Eupoecilaema Roewer – Costa Rica, Panama (two sp.)

Flirtea C.L. Koch – Honduras, Panama, Costa Rica (two sp.)

Holovonones Roewer – Belize, Costa Rica, Guatemala (one sp.)

Kevonones Chamberlin – Costa Rica (one sp.)

Metacynorta Pickard – Cambridge – Guatemala (one sp.)

Metarhaucus Pickard – Cambridge – Costa Rica (one sp.)

Metavonones Pickard – Cambridge – Costa Rica (two sp.)

Meterginus Pickard – Cambridge – Guatemala, Costa Rica, El Salvador (six sp.)

Paecilaema C.L. Koch – Costa Rica, Panama, Guatemala, Honduras, Belize (12 sp.)

Paecilaemana Roewer – Panama, Costa Rica (two sp.)

Paracynorta G. et G. – Panama (one sp.)

Paravonones Pickard – Cambridge – El Salvador (two sp.)

Poecilaemula Roewer – Costa Rica (one sp.)

Reimoserius Roewer – Costa Rica (one sp.)

Tajumulcia G. et G. – Guatemala (one sp.)

Vonones Roewer – Belize (one sp.)

Vononesta Roewer – Guatemala (one sp.)

Vononula Roewer – Guatemala (one sp.)

According to Townsend et al. (2010), from the family Cosmetidae in Central America are registered 133 species of 33 genera.

Family Cranaidae

Comboyus Roewer – Panama (one sp.)

Phareicranaus Roewer – Costa Rica, Panama (two sp.)

Family Gonyleptidae

Glysterus – Costa Rica (six sp.)
Hernandaria Soerensen – Costa Rica (two sp.)
Hernandarioides Picard-Cambridge – Panama (one sp.)
Nesopachylus Chamberlin – Panama (two sp.)

Family Manaosbiidae
Barrona Goodnight C. J. et M. L. Goodnight – Panama (one sp.)
Bugabitia Roewer – Panama (one sp.)
Poassa Roewer – Costa Rica (one sp.)
Zygopachylus Chamberlin – Panama (one sp.)

Family Samoidae
Arganotus Šilhavý – Guatemala (one sp.)
Neocynortina Goodnight C. J. et M. L. Goodnight – Costa Rica (one sp.)
Pellobunus insularis Banks – Panama (two sp.)
Pellobunus insulcatus (Roewer)

Family Stygnommatidae
Stygnomma Roewer – Belize, Costa Rica (six sp.)
Stygnomma fuhrmanni Roewer

Family Pyramidopidae
Jarmilana Cruz-López et al. – Belize (one sp., troglobite)

Family Stygnopsidae
Paramitraceras P. – Cambridge – El Salvador, Guatemala, Costa Rica (two sp.)

Family Zalmoxidae
Ethobunus Chamberlin, 1925 – Panama, Guatemala, El Salvador, Costa Rica (15 sp.)
Pachylicus Roewer, 1923 – Panama, Costa Rica (eight sp.)
Panopiliops Roewer, 1949 – Costa Rica (two sp.)
Phalangoduna Roewer, 1949 – Costa Rica, Panama (one sp.)
Stygnoleptes Banks, 1914 – Costa Rica, Panama, El Salvador (three sp.)

Family uncertain
Costabrimma Goodnight et Goodnight – Costa Rica (three sp.)
Isaeolus Roewer – El Salvador (one sp.)

Amblypygi

The Amblypygids are represented in Central America by the family Phrynidae and the genera *Phrynus* Lamarck (four species in Nicaragua, Guatemala, Honduras, Belize, Costa Rica, Panama) and *Paraphrynus* Moreno (four species in Belize, Guatemala, Costa Rica, El Salvador, Nicaragua, Panama, Honduras). Both genera live also in South America, Mexico and the Antilleans (Armas, 2004, Armas de & Gonzalez, 2001, Armas de & Maes, 2000, Armas de & Víquez, 2001, Avila Calvo & Armas, 1997, Gervais, 1842, Mullinex, 1975, Pocock, 1893, 1894, 1902, Roewer, 1954, Quintero, 1981). The genus *Charinus* (fam. Charinidae) is found in Panama (Viquez, Miranda & de Armas, 2012).

There are four species, endemic for Central America (between Mexico and Colombia):

Phrynus Lamarck – *Ph. maesi* Armas, 1996 (Nicaragua), *Ph. parvulus* Pocock, 1902 (Guatemala, Belize)

Paraphrynus Moreno – *P. emaciatus* Mullinex, 1975 (Guatemala), *P. leptus* Mullinex, 1975 (Guatemala)

Thelyphonida (Uropygi)

In Central America are found five species of Uropygi, and three endemic genera *Valeriophonus* Viquez et de Armas, 2005, *Mayacentrum* Viquez et Armas, 2006 and *Mimoscorpius* Butler, 1872). They live in Costa Rica – *Valeriophonus nara* (Valerio), El Salvador (*Mayacentrum tantalus* (Roewer)), Honduras (*M. pijol* Viquez et de Armas), Belize (*M. guatemalae* Viquez et de Armas), Guatemala (*Mimoscorpius pugnator* Butler)(Roewer, 1954, Valerio, 1981, Viquez & de Armas, 2005, 2006; Armas & Viquez, 2007).

Schizomida

In Central America (between Mexico and Colombia) are recorded nine species, but there is also unidentified material from many places (Armas, Villareal Manzanilla & Viquez, 2010, Armas & Viquez, 2010, Brignoli, 1973, Rowland & Reddell, 1977, Reddell & Cokendolpher, 1995). Besides the largely distributed *Stenochrus portoricensis* (Guatemala, Honduras, Nicaragua, Belize), from Central America are known the genera *Heteronochrus* (Guatemala), *Hansenochrus* (Costa Rica, Panama), *Rowlandius, Piaroa* and *Surazomus* (Costa Rica), *Belicenochrus* from Belize. *Surazomus* Reddell et Cokendolpher is known also from many Southamerican countries. *Rowlandius* Reddell et Cokendolpher is widespread in the Caribbean islands. *Hansenochrus* Reddell et Cokendolpher is found also in South America and the Caribbean.

Araneae

Pickard-Cambridge (1904 -1905), Dumitrescu & Georgescu (1992), Zhang & Maddison (2012) et al.

Many endemic genera, but **no endemic families.**

Some endemic genera in Central America and the Caribbeans:

Family Microstigmatidae

Micromygale Platnick et Forster, 1982 – Panama (one sp.)

Family Theraphosidae

Aenigmarachne Schmidt, 2005 – Costa Rica (one sp.)

Antillena Bertani, Huff et Fukushima, 2017 – Dominican Rep. (one sp.)

Barropelma Chamberlin, 1940 – Panama (one sp.)

Caribena Fukushima et Bertani, 2017 – Puerto Rico, Cuba, US Virgin Isls, Martinique (two sp.)

Crassicrus Reichling et West, 1996 – Belize (one sp.)

Longilyra Gabriel, 2014 – El Salvador (one sp.)

Mygalarachne Ausserer, 1871 – Honduras (one sp.)

Reichlingeria Rudloff, 2001 – Belize (one sp.)

Sphaerobothria Karsch, 1879 – Costa Rica, Panama (one sp.)

Stichoplastoris Rudloff, 1997 – El Salvador, Costa Rica, Panama (eight sp.)

Family Ochyroceratidae

Fageicera Dumitrescu et Georgescu, 1992 – Cuba (three sp.)

Family Barychelidae

Troglothele Fage, 1929 – Cuba

Family Agelenidae

Neowadotes Alayón, 1995 – Hispaniola

Family Cyatholipidae

Pokennips Griswold, 2001 – Jamaica

Family Tetragnathidae

Ancinosphenus Simon, 1895 – West Indies (one sp.)

Antillognatha Bryant, 1945 – Hispaniola (one sp.)

Hispanognatha Bryant, 1945 – Hispaniola (one sp.)

Family Linyphiidae

Lomaita Bryant, 1948 – Hispaniola

Primerigonina Wunderlich, 1995 – Panama (one sp.)

Sthelota Simon, 1894 – Panama, Guatemala (two sp.)

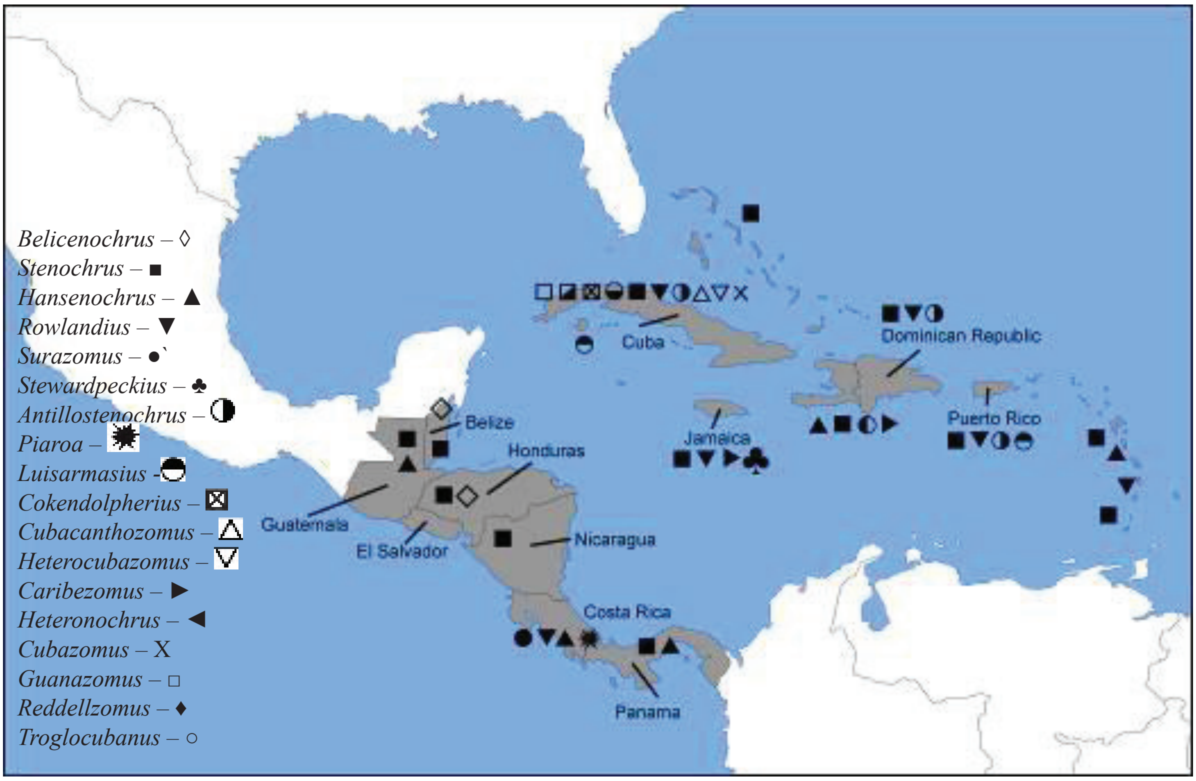
Family Filistatidae

Antilloides Breskovit et al., 2016 – Cuba, the Dominican Rep., Virgin Isls, Puerto Rico

Family Paratropididae

Anisaspis Simon, 1891 – St. Vincent (one sp.)

Family Amaurobiidae



Schizomida in Central America and the Caribbean

Tugana Chamberlin, 1948 – Cuba, Hispaniola (four sp.)

Family Anyphaenidae

Thaloe Brescovit, 1993 – Cuba, Hispaniola (three sp.)

Family Theridiidae

Jamaitidion Wunderlich, 1995 – Jamaica (one sp.)

Family Liocranidae

Laudetia Gertsch, 1941 – the Dominican Rep., Puerto Rico (three sp.)

Mesobria Simon, 1897 – St. Vincent (one sp.)

Family Ctenidae

Ciba Bloom et al., 2014 – Cuba, the Dominican Rep. (two sp.)

Ohvida Polotow et Brescovit, 2009 – Cuba, Puerto Rico, Bahamas (nine sp.)

Trujillina Bryant, 1948 – Hispaniola, Puerto Rico (three sp.)

Family Pholcidae

Bryantina Brignoli, 1985 – Cuba

Ciboneya Perez, 2001 – Cuba (four sp.)

Platnicknia Özdikmen et Demir, 2009 – Cuba (two sp.)

Tainonia Huber, 2000 – Hispaniola (five sp.)

Family Tetrablemmidae

Micromatta Lehtinen, 1981 – Belize

Famiy Miturgidae

Hoedillus Simon, 1898 – Guatemala, Nicaragua (one sp.)

Family Prodidomidae

Caudalia Alayón, 1980 – Cuba (one sp.)

Cubanopillus Alayón et Platnick, 1993 – Cuba

Family Sparassidae

Decaphora Franganillo, 1931 – Cuba (one sp.)

Defectrix Petrunkevitch, 1925 – Panama (one sp.)

Family Thomisidae

Rejanellus Lise, 2005 – Cuba, Puerto Rico, Hispaniola (four sp.)

Family Salticidae

Albionella Chikering, 1946, ***Banksetosa*** Chickering, 1946,***Carabella*** Chickering, 1946,

Gorgasella Chickering, 1946, ***Micalula*** Strand, 1932, ***Monaga*** Chickering,1946,

Orvilleus Chickering, 1946, ***Toloella*** Chickering, 1946, ***Udalmella*** Galiano, 1994,

Uluella Chickering, 1946 – all from Panama

Allodecta Bruyant, 1950 – Jamaica

Antillattus Bryant, 1943 – Hispaniola, Cuba

Bythocrotus Simon, 1903 – Hispaniola

Caribattus Bryant, 1950 – Jamaica

Cerionesta Simon, 1901 – St. Vincent

Commoris Simon, 1902 – Guadeloupe, Dominica

Corticettus Zhang et Maddison, 2012 – Porto Rico, Hispaniola

Paraplexippus Franganillo,1930 – Cuba

Parasaitis Bruyant, 1950 – Jamaica

Parathiodina Bruyant, 1943 – Hispaniola

Popcornella Zhang et Maddison, 2012 – Hispaniola, Puerto Rico

Truncattus Zhang et Maddison, 2012 – Hispaniola

Opilioacarida

From Central America (between Mexico and Colombia) are known two sp. of Opilioacarida: *Caribeacarus panamensis* Vásquez et Klompen (Panama) and *Neocarus nicaraguensis* (Vásquez et Klompen)(Nicaragua), but we can add three species of *Neocarus* Chamberlin et Mulaik, 1942 from Yucatan Peninsula in Mexico. Both *Neocarus* and *Caribeacarus* live also on the Antilleans. The species are (so far) **endemic** (Vásquez & Klompen, 2002, 2009).

Holothyrida – unknown

Antillean (Caribbean) Islands

Geography, General Zoogeography and Paleogeography

“The West Indies and Central America, the question of the relationships between Atlantic and Pacific Ocean, between North and South America, as well as the question of possible land-bridges between the islands on one hand and the continent on the other, have been dealt with in an almost interminable procession of biogeographical and geological publications”.

Rutten (1935)

The Antilles islands form the greater part of the West Indies in the Caribbean. The Antilles are divided into two major groups: the „Greater Antilles“ to the north and west, including the larger islands of Cuba, Jamaica, Hispaniola (Haiti and the Dominican Republic), and Puerto Rico; and the smaller „Lesser Antilles“ on the southeast—comprising the northerly Leeward Islands, the southeasterly Windward Islands, and the Leeward Antilles just north of Venezuela. The Bahamas, though part of the West Indies, are generally not included among the Antillean islands. Geologically, the Greater Antilles are made up of continental rock, compared to the Lesser Antilles, which are mostly young volcanic or coral islands.

Cuba – area 109,886 km^2, highest point Pico

Turkino (1974 m a.s.l.)(Isla de la Juventud – 2199 km^2). Remaining is only ca. 15% of the original forest cover.

Hispaniola – area 76 480 km^2, highest point Pico Duarte (3087 m)

Jamaica – area 10 990 km^2, highest point Blue Mountain Peak (2256 m)

Puerto Rico – area 9104 km^2, highest point Serro de Punta (1338 m)

The **Lesser Antilles**, also known as the **Caribbees**, are part of the Antilles, which together with the Bahamas, the Cayman Islands, the Turks and Caicos Islands, and the Greater Antilles form the West Indies. The islands are a long partly volcanic island arc, most of which wrap around the eastern end of the Caribbean Sea and on the western boundary with the Atlantic Ocean.

Many papers deal with the paleogeography of the Caribbean: Blair Hedges (2001), Bonatti & Gardner (1973), Burke et al. (1984), Curtis, Brenner & Hodell (2001), Freeland & Dietz (1971), Hedges (1982, 2001), Hedge, Haas & Marxson (1994), Iturralde-Vinent (1975), Iturralde-Vinent & MacPhee (1999), Jeannel (1939), Khudoley & Meyerhoff (1971), Koopman (1959), Meschede & Frish (1998, 2001), Meyerhoff & Meyerhoff (1972), Morrone (2001), Page & Lydeard (1994), Schuchert (1935), Weyl (1964), Woodring (1954), and others.

"A major deformation began in the Miocene, with folding of the Lower Tertiary sediments and uplifting of the cores of the present-day islands. During the Late Miocene and Pliocene, extensive peneplains were formed, which, as a result of the youngest crustal movements in the Antilles, now stand at elevations as great as 2000 m" (Weyl, 1966).

"In the Middle Eocene ends entyrely the movement of the plate and Caribbean Sea and its surroundings acquired approximately their actual configuration" (Iturralde-Vinent, 1975).

The Antilles and the West Indies in sensu lato (including the Bahamas Bank) have been interesting to biogeographers even since Wallace (1881). The Greater Antilles (Cuba, Hispaniola, Jamaica and Puerto Rico) are large enough to allow radiative speciation within the islands, between them and even to disperse some lines to the mainland (some exemples among the vertebrates have been quoted by Blair Hedges, 2006). This author analysied the paleogeography of the Antilles and the identity of the 1319 native terrestrial vertebrates on the islands. The problem how and when these animals arrived to the islands has been discussed (Darlington, 1938, Weyl, 1973, Hedges, 1982, Iturralde-Vinent & MacPhee, 1999, Morrone, 2001a, 2005, 2006, 2017, Rapoport, 1968, Rosen, 1975, and others).

Among the non-flying terrestrial vertebrates the endemicity is high: nearly all 173 sp. of Amphibians, 96% of the 499 species of Reptiles, 96% of the freshwater fishes, but only 35% of the birds and 50% of the bats. It would be interesting to compare these figures with the various orders of Arachnida (although with the vertebrates we have to deal with classes). Thanks to many local and foreign researchers the general picture of the Arachnida on the Antilles is more or less complete and a sound basis for discussions.

Actually, the main argument is centered on the importance (and feasability) of the three ways of "arrival" of the animals: dispersal, vicariance, and land bridges. The age of the various groups is also important. There are few fossils of Arachnida on the islands, mostly from Dominican amber (Miocene -15-20 MA to Upper Eocene – ca. 30-45 MA), so hypotheses should be based on speculations.

Based on insects (mostly Coleoptera), Krzhanovskiy (2002) considered the Antillean Subregion part of the Neotropical Region. For him the explanation is simple: volcanic archipelago, raised in the Late Tertiary and was populated by casual migrants from Central and South America. Some speciation took place after that.

According Morrone (2001), within the Caribbean Subregion there are seven insular provinces, plus Trinidad and Tobago. All major islands are separate provinces. In this monograph the biogeographical subregion "Caribeña" is rather wide – from Central Mexico to Ecuador and Galapagos.

According to Morrone (2005), the Antillean Dominion is divided into eight provinces: the Yucatan Peninsula (the states of Yucatan, Campeche and Quintana Roo), Bahama, Cuba, the Cayman Islands, Jamaica, Hispaniola, Puerto Rico, and the Lesser Antilles Provinces. These provinces reflect the distribution of some orders of insects in the area.

Morrone (2017) provided a detailed regionalization of the Neotropics, dividing the area in three subregions: Antillean, Brazilean and Chacoan.

Arachnogeography

The arachnofauna of the islands is varied and with many endemics, well studied by Cuban, Romanian and other specialists. Represented are all orders, except of Opilioacarida (Armas, 1982, 2004, Banks, 1909b, Perez-Gelabert, 2008, Teruel & de Armas, 2005, Armas & Avila, 2015). Remarkable is the finding of an endemic genus and species of

Holothyrida. Many endemic genera of Schizomida. Very rich fauna of scorpions (130 sp., only in Cuba are 55 sp.). According to these authors, there is a zoogeographical barriere between Trinidad and Tobago on the one hand and Grenada on the other, "the Bond line". Lourenço (1999b) indicates that the number of scorpion species doesn't seem to be correlated negatively with the distance from South America, but rather with the surface of the islands – five on Martinique,three on Saint Lucie and one on each of the smaller islands.

Lourenço (1999b) made important analysis of the origines and the affinities of the scorpions of the Greater Antilleans.

On the islands are lacking the suborders Cyphophthalmi, Dyspnoi, Paleoamblypygi and Mesothelae.

Palpigradi

The only troglobite Palpigradi in the New World (*Eukoenenia orghidani* Condé et Juberthie) was described from Cuba. Some non-described Palpigradi have been recorded from Guadeloupe, Haiti and the subspecies *Eukoenenia berlesei virginea* Condé, 1984 was described from the Virgin Islands (Condé, 1984, 1986, Condé & Juberthie, 1982, Remy, 1948).

Solifugae

From the Antilleans are known three genera of Solifugae, two of them **endemic**, all belonging to Ammotrechidae, as follows (Armas, 1994, 2004, Armas & Teruel, 2005, Muma, 1970, 1976, 1986, Muma & Nezario, 1971):

Ammotrechella apejii Muma, 1981 – Jamaica (**endemic**)

A. bahamica Muma, 1986 – Bahamas (**endemic**)

A. bonariensis (Werner, 1925) – Bonaire (**endemic**)

A. [Ammotrechona] cubae (Lucas, 1835) – Cuba (**endemic**)

A. geniculata (C.L. Koch, 1842) – Bahamas, Curacao, St. Vincent, Guadeloupe; also U.S.A., Mexico and Panama

A. jutisi Armas et Teruel, 2005 – Cuba (**endemic**)

A. hispaniolana Armas et Alegre, 2001 – the Dominican Republic (**endemic**)

A. maguirei Muma, 1986 – Caicos (**endemic**)

A. pallida Muma et Nezario, 1971 – Puerto Rico (**endemic**)

A. pseustes (Chamberlin, 1925) – Puerto Rico, Panama

Ammotrechinus gryllipes (Gervais, 1842) – Jamaica, Haiti (**endemic genus** and species)

Antillotrecha iviei Armas, 2002 — Leeward Islands (**endemic**)

A. fraterna Armas, 1994 – the Dominican Republic (**endemic genus** for the Caribbean, **endemic** species for Dominican Rep.)

A. disjunctodens Armas et Teruel, 2005 – Cuba (**endemic** sp.)

The genus *Ammotrechella* prevails and is found also in Panama, Mexico and the U.S.A. (Texas and Florida). In Cuba there are eight species of Solifugae, in Jamaica – two, in Dominican Rep. – three species (Armas, 2004, with catalogue and analysis of the distribution of Solifugae in Caribbean and Central America). Since only few taxa have been added (Armas & Teruel, 2005).

Ricinulei

The only Ricinuleids known from the Greater Antilleans were found in Cuba. These are one cave inhabiting *Pseudocellus*, described almost simultaneously by Cooke (1972) and by Dumitresco & Juvara-Bals (1973), and *Pseudocellus silvai* (Armas, 1977). Both species seem **endemic** for Cuba. Judson & Hardy (2001) described a protonymph of *Cryptocellus* sp. from the Tobago Island.

Scorpiones

The information on the Scorpions in the Antillean fauna was generalized by Armas (2001, 2009b), who has described many of the existing taxa in the islands. Zoogeographical analysis of the origine and the affinities of the Antillean scorpions is due to Lourenço (1999a). On the Antilleans have been recorded four families (Buthidae, Chactidae, Hormuridae, and Scorpionidae), 17 genera and 130 species. Four genera with 21 species are **endemic** to the Antilleans (Armas, 1973, 1974, 1982, 1983, 1999, Armas & Maes, 1998, Armas & Marcano, 1987, Francke, 1978, Francke & Sissom, 1980, Kjellesvig-Waering, 1966, Lourenço, 1984, 1986, 1987, Lourenço et al., 1991, Lourenço & Huber, 1999, Lourenço & Vachon, 1996, Kovarik & Teruel, 2014, Moreno, 1940, Teruel, 2006).

Family Buthidae

Alayotityus Armas, 1973 (Cuban endemics; seven species).

Tityopsis Armas, 1974 (Cuban endemics; two species)

Family Scorpionidae (incl. Diplocentridae)

Cazierius Francke, 1978 (a Greater Antillean endemics; 10 species).

Oiclus Simon, 1880 – (Lesser Antillean endemics; two species from the Leeward Islands).

The other 11 genera are distributed as follows:

Ananteris Borelli, 1910 (one species from Trinidad and Tobago).

Centruroides Marx, 1890 (28 species on the Antilles).

Isometrus Ehrenberg, 1828 (one introduced species).

Microtityus Kjellesvig-Waering, 1966 (15 species, incl. six recent sp. from Hispaniola).

Rhopalurus Thorell, 1876 (eight species from Cuba and Hispaniola).

Tityus C. L. Koch, 1836 (20 species on the Antilles, incl. 13 recent species from Hispaniola).

Broteochactas Pocock, 1893 (two species from Trinidad and Tobago).

Chactas Gervais, 1844 (one species from Trinidad and Tobago).

Opisthacanthus Peters, 1861 (one species from Hispaniola).

Didymocentrus Kraepelin, 1905 (nine species from the Lesser Antilles, and central Cuba).

Heteronebo Pocock, 1899 (14 species from the Greater Antilles).

The scorpions of the Antilleans belong to 17 genera of four families, but Chactidae (with three genera) is known only from the islands Trinidad and Tobago near the coast of Venezuela (also the genus *Ananteris*). From the other 13 genera by far the richest is the fauna of Cuba (55 sp.), followed of Hispaniola (the Dominican Republic and Haiti), with in total 41 species.

The list of the scorpions in the Lesser Antilleans (16 spp.) is provided by Lescure, Jeremie, Lourenço et al. (1991), the one for Pinos (Isla de la Juventud), three species *Centruroides, Rhopaluros*, no endemics) by Armas (1983).

Pseudoscorpiones

The fauna of Pseudoscorpiones in the Caribbean belong to 14 families as follows (only the species **endemic** for West Indies)(Barba Diaz & Pérez, 2001, Barba Diaz & Barroso, 2013, Beier, 1976, Dumitresco & Orghidan, 1977, 1981, Heurtault & Rebière, 1983, Hoff, 1945, 1946, 1959, 1963, 1964, 1976, Muchmore, 1967, 1979, 1982, 1984, 1992, 1998, Tullgren, 1907, Vitali-di-Castri, 1984).

Family Chthoniidae

Caribchthonius butleri Muchmore, 1976 – U.S. Virgin Isls (**endemic**)

Pseudochthonius thibaudi Vitali-di-Castri, 1984 – Guadeloupe (**endemic**)

Tyrannochthonius guadeloupensis Vitali-di-Castri, 1984 – Guadeloupe (**endemic**)

T. imitatus Hoff, 1959 – Jamaica, the Dominican Rep.

T. proximus Hoff, 1959 – Jamaica, the Dominican Rep.

Family Lechythiidae

Lechytia delamarei Vitali-di-Castri, 1984 – Guadeloupe (**endemic**)

L. trinitatis Beier, 1970 – the Dominican Rep., Trinidad

Family Syarinidae

Ideobisium balzanii With, 1905 – Guadeloupe, Dominica, St. Vincent

I. puertoricense Muchmore, 1982 – the Dominican Rep., Puerto Rico

I. puertoricense cavicola Muchmore, 1982 – Puerto Rico

I. yunquense Muchmore, 1982 – Puerto Rico

Ideoblothrus carinatus (Hoff, 1964) – Jamaica

I. insularum (Hoff, 1945) – Jamaica, Puerto Rico

I. pygmaeus (Hoff, 1964) – Jamaica, Martinique

I. truncatus (Hoff, 1964) – Jamaica

Family Bochicidae

Antillobisium mitchelli Dumitresco et Orghidan, 1977 – Cuba (**endemic genus**)

A. vachoni Dumitresco et Orghidan, 1977 – Cuba

Troglobochica Muchmore, 1984 – Jamaica (**endemic genus**)

T. jamaicensis Muchmore, 1984

T. pecki Muchmore, 1984

Mexobisium armasi Muchmore, 1980 – Cuba

M. cubanum Muchmore, 1973 – Cuba

M. sierramaestrae Muchmore, 1980 – Cuba

Nannobisium mollis (Hoff, 1964) – Jamaica

Family Ideoroncidae

Typhloroncus coralensis Muchmore, 1979 – U.S. Virgin Isls (**endemic**)(the other four *Typhloroncus* are from Mexico)

Family Olpiidae

Aphelolpium thibaudi Heurtault et Rebière, 1893 – Guadeloupe, Martinique

Novohorus subfuscus Hoff, 1945 – Jamaica, Puerto Rico

Olpiolum monae (Hoff, 1964) – Mona, Jamaica, the Dominican Rep., Florida

O. amplum Hoff, 1964 – Jamaica

O. aureum (Hoff, 1945) – Mona, Puerto Rico

O. confundens (Hoff, 1945) – Puerto Rico

O. puertoricensis (Hoff, 1945) – Puerto Rico

Family Garypidae

Table 2. Scorpiones in the Antilleans

Country	**Cuba**	**Hispaniola**	**Jamaica**	**Puerto Rico**	**Bahamas**	**Lesser Antilles**	**Trinidad and Tobago**
Number of species	55	(40+6) 41	6	17	2	16	11
Fam. Buthidae	+	+	+	+	+	+	+
Alayotityus Armas	8	-	-	-	-	-	-
Ananteris Thorell	-	-	-	-	-	-	1
Centruroides Marx	14	5	4	5	2	8	1
Isometrus Ehrenberg							
Microtityus K. – W.	9	12	-	2	-	-	2
Rhopalurus Thorell	7	3	-	1	-	-	-
Tityopsis Pocock	2	-	-	-	-	-	-
Tityus C.L. Koch	1	13	1	7	-	4	4
Fam. **Chactidae**	-	-	-	-	-	-	+
Neochactas Sol. et Fet	-	-	-	-	-	-	1
Chactas Gervais	-	-	-	-	-	-	1
Broteochactas Pocock	-	-	-	-	-	-	1
Fam. **Hormuridae**	-	+	-	-	-	-	-
Opisthocanthus Peters	-	1	-	-	-	-	-
Fam. **Scorpionidae**	+	+	+	+	-	+	+
Casierus Francke	7	2	-	1	-	1	-
Didymocentrus Kraepelin	4	-	-	-	-	3	-
Cryptoiclus Ter. et Kov.	1	-	-	-	-	-	-
Heteronebo Pocock	2	5	1	1	-	5	-
Oiclus Simon	-	-	-	-	-	3	-

Planctolpium arboreum Hoff, 1964 – Jamaica, the Dominican Rep.

Family Cheiridiidae

Cheiridium insulare Heurtault et Rebière, 1893 – Guadeloupe (**endemic**)

Family Pseudochiridiidae

Pseudochiridium insulae Hoff, 1964 – Cuba, the Dominican Rep.

Family Atemnidae

Paratemnoides elongatus (Banks, 1895) – Cuba, the Dominican Rep., U.S. Virgin Isls, Central America, Mexico, U.S.A.

P. nidificator (Balzan, 1888) – Haiti, St Vincent, Central and South America

Family Cheliferidae

Cubachelifer strator Hoff, 1946 – the Dominican Rep., Cuba

Parachelifer dominicanus Beier, 1976 – the Dominican Rep. (**endemic**)

P. parvus Muchmore, 1981 – U.S. Virgin Isls (**endemic**)

Tyrannochelifer cubanus Hoff, 1964 – Cuba (**endemic**)

T. floridanus (Banks, 1891) – the Dominican Rep., Florida

T. macropalpus (Tullgren, 1907) – Haiti (**endemic**)

Family Chernetidae

Americhernes puertoricensis Muchmore, 1976 – Puerto Rico

Antillochernes cruzensis Muchmore, 1984 – U.S. Virgin Isls (**endemic**)

Bituberochernes jonensis Muchmore, 1979 – U.S. Virgin Isls (**endemic**)

Byrsochernes caribicus Beier, 1976 – the Dominican Rep. (**endemic**)

Caribochernes pumilus Beier, 1976 – the Dominican Rep. (**endemic**)

Chelanops ? [*Dinocheirus*] *altimanus* (Ellingsen, 1910) – St Thomas (**endemic**)

Chernes hispaniolicus Beier, 1976 – the Dominican Rep. (**endemic**)

Dinochernes chalumeaui Heurtault et Rebière, 1893 – Guadeloupe (**endemic)**

Hesperochernes vespertilionis Beier, 1976 – the Dominican Rep. (**endemic**)

Lustrochernes communis (Balzan, 1890) – South America, Trinidad, the Dominican Rep.

L. mauriesi Heurtault et Rebière, 1893 – Guadeloupe (**endemic**)

Parachernes (Scapanochernes) compressus (Tullgren, 1907) – the Dominican Rep., Haiti, Florida

P. dominicanus Beier, 1976 – the Dominican Rep., Haiti (**endemic**)

Parazaona klapperichi Beier, 1976 – the Dominican Rep. (**endemic**)

Family Withiidae

Cacodemonius segmentidentatus [in Beier, 1976 – "*serratidentatus*"] (Balzan, 1891) – the Dominican Rep., South America

Dolichowithius canestrinii (Balzan, 1887) – Virgin Islands, St Thomas, South America

D. simplex Beier, 1932 – the Dominican Rep., Puerto Rico

Endemic genera for the Antilleans are:

Antillobisium Dumitresco et Orghidan, 1977 – Cuba (two species)

Caribochernes Beier, 1976 – the Dominican Republic (one species)

Cubachelifer Hoff, 1946 – Cuba, the Dominican Rep. (one species)

Troglobochica Muchmore, 1984 – Jamaica (two species)

The pseudoscorpions are distributed between the main countries as follow:

Cuba – 27; Jamaica – 31; Puerto Rico – 18; Haiti – three; the Dominican Rep. – 26; Barbados – one; American Virgin Isl. – 12; Dominica – two; Martinique – seven; Guadeloupe – eight.

Opiliones

Cyphophthalmi – not recorded on the Antilleans

Eupnoi

Family Sclerosomatidae – *Geaia* Roewer, 1910 (Haiti), *Prionostemma* Pocock, 1903 (Cuba)

Dyspnoi – not recorded

Laniatores

According to Kury (2003), in the Caribbean area are known 117 species of Opiliones Laniatores, belonging to 65 genera and 11 families: Cosmetidae, Agoristenidae, Stygnidae, Stygnommatidae, Kimulidae (= Minuidae), Biantidae, Samoidae, Podoctidae, Manaosbiidae, Phalangodidae, Zalmoxidae. The subfamily Stenostygninae of Biantidae consists almost entirely of taxa from the Caribbean (eight of the nine genera)(Avram, 1970, 1973a, 1973b, 1977a, 1977b, 1981, Banks, 1909, Cokendolpher & Camilo – Rivera, 1989, Goodnight & Goodnight, 1942, Rambla, 1969, Roewer, 1947, Šilhavý, 1971, 1973, 1976, 1979, Staręga, 1970).

By far the best studied island is Cuba, not only because of its size, but mainly as a result of the studies of the Cubano-Romanian Expeditions (S. Avram and V. Šilhavý described from Cuba and other islands 58 new species and many new genera).

Here are listed the **endemic taxa** in the Antilleans:

Family Cosmetidae

Arucillus hispaniolicus Šilhavý, 1971– the Dominican Republic

Cynortula garna Goodnight et Goodnight, 1942 – Bahamas (Andros)

C. sayensis Goodnight et Goodnight, 1942 – Bahamas (New Providence)

C. juncta (Gervais, 1844) – Cuba

C. fraterna Banks, 1909 – Cuba

C. quinquesignata Franganillo Balboa, 1926 – Cuba

Cynorta sextuberculata Franganillo Balboa, 1926 – Cuba

C. hassleri Goodnight et Goodnight, 1942 – Haiti

C. lithoclasica Avram 1981- Cuba

C. poaensis Avram 1981 – Cuba

C. quibijana Avram 1981 – Cuba

Cynortoides caraibicus (Sørensen, 1932) – U.S. Virgin Islands – St. Thomas

C. cubanus cubanus (Banks, 1909) – Cuba

C. cubanus signatus Roewer, 1912 – Cuba

C. lateralis Roewer, 1947 – Jamaica

C. roeweri (Henriksen, 1932) – Puerto Rico

C. quadrispinosus Goodnight et Goodnight, 1942 – Jamaica

C. roeweri (Henriksen, 1932) – Cuba, Puerto Rico

C. caraibicus (Sørensen, 1932) – the Dominican Republic

C. marginatus Goodnight et Goodnight, 1942– the Dominican Republic

C. v-album (Simon, 1879) – the Dominican Republic, Haiti, Tortuga Island

Cynortesta laevis Roewer, 1947 – the Winward Islands

C. granulata Roewer, 1947 – the Winward Islands – Saint Vincent and the Grenadines

Eucynortoides antillarum Roewer, 1947 – the Winward Islands — Saint Vincent and the Grenadines

Cynortellana quadrimaculata (Gervais, 1844) – Cuba

C. bisignata (Banks, 1909) – Cuba

Heterovonones insularis Roewer, 1947 – Cuba

Erginulus castaneus (Banks, 1906) – Bahamas (Andros, New Providence)

E. quadricristatus (Franganillo Balboa, 1926) – Cuba

Metacynortoides bilineatus Goodnight et Goodnight, 1942 – the Dominican Republic

M. obscurus dorsalis Roewer, 1916 – U.S. Virgin Islands – St. Croix, St. Thomas

M. obscurus obscurus (Banks, 1901) – Haiti, Jamaica, Puerto Rico, U.S. Virgin Islands – St. John

M. romanus Goodnight et Goodnight, 1942 – the Dominican Republic

M. transversalis Goodnight et Goodnight, 1942 – the Dominican Republic

M. scabrosus (Banks, 1909) – Cuba

Paecilaema luquillense H. Soares, 1990 – Puerto Rico

P. conspicillatum Simon, 1879 – the Windward Islands – Martinique

Platycynorta secunda Roewer, 1947 – Cuba

Prasiana fallax (Sørensen, 1932) – West Indies

Proerginus lineatus Roewer, 1917 – the Dominican Republic

Trinimontius darlingtoni Šilhavý, 1970 – Cuba

Vonones sayi (Simon, 1879) – Cuba

V. granulatus Roewer, 1947 – the Leeward Islands – Antigua and Barbuda

V. planus Goodnight et Goodnight, 1942 – the Leeward Islands – Dominica

Family Samoidae

Akdalima jamaicana Šilhavý, 1979 – Jamaica

Arganotus robustus Šilhavý, 1979 – Haiti

Hummelinckiolus parvus Šilhavý, 1979 – the Leeward Islands – Guadeloupe, Montserrat, St. Kitts & Nevis

Maracaynatum cubanum Šilhavý, 1979 – Cuba

M. stridulans Šilhavý 1979 – Cuba

Orsa daphne Šilhavý, 1979 – Haiti

Pellobunus haitiensis (Šilhavý, 1979) – Haiti

Reventula amabilis Šilhavý, 1979 – Jamaica

Family Stygnidae

Heterostygninae

Stygnoplus antiguanus (Roewer, 1943) – the Leeward Islands – Antigua and Barbuda

S . flavitarsis (Simon, 1879) – the Leeward Islands – Guadeloupe

S. tuberculatus (Goodnight et Goodnight, 1942) – the Leeward Islands – Dominica

Family Stygnommatidae

Stygnomma spiniferum bolivari (Goodnight et Goodnight, 1945) – Cuba

S. spiniferum spiniferum (Packard 1888) – Florida Keys (U.S.A.) – Tortugas, Jamaica

S. spinula (Goodnight et Goodnight, 1942) – Puerto Rico

S. fiskei Rambla, 1969 – Jamaica

Family Agoristenidae

Agoristeninae

Agoristenus cubanus Šilhavý, 1973 – Cuba

A. haitensis Šilhavý, 1973 – the Dominican Republic

Ahotta hispaniolica Šilhavý, 1973 – Haiti

Calmotrinus turquinensis Šilhavý, 1973 – Cuba

Dumitrescuella ornata Avram, 1977 – Cuba

Haitimera paeninsularis Šilhavý, 1973 – Haiti

Lichirtes hexapodoides Šilhavý, 1973 – Cuba

Meriosfera gertschi Šilhavý, 1973 – Haiti

M. lineata Šilhavý, 1973 – Haiti

Orghidaniella granpiedrae Avram, 1977 – Cuba

Piratrinus calcaratus Šilhavý, 1973 – Cuba

Torreana poeyi Avram, 1977 – Cuba

T. spinata Avram, 1977 – Cuba

Vampyrostenus kratochvili Šilhavý, 1976 – Puerto Rico

Yunquenus portoricanus Šilhavý, 1973 – Puerto Rico

Family Phalangodidae

Phalangodes flavipes (Banks, 1908) – Cuba

Family Biantidae

Stenostygninae

Caribbiantes cubanus Šilhavý, 1973 – Cuba

Galibrotus carlotanus Šilhavý, 1973 – Cuba

G. matiasis Avram, 1977- Cuba

G. riedeli Šilhavý, 1973 – Cuba

Bidoma indivisa Šilhavý, 1973 – Haiti

Decuella cubaorientalis Avram, 1977- Cuba

Negreaella fundorai Avram, 1977 – Cuba

N. palenquensis Avram, 1977 – Cuba

N. rioindiocubanicola Avram, 1977- Cuba

N. vinai Avram, 1977 – Cuba

N. yumuriensis Avram, 1977 – Cuba

Manahunca bielawskii Šilhavý, 1973 – Cuba

M. cuevajibarae Avram, 1977- Cuba

M. silhavyi Avram, 1977 – Cuba

Martibianta virginsulana Šilhavý, 1973 – U.S. Virgin Islands — St. John

Vestitecola haitensis Šilhavý, 1973 – Haiti

Family Podoctidae Ibaloniinae

[*Santobius cubanus* = *Ibantila cubana* (Šilhavý, 1969) – Cuba (probably introduced from Melanesia, see Kury & Machado, 2009)]

Family Kimulidae (Minuidae)

Kimula levii Šilhavý, 1969 – Cuba

K. banksi Šilhavý, 1969 – Cuba

K. goodnightiorum Šilhavý, 1969 – Cuba

K. cokendolpheri Pérez et Armas, 2000 – the Dominican Republic

K. elongata Goodnight et Goodnight, 1942 – Puerto Rico

K. tuberculata Goodnight et Goodnight, 1943 – Cuba

K. turquinensis Šilhavý, 1969 – Cuba

Metakimula botosaneanui Avram, 1973 – Cuba

Minuides milleri Šilhavý 1978 – Cuba

Family Manaosbiidae

Cranellus balthazar Roewer, 1932 – the Windward Islands

Sanvincentia tarsalis Roewer, 1943 – the Windward Islands — Saint Vincent and the Grenadines

Family Zalmoxidae

Cersa kratochvili Šilhavý 1979 – Cuba

Ethobunus cubensis (Šilhavý 1979) – Cuba

E. goodnighti (Rambla, 1969) – Jamaica

E. pecki (Rambla, 1969) – Jamaica

E. zebroides (Šilhavý 1979) – Cuba

Pachylicus castaneus (Šilhavý 1979) – Cuba

Family uncertain

Anamota custodiens Šilhavý 1979 – Cuba

Caribula longimana Šilhavý 1979 – Cuba

Jimeneziella negreai Avram, 1970 – Cuba (**endemic** genus)

J. decui Avram, 1970 – Cuba

Metapellobunus unicolor (Roewer, 1912) – U.S. Virgin Islands – St. Thomas

Mirda insulanus (Banks, 1901) – Haiti, Puerto Rico

Neoscotolemon pictipes (Banks, 1908) – Cuba

N. lutzi Goodnight et Goodnight, 1942 – the Leeward Islands – Dominica

Paraconomma ovala Goodnight et Goodnight, 1942 – Puerto Rico

P. spinooculorum Goodnight et Goodnight, 1942 – Puerto Rico

Pseudomitraceras minutus Goodnight et Goodnight, 1942 – Puerto Rico

Turquinia montana Šilhavý 1979 – Cuba

Valifema blanda Šilhavý 1979 – Cuba

Endemic genera of Opiliones in the Caribbean are:

Family Kimulidae (= Minuidae)

Jimeneziella Avram, 1970 — Cuba (two sp.)

Kimula Goodnight et Goodnight, 1942 – Cuba, the Dominican Republic, Puerto Rico (eight sp.)

Family Biantidae (Stenostygninae)

Bidoma Šilhavý, 1973 – Haiti (one sp.)

Caribbiantes Šilhavý, 1973 – Cuba (one sp.)

Decuella Avram, 1977 – Cuba (one sp.)

Galibrotus Šilhavý, 1973 – Cuba (three sp.)

Manahunca Šilhavý, 1973 – Cuba (three sp.)

Martibianta Šilhavý, 1973 – Virgin Islands (one sp.)

Negreaella Avram, 1977 – Cuba (five sp.)

Vestitecola Šilhavý, 1973 – Haiti (one sp.)

Family Samoidae

Neoorsa Ozdikmen, 2006 (= *Orsa* Šilhavý, 1979) – Haiti (one sp.)

Reventula Šilhavý, 1979 – Jamaica (one sp.)

Vlachiolus Šilhavý, 1979 – Cuba (one sp.)

Amblypygi

From the Antillean Archipelago have been recorded 29 species of Amblypygi from four genera (*Charinus, Heterophrynus, Paraphrynus, Phrynus*) and two families (Charinidae and Phrynidae). The endemism is only at species level (25 species), most species being confined to only one island (Armas, 2004, 2006, 2007, 2009a, 2010, 2013, Armas & Avila Calvo, 2000, Armas & Pérez Gonzalez, 1994, 2001, 2002, Armas & Teruel, 1997, Avila Calvo & Armas, 1997, Franganillo, 1926, Mullinex, 1975, Pocock, 1893, Quintero, 1981, 1983, 1986, Teruel, 2011, Teruel & Questel, 2011, Teruel, de Armas & Rodriguez, 2009).

Five species (three *Phrynus,* one *Paraphrynus* and one *Heterophrynus*) are known also from South and Central America, Mexico, the Bahamas or Florida). This is in contrast with the order of Scorpions, where four of the 15 genera are **endemic** to the Antilleans.

As Armas (2009b) points out, Cuba has the most diverse amblypygid fauna (two fam., three genera, 19 species, incl. 12 **endemic**). Follows Hispaniola with two families, two genera and seven species, incl. **endemic**). Currently the distribution of the Amblypygi in the Antillean s:

Fam. Charinidae – *Charinus* Simon (12 sp., Cuba, Jamaica, the Dominican Rep., Puerto Rico, the Lesser Antileans)

Fam. Phrynidae – *Heterophrynus* Pocock (one sp., Trinidad and Tobago), *Paraphrynus* Moreno (three sp., Bahamas and Cuba), *Phrynus* Lamarck (14 sp., Cuba, Puerto Rico, the Dominican Republic, US Virgin Isls, Barbados, St. Vincent, Jamaica, Grenada, Haiti, etc.)

Thelyphonida (Uropygi)

According to the list of Rowland & Cooke (1973), on the Antillean islands live only two sp. of Thelyphonida; *Mastigoproctus baracoensis* Franganillo, 1931 (Cuba) and the second described species in Thelyphonida *M. proscorpio* (Latreille, 1806)(the Dominican Rep., Haiti and Martinique). Another *Mastigoproctus* (*M. pelegrini* Armas, 2000) was described later from Cuba. Armas (2002) described a new Uropygid from the Dominican Rep., first as *Telyphonellus wetherbeei*, than raised in a new genus *Ravilops* Viquez et Armas, 2005. So far the two Cuban *Mastigoproctus* and *Ravilops wetherbeei* are considered **endemic species**, *Ravilops* is also **endemic genus** for the Dominican Republic (Armas, 2000, 2004, Franganillo, 1931, Viquez & de Armas, 2005).

Schizomida

Identified Schizomida are known (Ávila Calvo & Armas, 1997, Armas, 1977, 1989, 2004, 2011, Armas & Abud Antun, 1990, 2002, Armas & Teruel, 2002, Camilo & Cokendolpher, 1988, Dumitresco, 1973, 1977, Hilton, 1933, Quintero, 1983, Reddell & Cokendolpher, 1995, Rowland & Reddell, 1977, Teruel, 2003, 2004, 2007) from:

Cuba – *Antillostenochrus alejandroi, A. alticola, A. cokendolpheri, A. gibarensis, A. holguin, A. planicauda, Cubazomus armasi, C. montanus, C. orghidani, C. rowlandi, Guanazomus armatus, Reddellzomus cubensis, Rowlandius abeli, R. alayoni, R. baracoae, R. biconouros, R. cubanacan, R. cupeyalensis, R. decui, R. digitiger, R. falcifemus, R. florentiae, R. gladiger, R. gracilis, R. guantanamero, R. labarcae, R. littoralis, R. marianae, R. melici, R. mixtus, R. monticola, R. negreai, R. ramosi, R. recuerdo, R. reyesi, R. serrano, R. siboney, R. terueli, R. toldo, R. vinai, Stenochrus alejandroi, S. portoricensis, Troglocubazomus orghidani, T. rowlandi*

Pinos (Isla de la Juventud) – *Luisarmasius insulaepinorum*

Hispaniola (the Dominican Rep. and Haiti) – *Antillostenochrus brevipatellatus, A. subcerdoso, Cokendolpherius ramosi, Rowlandius anasilviae, R. casabito, R. ducoudrayi, R. engombe, R. isabel, R. jarmillae, R. lantiguai, R. longipalpus, R. naranjo, R. virginiae, Stenochrus subcerdoso, S. portoricensis*

Dominica – *Stenochrus portoricensis*

Puerto Rico (incl. Isla Desecheo, Mona Island) – *Antillostenochrus cerdoso, Luisarmasius yunquensis, Rowlandius desecheo, R. monensis*

Jamaica – *Caribezomus laurae, Rowlandius cousinensis, R. peckorum, R. primibiconourus, R. viridis, Stenochrus portoricensis, Stewardpeckius troglobius*

Navassa – *Rowlandius steineri*

The Virgin Islands – *Stenochrus portoricensis*

Martinique – *Hansenochrus dispar, Rowlandius insignis*

There is also unidentified material from Barbados and the Cayman Islands.

Except of *Stenochrus portoricensis*, all species are **endemic** to the respective islands. **Endemic** to the Caribbean are also the genera ***Cokendolpherius*** (Cuba), ***Luisarmasius*** (Cuba, Pinos, Puerto Rico), ***Reddellzomus*** (Cuba), ***Stewardpeckius*** (Jamaica), ***Cubazomus* (Cuba), *Troglocubazomus* (Cuba).**

Araneae

Simon (1888), Alayon (1994, 1995, 2000, 2005), Bruyant (1940, 1945, 1947, 1948), Dumitrescu (1973), Dumitrescu & Georgescu (1992)

According to Alayón (2000), the spiders recorded from Cuba are 567 species of 52 families, including 247 endemic of the Antilleans (43.56%) with seven endemic genera

From the Antilleans are known some **endemic genera** of spiders, but **no endemic families**:

Family Theraphosidae

Antillena Bertani, Huff et Fukushima, 2017 – the Dominican Rep. (one sp.)

Caribena Fukushima et Bertani, 2017 – Puerto Rico, Cuba, US Virgin Isls, Martinique (two sp.)

Cubanana Ortiz, 2008 – Cuba (one sp.)

Nesipelma Schmidt et Kovarik, 1996 – Nevis (one sp.)

Family Ochyroceratidae

Fageicera Dumitrescu et Georgescu, 1992 – Cuba

Family Barychelidae

Troglothele Fage, 1929 – Cuba

Family Agelenidae

Neowadotes Alayón – Hispaniola

Family Cyatholipidae

Pokennips Griswold, 2001 – Jamaica

Family Tetragnathidae

Ancinosphenus Simon, 1895 – West Indies (one sp.)

Antillognatha Bryant, 1945 – Hispaniola

Hispanognatha Bryant, 1945 – Hispaniola

Family Linyphiidae

Lomaita Bryant, 1948 – Hispaniola

Family Filistatidae

Antilloides Breskovit et al., 2016 – Cuba, the Dominican Rep., the Virgin Isls, Puerto Rico

Family Theridiidae

Jamaitidion Wunderlich, 1995 – Jamaica (one sp.)

Family Paratropididae

Anisaspis Simon, 1891 – St. Vincent (one sp.)

Family Amaurobiidae

Tugana Chamberlin, 1948 – Cuba, Hispaniola (four sp.)

Family Anyphaenidae

Thaloe Brescovit, 1993 – Cuba, Hispaniola (three sp.)

Family Liocranidae

Laudetia Gertsch, 1941 – the Dominican Rep., Puerto Rico (three sp.)

Mesobria Simon, 1897 – St. Vincent (one sp.)

Family Ctenidae

Ciba Bloom et al., 2014 – Cuba, the Dominican Rep. (two sp.)

Ohvida Polotow et Brescovit, 2009 – Cuba, Puerto Rico, Bahamas (nine sp.)

Trujillina Bryant, 1948 – Hispaniola, Puerto Rico (three sp.)

Family Pholcidae

Bryantina Brignoli, 1985 – Cuba

Ciboneya Perez, 2001 – Cuba (four sp.)

Platnicknia Özdikmen et Demir, 2009 – Cuba (two sp.)

Tainonia Huber, 2000 – Hispaniola (five sp.)

Family Prodidomidae

Caudalia Alayón, 1980 – Cuba

Cubanopillus Alayón et Platnick, 1993 – Cuba

Family Sparassidae

Decaphora Franganillo, 1931 – Cuba

Family Salticidae

Allodecta Bruyant, 1950 – Jamaica

Bythocrotus Simon, 1903 – Hispaniola

Caribattus Bryant, 1950 – Jamaica

Cerionesta Simon, 1901 – St. Vincent

Commoris Simon, 1902 – Guadeloupe, Dominica

Corticettus Zhang et Maddison, – Porto Rico, Hispaniola

Paraplexippus Franganillo, 1930 – Cuba

Parasaitis Bruyant, 1950 – Jamaica

Parathiodina Bruyant, 1943 – Hispaniola

Popcornella Zhang et Maddison, 2012 – Hispaniola, Puerto Rico

Truncattus Zhang et Maddison, 2012 – Hispaniola

Opilioacarida

From Cuba and the Dominican Republic has been described the new genus *Caribeacarus* Vásquez et Klompen, 2009, from which two species have been described from Cuba, one also from the Dominican Republic and one from Panama. Another species, described from Cuba (and the Antillean Isls), was *Neoacarus orghidani* (Juvara-Balş et Baltac, 1977). Two of the three Cuban species and *Caribeacarus panamensis* live in caves (Beron, 2014, Juvara-Balş & Baltac, 1977, Vásquez & Klompen, 2009).

Parasitiformes (Mesostigmata and Ixodida)

Beron (2014), Cruz (2001)

From *Capromys pilorides* (Rodentia, Capromyidae) has been described the **endemic** *Ixodes capromydis* Černy, 1966 (endemic subgenus *Alloixodes*).

The purely Neotropical family of Spelaeorhynchidae (parasites on bats of the families Phylostomatidae and Mormoopidae) are found, together with these bats, in Cuba, Jamaica, Puerto Rico and the Dominican Republic, but also in Central America.

Holothyrida

The only Holothyrid recorded from the Antilleans is the **endemic** genus *Carabothyrus* Kontschán et Mahunka with one species *C. barbatus* Kontschán et Mahunka, described from the Dominican Republic (Kontschán & Mahunka, 2004).

Comparison between the faunas of Central America and the Antilleans

Palpigradi – known only from the Antilleans

Ricinulei

Central America

In the seven countries of Central America (without S. Mexico) are registered 18 species of Ricinulei:

Cryptocellus Westwood, 1874 – 12 species

Pseudocellus Platnick, 1980 – six species

The Antilleans

Two **endemic** species of *Cryptocellus* from Cuba

Solifugae – endemic genera in **bold**

Central America – From the seven countries of Central America (without S. Mexico) are known 10 sp. of Solifugae of five genera, all belonging to Ammotrechidae family (Ammotrechinae): *Ammotrecha* Banks, 1900 (four sp.), *Ammotrechella* Roewer, 1934 (two sp.), ***Ammotrechesta*** Roewer, 1934 (five sp.), ***Innesa*** Roewer, 1934 (one sp., **endemic genus**), *Ammotrechula* Roewer

The Antilleans – From the Antilleans are known four genera of Solifugae (all from Ammotrechidae), three of them endemic, all belonging to Ammotrechidae: ***Ammotrechinus*** Roewer, 1934 (one sp.), *Ammotrechella* Roewer, 1934 (nine sp.), ***Ammotrechona*** Roewer, 1934 (one sp.),

Antillotrecha Roewer, 1934 (three sp.)

All Solifugae in both areas belong to the same family. There is only one genus in common (*Ammotrechella*), the species are **endemic**.

Amblypygi

Central America The Amblypygids are represented in Central America by nine sp.

Fam. Charinidae – *Charinus* Simon

Fam. Phrynidae – *Phrynus* Lamarck, *Paraphrynus* Moreno

The Antilleans – 29 species of Amblypygi from four genera (*Charinus, Heterophrynus, Paraphrynus, Phrynus*) and the same two families (Charinidae and Phrynidae). The **endemism** is only on species level (25 species). Except of *Heterophrynus*, known from the islands Trinidad and Tobago by the Venezuelan coast, the generic composition of Mesoamerica and the Antilleans is the same.

Thelyphonida (Uropygi)

Central America – five endemic species of three endemic genera (***Valeriophonus*** Viquez et Armas **endemic** for Costa Rica, ***Mayacentrum*** Viquez et Armas – Guatemala, Belize, Honduras, El Salvador, ***Mimoscorpius*** Pocock – Guatemala)

The **Antilleans** – four species (*Mastigoproctus* Pocock – three in Cuba, Haiti and Martinique, *Ravilops* Viques et Armas). All species and the genus ***Ravilops***, are **endemic** for the Antilleans.

Schizomida

Central America

In Central America (between Mexico and Colombia) are recorded seven species, but there is also unidentified material from many places (Reddell & Cokendolpher, 1995). Besides the largely distributed *Stenochrus portoricensis* (Guatemala, Honduras, Nicaragua, Belize), from Central America are known the genera *Hansenochrus* (Costa Rica, Panama), *Rowlandius* and *Surazomus* (Costa Rica). *Surazomus* Reddell et Cokendolpher is known lso from many Southamerican countries. *Rowlandius* Reddell et Cokendolpher is widespread in the Caribbean islands. *Hansenochrus* Reddell et Cokendolpher is found also in South America and the Caribbean.

The Antilleans

From the Antilleans are known Schizomids of nine genera (six **endemic**), all belonging to one family – Hubbardiidae.

Central America	The Antilleans
-	***Cubazomus*** Red. et Cokendolpher
-	***Heterocubazomus*** Teruel
Rowlandius===========	=*Rowlandius* Red. et Cok.
Stenochrus============	=*Stenochrus* Chamberlin
Piaroa Manz. et al.	-
-	***Luisarmasius*** Red. et Cok.
-	***Stewardpeckius*** Red. et Cok.
-	***Reddellzomus*** Armas
-	***Cokendolpherius*** Armas
Surazomus	-
Hansenochrus=======	=*Hansenochrus* Red. et Cok.
Mayazomus Red. et Cok. (*Heteronochrus* Armas et Viques) (Guatemala)	-
Belicenozomus Armas et Viques	-

The present list is based on the papers of: Ávila Calvo & Armas (1997), Armas (1977, 1989, 2004), Armas & Abud Antun (1990, 2002), Armas & Teruel (2002), Camilo & Cokendolpher (1988), Dumitresco (1973, 1977), Hilton (1933), Quintero (1983a), Reddell & Cokendolpher (1995), Rowland & Reddell (1977), and others.

Identified Schizomida are known from:

Cuba – *Cokendolpherius, Reddellzomus, Heterocubazomus, Cubazomus armasi, C. orghidani, C. rowlandi, Rowlandius alayoni, R. baracoae, R. biconouros, R. cubanacan, R. decui, R. digitiger, R. gladiger, R. labarcae, R. negreai, R. recuerdo, Stenochrus alejandroi, S. portoricensis,*

Pinos (Isla de la Juventud) – *Luisarmasius insulaepinorum*

Hispaniola (the Dominican Rep. and Haiti) – *Rowlandius anasilviae, R. brevipatellatus, R. casabito, R. ducoudrayi, R. engombe, R. isabel, R. jarmillae, R. lantiguai, R. longipalpus, R. naranjo, R. virginae, Stenochrus subcerdoso, S. portoricensis*

Dominica – *Stenochrus portoricensis*

Puerto Rico (incl. Isla Desecheo, Mona Island) – *Luisarmasius yunquensis, Rowlandius desecheo, R. monensis*

Jamaica – *Rowlandius cousinensis, R. peckorum, R. primibiconourus, R. viridis, Stenochrus portoricensis, Stewardpeckius troglobius*

The Virgin Islands – *Stenochrus portoricensis*

Martinique – *Hansenochrus dispar, H. insignis*

There is also unidentified material from Barbados and the Cayman Islands.

Except of *Stenochrus portoricensis*, all species are **endemic** to the respective islands. **Endemic** to the Caribbean are also the genera ***Cokendolpherius*** (Cuba), ***Luisarmasius*** (Cuba, Pinos, Puerto Rico), ***Reddellzomus*** (Cuba), ***Stewardpeckius*** (Jamaica), ***Cubazomus*** (Cuba), ***Heterocubazomus*** (Cuba).

Pseudoscorpiones

Central America

In the seven countries of Central America are recorded Pseudoscorpions of 18 genera and 12 families (Chthoniidae, Bochicidae, Neobisiidae, Syarinidae, Ideoroncidae, Sternophoridae, Garypinidae, Atemnidae, Olpiidae, Cheliferidae, Chernetidae, Withiidae).

The Antilleans

The fauna of Pseudoscorpiones in the Antilleans consists in 39 genera and 16 families.

Genera and families in both areas:

Central America **The Antilleans**

Chthoniidae

Caribchthonius=======*Caribchthonius* Muchmore
- *Mundochthonius* Chamberlin
Pseudochthonius========*Pseudochthonius* Balzan
Tyrannochthonius===*Tyrannochthonius* Chamberlin

Lechythiidae

- *Lechytia* Balzan

Tridenchthoniidae

- *Tridenchthonius* Balzan

Bochicidae

Antillobisium Dumitresco et Orghidan (**end. genus**, Cuba)
Mexobisium Muchmor====*Mexobisium* Muchmore
- ***Troglobochica*** Muchmore (**end. genus**, Jamaica)

Neobisiidae

Microbisium Chamberlin -

Syarinidae

Ideobisium Balzan ==========*Ideobisium* Balzan
Ideoblothrus Balzan=========*Ideoblothrus* Balzan

Ideoroncidae

- *Typhloroncus* Muchmore
Albiorix Chamberlin –
Pseudalbiorix Barba et Pérez –

Sternophoridae

Garyops===================*Garyops* Banks
- *Idiogaryops* Hoff

Cheiridiidae

- *Cheiridium* Menge
- *Cryptocheiridium* Chamberlin

Pseudochiridiidae

- *Pseudochiridium* With

Garypinidae

Pseudogarypinus Beier -
Serianus Chamberlin======*Serianus* Chamberlin

Atemnidae

- *Atemnus* Canestrini
- *Oratemnus* Beier
Paratemnoides Harvey=====*Paratemnoides* Harvey

Olpiidae

Aphelolpium Hoff
Olpiolum Beier===============*Olpiolum* Beier
- *Planctolpium* Hoff

Cheliferidae

Cubachelifer Hoff (Dominican Rep., Cuba – **endemic genus**)
Parachelifer Chamberlin==*Parachelifer* Chamberlin
- *Tyrannochelifer* Chamberlin

Chernetidae

Antillochernes Muchmore
- *Bituberochernes* Muchmore
- *Byrsochernes* Beier
Caribochernes Beier (the Dominican Rep., **endemic genus**)
Chelanops Gervais
Chernes Menge
Dinochernes Beier
- *Hesperochernes* Chamberlin
Lustrochernes Beiep=========*Lustrochernes* Beier
Parachernes (*Parachernes*) Chamberlin -
Parachernes (*Scapanochernes* Beier)======*Parachernes* (*Scapanochernes* Beier)
Parazaona Beier

Withiidae

Cacodemonius Chamberlin=======*Cacodemonius* Chamberlin
Dolichowithius (D.) Chamberlin====*Dolichowithius (D.)* Chamberlin

Both areas have 10 families and 15 genera of Pseudoscorpions in common. No endemic families, no endemic genera in Central America, four endemic genera in the Antilleans.

Scorpiones

Central America	**Antilleans (without Trinidad and Tobago)**
Buthidae	
	Alayotityus Armas
Centruroides =============	*Centruroides* Marx
-	*Microtytius* K.-W.
-	*Rhopalurus* Thorel
-	*Tityopsis* Pocock
Tityus ===================	*Tityus* C.L. Koch
Chactidae	-
Chactas Gervais	–
Hormuridae	
Opisthacanthus==========	*Opisthacanthus* Peters
Scorpionidae	
-	*Cazierus* Francke
-	*Cryptoiclus* Ter. et Kov.
Didymocentrus==========	*Didymocentrus* Kraep.
-	*Heteronebo* Pocock
Diplocentrus Peters	–
Euscorpiidae	
Plesiochactas Pocock	-
Vaejovidae	
Vaejovis C.L. Koch	–

Conclusion

Palpigradi are known only from the Antilleans.

In the seven countries of Cental America (without counting Yucatan) are known 18 sp. of **Ricinulei** of both American genera. From the Antilleans (Cuba) have been recorded only two (endemic) species. The genus *Cryptocellus* Westwood is in common of both areas.

From the seven countries of Central America (without S. Mexico) are known **Solifugae** of five genera, all belonging to Ammotrechidae family (Ammotrechinae). Two genera seem endemic. From the Antilleans are recorded four genera (all from the same family Ammotrechidae), three of them endemic. There is only one genus in common among both areas (*Ammotrechella*), the species are **endemic**.

The **Amblypygi** of the Antilleans are much numerous and varied (29 sp. of four genera), than in the seven countries of Central America (nine sp. of two genera, the families are the same). Again difference in the research?

Both areas have comparable fauna of **Thelyphonida** (**Uropygi**) (each one has the genus *Mastigoproctus* plus one endemic genus).

The **Schizomida** of both areas belong to one family, but the genera are very different (seven genera, one endemic in Central America, eight genera in the Antilleans, six endemic). Both areas have three genera in common. Again difference in the research?

Opiliones.

Cyphophthami – unknown in both areas.

Eupnoi: Sclerosomatidae (in both areas the same genera *Geaia* and *Prionostemma*);

Dyspnoi – in Honduras the genus *Trilasma* Goodnight et Goodnight, 1942 (Nemastomatidae, Ortholasmatinae); in the Antilleans Dyspnoi are not recorded.

Laniatores. The Catalogue of Kury (2003) enumerates from the seven countries of Central America 56 genera and nine families of Laniatores (Cosmetidae, Cranaidae, Gonyleptidae, Stygnommatidae, Samoidae, Pyramidopidae, Manaosbiidae, Stygnopsidae, Zalmoxidae). From the Antilleans in the same Catalogue are listed 117 species of Opiliones Laniatores, belonging to 65 genera and 11 families: Cosmetidae, Agoristenidae, Stygnidae, Stygnommatidae, Kimulidae (= Minuidae), Biantidae, Samoidae, Podoctidae, Manaosbiidae, Phalangodidae, Zalmoxidae. From this number there are genera and five families (underlined) in common. The endemic genera of opilions in the islands are 13 (Biantidae, Kimulidae). There are **no endemic families.**

The fauna of **pseudoscorpions** in the Antilles seems much richer (39 genera, 16 families) than the fauna of the seven countries of Central America (33 genera, 13 families). Both areas have 13 genera in common.

This comparison shows that from eight genera of **scorpions** in Central America and 11 genera in the Antilleans there are four genera in common. Three families in Central America (Chactidae, Euscorpiidae and Vaejovidae) are not recorded in the Antilleans. The fact that the scorpions in the islands are more genera and species than the scorpions of Central America, region with land connection with such rich areas like Mexico and northern South America. One explanation is the very active speciation, especially in Cuba (55 sp.) and the Dominican Rep. (40 species). The other explanation is the presence in Cuba of such specialists as Armas and Teruel.

Araneae

According to Alayón (2000), the spiders recorded from Cuba are 567 species of 52 families, including 247 endemic de Antilleans (43.56%) with eight endemic genera (*Troglothele* Fage, *Bryantina*

Brignoli, *Fageicera* Dumitresco et Georgesco, *Caudalia* Alayón, *Cubanopillus* Alayón et Platnick, *Decaphora* Franganillo, *Paraplexippus* Franganillo).

From the Antilleans are known some **endemic genera** of spiders.

Opilioacarida – Two genera from the same family (*Neocarus* Chamberlin et Mulaik and *Caribeacarus* Vasquez et Klompen live in both areas. The species are (so far) **endemic**.

Holothyrida are unknown in Central America. From the Dominican Republic has been described the endemic species *Caribothyrus barbatus* Kontchán et Mahunka, 2004.

In general, there is considerable difference (artificial ¿) between the arachnofaunae of both areas, but on low (genus, species) level. The Antilleans seem richer (or better explored).

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Сравнителен арахногеографски анализ на фауните на Централна Америка и Антилските (Карибските) острови

Петър Берон

(Резюме)

Разпространението на всички разреди от клас Arachnida в Централна Америка и Антилските острови е анализирано и сравнено, заедно с анализ на палеогеографската история на районите и на разните опити на зоогеографите да ситуират континенталната и островната части върху зоогеографската карта на Западното полукълбо.

Заключения:

Palpigradi са познати само от Антилските острови.

В седемте страни на Централна Америка (без да броим Юкатан) са познати 18 вида **Ricinulei** от двата американски рода. От Антилите (Куба) са съобщени само два (ендемични?) вида. Род *Cryptocellus* е общ за двата района.

От седемте страни на Централна Америка (без Южно Мексико) са познати **Solifugae** от пет рода, всички от Ammotrechidae (Ammotrechinae). Два рода изглеждат ендемични. От Антилите са съобщени четири рода (всички от същото сем. Ammotrechidae), три от тях ендемични. Има само един род общ и за двата района (*Ammotrechella*), видовете са ендемични.

Амблипигите (**Amblypygi**) на Антилите са по-многобройни и ранообразни (29 в. от четири рода), отколкото в седемте страни на Централна Америка (девет вида от два рода, семействата са същите). Отново разлика в проучеността?

Двата района имат различна фауна от **Thelyphonida** (**Uropygi):** в Централна Америка има три ендемични рода и пет ендемични вида, в Антилските острови има ендемични видове *Mastigoproctus* и един ендемичен род.

Схизомидите (**Schizomida)** в двата района спадат към едно и също семейство, но родовете са различни (седем рода, един ендемичен в Централна Америка, осем рода, шест ендемични в Антилите). Двата района имат три общи рода. Отново разлика в проучеността?

Opiliones. Cyphophthami – непознати и в двата района. **Eupnoi**: Sclerosomatidae (и в двата района едни и същи родове *Geaia* и *Prionostemma*); **Dyspnoi** – в Хондурас е познат род *Trilasma* (Nemastomatidae, Ortholasmatinae); в Антилските острови подразред Dyspnoi не е съобщен. **Laniatores.** Каталогът на Kury (2003) изброява за седемте страни на Централна Америка 56 рода

и девет семейства от Laniatores (Cosmetidae, Cranaidae, Gonyleptidae, Stygnommatidae, Samoidae, Pyramidopidae, Manaosbiidae, Stygnopsidae, Zalmoxidae). От Антилите в същия Каталог са изброени 117 вида Opiliones Laniatores, които спадат към 65 рода и 11 семейства: Cosmetidae, Agoristenidae, Stygnidae, Stygnommatidae, Kimulidae (= Minuidae), Biantidae, Samoidae, Podoctidae, Manaosbiidae, Phalangodidae, Zalmoxidae. От този брой има пет общи семейства (подчертани). Ендемичните родове по островите са 13 (от Biantidae и Kimulidae). **Няма ендемични семейства.**

Фауната на **псевдоскорпионите** в Антилите изглежда по-богата (39 рода, 16 семейства), отколкото тази на седемте страни на Централна Америка (33 рода, 13 семейства). Двата района имат 13 общи рода.

Това сравнение сочи, че от осем рода **скорпиони** в Централна Америка и 11 рода в Антилите има четири общи рода. Три семейства от Централна Америка (Chactidae, Euscorpiidae и Vaejovidae) не са съобщавани за Антилите. Интересен факт е, че скорпионите по островите са повече родове и видове, отколкото скорпионите в Централна Америка, която и свързана по суша с такива богати райони като Мексико и северната част на Южна Америка. Едно от обясненията е много активното видообразуване, специално в Куба (55 вида) и Доминиканската република (40 вида). Друго обяснение е наличието в Куба на такива специалисти като Armas и Teruel.

Araneae. От Куба са съобщени 567 вида от 52 сем., вкл. 247 ендемични за Антилите (43.56%) със седем ендемични рода (Ochyroceratidae – ***Fageicera***, Barychelidae – ***Troglothele***, Pholcidae – ***Bryantina***, Prodidomidae – ***Caudalia***, ***Cubanopillus***, Sparassidae – ***Decaphora***, Salticidae ***Paraplexippus*** Franganillo). Изброени са редица ендемични родове за Антилите и за Централна Америка. Няма ендемични семейства.

Opilioacarida. Два рода от едно и също семейство (*Neocarus* и *Caribeacarus*) се срещат в двата района. Видовете са (засега) ендемични.

Holothyrida са непознати в Централна Америка. От Доминиканската република беше описан ендемичният вид *Caribothyrus barbatus*.

Общо взето, има значителна разлика (изкуствена ?) между арахнофауните на двата района, но на ниско ниво (род, вид). Антилите изглеждат по-богати (или по-добре изследвани). И в двата района липсват ендемични семейства.

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Vertical distribution and comparative zoogeographical characteristic of dipteran fauna (Insecta: Diptera) according to the vegetation belts of the Pirin and Rila Mountains

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Abstract: A total of 1351 species from 63 families (759 species from the Pirin Mts. and 1003 species from the Rila Mts.) have been recorded from the two mountains so far. The low degree of similarity (46.2%) of the fauna between these mountains is related to their natural features and insufficient research. The greatest number of species has been found in the zone of the beech forests (409 species or 55.1% from Pirin Mts. and 736 species or 73.4% from the Rila Mts.). The degree of similarity between the dipteran fauna of the different vegetation belts of the two mountains ranges from 0% to 46.6%. The dipterans belong to 92 areographical categories, divided into two supergroups: 1) species with Mediterranean type of distribution: more thermophilic and distributed mainly in the southern parts of the Palaearctic (49 species or 6.5% from Pirin Mts. and 48 species or 4.8% from the Rila Mts.); 2) species with Palaearctic and Eurosiberian type of distribution: more eurybiontic and widely distributed in the Palaearctic (710 species or 93.5% from Pirin Mts. and 955 species or 95.2% from the Rila Mts.). The Holomediterranean and Mediterranean-Central Asian forms (from 0.6% to 1.3%) are the best represented in the first group. The European, Holarctic, Holoeurosiberian and Transpalaearctic taxa (from 7.8% to 19.0%) prevail in the second group. A total of 12-13 species (from 1.2% to 1.7%) are endemics. The distribution of the zoogeographical categories in the separate vegetation belts of the mountains is scrutinised.

Key words: Diptera, Pirin Mts., Rila Mts., areography, zoogeography, faunistic composition, Bulgaria

Introduction

The first data on Diptera from the Pirin Mts. are reported by Drensky (1929). In 82 publications there are data related to dipterans of the mountain (Hubenov, 2015b). The first data on Diptera from the Rila Mts. are reported by Joakimoff (1899) and Nedelkov (1909, 1910, 1912). In 120 publications there are data concerning dipterans of the mountain (Hubenov, 2016).

The data are fragmentary, concern separated parts of the mountains and are scattered in different articles, which are not specially referred to the Pirin or Rila Mts. There are more systematic studies (presented differently for each of the mountains) for the families Limoniidae, Cecidomyiidae, Simuliidae, Chironomidae, Syrphidae, Agromyzidae, Chloropidae, Muscidae and Tachinidae. There are systematic studies on the Pirin Mts. for the family Tachinidae (Hubenov, 1992) and the Rila Mts. – for the families Simuliidae (Kovachev, 2000) and Chironomidae (Stoichev, 2000a, 2000b, 2002, 2004; Stoichev & Cernev, 2001, Stoichev & Danova, 2003). Generalised investigations on the tachinid fauna of both mountains are reported by Hubenov (2015b, 2016).

The aim of this work is to present the distribution of Diptera in the vegetation belts of the Pirin and Rila Mountains, as well as to make a comparative zoogeographical analysis of the fauna.

Study area, materials and methods

The two mountains vary in respect of their physical geographical features. **Pirin Mts.** are situated between the valleys of the Struma and Mesta Rivers, south of the Rila Mts., from which are separated by the Predel Col (1140 m a.s.l.).

The Paril Col (1174 m a.s.l.) separates the Pirin Mts. from the situated in the south Slavyanka Mts. The Pirin Mts. stretche northwest-southeast and is about 80 km long and 40 km wide. The maximum height at Vihren Peak is 2914.3 m a.s.l.. The total area of the mountains is 2585 km^2. They are divided into North, Middle and South Pirin. In the Pleistocene glacial forms have been formed in the Pirin Mts. Gravity forms of alpine type are characteristic of its high parts. Climatically the Pirin Mts. belong to the Continental-Mediterranean climatic region and include parts of the Maleshevska-Pirin Low Mountain, Mestenski and Mountain climatic areas (Stanev, 1991). Glacial lakes are situated in the cirques of the granite part of Northern Pirin, whereas the marble part is relatively anhydrous. The Pirin Mts. belong to the region of the Illyrian Province of the European deciduous forest area. The vegetation is differentiated in a system of six vegetation belts (Stojanov, 1966; Velchev et al., 1982, 1989; Velchev, Tonkov, 1986; Bondev, 1991, 1997, 2002; Velchev, 1997, 2002): 1) Xerothermic oak forests, best presented in the west and south hillsides up to 600-700 m a.s.l.; 2) Mesophylic and xeromesophylic mixed forests, well presented in the south-west and east hillsides from 600-700 m a.s.l. to 900-1000 m a.s.l.; 3) Beech forests, best presented in the middle and south parts of the mountain from 900-1000 m a.s.l. to 1500-1600 m a.s.l.; 4) Coniferous forests from 1300-1600 m a.s.l. to 2000-2200 m a.s.l.; 5) Subalpine vegetation from 2000 to 2500 m a.s.l.; 6) Alpine vegetation above 2400-2500 m a.s.l. For the coniferous zone of the marble part of Northern Pirin, the Mediterranean plant formation of *Pinus leucodermis* Ant. is typical. The Pirin Mts. belong to the Rila-Rhodope zoogeographical region and have an Eurosiberian and Submediterranean faunistic character in the lower parts (Georgiev, 1982, 2002). The territory of the Pirin National Park includes 40332 ha with the reserves Bayuvi Dupki-Dzhindzhiritsa (2873 ha) and Yulen (3156 ha). The park's boundary descends to 800-900 m a.s.l. but usually lies significantly higher (above 1300-1700 m a.s.l.).

Rila Mts. are situated north of the Pirin Mts. They are connected with the Verila, Ihtimanska Sredna Gora and Rhodope Mountains through the Klisurska (1025 m a.s.l.), Borovetska (1305 m a.s.l.), Yundolska (1375 m a.s.l.) and Avramova (1295 m a.s.l.) Cols. The Rila Mts. stretch west-east and are over 70 km long and 50 km wide. The maximum height at Musala Peak is 2925 m a.s.l.. The total area of the mountains is 2629 km^2. They are divided into four parts: North-west, Central, East and South-west. The Rila Mts. are a silicate massif consisting essentially of granites. In the Pleistocene glacial forms have been formed. Gravity forms of alpine type are characteristic of the high parts. The Rila Mts. are under the influence of the Intermediate-Continental and Continental-Mediterranean climatic regions. They include parts of the Rila-Osogovo and Mountain climatic regions (Stanev, 1991). In the cirques of the mountains 190 glacial lakes are situated. The Rila Mts. belong to the region of the Illyrian Province of the European deciduous forest area. The vegetation is differentiated in a system of six vegetation belts (Stojanov, 1966; Velchev et al., 1982, 1989; Velchev, Tonkov, 1986; Bondev, 1991, 1997, 2002; Velchev, 1997, 2002): 1) Xerothermic oak forests, best presented in the north-east, west and south-west hillsides to 500-700 m a.s.l.; 2) Mesophylic and xeromesophylic mixed forests, well presented in the west, east and south-east hillsides from 600-700 m a.s.l. to 900-1000 m a.s.l.; 3) Beech forests, best presented in the north, north-east and west parts of the mountains from 900-1000 m a.s.l. to 1500-1600 m a.s.l.; 4) Coniferous forests, best presented in the north, east and south hillsides from 1500-1600 m a.s.l. to 2000-2200 m a.s.l.; 5) Subalpine vegetation – from 2000-2200 a.s.l. to 2500 m a.s.l.; 6) Alpine vegetation – above 2400-2500 m a.s.l. Under the human impact, the vegetation has undergone destructive changes, expressed most strongly in the first two zones. The boundaries between the vegetation belts are not defined clearly and depending on the exposure, topography and human activities there are mixed zones up to 200-300 m a.s.l. The Rila Mts. belong to the Rila-Rhodope zoogeographical region and have an Eurosiberian faunistic character (Georgiev, 1982, 2002). The mountains are the richest area in endemics (268) and relicts (230) in Bulgaria (Hubenov, 2008). The territory of the Rila National Park includes 81046 ha with the Parangalitsa (1509 ha), Central Rila (12393.7 ha), Ibar (2248.6 ha) and Skakavitsa (70.8 ha) Reserves. The park's boundary rarely descends below 1000 m a.s.l. and usually lies higher (to 1500-2000 m a.s.l.). The Rila Monastery Nature Park (27270 ha) with the Rila Monastery Forest Reserve (3678 ha) is also included in the mountains' territory.

The material from the Pirin Mts. was collected from 77 localities after 1914. From the western and south-western slopes of the mountains, the territory above 300 m a.s.l. is included. The material from the Rila Mts. was collected from 160 localities after 1890. Some collectors at the beginning of the last century did not give accurate localities on the labels and indicated only Pirin Mts. or Rila Mts. There are no exact localities for 47 species from the Pirin Mts. and 111 species from the Rila Mts. For a number of widespread and numerous species, the authors did not give the localities and mentioned they occurred everywhere. Such species are included in the review only if they are reported from the Pirin Mts. or Rila Mts. The main part of the material is stored in the National Museum of Natural History and the Institute of Biodiversity and Ecosystem Research. A number of foreign entomologists have been collecting and publishing materials from Bulgaria, containing data about the Pirin and Rila Mts. The species distribution in the vegetation belts is determined according to the altitude and the landscape of the localities.

Zoogeographical analysis for the species categorisation was used. This method allows obtaining data information about species complexes with different zoogeographical character based on the published data regarding species distribution and results of the faunistic research. The classification of the areas follows de Lattin (1967), Malicky et al. (1983), Gorodkov (1984) and Vigna Taglianti et al. (1999). To compare the fauna, Czekanowski-Dice-Sørensen coefficient of similarity was used.

Abbreviations used: ♦ – presence of the species in the Pirin Mts., ● – presence of the species in the Rila Mts., **?** – uncertain data or lack of data, +++ – species without exact locality in the Pirin Mts. or Rila Mts., **atm** – Afrotropical-Mediterranean, **ba** – Boreoalpine, **ban** – Balkan-Anatolian, **bm** – Boreomontane, **cee** – Central and East European, **cse** – Central and South European, **csean** – Central and South European-Anatolian, **csee** – Central and South-East European, **cseean** – Central and South-East European-Anatolian, **cseeit** – Central and South-East European-Iran-Turanian, **cseel** – Central and South-East European-Lebanonian, **cseit** – Central and South European-Iran-Turanian, **csena** – Central and South European-North African, **des** – Disjunct Eurosiberian, **dp** – Disjunct Palaearctic, **dpo** – Disjunct Palaearctic-Oriental, **e** – European, **ean** – European-Anatolian, **eanna** – European-Anatolian-North African, **Eb** – Balkan endemic, **Ebg** – Bulgarian endemic, **Ebs** – Balkan subendemic, **eca** – European-Central Asian, **eeca** – East European-Central Asian, **eit** – European-Iran-Turanian, **em** – East Mediterranean, **ena** – European-North African, **Er** – Regional endemic, **esanca** – Eurosiberian-Anatolian-Central Asian, **esca** – Eurosiberian-Central Asian, **ess** – European and South Siberian, **eswa** – European-South-West Asian, **et** – European-Turanian, **ewca** – European-West Central Asian, **h** – Holarctic, **h*** – species introduced in North America, **ha** – Holarctic-Australian, **hat** – Holarctic-Afrotropical, **hata** – Holarctic-Afrotropical-Australian, **hn** – Holarctic-Neotropical, **hnat** – Holarctic-Neotropical-Afrotropical, **hno** – Holarctic-Neotropical-Oriental, **ho** – Holarctic-Oriental, **hoa** – Holarctic-Oriental-Australian, **hoes** – Holoeurosiberian, **hom** – Holomediterranean, **hop** – Holopalaearctic, **hpt** – Holarctic-Paleotropical, **hpta** – Holarctic-Paleotropical-Australian, **hptn** – Holarctic-Paleotropical-Neotropical, **I** – introduced species (immigrants), **k** – Cosmopolitan, **m** – montane, **mca** – Mediterranean-Central Asian, **mss** – Mediterranean and South Siberian, **msws** – Mediterranean and South-West Siberian, **mt** – Mediterranean-Turanian, **mwca** – Mediterranean-West Central Asian, **nemit** – North-East Mediterranean-Iran-Turanian, **nm** – North Mediterranean, **nmca** – North Mediterranean-Central Asian, **nmt** – North Mediterranean-Turanian, **om** – Oriental-Mediterranean, **pa** – Palaearctic-Australian, **pat** – Palaearctic-Afrotropical, **pata** – Palaearctic-Afrotropical-Australian, **po** – Palaearctic-Oriental, **poa** – Palaearctic-Oriental-Australian, **ppt** – Palaearctic-Paleotropical, **ppta** – Palaearctic-Paleotropical-Australian, **ptm** – Paleotropical-Mediterranean, **se** – South European, **see** – South-east European, **sena** – South European-North African, **sess** – South European and South Siberian, **sk** – Semicosmopolitan, **sp** – South Palaearctic, **spat** – South Palaearctic-Afrotropical, **sppta** – South Palaearctic-Paleotropical-Australian, **tp** – Transpalaearctic, **wces** – West and Central Eurosiberian, **wcp** – West and Central Palaearctic, **wes** – West Eurosiberian, **wesanca** – West Eurosiberian-Anatolian-Central Asian, **wesca** – West Eurosiberian-Central Asian, **wesit** – West Eurosiberian-Iran-Turanian, **wp** – West Palaearctic, **wpat** – West Palaearctic-Afrotropical, **wpo** – West Palaearctic-Oriental.

Results and discussion

A total of 1351 species of Diptera (33.3% of the species found in Bulgaria) that belong to 63 families have been established in the Pirin and Rila Mountains so far (Tables 1, 2). The family Tachinidae was the most numerous with 231 species, followed by Syrphidae – 163, Limoniidae – 113, Chloropidae – 87, Cecidomyiidae – 85, Muscidae – 75, Chironomidae – 57 and Agromyzidae – 53 species. The remaining families contained from one to 39 species. A total of 759 dipteran species (18.5% of the Bulgarian species) from 44 families were recorded from the Pirin Mts. and 1003 species (25.1% of the Bulgarian species) from 58 families were established from the Rila Mts. A total of 403 species were common for both mountains, while 339 species were found only in the Pirin Mts., and 600 species – only in the Rila Mts. The relatively low degree of similarity of the fauna of Diptera between the two mountains (46.2%) is due to their specific natural conditions and insufficient studies. The degree of similarity was higher (over 60%) in separated families that are better studied. The wide distribution of the dipterans suggests similar fauna of the mountains in Bulgaria. Most Diptera species have vast ranges and the endemics are exceptional (1-1.5% of the Bulgarian species – Hubenov, 2008a). Usually they are newly described taxa or rare species with unclear distribution. The taxa presence in most cases was connected with the exploration of the corresponding mountain region. This was evident when comparing the established species with regard to the localities they were found.

Six areas of detailed research are outlined in the Pirin Mts. (over 70 species found: Hubenov, 2015b). First are the surroundings of Bansko (132 species) and Melnik (139 species), the most visited places at the foot of the mountains. The popular resorts and starting points for entering the Pirin Mts., Sandanski and Lilyanovo Villages, Popina laka and Razlog (from 77 to 92 species) also form a group of well-studied regions. Of the inner parts of the mountains, the surroundings of the chalets Banderitsa, Vihren, Gotse Delchev, Yavorov and Demyanitsa are better studied (from 23 to 53 species). Usually the localities from which material has been collected are concentrated around the popular tourist centers or routes.

Five areas of detailed research are outlined in the Rila Mts. (with over 80 species established: Hubenov, 2016). First are the surroundings of the Rila Monastery (266 species) and Borovets (179 species), the most visited places of the mountains. The popular starting points for entering the Rila Mts., Blagoevgrad and Yundola (89-98 species), form a group of well-studied regions. The Parangalitsa Reserve (120 species), where there is a research base of the Bulgarian Academy of Sciences, is also well studied. Of the other parts of the mountains, the surroundings of Belovo, Kostenets, Dolna Banya, Govedartsi Village, Dupnitsa and the Predela Area (from 36 to 47 species) are better studied. Of the inner parts of the mountains, the surroundings of Kravarsko Dere, Kirilova Polyana, the valley of Rilska Reka River, the Slavovo Area, and the chalets Malyovitsa and Musala (from 30 to 53 species) are better studied. Also here the localities from which a material has been collected are concentrated around the popular tourist centres.

At present, significant parts of both mountains remain unexplored and material has not been collected. This relates both to the difficulties when approaching the terrain and the insufficient investigation of the specific families. The number of the established species probably represents about 45-55% of the actual species composition of the studied territory. The dipterans are a highly mobile group and after further studies the number of the recorded taxa might reach 50-60% of the species composition of most families found in the country. The Diptera fauna of the Rila Mts. is better studied than that of the Pirin Mts. This is evident when comparing the number of localities from which material is collected, the first publications, the number of publications and the taxonomic review of the established families (Table 1, 2).

A total of 564 species have been established in the protected areas of the Rila Mts. (Hubenov 2016: Rila National Park – 379 species and Rila Monastery Nature Park – 304 species). In comparison with the Central Balkan National Park [184 species (Hubenov et al., 2000)], East Rhodopes [279 species (Hubenov, 2004)], Vitosha Mts. [1000 species (Hubenov, 2014)] and Pirin National Park [557 species (Hubenov 2015b)] the dipteran fauna of the Rila Mts. is commensurable with the fauna of the Pirin Mts. The number of taxa recorded from the Rila Mts. significantly exceeds that of the Central Balkan National Park and East Rhodopes, and decreases vis-a-vis Vitosha Mts. Vitosha Mt. is the

Table 1. Dipteran insects (Insecta: Diptera) of the Pirin and Rila Mountains

Families	Total number of the species of the two mountains		Species of the Pirin Mt.		Species of the Rila Mt.	
	number	%	number	%	number	%
NEMATOCERA	**397**	**29.40**	**200**	**26.35**	**294**	**29.31**
Tipulidae	9	0.66			9	0.90
Limoniidae	113	8.37	84	11.06	62	6.18
Pediciidae	18	1.33	9	1.18	13	1.30
Blephariceridae	2	0.15			2	0.20
Bibionidae	4	0.30			4	0.40
Mycetophilidae	29	2.15	15	1.98	14	1.40
Bolitophilidae	7	0.52	5	0.66	4	0.40
Diadocidiidae	1	0.07	1	0.13	1	0.10
Keroplatidae	6	0.44	3	0.39	3	0.30
Macroceridae	5	0.37	4	0.53	4	0.40
Sciaridae	4	0.30			4	0.40
Cecidomyiidae	85	6.29	54	7.11	65	6.48
Trichoceridae	1	0.07			1	0.10
Scatopsidae	1	0.07			1	0.10
Ptychopteridae	2	0.15	1	0.13	1	0.10
Culicidae	9	0.66			9	0.90
Simuliidae	37	2.74	10	1.32	37	3.69
Ceratopogonidae	7	0.52	1	0.13	6	0.60
Chironomidae	57	4.22	13	1.71	53	5.28
BRACHYCERA ORTHORRHAPHA	**144**	**10.66**	**53**	**6.98**	**108**	**10.77**
Coenomyiidae	1	0.07			1	0.10
Stratiomyidae	14	1.04	12	1.58	5	0.50
Rhagionidae	9	0.66	8	1.05	5	0.50
Tabanidae	26	1.93	5	0.66	25	2.49
Acroceridae	1	0.07	1	0.13		
Bombyliidae	9	0.66			9	0.90
Therevidae	2	0.15			2	0.20
Asilidae	30	2.22	11	1.45	23	2.29
Empididae	15	1.11	7	0.92	8	0.80
Hybotidae	7	0.52	3	0.39	5	0.50
Dolichopodidae	30	2.22	6	0.79	25	2.49
BRACHYCERA CYCLORRHAPHA	**809**	**59.92**	**506**	**66.67**	**601**	**59.92**
Platypezidae	1	0.07			1	0.10
Phoridae	3	0.22	2	0.26	1	0.10
Pipunculidae	16	1.18	14	1.84	5	0.50
Syrphidae	163	12.07	49	6.46	149	14.86
Conopidae	21	1.56	2	0.26	20	1.99
Tephritidae	10	0.74	2	0.26	8	0.80
Piophilidae	1	0.07	1	0.13		
Lauxaniidae	1	0.07			1	0.10
Cremifaniidae	1	0.07			1	0.10
Chamaemyiidae	12	0.89	12	1.58	1	0.10
Sciomyzidae	2	0.15			2	0.20
Sepsidae	1	0.07	1	0.13		
Agromyzidae	53	3.93	15	1.98	48	4.79
Opomyzidae	3	0.22	3	0.39	2	0.20
Carnidae	5	0.37	5	0.66		
Milichiidae	4	0.30	4	0.53	1	0.10
Chloropidae	87	6.44	72	9.49	61	6.08
Heleomyzidae	2	0.15			2	0.20
Sphaeroceridae	4	0.30	2	0.26	2	0.20

Table 1. Continued

Families	Total number of the species of the two mountains		Species of the Pirin Mt.		Species of the Rila Mt.	
	number	%	number	%	number	%
Camillidae	1	0.07	1	0.13		
Drosophilidae	1	0.07			1	0.10
Diastatidae	1	0.07	1	0.13	1	0.10
Ephydridae	39	2.89	33	4.35	26	2.59
Hippoboscidae	4	0.30	2	0.26	2	0.20
Scathophagidae	2	0.15			2	0.20
Anthomyiidae	3	0.22	1	0.13	3	0.30
Fanniidae	6	0.44	6	0.79	2	0.20
Muscidae	75	5.55	49	6.45	55	5.48
Calliphoridae	14	1.04	3	0.39	14	1.40
Sarcophagidae	38	2.81	18	2.37	24	2.39
Rhinophoridae	1	0.07			1	0.10
Gasterophilidae	3	0.22			3	0.30
Tachinidae	231	17.11	203	26.74	162	16.15
Families	**63**		**44**	**69.84**	**58**	**92.06**
Species	**1351**		**759**	**56.18**	**1003**	**74.24**

most well-studied Bulgarian mountain and its whole territory is used for comparison (not only Vitosha Nature Park), while the Central Balkan National Park is poorly studied with respect to the two-winged insects. When comparing the whole mountain with the Vitosha Mt., there is no difference in the number of the established species. The last studies on Diptera of the Pirin Mts. (Hubenov 2015b) allow the fauna families to be compared with these of the Rila Mts. It is expected, after further investigations, the species composition of Diptera from the Pirin Mts. to exceed most of the Bulgarian mountains. This is owing to the wide variety of natural habitats, as well as to the geographical location, which the mountains occupy in South-West Bulgaria, on the border between the Eurosiberian and Mediterranean Palaearctic subregions. Further, the Rila Mts. are expected to be similar to the most of the Bulgarian high mountains in terms of species composition of Diptera. This relates to the natural habitats of the mountain, as well as to the wide distribution of the dipterans, their high mobility and poorly expressed endemism. The great number of species, established in the Rila Monastery Nature Park (commensurable with the Rila National Park), is related to the fact that the surroundings of the Rila Monastery is the most visited region of the Rila Mts.

Despite its limited development, in the xerothermic oak forest belt of the Pirin Mts. 273 species (36.8%) were established. This is connected with its open spaces enabling species from the Sandanski-Petrich Valley and the belt above it to penetrate. In the same belt of the Rila Mts. the number of species was smaller by 11.3% (25.5%, or 256 species). In this mountain, the xerothermic oak forests were with quite limited development but here also in the open areas species from neighbouring valleys penetrate. Most taxa were found in the beech forests (409 species or 55.1% in the Pirin Mt. and 736 species or 73.4% in the Rila Mts.) and the mesophilic and xeromesophilic mixed forests (349 species or 47.0% in the Pirin Mts. and 351 species or 35.0% in the Rila Mts.). The border between beech and coniferous forests of the Pirin Mts. and Rila Mts. is not clear and depending on the exposure, relief and anthropogenic impact, there are wide areas of mixing. This determined the high species richness in the beech belt, the great number of common species and the similarity of the dipteran fauna from vegetation belts 2, 3 and 4 for each mountain. When comparing the respective belts between the two mountains (Table 3) the degree of similarity was low (from 30.7% to 46.6%). Regarding the hypsometric belts, the maximum number of species was recorded between 900 and 1300 m a.s.l. in the Pirin Mts. and between 1000 and 1500 m a.s.l. in the Rila Mts. For family Tachinidae, such investigations have been carried out for the whole country and the maximum number of species was established between 400 and 1000 m a.s.l. as there are differences in the mountains of ±200 m (Hubenov, 1993, 1995, 2015c). There were considerable dif-

Table 2. Species composition and distribution of the two-winged insects (Insecta: Diptera) of the Pirin and Rila Mountains

Taxa	Distribution			Vegetation belts of the Pirin Mts.						Vegetation belts of the Rila Mts.					
	Vertical		Areo-graphy	Xerothermic oak forests – up to 600-700 m a.s.l.	Mesophyllic and xeromesophyllic oak-hornbeam forests – from 600-700 m to 900-1000 m a.s.l.	Beech forests – from 900-1000 to 1500-1600 m a.s.l.	Coniferous forests – from 1500-1600 m to 2000-2200 m a.s.l.	Subalpine vegetation – from 2000-2200 m to 2500 m a.s.l.	Alpine vegetation – over 2400-2500 m a.s.l.	Xerothermic oak forests – up to 500-700 m a.s.l.	Mesophyllic and xeromesophyllic oak-hornbeam forests – from 600-700 m to 900-1000 m a.s.l.	Beech forests – from 900-1000 to 1500-1600 m a.s.l.	Coniferous forests – from 1500-1600 m to 2000-2200 m a.s.l.	Subalpine vegetation – from 2000-2200 m to 2500 m a.s.l.	Alpine vegetation – over 2400-2500 m a.s.l.
	Pirin Mts.	Rila Mts.													
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
NEMATOCERA															
Tipulomorpha															
Tipulidae															
Tanyptera (*Tanyptera*) *atrata* (Linnaeus, 1758)		1147	tp, ? hoes									●			
Nephrotoma cornicina (Linnaeus, 1758)		1147	ho									●			
Tipula (*Acutipula*) *maxima* Poda, 1761		1147	ena									●			
Tipula (*Lunatipula*) *lunata* Linnaeus, 1758		1147	hoes									●			
Tipula (*Lunatipula*) *vernalis* Meigen, 1804		550-2100	e							●	●	●	●		
Tipula (*Vestiplex*) *excisa* Schummel, 1833		550-2900	hoes							●	●	●	●	●	●
Tipula (*Vestiplex*) *nubeculosa* Meigen, 1804		1350	eca									●			
Tipula (*Vestiplex*) *scripta* Meigen, 1830		550-2100	wces							●	●	●	●		
Tipula (Yamatotipula) montium Egger, 1863		1350	wces									●			
Limoniidae															
**Phyllolabis pubipennis* Lackschewitz, 1940	1200-1850	2389	csee			◆	◆							●	
Paradelphomyia (*Oxyrhiza*) *fuscula* (Loew, 1873)		1147	eit									●			
Austrolimnophila (*Austrolimnophila*) *ochracea* (Meigen, 1804)	1250		eit			◆									
Austrolimnophila (*Archilimnophila*) *unica* (Osten Sacken, 1869)		1876	h										●		
Dactylolabis (*Dactylolabis*) *transversa* (Meigen, 1804)	1700		cse				◆								
Epiphragma (*Epiphragma*) *ocellare* (Linnaeus, 1761)	1250	1147	h			◆						●			
**Eloeophila apicata* (Loew, 1871)	900-1000		et		◆										
Eloeophila maculata (Meigen, 1804)	1142	1147	et			◆						●			
Eloeophila mundata (Loew, 1871)	1230-2000	2389	e			◆	◆							●	

Table 2. Continued

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Eloeophila trimaculata (Zetterstedt, 1838)		2389	e											●	
Euphylidorea lineola (Meigen, 1804)		2389	wp											●	
Neolimnomyia (*Brachylimnophila*) *nemoralis* (Meigen, 1818)	1230-1810	1147-2389	tp			◆	◆					●	●	●	
Phylidorea (*Macrolabina*) *alexanderi* (Starý, 1974)	1750		Ebg				◆								
Phylidorea (*Paraphylidorea*) *fulvonervosa* (Schummel, 1829)		1876	des										●		
Phylidorea (*Phylidorea*) *ferruginea* (Meigen, 1818)		1700	esca										●		
Pilaria fuscipennis (Meigen,1818)	1960-2914		des				◆	◆	◆						
**Prionolabis cognata* (Lackschewitz 1940)	1200-1700		Eb			◆	◆								
Prionolabis hospes (Egger, 1863)	1300-2200	1360-2389	cse			◆	◆	◆				●	●	●	
Pseudolimnophila (*Pseudolimnophila*) *lucorum* (Meigen, 1818)		1147	esca									●			
Pseudolimnophila (*Pseudolimnophila*) *sepium* (Verrall, 1886)	2100	1147	eit				◆					●			
Hexatoma (*Hexatoma*) *bicolor* (Meigen, 1818)		1147	csean									●			
Chionea (*Sphaeconophilus*) *lutescens* Lundstrom, 1907		2000	ean										●		
Crypteria limnophiloides Bergroth, 1913		1230-1390	ean									●			
Neolimnophila carteri (Tonnoir, 1921)		1700-2389	ean										●	●	
Erioptera (*Erioptera*) *divisa* (Walker, 1848)		1700-2389	ean										●	●	
Erioptera (*Erioptera*) *flavata* (Westhoff, 1882)		1700	wes										●		
Erioptera (*Erioptera*) *griseipennis* Meigen, 1838	1000		e		◆	◆									
Erioptera (*Erioptera*) *lutea* Meigen, 1804	1200-1700	1147-1876	wcp			◆	◆					●	●		
Erioptera (*Mesocyphona*) *bivittata* (Loew, 1873)		2389	esca											●	
Gonempeda flava (Schummel, 1829)	1000		e		◆	◆									
Scleroprocta balcanica Starý, 1976	1230-1350	1147	Eb			◆						●			
Symplecta (*Symplecta*) *hybrida* (Meigen, 1804)	900-1000	930-1000	ho		◆						●	●			
**Cheilotrichia* (*Cheilotrichia*) *meridiana* Mendl, 1974	450-650		nmt	◆											
Cheilotrichia (*Empeda*) *stary* Mendl, 1973	1900-2300	1230-1390	cse				◆	◆				●			
Erioconopa symplectoides (Kuntze,1914)	2100		hom				◆								
Erioconopa trivialis (Meigen, 1818)	1900-2000	2389	eit				◆							●	
Hoplolabis (*Parilisia*) *yezoana* (Alexander, 1924)		1180-1250	esca									●			
Ilisia maculata (Meigen, 1804)	1000		eit		◆	◆									
Molophilus (*Molophilus*) *aduncus* Starý, 1978	900-1000		nmt		◆										
Molophilus (*Molophilus*) *appendiculatus* (Staeger, 1840)	1950	1230-1390	wes				◆					●			
Molophilus (*Molophilus*) *bifidus* Goetghebuer, 1920		1147	eit									●			
Molophilus (*Molophilus*) *brevihamatus* Bangerter, 1947	900-1230		csee		◆	◆									
Molophilus (*Molophilus*) *crassipygus* Meijere, 1918		1147-1250	e									●			
Molophilus (*Molophilus*) *curvatus* Tonnoir, 1920	1230		e			◆									
Molophilus (*Molophilus*) *directidens* Starý, 1976	1230-2000	1147-1450	Ebg			◆	◆					●			

Table 2. Continued

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Molophilus (*Molophilus*) *flagellatus* Starý, 1976	1900-2000	1230-1390	Ebg				♦					●			
**Molophilus* (*Molophilus*) *griseus* (Meigen, 1804)	900-1000		wp		♦										
Molophilus (*Molophilus*) *lackschewitzianus* Alexander, 1953			csean												
Molophilus (*Molophilus*) *lanceolatus* Starý, 1971	1400		Er			♦									
Molophilus (*Molophilus*) *lautereri* Stary, 1974		2666	Ebg												●
Molophilus (*Molophilus*) *medius* Meijere, 1918	1500	1147-1700	e			♦						●	●		
Molophilus (*Molophilus*) *obscurus* (Meigen, 1818)	1000	1147-1700	e			♦						●	●		
Molophilus (*Molophilus*) *obsoletus* Lackschewitz, 1940	1700	2389	Ebs				♦							●	
Molophilus (*Molophilus*) *ochraceus* (Meigen, 1818)	1000		e		♦	♦									
Molophilus (*Molophilus*) *priapoides* Starý, 1971	1000-1850		e			♦	♦								
Molophilus (*Molophilus*) *propinqueus* (Egger, 1863)	900-1200	1147-1700	tp		♦	♦						●	●		
Molophilus (*Molophilus*) *scutellatus* Goetghebuer, 1929		2389	cse											●	
**Molophilus* (*Molophilus*) *stroblianus* Nielsen, 1953	1000		csee		♦	♦									
Ormosia (*Ormosia*) *albitibia* Edwards, 1921		1230-1390	cse									●			
Ormosia (*Ormosia*) *bifida* (Lackschewitz, 1940)	1700-2000		e, ? cse				♦								
Ormosia (*Ormosia*) *clavata* (Tonnoir, 1920)		1230-1390	e									●			
Ormosia (*Ormosia*) *fascipennis* (Zetterstedt, 1838)	1200-1900	2389	h			♦	♦							●	
Ormosia (*Ormosia*) *pirinensis* Starý, 1971	1400	1230-1390	Ebg			♦						●			
Ormosia (*Ormosia*) *staegeriana* Alexander, 1953	1400-1800	1230-1390	e			♦	♦					●			
Rhypholophus bifurcatus Goetghebuer, 1920	2000		e				♦								
Rhypholophus haemorrhoidalis (Zetterstedt, 1838)	2000	1147-1850	e				♦					●	●		
Rhypholophus obtusistyla (Stary, 1976)		1147-1850	Ebg									●	●		
Rhypholophus phryganopterus Kolenati, 1860	1700-2400		cse, ? e				♦	♦							
**Tasiocera* (*Dasymolophilus*) *fuscescens* (Lackschewitz, 1940)	1200		e			♦									
Dicranoptycha cinerascens (Meigen, 1818)	2000		e				♦								
Dicranoptycha fuscescens (Schummel, 1829)	1230-1350		wp			♦									
Dicranoptycha livescens Loew, 1871	2000	1147-1250	cse				♦					●			
Dicranoptycha paralivescens Starý, 1972	2000	1147-1250	cse				♦					●			
**Ellipteroides* (*Protogonomyia*) *alboscutellatus* (von Roser, 1840)	450-700		ena, ? csena	♦											
**Gnophomyia viridipennis* (Gimmerthal, 1847)	300-400		wes	♦											
Gonomyia (*Gonomyia*) *conoviensis* Barnes, 1924	1230-1350		eit			♦									
Gonomyia (*Gonomyia*) *lucidula* Meijere, 1920	1000-1350		e			♦									
Gonomyia (*Gonomyia*) *tenella* (Meigen, 1818)	900-2000		ena		♦	♦	♦								
**Gonomyia* (*Prolipophleps*) *abbreviata* Loew, 1873	300-400		eswa	♦											
Gonomyia (*Teuchogonomyia*) *edwardsi* Lackschewitz, 1925	1200		e			♦									
Idiocera (*Idiocera*) *pulchripennis* (Loew, 1856)	1000		? mwca		♦	♦									

Table 2. Continued

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Lipsothrix errans (Walker, 1848)	1230-1350	1147	e			◆						●			
**Lipsothrix nobilis* Loew, 1873	450-700		e, ? csean	◆											
Lipsothrix remota (Walker, 1848)	1230-1350	1147	e			◆						●			
Antocha (*Antocha*) *vitripennis* (Meigen, 1830)	1810		ewca				◆								
Antocha (*Orimargula*) *alpigena* (Mik, 1883)	1230-2000	1147-1850	csean			◆	◆					●	●		
Orimarga (*Orimarga*) *attenuata* (Walker, 1848)	2000-2200		ena				◆								
Orimarga (*Orimarga*) *juvenilis* (Zetterstedt, 1851)	1000		e		◆	◆									
**Achyrolimonia decemmaculata* (Loew, 1873)	1200		eswa			◆									
Dicranomyia (*Dicranomyia*) *chorea* (Meigen, 1818)	1200-1700		h			◆	◆								
Dicranomyia (*Dicranomyia*) *conchifera* (Strobl, 1901)	1230-1350		cse, ? e			◆									
Dicranomyia (Dicranomyia) luteipennis Goetghebuer, 1920		1147-1475	cse									●			
Dicranomyia (*Dicranomyia*) *mitis* (Meigen, 1830)	1300-1900	1147-1850	wp			◆	◆					●	●		
**Dicranomyia* (*Dicranomyia*) *ornata* (Meigen, 1818)	300-1000		ean	◆	◆										
Dicranomyia (*Dicranomyia*) *signata* (Lackschewitz, 1941)	1000		em		◆										
Dicranomyia (*Melanolimonia*) *caledonica* Edwards, 1926	1300-1800		hoes			◆	◆								
**Dicranomyia* (*Melanolimonia*) *morio* (Fabricius, 1787)	300-450		wp	◆											
Dicranomyia (*Numantia*) *fusca* (Meigen, 1804)	1900-2000		h				◆								
Discobola annulata (Linnaeus 1758)		1147-1250	hoa									●			
Limonia flavipes (Fabricius, 1787)	1230-1810	1147	ena			◆	◆					●			
Limonia hercegovinae (Strobl, 1898)	1200		? eit			◆									
Limonia macrostigma (Schummel, 1829)	1200-1700	1147-1250	po			◆	◆					●			
Limonia nigropunctata (Schummel, 1829)	1300-1800		e			◆	◆								
Limonia nubeculosa Meigen, 1804	2000		h				◆								
Limonia pannonica (Kowarz, 1868)	1230-1350		cse			◆									
Limonia phragmitidis (Schrank, 1781)	1230-1350	1147	wp			◆						●			
Limonia stigma (Meigen, 1818)	1250-2300		e			◆	◆	◆							
Limonia sylvicola (Schummel, 1829)	1600-1700	1147-1850	wces			◆	◆					●	●		
Limonia taurica (Strobl, 1895)	1300-1800		ean			◆	◆								
Limonia trivittata (Schummel, 1829)		1230-1390	esca									●			
Metalimnobia (*Metalimnobia*) *zetterstedti* (Tjeder, 1968)		1876	hoes										●		
Neolimonia dumetorum (Meigen, 1804)	1230-1350	1174-1700	e			◆						●	●		
Rhipidia (*Rhipidia*) *maculata* Meigen, 1818	1200-1950	1147-1390	h			◆	◆					●			
Pediciidae															
Dicranota (*Dicranota*) *bimaculata* (Schummel, 1829)		1876	wp										●		
Dicranota (*Ludicia*) *lucidipennis* (Edwards, 1921)	1230-1810	1174-1876	cse			◆	◆					●	●		
Dicranota (*Paradicranota*) *brevicornis* Bergroth, 1891		1876	cse										●		
Dicranota (*Paradicranota*) *flammatra* Stary, 1981		1147	cse									●			

Table 2. Continued

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
**Dicranota* (*Paradicranota*) *landrocki* Czizek, 1931	450-650		? wp, ? eit	♦											
Dicranota (*Paradicranota*) *pallens* Lackschewitz, 1940		1876-2389	csee										●	●	
**Dicranota* (*Paradicranota*) *schistacea* Lackschewitz, 1940	450-700		csee	♦											
Dicranota (*Paradicranota*) *simulans* Lackschewitz, 1940		1147	csea									●			
Dicranota (*Paradicranota*) *subtilis* Loew, 1871	1230-1350		e			♦									
Pedicia (*Amalopis*) *occulta* (Meigen, 1830)	1600-2000	1147-2389	eswa				♦					●	●	●	
Pedicia (*Crunobia*) *littoralis* (Meigen, 1804)		1147	e									●			
Pedicia (*Crunobia*) *riedeli* (Lackschewitz, 1940)		1250	cse									●			
Pedicia (*Pedicia*) *rivosa* (Linnaeus, 1758)	1750	1230-1390	wes				♦					●			
Pedicia (*Crunobia*) *spinifera* Stary, 1974		1876	Ebs										●		
Tricyphona (*Tricyphona*) *immaculata* (Meigen, 1804)	1900-2200		? wp				♦								
Tricyphona (*Tricyphona*) *livida* Madarassy, 1881	2000	1230-1390	e				♦					●			
**Tricyphona* (*Tricyphona*) *zwicki* Mendl, 1973	1200		se			♦									
Ula (*Ula*) *mollissima* Haliday 1833		1230-1390	ean									●			
BLEPHARICEROMORPHA															
Blephariceridae															
Blepharicera fasciata (Westwood, 1842)		1400	? cseit									●			
Liponeura cinerascens Loew, 1844		1230-2925	csean									●	●	●	●
BIBIONOMORPHA															
Bibionidae															
Bibio hortulanus (Linnaeus, 1758)		1147	wp									●			
Bibio lanigerus Meigen, 1818		550-2100	e							●	●	●	●		
Bibio marci (Linnaeus, 1758)		400	ena, ? wp							●					
Bibio pomonae (Fabricius, 1775)		850-1000	des								●				
Mycetophilidae															
Mycomya (*Mycomya*) *cinerascens* (Macquart, 1826)	1740	1230-1390	ho				♦					●			
Mycomya (*Mycomya*) *disa* Vaisanen, 1984		1450	e									●			
Mycomya (*Mycomya*) *flavicollis* (Zetterstedt, 1852)	1740		e				♦								
Mycomya (*Mycomya*) *marginata* (Meigen, 1818)	1740		po				♦								
Mycomya (*Mycomya*) *prominens* (Lundström, 1913)		930-1000	e, ? wes								●	●			
Mycomya (*Mycomya*) *ruficollis* (Zetterstedt, 1852)		1450	h									●			
Mycomya (*Mycomya*) *tenuis* (Walker, 1856)	1740	1450	? h				♦					●			
Mycomya (*Mycomyopsis*) *trilineata* (Zetterstedt, 1838)	1740		hoes				♦								
Boletina gripha Dziedzicki, 1885		2389	hoes											●	
Boletina plana (Walker, 1856)	1740		hoes				♦								
Boletina sciarina Staeger, 1840	1740-1800	1000-1100	h				♦					●			

Table 2. Continued

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Acnemia nitidicollis (Meigen, 1818)	1740		des				◆								
Polylepta guttiventris (Zetterstedt, 1852)	1740		h				◆								
Sciophila lutea Macquart, 1826	1142		tp			◆									
Sciophila rufa Meigen, 1830	1142		hoes			◆									
Leia bimaculata (Meigen, 1804)	1142		tp			◆									
Leia winthemii Lehmann, 1822		1230-1390	ho									●			
Novakia scatopsiformis Strobl, 1893		1230-1390	ena									●			
Cordyla murina Winnertz, 1863		2200	hoes										●	●	
Exechia fusca (Meigen, 1804)		550-2100	h							●	●	●	●		
Exechiopsis (*Exechiopsis*) *clypeata* (Lundstrom, 1911)		2389	e											●	
Sceptonia membranacea Edwards, 1925		1147-1524	e									●	●		
Sceptonia pilosa Bukowski, 1934		1147	e									●			
Mycetophila blanda Winnertz, 1863	2000		wces				◆								
Mycetophila confluens Dziedzicki, 1884	2000		des				◆								
Mycetophila czizekii Landrock, 1911	2000		e				◆								
Mycetophila marginata Winnertz, 1863	2000		e				◆								
Mycetophila ocellus Walker, 1848	2000		h				◆								
Mycetophila stylata (Dziedzicki, 1884)	2000		hoes				◆								
Bolitophilidae															
Bolitophila (*Bolitophila*) *cinerea* Meigen, 1818	1740	1500	hoes				◆					●	●		
Bolitophila (*Bolitophila*) *saundersii* (Curtis, 1836)	1740-1800	1500	tp				◆					●	●		
Bolitophila (*Bolitophila*) *tenella* Winnertz, 1863		1500	des									●	●		
Bolitophila (*Cliopisa*) *hybrida* (Meigen, 1804)		+++	hoes												
Bolitophila (*Cliopisa*) *occlusa* Edwards, 1913	1740		des				◆								
Bolitophila (*Cliopisa*) *pseudohybrida* Landrock, 1912	600		des	◆											
Bolitophila (*Cliopisa*) *rossica* Landrock, 1912	2000		des				◆								
Diadocidiidae															
Diadocidia (*Diadocidia*) *spinosula* Tollet, 1948	1740	1147-1500	e				◆					●	●		
Keroplatidae															
Antlemon (*Antlemonopsis*) *brevimanum* (Loew, 1871)		1147-1500	cse, ? csee									●	●		
Orfelia nemoralis (Meigen, 1818)	500		e	◆											
Orfelia tristis (Lundström, 1911)	1430		e			◆									
Orfelia unicolor (Stæger, 1840)		1475	hoes									●			
Platyura marginata Meigen, 1804		900	des								●				
Pyratula zonata (Zetterstedt, 1855)	550		e	◆											

Table 2. Continued

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Macroceridae															
Macrocera centralis Meigen, 1818	1700-1820	1350-1450	wes				♦					●			
Macrocera grandis Lundström, 1912		1150	cee									●			
Macrocera inversa Loew, 1869	1740	1300	wes				♦					●			
Macrocera parva Lundström, 1914	1740		wces				♦								
Macrocera stigmoides Edwards, 1925	1700-1820	1300	e				♦					●			
Sciaridae															
Phytosciara (*Phytosciara*) *halterata* (Lengersdorf, 1926)		1150	e									●			
Phytosciara (*Phytosciara*) *macrotricha* (Lengersdorf, 1926)		1150	cee									●			
Sciara analis Schiner, 1864		550-2100	csee, ? wes							●	●	●	●		
Sciara hemerobioides (Scopoli, 1763)		545-1150	po							●	●	●			
Cecidomyiidae															
Lasioptera eryngii (Vallot, 1829)	850	850-900	ena		♦						●				
Lasioptera rubi (Schrank, 1803)		800-1000	des								●	●			
Bayeriola capitigena (Bremi, 847)	850-1300	850-1150	e		♦	♦					●	●			
Bayeriola thymicola (Kieffer, 1888)	850	400-900	ena		♦					●	●				
Cystiphora taraxaci (Kieffer, 1888)	980		e		♦										
Dasineura acrophila (Winnertz 1853)		850	h								●				
Dasineura asperulae (Löw, 1875)	850	850	cse, ? e		♦						●				
Dasineura crataegi (Winnertz, 1853)	350-850	800-1300	e	♦	♦						●	●			
Dasineura filicina (Kieffer, 1889)	1500-2500		des, ? dp			♦	♦	♦	♦						
Dasineura fraxinea Kieffer, 1907		850	e								●				
Dasineura galiicola (Löw, 1880)	1100	1150	e			♦						●			
Dasineura hyperici (Bremi, 1848)	850-1300	800-1150	e		♦	♦					●	●			
Dasineura irregularis (Bremi, 1847)		1200	cse, ? e									●			
Dasineura medicaginis (Bremi, 1847)		850	wes								●				
Dasineura papaveris (Winnertz, 1890)		400-850	cseean							●	●				
Dasineura plicatrix (Loew, 1850)	1100-1300	400	ena			♦				●					
Dasineura potentillae (Wachtl, 1885)	1300		e			♦									
Dasineura pteridicola (Kieffer 1901)		850	wes, ? e								●				
Dasineura pyri (Bouché 1847)		400	ha							●					
Dasineura rosae (Bremi, 1847)	850-1300	400-1200	dp, ? h		♦	♦				●	●	●			
Dasineura rossi Rübsaamen, 1914		850	wes								●				
Dasineura schulzei (Rübsaamen, 1917)	1100-1300	1150	csee, ? e			♦						●			

Table 2. Continued

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Dasineura sisymbrii (Schrank, 1803)	980-1000		e		♦	♦									
Dasineura thomasiana (Kieffer, 1888)	980		e		♦	♦									
Dasineura tortilis (Bremi, 1847)	1000-1100	1150	e			♦						●			
Dasineura tortrix (Löw, 1877)	1100-1300	400-1200	e			♦				●	●	●			
Dasineura trifolii (Löw, 1874)	900-1100	900-1150	h		♦	♦					●	●			
Dasineura ulmaria (Bremi, 1847)	1000		des, ? dp			♦									
Dasineura urticae (Perris, 1840)	980-1100	900-1150	des, ? dp		♦	♦					●	●			
Euphorbomyia loewii (Mik, 1882)		400	csee							●					
Rabdophaga heterobia (Loew, 1850)	1100-1300	1150	dp			♦						●			
Rabdophaga saliciperda (Dufour, 1841)	1300		dp, ? tp			♦									
Rabdophaga salicis (Schrank, 1803)	1300		h			♦									
Rabdophaga terminalis (Loew, 1850)	980-1300	1150	tp, ? dp		♦	♦						●			
Dryomyia circinans (Giraud, 1861)	450		dp	♦											
Geocrypta galii (Loew, 1850)	1100-1300	1100-1200	? des, ? dp			♦						●			
Gephyraulus raphanistri (Kieffer, 1886)		800	e								●				
Hartigiola annulipes (Hartig, 1839)	+++	800-1200	dp								●	●			
Iteomyia capreae (Winnertz, 1853)	1100	1150	tp			♦						●			
Jaapiella bryoniae (Bouche, 1847)	980-1000	900	ena		♦						●				
Jaapiella cucubali (Kieffer, 1909)	850		cse		♦										
Jaapiella jaapiana (Rubsaamen, 1914)		400	e							●					
Jaapiella veronicae (Vallot, 1827)	1100	800-1200	e			♦					●	●			
Fabomya medicaginis (Rübsaamen, 1912)	850		wes, wesca		♦										
Janetiella fallax Kieffer, 1904		850-900	e								●				
Janetiella lemeei (Kieffer, 1904)		400	ean							●					
Janetiella thymi (Kieffer, 1888)	1100-1300	1150	e			♦						●			
Macrolabis heraclei Kaltenbach, 1862	980	1150	e		♦							●			
Macrolabis lamii Rübsaamen, 1916	980		e		♦										
Macrolabis stallariae (Liebel, 1889)	980		e		♦										
Mayetiola poae (Bosc, 1817)		+++	e												
Phegomyia fagicola (Kieffer, 1901)	1100	1150	e			♦						●			
Physemocecis ulmi (Kieffer, 1909)		400-1150	e							●	●	●			
Mikiola fagi (Hartig, 1839)	1100	800-1200	e, ? des			♦					●	●			
Mikiola orientalis Kieffer 1909		1230-1400	ban									●			
Mikomya coryli (Kieffer, 1901)		850-1150	ean								●	●			
Oligotrophus juniperinus (Linnaeus, 1758)	850-1300	850-2500	e		♦	♦					●	●	●	●	

Table 2. Continued

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Oligotrophus panteli (Kieffer, 1898)	850-1300	850-900	ena		◆	◆					●	●			
Rhopalomyia foliorum (Loew, 1850)		850-900	e								●	●			
Semudobia betulae (Winnertz, 1853)	850-1100	400-1150	h		◆	◆				●	●	●			
Semudobia skuhravae Roskam, 1977	850-1100		h		◆	◆									
Wachtliella stachydis (Bremi, 1847)	1100	1150	e			◆						●			
Zygiobia carpini (Löw, 1874)	1100	1100-1200	e			◆						●			
Asphondylia cytisi Frauenfeld, 1873	1300		wes			◆									
Asphondylia hornigi Wachtl, 1880		800	e								●				
Acodiplodis inulae (Loew, 1847)		900	e								●				
Aschistonyx carpinicolus Rübsaamen, 1917	1100	1100-1150	e, ? cse			◆						●			
Contarinia anthobia (Löw, 1877)	1300		e			◆									
Contarinia baeri (Prell, 1931)	850-1300		des		◆	◆									
Contarinia carpini Kieffer, 1897		1200	e									●			
Contarinia coryli (Kaltenbach, 1859)		800	esca								●				
Contarinia craccae Loew, 1850		400	wes							●					
Contarinia fagi Rübsaamen, 1921	1100	800-1100	e			◆					●	●			
Contarinia gei Kieffer, 1909		1200	e									●			
Contarinia hypochoeridis (Rübsaamen 1891)		850-900	e								●				
Contarinia lamii Kieffer, 1909		1140	e, ? cse									●			
Contarinia nasturtii (Kieffer, 1888)	850-1100	800-1100	ean, i, h		◆	◆					●	●			
Contarinia quinquenotata (Löw, 1888)	980		ean		◆										
Contarinia steini (Karsch, 1881)		1140	e									●			
Drisina glutinosa Giard, 1893		1200	e									●			
Harmandiola cavernosa (Rübsaamen, 1899)		1400	wes									●			
Harmandiola globuli (Rübsaamen, 1889)		1400	wes									●			
Harmandiola tremulae (Winnertz, 1853)		1400	wes, ? esca									●			
Mycodiplosis coniophaga (Winnertz, 1853)	1300	1140	h			◆						●			
Mycodiplosis saundersi Barnes, 1927	1000		e		◆	◆									
Putoniella pruni Kaltenbach, 1872	850	400-850	e		◆					●	●				
Trichoceridae															
Trichocera (*Trichocera*) *hiemalis* (De Geer, 1776)		2000	h										●		
Scatopsidae															
Colobostema nigripenne (Meigen, 1830)		1150-1500	ena									●			
Ptychopteridae															
Ptychoptera (*Ptychoptera*) *albimana* (Fabricius, 1787)	500		h	◆											

Table 2. Continued

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Ptychoptera (*Ptychoptera*) *scutellaris* Meigen, 1818		2100	h										●		
CULICOMORPHA															
Culicidae															
Anopheles (*Anopheles*) *maculipennis* Meigen, 1818		2190-2200	hoes, ? tp										●	●	
Culiseta (*Culiseta*) *annulata* (Schrank, 1776)		1230-1390	ena									●			
Culiseta (*Culiseta*) *glaphyroptera* (Schiner, 1864)		1230-1390	csee, m									●			
Ochlerotatus (*Ochlerotatus*) *communis* (De Geer, 1776)		1230-1390	h									●			
Ochlerotatus (*Ochlerotatus*) *pullatus* (Coquillett, 1904)		1230-2300	h, ba									●			
Ochlerotatus (*Ochlerotatus*) *punctor* (Kirby, 1837)		1230-1390	h									●			
Ochlerotatus (*Finlaya*) *geniculatus* (Olivier, 1791)		1230-1390	wp, ? tp									●			
Culex (*Culex*) *pipiens* Linnaeus, 1758		550-2100	hnat							●	●	●	●		
Culex (*Maillotia*) *hortensis* Ficalbi 1889		1230-1390	wpo									●			
Simuliidae															
Prosimulium (*Prosimulium*) *fulvipes* (Edwards, 1921)		1300-2400	cseea, des									●	●	●	
Prosimulium (*Prosimulium*) *hirtipes* (Fries, 1824)		1300-2450	tp, ? h									●	●	●	
Prosimulium (*Prosimulium*) *latimucro* (Enderlein, 1925)		1200-2400	e									●	●	●	
Prosimulium (*Prosimulium*) *petrosum* Rubtsov, 1955		1100-2235	see									●	●	●	
Prosimulium (*Prosimulium*) *rufipes* (Meigen, 1830)	1200-1400	1300-2300	ena			◆						●	●	●	
Prosimulium (*Prosimulium*) *tomosvaryi* (Enderlein, 1921)		850-2000	des								●	●	●		
Simulium (*Nevermannia*) *angustitarse* (Lundstrom 1911)		1000-1700	wcp, ? dp									●	●		
Simulium (*Nevermannia*) *bertrandi* Grenier et Dorier, 1959	1950	1950-2300	e				◆						●	●	
Simulium (*Nevermannia*) *brevidens* (Rubtsov, 1956)		450-2350	e							●	●	●	●	●	
Simulium (*Nevermannia*) *carpathicum* (Knoz, 1961)	2000	400-2000	e				◆			●	●	●	●		
Simulium (*Nevermannia*) *carthusiense* Grenier & Dorier, 1959		1000-2300	e									●	●	●	
Simulium (*Nevermannia*) *codreanui* (Serban, 1958)	1950	1300-2150	e				◆					●	●		
Simulium (*Nevermannia*) *costatum* Friederichs, 1920		1100-2300	ena									●	●	●	
Simulium (*Nevermannia*) *crenobium* (Knoz, 1961)		1400	csee									●			
Simulium (*Nevermannia*) *cryophilum* (Rubzov, 1959)	700-750	750-2200	eanna, ? tp		◆						●	●	●		
Simulium (*Nevermannia*) *curvans* (Rubtsov & Carlsson, 1965)		1200-2100	hoes									●	●		
Simulium (*Nevermannia*) *latigonia* (Rubzov, 1956)		1100-2000	e									●	●		
Simulium (*Simulium*) *argenteostriatum* Strobl, 1898	700-1300	700-2100	? csena		◆	◆					●	●	●		
Simulium (*Simulium*) *argyreatum* Meigen, 1838		400-2400	e							●	●	●	●	●	
Simulium (*Simulium*) *bezzii* (Corti, 1914)		1200-2200	ena, mwca									●	●		
Simulium (*Simulium*) *degrangei* Dorier et Grenier, 1959	700	700-2200	cse		◆						●	●	●		
Simulium (*Simulium*) *ibariense* Zivkovitch & Grenier, 1959		868	csee								●				
Simulium (*Simulium*) *maximum* Knoz, 1961	450	450-2200	e, cse	◆						●	●	●	●		

Table 2. Continued

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Simulium (*Simulium*) *monticola* Friederichs, 1920		600-2200	ena							●	●	●	●		
Simulium (*Simulium*) *morsitans* Edwards, 1915		1400-2000	des									●	●		
Simulium (*Simulium*) *noelleri* Friederichs, 1920		800-1800	wces								●	●	●		
Simulium (*Simulium*) *colombaschense* (Scopoli, 1780)		1800-2250	cse										●	●	
Simulium (*Simulium*) *ornatum* (Meigen, 1818)		780-960	tp, ? e								●				
Simulium (*Simulium*) *reptans* (Linnaeus, 1758)		800-2000	hoes, h								●	●	●		
Simulium (*Simulium*) *tuberosum* (Lundstrom, 1911)		500-2300	h							●	●	●	●	●	
Simulium (*Simulium*) *variegatum* Meigen, 1818		400-2300	e, ? wp							●	●	●	●	●	
Simulium **(***Simulium***)** *verecundum* **Stone & Jamnback, 1955**		1000-2000	h, bm									●	●		
Simulium (*Hellichiella*) *latipes* Meigen, 1804	2060	900-2200	tp, ? h				♦				●	●	●		
Simulium (*Eusimulium*) *angustipes* Edwards, 1915	2240	900-2240	wp					♦			●	●	●	●	
Simulium (*Eusimulium*) *aureum* Fries, 1824		700-2000	wes, ? h								●	●	●		
Simulium (*Eusimulium*) *velutinum* (Santos Abreu, 1922)		1000-2000	ena									●	●		
Simulium (*Obuchovia*) *auricoma* Meigen, 1818		1000-2400	ena ? dp									●	●	●	
Ceratopogonidae															
Culicoides (*Avaritia*) *obsoletus* (Meigen, 1818)		1230-1390	h									●			
Culicoides festivipennis Kieffer, 1914		+++	tp												
Culicoides (*Silvaticulicoides*) *pallidicornis* Kieffer, 1919		1230-1390	tp									●			
Culicoides pictipennis (Staeger, 1839)		2400-2900	wcp											●	●
Dasyhelea (*Dasyhelea*) *bilineata* Goetghebuer 1920	2090-2190		? tp				♦								
Dasyhelea (*Dasyhelea*) *flavifrons* (Guerin, 1833)		2200	tp, ? hoes										●	●	
Forcipomyia (*Forcipomyia*) *pallidipes* Santos Abreu, 1918		1230-1390	mwca									●			
Chironomidae															
Anatopynia plumipes (Fries, 1823)		2283-2340	e											●	
Guttipelopia guttipennis (Wulp, 1861)		2250-2324	h											●	
Larsia curticalcar (Kieffer, 1918)	2020-2365	800-2440	e				♦	♦			●	●	●	●	
Trissopelopia flavida Kieffer, 1923		340-900	et							●	●				
Zavrelimyia melanura (Meigen, 1804)		1070-1850	tp									●	●		
Diamesa (*Diamesa*) *insignipes* Kieffer, 1908		1500-2440	h									●	●	●	
Potthastia gaedii (Meigen, 1838)		1070-1850	ho									●	●		
Pseudodiamesa (*Pseudodiamesa*) *branickii* (Nawicki, 1873)	1140-1950		ho			♦	♦								
Pseudodiamesa (*Pseudodiamesa*) *nivosa* (Goetghebuer, 1928)		1040	wcp									●			
Prodiamesa olivacea (Meigen, 1818)		1040-2196	h									●	●		
Acricotopus lucens (Zetterstedt, 1850)	1140-1950	1140-1950	h			♦	♦					●	●		
Brillia bifida (Kieffer, 1909)		1040-2535	po									●	●	●	●
Corynoneura celeripes Winnertz, 1852		2178	h										●	●	

Table 2. Continued

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Cricotopus (*Cricotopus*) *algarum* (Kieffer, 1911)	2020-2394	400-2394	e, ? wes				♦	♦		●	●	●	●	●	
Cricotopus (*Cricotopus*) *annulator* Goetghebuer, 1927	2365	480-2030	h					♦		●	●	●	●		
Cricotopus (*Cricotopus*) *fuscus* (Kieffer, 1909)		340	h							●					
Cricotopus (*Cricotopus*) *tremulus* (Linnaeus, 1758)		2250	h											●	
Cricotopus (*Isocladius*) *sylvestris* (Fabricius, 1794)	2020-2365	370-2535	hno				♦	♦		●	●	●	●	●	●
Eukiefferiella brevicalcar (Kieffer, 1911)		1568	wp									●			
Eukiefferiella clypeata (Thienemann, 1919)		1550	wp									●			
Eukiefferiella gracei (Edwards, 1929)		1170-1200	h									●			
Eukiefferiella similis Goetghebuer, 1939		900-2350	tp								●	●	●	●	
Limnophyes minimus (Meigen, 1818)		860-900	hptn								●				
? *Orthocladius murvanidzei* (Chernovskij, 1949)		2250-2440	wces											●	●
? *Paracladius inaequalis* Kieffer, 1926		800-1200	? e								●	●			
Psectrocladius (*Psectrocladius*) *psilopterus* (Kieffer, 1906)		2250-2324	h											●	
Psectrocladius (*Psectrocladius*) *simulans* (Johannsen, 1937)		2228-2324	h											●	
Rheocricotopus (*Rheocricotopus*) *effusus* (Walker, 1856)	1140-1950	850-1150	ho			♦	♦				●	●			
Synorthocladius semivirens (Kieffer, 1909)		980-2250	h								●	●	●	●	
Thienemannia gracilis Kieffer, 1909		1070-1850	e									●	●		
Thienemanniella acuticornis (Kieffer, 1912)		512	wp							●					
Thienemanniella flaviforceps Kieffer, 1925		350-1850	e							●	●	●	●		
Tvetenia bavarica (Goetghebuer, 1934)		480	h							●					
Tvetenia calvescens (Edwards, 1929)		400-2250	wp							●	●	●	●	●	
Zalutschia mucronata (Brundin, 1949)		350-1000	wes							●	●				
Chironomus (*Lobochironomus*) *dorsalis* Meigen, 1818		2353-2535	h											●	●
Chironomus (*Chironomus*) *plumosus* (Linnaeus, 1758)	2020-2394	2250-2324	hno				♦	♦						●	
Chironomus (*Chironomus*) *riparius* Meigen, 1804	2020-2365	400-2535	hn				♦	♦		●	●	●	●	●	●
Cryptochironomus (*Cryptochironomus*) *defectus* (Kieffer, 1913)	2020-2394	2020-2545	pa				♦	♦					●	●	●
Orthocladius (*Eudactylocladius*) *fuscimanus* (Kieffer, 1908)		800-1000	wp								●				
Demicryptochironomus (*Demicryptochironomus*) *vulneratus* (Zetterstedt, 1838)		1568-2228	po									●	●	●	
Dicrotendipes nervosus (Staeger, 1839)		1568-2440	ho									●	●	●	
Einfeldia longipes (Staeger, 1839)		2324-2440	h											●	
Endochironomus dispar (Meigen, 1830)		800-1000	hes								●				
Glyptotendipes (*Glyptotendipes*) *pallens* (Meigen, 1804)		1550-1568	po									●			
Paratendipes nudisquama (Edwards, 1929)		440-1140	hno							●	●	●			
Polypedilum (*Pentapedilum*) *exsectum* (Kieffer, 1916)		2200	des										●	●	

Table 2. Continued

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Polypedilum (*Pentapedilum*) *sordens* (van der Wulp, 1875)		2250	h											●	
Polypedilum (*Polypedilum*) *nubeculosum* (Meigen, 1804)		2228-2535	h											●	●
Polypedilum (*Tripodura*) *scalaenum* (Schrank, 1803)		440-2003	ho							●	●	●	●		
Cladotanytarsus (*Cladotanytarsus*) *mancus* (Walker, 1856)		400-1000	h							●	●				
Stictochironomus pictulus (Meigen, 1830)	2020-2394		h				♦	♦							
Micropsectra junci (Meigen, 1818)		400-2368	h							●	●	●	●	●	
Micropsectra lindrothi Goetghebuer, 1931	1142		h			♦									
Micropsectra notescens (Walker, 1856)	1950		ena				♦								
Micropsectra radialis Goetghebuer 1939		2545-2709	po												●
Tanytarsus gregarius Kieffer, 1909		400-2709	h							●	●	●	●	●	●
BRACHYCERA ORTHORRHAPHA															
STRATIOMYOMORPHA															
Coenomyiidae															
Coenomyia ferruginea (Scopoli, 1763)		1147	h									●			
Stratiomyidae															
Beris chalybata (Forster, 1771)	+++		e												
Chloromyia formosa (Scopoli, 1763)	300-1000	800-1147	h	♦	♦						●	●			
Chloromyia speciosa (Macquart, 1834)	300-400		tp	♦											
Odontomyia hydroleon (Linnaeus, 1758)	300-400		tp	♦											
Oplodontha viridula (Fabricius, 1775)	300-400		tp	♦											
Stratiomys chamaeleon (Linnaeus, 1758)	900-1000		esca		♦										
Stratiomys ruficornis (Macquart, 1838)	1200		? cseeit			♦									
Stratiomys singularior (Harris, 1776)		550	tp							●					
Lasiopa balius (Walker, 1849)	300-1000	300-1000	ban	♦	♦					●	●				
Lasiopa calva (Meigen, 1822)		1147	cse									●			
Lasiopa villosa (Fabricius, 1794)	350-450		? cseit	♦											
Oxycera nigricornis Olivier, 1812	300-500		e	♦											
Oxycera trilineata (Linnaeus, 1758)	300-400		wcp	♦											
Pachygaster atra (Panzer, 1798)	350-450	1700	eswa	♦									●		
TABANOMORPHA															
Rhagionidae															
Chrysopilus cristatus (Fabricius, 1775)	1000-1200	1200	e			♦						●			
Chrysopilus maerens Loew, 1873		1147-2600	cseel									●	●	●	●
Chrysopilus pullus (Löw, 1869)	1000		e		♦	♦									
Chrysopilus splendidus (Meigen, 1820)	1000		e		♦	♦									

Table 2. Continued

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Rhagio conspicuus Meigen, 1804	1700-1800	550-1800	e				♦			●	●	●	●		
Rhagio lineola Fabricius, 1794	1000-1100		des			♦									
Rhagio scolopaceus (Linnaeus, 1758)	1000	1150	wes			♦						●			
Rhagio tringarius (Linnaeus, 1758)	350-450	550	wes	♦						●					
Rhagio vitripennis (Meigen, 1820)	1000		e		♦	♦									
Tabanidae															
Nemorius vitripennis (Meigen, 1820)		+++	cseit												
Chrysops (*Chrysops*) *caecutiens* (Linnaeus, 1758)		400-900	hoes. ? tp							●	●				
Chrysops (*Petersenichrysops*) *hamatus* Loew, 1858	300-400		ban	♦											
Atylotus fulvus (Meigen, 1804)		900-2550	tp								●	●	●	●	●
Hybomitra aterrima (Meigen, 1820)	1500	900-2654	cse, m			♦					●	●	●	●	●
Hybomitra auripila (Meigen, 1820)	1500	900-2550	e			♦					●	●	●	●	●
Hybomitra ciureai (Séguy, 1937)		1200-1800	esca									●	●		
Hybomitra distinguenda (Verrall, 1909)		1800	hoes, ? tp										●		
Hybomitra micans (Meigen, 1804)		1150-2100	e									●	●		
Hybomitra montana (Meigen, 1820)		900-1390	hoes, ? tp								●	●			
Hybomitra tropica (Linnaeus, 1758)		900-1390	e								●	●			
Tabanus bovinus Linnaeus, 1758		1200-1800	tp, ? hop									●	●		
Tabanus bromius Linnaeus, 1758		550-1800	wp							●	●	●	●		
Tabanus cordiger Meigen, 1820		1200-1800	wp									●	●		
Tabanus glaucopis Meigen, 1820		550-1800	esca							●	●	●	●		
Tabanus maculicornis Zetterstedt, 1842		1200-1600	wes									●	●		
Tabanus miki Brauer, 1880		900-1600	eit								●	●			
Tabanus quatuornotatus Meigen, 1820		1200	wp									●			
Tabanus spodopterus Meigen, 1820	1000	1200-2550	? csean			♦						●	●	●	●
Tabanus tergestinus Egger, 1859		1200-1600	eit									●	●		
Tabanus unifasciatus Loew, 1858		1200-1600	? wp									●	●		
Haematopota grandis Meigen, 1820		1200-1400	wp									●			
Haematopota italica Meigen, 1804		+++	eanna												
Haematopota pluvialis (Linnaeus, 1758)		1600	wcp									●	●		
Philipomyia aprica (Meigen, 1820)	+++	900-1400	eit, ? cseit								●	●			
Philipomyia graeca (Fabricius, 1794)		900-2000	csea								●	●	●		
Acroceridae															
Ogcodes (*Ogcodes*) *lautereri* Chvala, 1980	2000-2500		hom, ? mm				♦	♦							
Bombyliidae															

Table 2. Continued

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Bombylella atra (Scopoli, 1763)		550-2100	tp							●	●	●	●		
Bombylius (*Bombylius*) *major* Linnaeus, 1758		545-1900	ho							●	●	●	●		
Bombylius (*Bombylius*) *medius* Linnaeus, 1758		545-2100	wcp							●	●	●	●		
Bombylius (*Bombylius*) *minor* Linnaeus, 1758		1147	esca									●			
Lomatia sabea (Fabricius, 1781)		550	? mwca							●					
Exoprosopa capucina (Fabricius, 1781)		+++	hoes, ? tp												
Hemipenthes maura (Linnaeus, 1758)		+++	esca												
Hemipenthes morio (Linnaeus, 1758)		+++	h												
Villa hottentotta (Linnaeus, 1758)		550	tp							●					
Therevidae															
Pandivirilia eximia (Meigen, 1820)		1200-1400	e									●			
Thereva tuberculata Loew, 1847		1200-1400	sena									●			
Asilidae															
Choerades fimbriata (Meigen, 1820)		1200	wes									●			
Choerades fuliginosa (Panzer, 1798)	1000		? wces			♦									
Choerades ignea (Meigen, 1820)		900	wes								●				
Laphria flava (Linnaeus, 1761)	1000	900-2500	po		♦	♦					●	●	●	●	●
Laphria gibbosa (Linnaeus, 1761)		1200-1400	hoes									●			
Dioctria cothurnata Meigen, 1820		+++	wces												
Dioctria oelandica (Linnaeus, 1758)	1000	550-1200	e		♦	♦				●	●	●			
Pycnopogon fasciculatus (Loew, 1847)	300-400		hom	♦											
Molobratia teutonus (Linnaeus, 1767)	1000		eca		♦	♦									
Leptarthrus brevirostris (Meigen, 1804)	1000		e		♦	♦									
Lasiopogon cinctus (Fabricius, 1781)		1789-2600	e										●	●	●
Lasiopogon montanus Schiner, 1862		1374	? cse									●			
Cyrtopogon ruficornis (Fabricius, 1794)		1374	e									●			
Dasypogon diadema (Fabricius, 1781)		+++	wp												
Leptogaster cylindrica (De Geer, 1776)		550	tp							●					
Didysmachus picipes (Meigen, 1820)	1000	550-2100	wes		♦	♦				●	●	●	●		
Dysmachus cephalenus Loew, 1871		1374	ban									●			
Dysmachus fuscipennis (Meigen, 1820)		1500	? wes									●			
Dysmachus stylifer (Loew, 1854)	1000	1374	cse			♦						●			
Erax barbatus Scopoli, 1763		350-400	e							●					
Eutolmus rufibarbis (Meigen, 1820)		+++	tp												
Machimus caliginosus (Meigen, 1820)	1000		csean		♦	♦									

Table 2. Continued

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Neoitamus cothurnatus (Meigen, 1820)		+++	e												
Neoitamus cyanurus (Loew, 1849)		1200-1450	hoes									●			
Neoitamus impudicus (Gerstaecker, 1862)	1000		Eb		◆	◆									
Philonicus albiceps (Meigen, 1820)	1000		tp		◆	◆									
Neomochtherus geniculatus (Meigen, 1820)		+++	e, ? cse												
Stilpnogaster aemula (Meigen, 1820)		850-1300	e								●	●			
Tolmerus atricapillus (Fallen, 1814)		1200-1400	hoes, ? tp									●			
Tolmerus bolgaricus Lehr, 1981		1000-1100	Ebg									●			
Empididae															
Hilara discoidalis Lundbeck, 1910	2500		e					◆	◆						
Hilara setipes Straka, 1976	1230-1900		Ebg			◆	◆								
Empis (*Euempis*) *ciliata* Fabricius, 1787		1200	des									●			
Empis (*Empis*) *prodromus* Loew, 1867	900-1000		e		◆										
Empis (*Euempis*) *tessellata* Fabricius, 1794		545-2100	hop							●	●	●	●		
Empis (*Polyblepharis*) *opaca* Meigen, 1804		+++	e												
Rhamphomyia (*Rhamphomyia*) *morio* (Zetterstedt, 1838)	1950-2230		e				◆	◆							
Rhamphomyia (*Rhamphomyia*) *sulcata* (Meigen, 1804)		+++	hoes												
Rhamphomyia (*Rhamphomyia*) *tibialis* Meigen, 1822		1200	des									●			
Rhamphomyia (*Pararhamphomyia*) *simplex* (Zetterstedt, 1849)	1810		e				◆								
Rhamphomyia (*Holoclera*) *culicina* (Fallen, 1816)		+++	e												
Rhamphomyia (*Holoclera*) *trigemina* Oldenberg, 1927	1810		e				◆								
Phaeobalia dimidiata (Loew, 1869)	+++		e, ? cse												
Chelifera precabunda Collin, 1961		+++	? e												
Wiedemannia (*Chamaedipsia*) *lota* Walker, 1851		+++	eswa												
Hybotidae															
Bicellaria nigra (Meigen, 1824)		930-1000	e								●	●			
Platypalpus maculipes (Meigen, 1829)	+++	930-1000	e								●	●			
Platypalpus niger (Meigen, 1804)		930-1000	e								●	●			
Platypalpus nigritarsis (Fallén, 1816)	+++		e												
Platypalpus pallidicornis (Collin, 1926)		930-1000	e								●	●			
Crossopalpus humilis (Frey, 1913)	+++		wces												
Drapetis (Drapetis) assimilis (Fallen, 1815)		930-1000	e, ? h								●	●			
Dolichopodidae															
Rhaphium crassipes (Meigen, 1824)		1374-1400	wes									●			
Rhaphium monotrichum Loew, 1850		1374-1400	wces									●			

Table 2. Continued

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Hydrophorus balticus (Meigen, 1824)	2020-2394	1374-1400	ppt				♦	♦				●			
Sympycnus desoutteri Parent, 1925		1374-1400	e									●			
Syntormon denticulatum (Zetterstedt, 1843)		1374-1400	wes									●			
Syntormon fuscipes (von Roser,1840)		1374-1400	e									●			
Syntormon monile (Haliday, 1815)		1374-1400	wp									●			
Syntormon pallipes (Fabricius, 1794)		1374-1400	wp									●			
Syntormon pumilum (Meigen, 1824)		1374-1400	wp									●			
Campsicnemus curvipes (Fallén, 1823)		1374-1400	ena									●			
Argyra auricollis (Meigen, 1824)		1374-1400	e									●			
Chrysotus gramineus (Fallén, 1823)		1374-1530	tp									●			
Chrysotus laesus (Wiedemann, 1817)		1374-1400	hoes									●			
Chrysotus pulchellus Kowarz, 1874		1374-1400	po									●			
Gymnopternus angustifrons (Stæger, 1842)		1374-1400	wes									●			
Gymnopternus brevicornis (Stæger 1842)		1374-1400	e									●			
Hercostomus fugax (Loew, 1857)	2000		hoes				♦								
Hercostomus labiatus (Loew, 1857)	1600-2200		e, cse			♦	♦								
Hercostomus sahlbergi (Zetterstedt, 1838)		1000-1750	e									●	●		
Dolichopus albipalpus Negrobov, 1973	2000-2200		dp				♦	♦							
Dolichopus beschovskii Negrobov & Kechev, 2010	2200		Er				♦	♦							
Dolichopus lepidus Staeger, 1842		1374-1400	po									●			
Dolichopus pennatus Meigen, 1824		1374-1400	po									●			
Dolichopus phaeopus Haliday, 1851		2000	e										●		
Dolichopus picipes Meigen, 1824		1374-1400	wes									●			
Dolichopus pyrenaicus Parent, 1920	1800-2200		wes				♦								
Dolichopus plumipes (Scopoli, 1783)		1374-1400	hno									●			
Dolichopus popularis Wiedemann, 1817		1374-1400	wces									●			
Dolichopus simplex Meigen, 1824		1374-1400	wes									●			
Dolichopus ungulatus (Linnaeus, 1758)		1374-1400	h									●			
BRACHYCERA CYCLORRHAPHA															
ASCHIZA															
Platypezidae															
Callomyia saibhira Chandler, 1976		930-1000	des								●	●			
Phoridae															
Aenigmatias franzi Schmitz, 1950	2270		des, ? ess					♦							
Triphleba antricola (Schmitz, 1918)	1648		e				♦								

Table 2. Continued

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Triphleba bicornuta (Strobl, 1910)		2000-2100	e										●		
Syrphidae															
Dasysyrphus albostriatus (Fallén, 1817)		1200-1400	tp									●			
Dasysyrphus venustus (Meigen, 1822)		1200-2000	h									●	●		
Didea alneti (Fallen, 1817)		2925	h												●
Doros profuges (Harris 1780)		1200-1400	hoes									●			
Epistrophe diaphana (Zetterstedt, 1843)		1200-1400	esca									●			
Epistrophe eligans (Harris, 1780)	1000	1200-1400	et		♦	♦						●			
Epistrophe grossulariae (Meigen, 1822)		+++	h												
Epistrophe nitidicollis (Meigen, 1822)		1200-1400	h									●			
Epistrophella euchroma (Kowarz, 1885)		1500-1550	hoes									●			
Episyrphus balteatus (De Geer, 1776)		1147	poa									●			
Leucozona lucorum (Linnaeus, 1758)		1500-2300	h									●	●	●	
Melangyna lasiophthalma (Zetterstedt, 1843)		1800	esca										●		
Meligramma guttata (Fallen, 1817)		1200-1400	h									●			
Meligramma triangulifera (Zetterstedt, 1843)		1200-1400	h									●			
Meliscaeva auricollis (Meigen, 1822)		1200-1400	wp									●			
Meliscaeva cinctella (Zetterstedt, 1843)	+++	1170-1200	ho									●			
Eupeodes lapponicus (Zetterstedt, 1838)	+++	1200-1400	h									●			
Eupeodes corollae (Fabricius, 1794)	300-1000	900-1550	ppta	♦	♦						●	●			
Eupeodes latifasciatus (Macquart, 1829)		1147	ho									●			
Eupeodes luniger (Meigen, 1822)	1000	1200-1400	ho		♦	♦						●			
Eupeodes nitens (Zetterstedt, 1843)	1500	400-1374	tp			♦				●	●	●			
Parasyrphus lineolus (Zetterstedt, 1843)	1500	1200-1800	h			♦						●	●		
Parasyrphus malinellus (Collin, 1952)	1500	1800	des			♦							●		
Scaeva pyrastri (Linnaeus, 1758)	1000	1200-1400	ho		♦	♦						●			
Sphaerophoria menthastri (Linnaeus, 1758)		1200-1400	hop									●			
Sphaerophoria philantha (Meigen, 1822)		550-650	h							●					
Sphaerophoria scripta (Linnaeus, 1758)	1000	550-1900	ho		♦	♦				●	●	●	●		
Syrphus ribesii (Linnaeus, 1758)	1000-1500	800-1100	h			♦					●	●			
Syrphus torvus Osten-Sacken, 1875	1500		ho			♦									
Syrphus vitripennis Meigen, 1822	1500	800-1000	ho			♦					●	●			
Xanthogramma pedissequum (Harris, 1776)		1500-1550	tp									●			

Table 2. Continued

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Baccha elongata (Fabricius, 1775)	+++	1147	h									●			
Chrysotoxum arcuatum (Linnaeus, 1758)		400-1550	tp							●	●	●			
Chrysotoxum elegans Loew, 1841		1200-1550	e									●			
Chrysotoxum fasciolatum (De Geer, 1776)		1200-1550	h									●			
Chrysotoxum festivum (Linnaeus, 1758)	1500	450-1147	po			♦				●	●	●			
Chrysotoxum intermedium (Meigen, 1822)		1500-1550	wp									●			
Chrysotoxum octomaculatum Curtis, 1837		1200-1400	wes									●			
Chrysotoxum vernale Loew, 1841	1500	350-450	esca			♦				●					
Melanostoma mellinum (Linnaeus, 1758)	300-1800	540-2100	h	♦	♦	♦	♦			●	●	●	●		
Xanthandrus comtus (Harris, 1780)		1200-1550	po									●			
Platycheirus ambiguus (Fallén, 1817)		1200-1400	ho									●			
Platycheirus albimanus (Fabricius, 1781)	1500	1800	ho			♦							●		
Platycheirus clypeatus (Meigen, 1822)		1147	h									●			
Platycheirus fulviventris (Macquart, 1829)		1200-1400	esca									●			
Platycheirus manicatus (Meigen, 1822)		900-1400	h								●	●			
Platycheirus melanopsis Loew, 1856		1800	des										●		
Platycheirus peltatus (Meigen, 1822)		1147-1550	h									●			
Platycheirus podagratus (Zetterstedt, 1838)		900	h								●				
Platycheirus scutatus (Meigen, 1822)	+++	1170-1400	h									●			
Paragus albifrons (Fallen, 1817)		1147	tp									●			
Paragus bicolor (Fabricius, 1794)		400-1374	h							●	●	●			
Paragus cinctus Schiner & Egger, 1853			? mt												
Paragus haemorrhous Meigen, 1822		1200-1400	hat									●			
Paragus quadrifasciatus Meigen, 1822		1500-1550	tp									●			
Paragus tibialis (Fallén, 1817)	+++	400-1400	ho							●	●	●			
Heringia pubescens (Delucchi & Pschorn-Walcher, 1955)	+++		h												
Pipiza austriaca Meigen, 1822		1374-1400	hoes									●			
Pipiza quadrimaculata (Panzer, 1804)		+++	h												
Pipizella virens (Fabricius, 1805)	1800	900-1200	tp				♦				●	●			
Trichopsomyia flavitarsis (Meigen, 1822)		900	hoes								●				
Triglyphus primus Loew, 1840		1500-1550	hoes, ? tp									●			
Chamaesyrphus scaevoides (Fallén, 1817)	1810	1200	des				♦					●			
Cheilosia albitarsis (Meigen, 1822)	1500	1200-1800	h			♦						●	●		
Cheilosia antiqua (Meigen, 1822)	1800		e, ? cse				♦								
Cheilosia barbata Loew, 1857		900	e								●				

Table 2. Continued

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Cheilosia bureschi (Delkeskamp, 1942)	900-1000		Ebg		♦										
Cheilosia canicularis (Panzer, 1801)		900-1400	hoes								●	●			
Cheilosia carbonaria Egger, 1860	1500		wces			♦									
Cheilosia flavipes (Panzer, 1798)	1500		wces			♦									
Cheilosia frontalis Loew, 1857	900-1000		e		♦										
Cheilosia gagatea Loew, 1857	1200-1400		cse			♦									
Cheilosia illustrata (Harris, 1780)		1200-1550	hoes									●			
Cheilosia impressa Loew, 1840	900-1000	1200-1800	hoes		♦							●	●		
Cheilosia latifrons (Zetterstedt, 1843)		1200-1400	wp									●			
Cheilosia melanopa (Zetterstedt, 1843)		400-1550	e							●	●	●			
Cheilosia melanura (Becker, 1894)		1800	des										●		
Cheilosia montana Egger, 1860	1500		wes			♦									
Cheilosia morio (Zetterstedt, 1838)		400-1550	wces							●	●	●			
Cheilosia mutabilis (Fallén, 1817)	1500-2000	1200-1400	wcp			♦	♦					●			
Cheilosia nebulosa (Verrall, 1871)	1800		e				♦								
Cheilosia pagana (Meigen, 1822)		1500-1550	h									●			
Cheilosia pallipes Loew, 1863		1500-1550	h									●			
Cheilosia proxima (Zetterstedt, 1843)	+++	1150-1400	hoes									●			
Cheilosia pubera (Zetterstedt, 1838)	1800	1800	e				♦						●		
Cheilosia rhynchops Egger, 1860		1800	e										●		
Cheilosia ruralis (Meigen, 1822) [*Ch. urbana* (Meigen, 1822)]	300-1800	1150	hoes, ? tp	♦	♦	♦	♦					●			
Cheilosia sahlbergi Becker, 1894	1810		e				♦								
Cheilosia schineri Egger, 1860		1500-1550	se									●			
Cheilosia semifasciata (Becker, 1894)		+++	e												
Cheilosia variabilis (Panzer, 1798)	1500	1350-1475	wcp			♦						●			
Cheilosia velutina Loew, 1840	+++	400-1000	hoes							●	●				
Cheilosia vernalis (Fallén, 1817)	1800	1200-1400	hoes				♦					●			
Cheilosia vulpina (Meigen, 1822)		1200-1400	e									●			
Ferdinandea cuprea (Scopoli, 1763)		1200-1400	tp									●			
Pelecocera tricincta Meigen, 1822		1200-1400	des									●			
Rhingia campestris Meigen, 1822		1350-1475	hoes									●			
Rhingia rostrata (Linnaeus, 1758)		1200-1400	wes									●			
Volucella bombylans (Linnaeus, 1758)		1150-2500	h									●	●	●	●
Volucella inanis (Linnaeus, 1758)		1150-2000	esca									●	●		
Volucella pellucens (Linnaeus, 1758)		+++	po												
Volucella zonaria (Poda, 1761)		1150-1400	tp									●			

Table 2. Continued

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Brachyopa bicolor (Fallén, 1817)		1500-1550	? hoes									●			
Brachyopa panzeri Goffe, 1945		1147	des									●			
Melanogaster parumplicata (Loew, 1840)		1200-1400	? hoes									●			
Chrysogaster solstitialis (Fallén, 1817)		900-1400	ena								●	●			
Pipizella viduata (Linnaeus, 1758)	1000-1500	550-1800	e			♦				●	●	●	●		
Lejogaster metallina (Fabricius, 1781)	1000-1500	1200-1400	tp			♦						●			
Lejogaster tarsata (Meigen, 1822)	300-400	900-1550	esca, ? tp	♦							●	●			
Orthonevra elegans (Meigen, 1822)		1200-1400	hoes									●			
Orthonevra geniculata (Meigen 1830)		1500-1550	hoes									●	●		
Orthonevra nobilis (Fallén, 1817)		1170-1400	esca									●			
Neoascia annexa (Müller, 1776)		+++	e												
Neoascia podagrica (Fabricius, 1775)		550-650	wcp							●					
Neoascia meticulosa (Scopoli, 1763)		1800	hoes,? esca										●		
Neoascia geniculata (Meigen, 1822)		1800	wces										●		
Sphegina clunipes (Fallen, 1816)		1200-1800	des									●	●		
Sphegina montana Becker, 1921		1200-1400	e									●			
Arctophila bequaerti Herve-Bazin, 1913		900-1000	ban								●	●			
Arctophila bombiforme (Fallén, 1810)		1150-2145	e									●	●		
Sericomyia lappona (Linnaeus, 1758)		1800	hoes										●		
Sericomyia silentis (Harris, 1776)		1150-1400	hoes									●			
Eumerus strigatus (Fallén, 1817)		800-1500	ha, ? i								●	●			
Merodon aberrans Egger, 1860		1150	ena									●			
Merodon aeneus Meigen, 1822		1150-1400	ena									●			
Merodon avidus (Rossi, 1790)		1150-1400	ena									●			
Merodon cinereus (Fabricius, 1794)		+++	cse												
Merodon clavipes (Fabricius, 1781)		1500-1550	ena									●			
Merodon equestris (Fabricius, 1794)		+++	ha												
Merodon loewi van der Goot, 1964		1500-1550	? e									●			
Merodon ruficornis Meigen, 1822	300-400	800-1800	ena	♦							●	●	●		
Merodon rufus Meigen, 1838		+++	ena												
Merodon testaceus Sack, 1913		1500-1550	nm									●			
Psilota anthracina Meigen, 1822		400-1550	e							●	●	●			
Psarus abdominalis (Fabricius, 1794)		1500-1550	e									●			
Ceriana conopsoides (Linnaeus, 1758)		1200-1400	tp									●			
Eristalinus aeneus (Scopoli, 1763)		350-400	hpta, ? sk							●					

Table 2. Continued

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Eristalinus sepulchralis (Linnaeus, 1758)		1150	po									●			
Eristalis arbustorum (Linnaeus, 1758)	1000	550-1800	ho		♦	♦				●	●	●	●		
Eristalis horticola (De Geer, 1776)		1200-1800	po									●	●		
Eristalis intricaria (Linnaeus, 1758)		1150	hoes,? esca									●			
Eristalis jugorum Egger, 1858		1800	e										●		
Eristalis nemorum (Linnaeus, 1758) ?		350-1400	h							●	●	●			
Eristalis cryptarum (Fabricius, 1794)		1200-1400	e									●			
Eristalis similis (Fallén, 1817)		1150-1800	wp									●	●		
Eristalis rupium Fabricius, 1805		1200-1800	h									●	●		
Eristalis tenax (Linnaeus, 1758)		550-1374	k							●	●	●			
Myathropa florea (Linnaeus, 1758)	1000		ena		♦	♦									
Helophilus hybridus Loew, 1846		350-1374	h							●	●	●			
Helophilus trivittatus (Fabricius, 1805)		550-1150	tp							●	●	●			
Helophilus pendulus (Linnaeus, 1758)		800-1000	hoes								●				
Blera fallax (Linnaeus, 1758)		1200-1400	hoes									●			
Spilomyia saltuum (Fabricius, 1794)		1200-1400	cse									●			
Syritta pipiens (Linnaeus, 1758)	900-1000	550-1000	hno, ? sk		♦	♦				●	●				
Brachypalpus laphriformis (Fallen, 1816)		1200-1400	e									●			
Chalcosyrphus femoratus (Linnaeus, 1758)		2100-2300	hoes,? esca										●	●	
Xylota ignava (Panzer, 1798)		1200-1400	tp									●			
Xylota segnis (Linnaeus, 1758)		1200-1400	h									●			
Xylota sylvarum (Linnaeus, 1758)		1200-1400	hoes									●			
Microdon devius (Linnaeus, 1761)		1350-1475	wces									●			
Microdon mutabilis (Linnaeus, 1758)	1000-1600		hoes			♦									
Pipunculidae															
Verrallia aucta (Fallén, 1817)	300-400		h	♦											
Pipunculus campestris Latreille, 1805		800-1000	ho								●				
Eudorylas fusculus (Zetterstedt, 1844)	1500		e			♦									
Eudorylas jenkinsoni Coe, 1966		2729	e												●
Eudorylas ruralis (Meigen, 1824)	300-1750		ena, ? wp	♦	♦	♦	♦								
Eudorylas subterminalis Collin, 1956	400-1400		e	♦	♦	♦									
Eudorylas terminalis (Thompson, 1869)	1250-1430		e			♦									
Eudorylas zonellus (Collin, 1956)	400-950		e	♦	♦										
Dasydorylas horridus (Becker, 1897)	300-400		e	♦											
Dorylomorpha (*Dorylomorpha*) *confusa* (Verrall, 1901)	1250-1900		e			♦	♦								

Table 2. Continued

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Dorylomorpha (*Dorylomyia*) *incognita* (Verrall, 1901)	1900-2000	930-1700	e				♦				●	●	●		
Tomosvaryella coquilletti (Kertész, 1907)	400-1900	360	ho	♦	♦	♦	♦			●					
Tomosvaryella geniculataq (Meigen, 1824)	300-400	1350-1475	e	♦								●			
Tomosvaryella kuthyi (Aczél, 1944)	400-950		ean	♦	♦										
Tomosvaryella nutata (Becker, 1898)	650		hom	♦											
Tomosvaryella sylvatica (Meigen, 1824)	450-2350		ho	♦	♦	♦	♦	♦							
SCHIZOPHORA															
ACALYPTRATA															
Conopidae															
Conops (*Asiconops*) *elegans* Meigen, 1824		900	hom								●				
Conops (*Conops*) *quadrifasciatus* De Geer, 1776		1200-1400	esanca									●			
Conops (*Conops*) *scutellatus* Meigen 1804		1150-1550	e									●			
Conops (*Conops*) *silaceus* Wiedemann in Meigen, 1824		1500-1550	se									●			
Conops (*Conops*) *vesicularis* Linnaeus, 1761		1150	tp									●			
Conops (*Conops*) *vitellinus* Loew, 1847		400-450	nm							●					
Physocephala chrysorrhoea (Meigen, 1824)		1200-1400	tp, ? hop									●			
Physocephala nigra (De Geer, 1776)		900	tp, ? hop								●				
Physocephala pusilla (Meigen, 1824)	300-400		wcp	♦											
Physocephala variegata (Meigen, 1824)		1200-1400	sp									●			
Zodion cinereum (Fabricius, 1794)		1150-1500	po									●			
Zodion erythrurum Rondani, 1865		1200-1400	sp, ? tp									●			
Zodion notatum (Meigen, 1804)		800-1200	hop									●			
Myopa buccata (Linnaeus, 1758)	1800	1150-1800	tp				♦					●	●		
Myopa dorsalis Fabricius, 1794		1200-1400	wpo									●			
Myopa testacea (Linnaeus, 1767)		800-1700	ho								●	●	●		
Melanosoma bicolor (Meigen 1824)		1200	wp									●			
Myopotta pallipes (Wiedemann in Meigen, 1824)		400	wesanca							●					
Thecophora atra (Fabricius, 1775)		1150	po									●			
Thecophora pusilla (Meigen, 1824)		1000-1400	hop								●	●			
Sicus ferrugineus (Linnaeus, 1761)		1150-1700	po									●	●		
Tephritidae															
Acidia cognata (Wiedemann, 1817)		1150-1300	e									●			
Euleia heraclei (Linnaeus, 1758)		2200	wp										●	●	
Terellia (*Terellia*) *colon* (Meigen 1826)		1200	wp									●			
Aciura coryli (Rossi, 1790)	900-1000		mwca		♦										

Table 2. Continued

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Oxyna flavipennis (Loew, 1844)		1200-1400	wces									●			
Oxyna nebulosa (Wiedemann, 1817)	1800		eswa				♦								
Tephritis bardanae (Schrank, 1803)		1150-1300	wes									●			
Tephritis vespertina (Loew, 1844)		1200-1400	ena									●			
Trypeta artemisiae (Fabricius, 1794)		1150	ess									●			
Stemonocera cornuta (Scopoli, 1763)		1150-1300	wces									●			
Piophilidae															
Liopiophila varipes (Meigen, 1830)	1800		h				♦								
Lauxaniidae															
Calliopum aeneum (Fallén, 1820)		900	e								●				
Cremifaniidae															
Cremifania bulgarica L. Papp, 2010		2250	Er											●	
Chamaemyiidae															
Parochthiphilla (*Euestelia*) *coronata* (Loew, 1858)	350-2350		tp	♦	♦	♦	♦	♦							
Chamaemyia aestiva Tanasijtshuk, 1970	1800-2200		tp				♦								
Chamaemyia aridella (Fallén, 1823)	300-2200		e	♦	♦	♦	♦								
Chamaemyia bicolor Bheschovski, 1994	+++		Ebg												
Chamaemyia juncorum (Fallén, 1823)	350-2200		tp, ? hop	♦	♦	♦	♦								
Chamaemyia polystigma (Meigen, 1830)	350-650		tp, ? hop	♦											
Chamaemyia subjuncorum Tanasijtshuk, 1970	600-1000	2500	dp, ? tp	♦	♦									●	●
Leucopis (*Leucopis*) *aphidiperda* Rondani, 1847	300-650		esca	♦											
Leucopis (*Leucopis*) *atritarsis* Tanasijtshuk, 1958	350-450		h	♦											
Leucopis (*Leucopis*) *gliphinivora* Tanasijtshuk, 1958	350-700		ho	♦	♦										
Leucopis (*Leucopis*) *pseudomelanopus* Tanasijtshuk, 1961	350-450		esca	♦											
Leucopis (*Leucopis*) *revisenda* Tanasijtshuk, 1970	350-450		esca	♦											
Sciomyzidae															
Pherbellia cinerella (Fallén, 1820)		900	wpo								●				
Tetanocera ferruginea Fallen, 1820		1150-1300	h									●			
Sepsidae															
Sepsis fulgens Meigen, 1826	1800		tp				♦								
Agromyzidae															
Agromyza alnibetulae Hendel, 1931		1150-1300	e									●			
Agromyza lithospermi Spencer, 1963	900-1000		e		♦										
Agromyza nana Meigen 1830		1374	wpo									●			
Agromyza pseudoreptans Nowakowski, 1967		1374	h									●			

Table 2. Continued

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Agromyza reptans Fallen, 1823	900-1000	1700	ho		♦								●		
Agromyza rufipes Meigen, 1830		1700	wpo										●		
Ophiomyia heringi Stary, 1930		1150-1300	e									●			
Ophiomyia labiatarum Hering, 1937		1150-1300	h									●			
Ophiomyia maura (Meigen, 1838)		1150-1300	h									●			
Amauromyza (*Amauromyza*) *lamii* (Kaltenbach, 1858)		1700	e										●		
Amauromyza (*Amauromyza*) *morionella* (Zetterstedt, 1848)	900-1000	1300	ena		♦							●			
Amauromyza (*Cephalomyza*) *flavifrons* (Meigen, 1830)		580-1150	h							●	●	●			
Amauromyza (Cephalomyza) gyrans (Fallen 1823)		1150-1200	e									●			
Amauromyza (*Cephalomyza*) *labiatarum* (Hendel, 1920)	900-1000	1150-1200	e		♦							●			
Amauromyza (*Cephalomyza*) *verbasci* (Bouché, 1847)		1150-1200	e									●			
Cerodontha (*Poemyza*) *pygmaea* (Meigen 1830)		1374	h									●			
Liriomyza amoena (Meigen, 1830)		580	wpo							●					
Liriomyza artemisicola de Meijere, 1924		1150-1200	wpo									●			
Liriomyza buhri Hering, 1937		580-660	e							●					
Liriomyza congesta (Becker, 1903)		580-1374	po							●	●	●			
Liriomyza demeijerei Hering, 1930		1150-1200	e									●			
Liriomyza eupatorii (Kaltenbach, 1873)	900-1000	1150-1200	h		♦							●			
Liriomyza pascuum (Meigen, 1838)		1374	e									●			
Liriomyza puella (Meigen, 1830)		1150-1200	e									●			
Liriomyza sonchi Hendel, 1931		580-1200	ho							●	●	●			
Liriomyza strigata (Meigen, 1830)		580-1200	po							●	●	●			
Liriomyza taraxaci Hering, 1927		1150-1374	h									●			
Phytoliriomyza melampyga (Loew, 1869)		1150-1200	h									●			
Phytoliriomyza variegata (Meigen, 1830)		580-1200	po							●	●	●			
Calycomyza artemisiae (Kaltenbach, 1856)		1150-1200	hno									●			
Aulagromyza similis (Brischke, 1880)		1150-1200	e									●			
Aulagromyza tridentata (Loew, 1858)		580-1200	ewca, ? eca							●	●	●			
Pseudonapomyza europaea Spencer, 1973	1800		h				♦								
Phytomyza affinis Fallén, 1823		580-660	e, ? h							●					
Phytomyza alpina Groschke, 1957	2000	1374	e, ? h				♦					●			
Phytomyza artemisivora Spencer, 1971	900-1000	1150-1200	ewca		♦							●			
Phytomyza chaerophylli (Kaltenbach, 1856)	900-1000	580-1374	e		♦					●	●	●			
Phytomyza cirsii Hendel, 1923		1150-1200	e									●			
Phytomyza conyzae Hendel, 1920	900-1000		wpo		♦										

Table 2. Continued

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Phytomyza erigerophila Hering 1927		580-660	e							●					
Phytomyza eupatorii Hendel 1927		1150-1200	wpo									●			
Phytomyza notata Meigen 1830		1374	e									●			
Phytomyza obscura Hendel 1920		1374	e, ? ena									●			
Phytomyza obscurella Fallén, 1823	900-1000		e		♦										
Phytomyza pastinacae Hendel 1923		1150-1200	h									●			
Phytomyza petoei Hering, 1924	900-1000	1150-1374	wpo		♦							●			
Phytomyza ranunculivora Hering, 1932		1374	e									●			
Phytomyza salviae (Hering, 1924)	900-1000	1150-1374	e		♦							●			
Phytomyza senecionis Kaltenbach 1869		1150-1200	e									●			
Phytomyza spondylii Robineau-Desvoidy 1851		1150-1200	ho									●			
Phytomyza tetrasticha Hendel 1927		580-1374	e, ? eswa							●	●	●			
Phytomyza tussilaginis Hendel 1925	900-1000	1374	h		♦							●			
Chromatomyia saxifragae (Hering, 1924)	2000		csee				♦								
Opomyzidae															
Opomyza florum (Fabricius, 1794)	300-1800	1200-2389	e	♦	♦	♦	♦					●	●	●	
Opomyza germinationis (Linnaeus, 1758)	300-450		h	♦											
Geomyza tripunctata Fallén, 1823	1800-2575	2389	h				♦	♦	♦					●	
Carnidae															
Meoneura alpina Hennig, 1948	2000		csee				♦								
Meoneura flavifacies Collin, 1930	2000		h				♦								
Meoneura flavifrons Papp, 1981	1800-2700		e				♦	♦	♦						
Meoneura glaberrima Becker, 1910	450-1800		wp	♦	♦	♦	♦								
Meoneura graeca Hennig, 1972	350-450		Eb	♦											
Milichiidae															
Desmometopa sordida (Fallén, 1820)	600-1000		ho	♦	♦										
Leptometopa niveipennis (Strobl, 1900)	350-650		wp	♦											
Leptometopa rufifrons Becker, 1903	350-650		mca	♦											
Madiza glabra Fallén, 1820	1000-1200	1400-2100	h		♦	♦						●	●		
Chloropidae															
Rhodesiella fedtschenkoi Nartshuk, 1978	350-450		nemit	♦											
Aphanotrigonum femorellum Collin, 1948	350-450		wp	♦											
Aphanotrigonum parahastatum Dely-Draskovits, 1981	350-500		hom	♦											
Aphanotrigonum trilineatum (Meigen, 1830)	350-1150	800-1150	wces	♦	♦	♦					●	●			
Conioscinella frontella (Fallén, 1820)	1000-2200	1500-1550	hoes			♦	♦					●	●		

Table 2. Continued

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Conioscinella sordidella (Zetterstedt, 1848)		1400	e									●			
Dicraeus (*Dicraeus*) *ingratus* (Loew, 1866)	1800		h				♦								
Dicraeus (*Dicraeus*) *nigropilosus* Becker, 1910	1000-1100	800-1150	eit			♦					●	●			
Dicraeus (*Dicraeus*) *raptus* (Haliday, 1838)	1000-1250	800-1150	e			♦					●	●			
Dicraeus (*Dicraeus*) *tibialis* (Macquart, 1835)	800-1000	800-1150	ha		♦						●	●			
Elachiptera cornuta (Fallén, 1820)	600-1100	800-1400	hop	♦	♦	♦					●	●			
Elachiptera diastema Collin, 1946		2000-2100	ena										●		
Elachiptera submediterranea Beschovski, 1980	1230		Eb			♦									
Elachiptera tuberculifera (Corti, 1909)	600-1200		hop	♦	♦	♦									
Gaurax fascipes Becker, 1910		1400	e									●			
Hapleginella laevicollis (Zetterstedt, 1858)		1400	hoes									●			
Incertella albipalpis (Meigen, 1830)	600-1800	800-1500	hoes	♦	♦	♦	♦				●	●			
Incertella kerteszi (Becker, 1910)		1400	hoes									●			
Lasiambia palposa (Fallén, 1820)		1400	? hoes									●			
Lipara lucens Meigen, 1830		400-650	h*, ? wp							●					
Lipara pullitarsis Doskocil & Chvala, 1971		460	e							●					
Lipara similis Schiner, 1854	500-700	460	? wp	♦						●					
Microcercis trigonella (Duda, 1933)	450-650		wes	♦											
Oscinella (*Oscinella*) *alopecuri* Balachovsky & Mesnil, 1935	850-1100	800-1150	e		♦	♦					●	●			
Oscinella (*Oscinella*) *cariciphila* Collin, 1946	300-2700	360	wces	♦	♦	♦	♦	♦	♦	●					
Oscinella (*Oscinella*) *frit* (Linnaeus, 1758)	300-2700	800-1400	hpta, k	♦	♦	♦	♦	♦	♦		●	●			
Oscinella (*Oscinella*) *maura* (Fallén, 1820)	350-1000	1400	wes	♦	♦							●			
Oscinella (*Oscinella*) *nigerrima* (Macquart, 1835)	700-2500	360-2100	e		♦	♦	♦	♦	♦	●	●	●	●		
Oscinella (*Oscinella*) *nitidissima* (Meigen, 1838)	300-2100	400-1400	h	♦	♦	♦	♦			●	●	●			
Oscinella (*Oscinella*) *phlei* Nartshuk, 1955	600-2500		e	♦	♦	♦	♦	♦	♦						
Oscinella (*Oscinella*) *pusilla* (Meigen, 1830)	600-2700	800-1150	hop	♦	♦	♦	♦	♦	♦		●	●			
Oscinella (*Oscinella*) *vastator* (Curtis, 1845)	1000-1740	800-1300	e			♦	♦				●	●			
Oscinella (*Oscinella*) *ventricosi* Nartshuk, 1955	2200	400-450	wes				♦	♦		●					
Oscinimorpha arcuata (Duda, 1932)	300-1230		eswa	♦	♦	♦									
Oscinimorpha minutissima (Strobl, 1900)	350-2000	850-1400	wp	♦	♦	♦	♦				●	●			
Oscinimorpha sordidissima (Strobl, 1903)	1000-1200	850-1400	e			♦					●	●			
Polyodaspis ruficornis (Macquart, 1835)	300-650	400-450	po	♦						●					
Rhopalopterum anthracinum (Meigen, 1830)	300-650		wces ?	♦											
Siphonella oscinina (Fallén, 1820)		1400	h									●			
Trachysiphonella pygmaea (Meigen, 1838)	300-1000		wes ?	♦	♦										

Table 2. Continued

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Trachysiphonella ruficeps (Macquart, 1835)	350-500	1150-1600	e	♦								●	●		
Trachysiphonella scutellata von Roser, 1840	900-1600		eca		♦	♦									
Tricimba (*Nartshukiella*) *cincta* (Meigen, 1830)	300-1400	800-1150	h	♦	♦	♦					●	●			
Tricimba (*Nartshukiella*) *humeralis* (Loew, 1858)	300-400		hop	♦											
Cetema (*Cetema*) *cereris* (Fallén, 1820)	700-1800	850-1450	hoes		♦	♦	♦				●	●			
Cetema (*Cetema*) *elongatum* (Meigen, 1830)	300-1200	850-1600	h	♦	♦	♦					●	●			
Cetema (*Cetema*) *myopinum* (Loew, 1866)	350-1000	1350-1800	wesca	♦	♦							●	●		
Cetema (*Cetema*) *neglectum* Tonnoir, 1921		1450	e									●			
Chlorops (*Chlorops*) *calceatus* Meigen, 1830	350-1200	800-1400	wces	♦	♦	♦					●	●			
Chlorops (*Chlorops*) *fasciatus* Meigen, 1830	1900		wces				♦								
Chlorops (*Chlorops*) *finitimus* Becker, 1910	1230-2350		ewca			♦	♦	♦							
Chlorops (*Chlorops*) *geminatus* Meigen, 1830	1000-1900	1450	wces			♦	♦					●			
Chlorops (*Chlorops*) *hypostigma* Meigen, 1830	900-1000	1150-1200	e		♦	♦						●			
Chlorops (*Chlorops*) *meigenii* Loew, 1866	1000-1430		hoes			♦									
Chlorops (*Chlorops*) *pumilionis* (Bjerkander, 1778)		1200-1400	wp, ? wcp									●			
Chlorops (*Chlorops*) *ringens* Loew, 1866	1000-1200		wces			♦									
Chlorops (*Chlorops*) *scalaris* Meigen, 1830	1000-1430		wces			♦									
Chlorops (*Chlorops*) *speciosus* Meigen, 1830	1140-2500	850-1450	wes			♦	♦	♦	♦		●	●			
Chlorops (*Chlorops*) *troglodytes* (Zetterstedt, 1848)	1000-2000	400-1450	wces			♦	♦			●	●	●			
Chlorops (*Sclerophallus*) *limbatus* Meigen, 1830		360-400	? hoes							●					
Diplotoxa messoria (Fallén, 1820)	300-1230	800-1400	h	♦	♦	♦					●	●			
Elachiptereicus italicus Duda, 1933	350	360	se	♦						●					
Lasiosina albipila (Loew, 1866)	350-500		des ?	♦											
Lasiosina herpini (Guérin-Menéville, 1843)	600-1400	400-1374	tp	♦	♦	♦				●	●	●			
Meromyza (*Meromyza*) *athletica* Fedoseeva, 1974	450-1200	1450-1600	csee	♦	♦	♦						●	●		
Meromyza (*Meromyza*) *bohemica* Fedoseeva, 1962	350-500	1600	e	♦								●	●		
Meromyza (*Meromyza*) *femorata* Macquart, 1835	350-1200	1400-1450	e	♦	♦	♦						●			
Meromyza (*Meromyza*) *meigeni* Nartshuk, 2006	1600		wes			♦	♦								
Meromyza (*Meromyza*) *mosquensis* Fedoseeva, 1960		900-1450	e								●	●			
Meromyza (*Meromyza*) *nigriseta* Fedoseeva, 1960	1100-1200	850-1150	wces			♦					●	●			
Meromyza (*Meromyza*) *nigriventris* Macquart, 1835	350-2200	1150-1600	h	♦	♦	♦	♦					●	●		
Meromyza (*Meromyza*) *pluriseta* Péterfi, 1961	1000-1200		wces			♦									
Meromyza (*Meromyza*) *pratorum* Meigen, 1830		1400-1450	h									●			
Meromyza (*Meromyza*) *rohdendorfi* Fedoseeva, 1974	1140	850-1150	e			♦					●	●			
Meromyza (*Meromyza*) *rufa* Fedoseeva, 1962	350-1140	900-1600	e	♦	♦	♦					●	●			

Table 2. Continued

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Meromyza (*Meromyza*) *saltatrix* (Linnaeus, 1761)	950-2200	850-1450	h		♦	♦	♦				●	●			
Meromyza (*Meromyza*) *triangulina* Fedoseeva, 1960	950-1200	850-1150	e		♦	♦					●	●			
Meromyza (Meromyza) variegata Meigen 1830		1150-1200	e									●			
Meromyza (*Meromyza*) *zahvatkini* Fedoseeva, 1960	450-1800	1600	des	♦	♦	♦	♦					●	●		
Parectecephala longicornis (Fallén, 1820)	350-500		eswa	♦											
Phyladelphus thalhammeri Becker, 1910	350-500		e, ? cse	♦											
Thaumatomyia elongatula (Becker, 1910)	350-500		e, ? cse	♦											
Thaumatomyia glabra (Meigen, 1830)	1000-1800	360-1450	h			♦	♦			●	●	●			
Thaumatomyia hallandica Andersson, 1966	350-1450	1400-1450	wces	♦	♦	♦						●			
Thaumatomyia notata (Meigen, 1830)	600-2200	850-1450	ppt	♦	♦	♦	♦				●	●			
Thaumatomyia rufa (Macquart, 1835)	1500		hop			♦									
Thaumatomyia sulcifrons (Becker, 1907)	600-1000		wcp	♦	♦										
Heleomyzidae															
Orbellia borisregis Czerny, 1930		2005	Er										●		
Scoliocentra (*Leriola*) *nigrinervis* (Wahlgren, 1918)		2000	wces, ? bm										●		
Sphaeroceridae															
Copromyza equina Fallén, 1820		1500	hno									●			
Crumomyia rohaceki Norrbom & Kim, 1985		2005	e										●		
Pseudocollinella humida (Haliday, 1836)	+++		pat												
Rachispoda lutosa (Stenhammar, 1855)	2020-2392		h				♦	♦							
Camillidae															
Camilla atrimana Strobl, 1910	1000-1200		eswa			♦									
Drosophilidae															
Scaptomyza (*Scaptomyza*) *flava* (Fallén, 1823)		1150-1200	h									●			
Diastatidae															
Diastata costata Meigen, 1830	1230	1400	e, ? h			♦						●			
Ephydridae															
Psilopa nitidula (Fallén, 1813)	300-2575	400-1600	pat	♦	♦	♦	♦	♦	♦	●	●	●			
Psilopa obscuripes Loew, 1860	300-2000		wp	♦	♦	♦	♦								
Psilopa polita (Macquart, 1835)	600-2200	400-1600	dp	♦	♦	♦	♦	♦		●	●	●			
Hydrelia griseola (Fallén, 1813)	600-2500	850-2196	sk	♦	♦	♦	♦	♦	♦		●	●	●	●	
Hydrelia maura Meigen, 1838	2200-2500	1500-1600	wp					♦	♦			●	●		
Dichaeta caudata (Fallén, 1813)		400	h							●					
Notiphila (*Notiphila*) *cinerea* Fallén, 1813		1400	tp, ? hop									●			
Notiphila (*Notiphila*) *dorsata* Stenhammar, 1844		400	dp, ? wcp							●					

Table 2. Continued

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Notiphila graecula Becker, 1926	1230	1400	ewca			◆						●			
Notiphila nigricornis Stenhammar, 1844	1230	1400	wcp			◆						●			
Notiphila venusta Loew, 1856	1230		dp			◆									
Athyroglossa nudiuscula Loew, 1873	350-650		cse,? csena	◆											
Athyroglossa ordinata Becker, 1896	350-650		wp	◆											
Allotrichoma laterale (Loew, 1860)	350-650		h	◆											
Dicrocerina obscurella (Fallén, 1813)	300-600	400	hnat	◆						●					
Ditrichophora calceata (Meigen, 1830)	700-750		ena		◆										
Ditrichophora fuscella (Stenhammar, 1844)	700-1230		des, ? dp		◆	◆									
Hecamedoides unispinosus (Collin, 1943)	1230		hnat			◆									
Ilythea spilota (Curtis, 1832)	900-1000		h		◆										
Nostima picta (Fallén, 1813)	2000-2190	400-2400	hn				◆			●	●	●	●	●	
Philygria posticata (Meigen, 1830)	1000-1200		des			◆									
Philygria stictica (Meigen, 1830)	600-2100	1400-2400	e	◆	◆	◆	◆					●	●	●	
Philygria vittipennis (Zetterstedt, 1838)	1000-2400		h			◆	◆	◆							
Hyadina guttata (Fallén, 1813)	600-2320	1400	tp	◆	◆	◆	◆	◆				●			
Parydra (*Chaetoapnaea*) *fossarum* (Haliday, 1833)	900-1230	2000	h		◆	◆							●		
Parydra (*Parydra*) *coarctata* (Fallén, 1813)	350-700	1500-1600	tp, ? hop	◆	◆							●	●		
Parydra (*Parydra*) *cognata* Loew, 1860	350-700	400-1600	wp	◆	◆					●	●	●			
Parydra (*Parydra*) *littoralis* (Meigen, 1830)		400-2000	wp							●	●	●	●		
Scatophila caviceps (Stenhammar, 1844)	600-2500	400	hop	◆	◆	◆	◆	◆	◆	●					
Scatophila despecta (Haliday, 1839)	2500		h					◆	◆						
Scatophila farinae Becker, 1903	300-400		hom	◆											
Limnellia quadrata (Fallén, 1813)	1000-1200	2300	h			◆								●	
Lamproscatella bimaculata Hendel, 1933	2200-2500	2000	h					◆	◆				●		
Lamproscatella sibilans (Haliday, 1833)	600-2300	2000	h	◆	◆	◆	◆	◆					●		
Lamproscatella unipunctata (Becker, 1907)	1000-2500	2000	mca			◆	◆	◆	◆				●		
Scatella (*Neoscatella*) *subguttata* (Meigen, 1830)		2000	ena, ? sk										●		
Scatella (*Scatella*) *paludum* (Meigen, 1830)		900-2000	hptn										●		
Scatella (*Scatella*) *stagnalis* (Fallén, 1813)	1230	1400-2200	hpta, sk			◆						●	●		
Scatella (*Scatella*) *tenuicosta* Collin, 1930	600-2500	1400-2200	hat	◆	◆	◆	◆	◆	◆			●	●		
CALYPTRATA															
Hippoboscidae															
Hippobosca equina Linnaeus 1758		1350-2100	ppta									●	●		
Hippobosca longipennis Fabricius 1805		1200-1400	hpt, ? shpt									●			

Table 2. Continued

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Melophagus ovinus (Linnaeus, 1758)	1500-2000		k			♦	♦								
Ornithomyia avicularia (Linnaeus, 1758)	2340		ppta					♦							
Scathophagidae															
Norellisoma armipes (Meigen, 1826)		2500	e											●	●
Scathophaga stercoraria (Linnaeus, 1758)		550-2100	hat							●	●	●	●		
Anthomyiidae															
Delia radicum (Linnaeus, 1758)	1810	550	h				♦			●					
Egle parva Robineau-Desvoidy, 1830		400-1500	des, ? dp							●	●	●			
Hylemya vagans (Panzer, 1798)		1500	wcp									●			
Fanniidae															
Fannia canicularis (Linnaeus, 1761)	300-2300	550-1960	k	♦	♦	♦	♦	♦		●	●	●	●		
Fannia incisurata (Zetterstedt, 1838)	300-1810		hn	♦	♦	♦	♦								
Fannia lepida (Wiedemann, 1817)	1810		ho				♦								
Fannia manicata (Meigen, 1826)	1810		ho				♦								
Fannia monilis (Haliday, 1838)	1810		wcp				♦								
Fannia scalaris (Fabricius, 1794)	300-2500	550-1960	hptn	♦	♦	♦	♦	♦	♦	●	●	●	●		
Muscidae															
Muscina levida (Harris, 1780)	300-2500	550-1960	h	♦	♦	♦	♦	♦	♦	●	●	●	●		
Muscina stabulans (Fallén, 1817)	300-2500	550-1960	k	♦	♦	♦	♦	♦	♦	●	●	●	●		
Thricops cunctans (Meigen, 1826)	1500-2000	1500-2000	hoes			♦	♦					●	●		
Thricops furcatus (Stein, 1916)	1200		h			♦									
Thricops genarum (Zetterstedt, 1838)	1300-1700		des			♦	♦								
Thricops longipes (Zetterstedt, 1845)	900-2000	900-2000	hoes			♦	♦				●	●	●		
Thricops nigrifrons (Robineau-Desvoidy, 1830)		600-1900	eswa							●	●	●	●		
Thricops nigritellus (Zetterstedt, 1838)	1200-2000	1200-2000	wes			♦	♦					●	●		
Thricops simplex (Wiedemann, 1817)	200-1600		wp	♦	♦	♦									
Drymeia fasciculata (Stein, 1916)		1500-2000	se, ? m									●	●		
Hydrotaea armipes (Fallén, 1825)	1810-2500		ho				♦	♦	♦						
Hydrotaea dentipes (Fabricius, 1805)	1810		hno				♦								
Hydrotaea glabricula (Fallén, 1825)	900		hop		♦										
Hydrotaea ignava (Harris, 1780)	300-1200	400	ho	♦	♦	♦				●					
Hydrotaea irritans (Fallen, 1823)	1000-1810	1500	tp			♦	♦					●			
Hydrotaea meteorica (Linnaeus, 1758)	1810	1500	h				♦					●			
Hydrotaea similis Meade, 1887	1810	1374	tp				♦					●			
Hydrotaea tuberculata Rondani, 1866		1500	h									●			

Table 2. Continued

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mesembrina intermedia Zetterstedt, 1849		700-1700	wces								●	●	●		
Mesembrina meridiana (Linnaeus, 1758)		1200-1400	tp									●			
Mesembrina resplendens Wahlberg, 1844		900-1900	hoes								●	●	●		
Polietes lardarius (Fabricius, 1781)		400-2000	pat							●	●	●	●		
Musca amita Hennig, 1964	300-2500	550-1960	hoes, ? tp	♦	♦	♦	♦	♦	♦	●	●	●	●		
Musca autumnalis De Geer, 1776	300-2400	550-2300	hpt	♦	♦	♦	♦	♦		●	●	●	●	●	
Musca domestica Linnaeus, 1758	300-1810	400-2200	k	♦	♦	♦	♦			●	●	●	●		
Musca larvipara Portschinsky, 1910	300-1500		wcp	♦	♦	♦									
Musca tempestiva Fallén, 1817	300-1200	400-1200	ppt	♦	♦	♦				●	●	●			
Musca vitripennis Meigen, 1826	300-2500	550-1960	po	♦	♦	♦	♦	♦	♦	●	●	●	●		
Morellia aenescens Robineau-Desvoidy, 1830		600-1500	tp							●	●	●			
Morellia hortorum (Fallén, 1817)	900-1200		po		♦	♦									
Morellia podagrica (Loew, 1857)	1000-1810	590-1400	h			♦	♦			●	●	●			
Morellia simplex (Loew, 1857)	900-1200	400-1400	tp		♦	♦				●	●	●			
Neomyia cornicina (Fabricius, 1781)	900-1200	400-1500	sk		♦	♦				●	●	●			
Pyrellia vivida Robineau-Desvoidy, 1830	300-2500	550-2000	po	♦	♦	♦	♦	♦	♦	●	●	●	●		
Dasyphora gussakovskii Zimin, 1947		1800-2000	po										●		
Dasyphora penicillata (Egger, 1865)	300-2400	550-1960	wp	♦	♦	♦	♦	♦		●	●	●	●		
Dasyphora pratorum (Meigen, 1826)	300-2400	550-1960	wp	♦	♦	♦	♦	♦		●	●	●	●		
Haematobia irritans (Linnaeus, 1758)		1200	hn								●				
Phaonia angelicae (Scopoli, 1763)		500-1800	tp							●	●	●	●		
Phaonia bitincta (Rondani 1866)		1500	e									●			
Phaonia candicans (Pandellé, 1898)	1000-1100		e		♦	♦									
Phaonia errans (Meigen, 1826)	500-1200	1200-1400	h	♦	♦	♦						●			
Phaonia fuscata (Fallén, 1825)	1000		po		♦	♦									
Phaonia lugubris (Meigen, 1826)		600-1800	h							●	●	●	●		
Phaonia rufiventris (Scopoli, 1763)		1500	? wp									●			
Phaonia scutellata (Zetterstedt, 1845)	1500	1374	ena			♦						●			
Phaonia serva (Meigen, 1826)	900-2000	1200-1400	h		♦	♦	♦					●			
Phaonia subventa (Harris, 1780)	300-1900		ena	♦	♦	♦	♦								
Phaonia tuguriorum (Scopoli, 1763)	900-1000		wcp		♦	♦									
Helina annosa (Zetterstedt, 1838)		1200-1400	h									●			
Helina ciliatocosta (Zetterstedt, 1845)		400-1500	e							●	●	●			
Helina confinis (Fallén, 1825)	300-1800		des	♦	♦	♦	♦								

Table 2. Continued

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Helina depuncta (Fallén, 1825)	900-1200	1500	esca		♦	♦						●			
Helina evecta (Harris, 1780)		400-2000	ppt, ? hpt							●	●	●	●		
Helina fratercula (Zetterstedt, 1845)	900-1200		e		♦	♦									
Helina laxifrons (Zetterstedt, 1860)	1810		h				♦								
Helina latitarsis Ringdahl, 1924		1200-1400	ean									●			
Helina montana (Rondani, 1866)		1374	dpo, ? wpo									●			
Helina obscurata (Meigen, 1826)		1200-1900	h									●	●		
Helina pubiseta (Zetterstedt, 1845)		1500	e									●			
Helina reversio (Harris, 1780)		1200-1400	h, ? ho									●			
Mydaea corni (Scopoli, 1763)	1500	1500	hop			♦						●			
Mydaea electra (Zetterstedt, 1860)	300-1000		h	♦	♦										
Mydaea humeralis Robineau-Desvoidy, 1830	300-1000		esca	♦	♦										
Myospila meditabunda (Fabricius, 1781)	1000-1800	400	hno		♦	♦	♦			●					
Hebecnema fumosa (Meigen, 1826)		600-2000	po							●	●	●	●		
Hebecnema umbratica (Meigen, 1826)		1500	ho									●			
Hebecnema vespertina (Fallén, 1823)	300-1500	1150-1500	h	♦	♦	♦						●			
Graphomya maculata (Scopoli, 1763)	900-1000	1150-1300	po, ? poa		♦	♦						●			
Spilogona carbonella (Zetterstedt, 1845)		+++	ean												
Spilogona denigrata (Meigen, 1826)		1500	e									●			
Spilogona dispar (Fallén, 1823)	300-2000	1500-2000	wes	♦	♦	♦	♦					●	●		
Limnophora maculosa (Meigen, 1826)	300-1800		ewca	♦	♦	♦	♦								
Limnophora obsignata (Rondani, 1866)	900-1000		wpat		♦	♦									
Calliphoridae															
Bellardia pandia (Walker 1849)		1600	e									●	●		
Calliphora genarum (Zetterstedt 1838)		1600	h									●	●		
Calliphora vicina Robineau-Desvoidy, 1830	1810	900	k				♦				●				
Calliphora vomitoria (Linnaeus, 1758)	1810	1200-1400	ha				♦					●			
Lucilia caesar (Linnaeus, 1758)	1810	400-1300	hop				♦			●	●	●			
Lucilia richardsi Collin, 1926		900-1100	e								●	●			
Lucilia sericata (Meigen, 1826)		550-2100	k							●	●	●	●		
Lucilia silvarum (Meigen, 1826)		+++	hn												
Protophormia terraenovae (Robineau-Desvoidy, 1830)		1500	h									●			
Pollenia dasypoda Portschinsky, 1881		900-1100	wpo								●	●			
Pollenia rudis (Fabricius, 1794)		900-1600	hpta								●	●	●		
Pollenia tenuiforceps Séguy, 1928		1200-1400	ena									●			

Table 2. Continued

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Pollenia viatica Robineau-Desvoidy, 1830		1600	ewca									●	●		
Rhyncomya cyanescens (Loew, 1844)		900-1100	hom								●	●			
Sarcophagidae															
Pterella grisea (Meigen, 1824)		1200	wcp									●			
Taxigramma stictica (Meigen, 1830)		1100	ena									●			
Metopia argyrocephala (Meigen, 1824)		1100	hno									●			
Metopia campestris (Fallén, 1810)		900-1600	h								●	●	●		
Brachicoma devia (Fallén, 1820)		1200-1800	h									●	●		
Eurychaeta muscaria (Meigen, 1826)		1200-1600	ena									●	●		
Blaesoxipha (*Blaesoxipha*) *ungulata* (Pandellé, 1896)		1600	ena									●	●		
Blaesoxipha (*Servaisia*) *erythrura* (Meigen 1826)	900-1000		eca		♦	♦									
Blaesoxipha (*Servaisia*) *rossica* Villeneuve, 191		900-1200	esca								●	●			
Ravinia pernix (Harris, 1780)	1810-2000	900-1200	po				♦				●	●			
Sarcophaga (*Bellieriomima*) *subulata* Pandellé, 1896	900-1000		wes		♦	♦									
Sarcophaga (*Helicophagella*) *agnata* Rondani, 1860		1150	e									●			
Sarcophaga (*Helicophagella*) *crassimargo* Pandellé, 1896	2000		wesca				♦								
Sarcophaga (*Helicophagella*) *maculata* Meigen, 1835	1810		sp, ? wcp				♦								
Sarcophaga (*Helicophagella*) *noverca* Rondani, 1860		1150-1600	e									●	●		
Sarcophaga (*Helicophagella*) *novercoides* (Böttcher, 1913)	2000		ena				♦								
Sarcophaga (*Helicophagella*) *rosellei* Böttcher, 1912		1150	des									●			
Sarcophaga (*Myorhina*) *nigriventris* (Meigen, 1826)	2400		dp					♦							
Sarcophaga (*Myorhina*) *socrus* Rondani, 1860	1810		e				♦								
Sarcophaga (*Myorhina*) *soror* Rondani, 1860	1950-2200		e				♦	♦							
Sarcophaga (*Sarcotachinella*) *sinuata* Meigen, 1826	1810		h				♦								
Sarcophaga (*Krameromyia*) *anaces* Walker, 1849		630-700	h							●					
Sarcophaga (*Heteronychia*) *benaci* Bottcher, 1913		1600	cse									●	●		
Sarcophaga (*Heteronychia*) *dissimilis* Meigen, 1826		400-1600	des							●	●	●	●		
Sarcophaga (*Heteronychia*) *infantilis* Böttcher, 1913	1950-2200	630-700	e				♦	♦		●					
Sarcophaga (*Heteronychia*) *mutila* Villeneuve, 1912	1950-2400		csee				♦	♦							
Sarcophaga (*Heteronychia*) *porrecta* (Böttcher, 1913)	1950-2200	1200-2200	se, m				♦	♦				●	●	●	
Sarcophaga (*Heteronychia*) *schineri* Bezzi, 1891		1150-1600	e									●	●		
Sarcophaga (*Heteronychia*) *vagans* Meigen, 1826		1150-1600	hoes									●	●		
Sarcophaga (*Heteronychia*) *vicina* Macquart, 1835	1950-2400		e				♦	♦							
Sarcophaga (*Bercaea*) *africa* (Wiedemann, 1824)	300-400	400	sk	♦						●					
Sarcophaga (*Liosarcophaga*) *jacobsoni* (Rohdendorf, 1937)		400	tp							●					

Table 2. Continued

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Sarcophaga (*Liosarcophaga*) *portschinskyi* (Rohdendorf, 1937)		1200-1800	tp									●	●		
Sarcophaga (*Pandelleana*) *protuberans* Pandellé, 1896	350-2200		wces, esca	♦	♦	♦	♦	♦							
Sarcophaga (*Parasarcophaga*) *albiceps* Meigen, 182		400-1400	poa							●	●	●			
Sarcophaga (*Parasarcophaga*) *hirtipes* (Wiedemann, 1830)	350-450		ptm	♦											
Sarcophaga (*Robineauella*) *caerulescens* Zetterstedt, 1838		1200-1600	h									●	●		
Sarcophaga (*Sarcophaga*) *variegata* (Scopoli, 1763)	350-600		e	♦											
Rhinophoridae															
Stevenia umbratica (Fallén, 1820)		1000-1100	e									●			
Gasterophilidae															
Gasterophilus haemorrhoidalis (Linnaeus, 1758)		1200-1400	hata, ? k									●			
Gasterophilus intestinalis (De Geer, 1776)		1200-1400	pata, ? k									●			
Gasterophilus pecorum (Fabricius, 1794)		1200-1400	ppt									●			
Tachinidae															
Exorista (*Exorista*) *larvarum* (Linnaeus, 1758)	300-1000	360-1000	hop	♦	♦					●	●	●			
Exorista (*Podotachina*) *sorbillans* (Wiedemann, 1830)	700-1200		sppta		♦	♦									
Exorista (*Adenia*) *mimula* (Meigen, 1824)	350-1200	360-1200	hop	♦	♦	♦				●	●	●			
Exorista (*Adenia*) *rustica* (Fallén, 1810)	350-1250	450-1600	hop	♦	♦	♦				●	●	●			
Chetogena acuminata Rondani, 1859		450-1000	tp							●	●				
Chetogena filipalpis Rondani, 1859	850	450-1600	nmt		♦					●	●	●			
Chetogena obliquata (Fallén, 1810)	900-1200		tp		♦	♦									
Parasetigena silvestris (Robineau-Desvoidy, 1863)	1400	1400	des			♦						●			
Phorocera assimilis (Fallén, 1810)	500-1200	400-450	des	♦	♦	♦				●					
Phorocera grandis (Rondani, 1859)	550-650	440	dp	♦						●					
Phorocera obscura (Fallén, 1810)	700-1300	900-1000	des		♦	♦					●	●			
Bessa selecta (Meigen, 1824)	350-750		hoes	♦	♦										
Belida angelicae (Meigen, 1824)	1250		wcp			♦									
Meigenia dorsalis (Meigen, 1824)	350-1300	600-1250	hoes	♦	♦	♦				●	●	●			
Meigenia majuscula (Rondani, 1859)		400	po ?							●					
Meigenia mutabilis (Fallén, 1810)	300-2400	360-2350	wcp	♦	♦	♦	♦	♦		●	●	●	●	●	
Zaira cinerea (Fallén, 1810)	300-1300		tp	♦	♦	♦									
Steleoneura czernyi Stein, 1924		400-500	mca							●					
Medina collaris (Fallén, 1820)	700-900		hoes		♦										
Medina luctuosa (Meigen, 1824)	700-1300	1000-1200	hoes		♦	♦						●			
Lecanipa bicincta (Meigen, 1824)	800-1300		wces		♦	♦									
Admontia podomyia Brauer & Bergenstamm, 1889	2000-2300	1900-2200	e, bm				♦	♦					●	●	

Table 2. Continued

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Oswaldia muscaria (Fallén, 1810)	1250		des			♦									
Oswaldia spectabilis (Meigen, 1824)	850-1250	850-1150	e		♦	♦					●	●			
Lomachantha parra Rondani, 1859	1100-1400		et			♦									
Erynniopsis antennata (Rondani, 1861)	300-450	360-545	? hom, h*	♦						●					
Blondelia nigripes (Fallén, 1810)	300-2400	360-2360	tp, h*	♦	♦	♦	♦	♦		●	●	●	●	●	
Compsilura concinnata (Meigen, 1824)	300-1300	500-1400	hoes, h*	♦	♦	♦				●	●	●			
Vibrissina turrita (Meigen, 1824)	1000-1400		dp		♦	♦									
Acemya acuticornis (Meigen, 1824)	900-1200		ess		♦	♦									
Smidtia amoena (Meigen, 1824)	450-1230	500-900	hoes	♦	♦	♦				●	●				
Winthemia quadripustulata (Fabricius, 1794)	350-1300	1150-1400	h	♦	♦	♦						●			
Nemorilla floralis (Fallén, 1810)	300-650		hop	♦											
Aplomya confinis (Fallén, 1820)	500-1350	400-1650	hop	♦	♦	♦				●	●	●	●		
Phebellia nigripalpis (Robineau-Desvoidy, 1847)	400-1400		des	♦	♦	♦									
Tlephusa cincinna (Rondani, 1859)	700-900		ess		♦										
Epicampocera succincta (Meigen, 1824)	700-1500	1200-1500	tp		♦	♦						●			
Phryxe nemea (Meigen, 1824)	400-1950	800-1900	hoes	♦	♦	♦	♦				●	●	●		
Phryxe prima (Brauer & Bergenstamm, 1889)	700-750		mt		♦										
Phryxe vulgaris (Fallén, 1810)	350-2000	1000-2000	h	♦	♦	♦	♦					●	●		
Periarchiclops scutellaris (Fallén, 1820)		500-1100	wces							●	●	●			
Pseudoperichaeta nigrolineata (Walker, 1853)	700-1450	1500	des		♦	♦						●			
Lydella stabulans (Meigen, 1824)	500-700		wes	♦											
Cadurciella tritaeniata (Rondani, 1859)	450-700		des	♦											
Drino atropivora (Robineau-Desvoidy, 1830)	300-1300	900-1300	sp	♦	♦	♦					●	●			
Drino inconspicua (Meigen, 1830)	1200-1300	1000-1300	wces			♦						●			
Drino lota (Meigen, 1824)	700-1300		pat		♦	♦									
Drino vicina (Zetterstedt, 1849)	500-1300	900	wces	♦	♦	♦					●				
Huebneria affinis (Fallén, 1810)	450-2400	900-2000	ess	♦	♦	♦	♦	♦			●	●	●		
Carcelia (*Carcelia*) *bombylans* Robineau-Desvoidy, 1830	1750-1800		des				♦								
Carcelia (*Carcelia*) *gnava* (Meigen, 1824)	700-1000	690-1000	des		♦	♦				●	●				
Carcelia (*Carcelia*) *lucorum* (Meigen, 1824)	600-1300	1400	tp	♦	♦	♦						●			
Erycia festinans (Meigen, 1824)	800-1300		wces		♦	♦									
Alsomyia capillata (Rondani, 1859)	500-1000		hom	♦	♦										
Platymya fimbriata (Meigen, 1824)	2000-2500	2200-2370	tp, bm				♦	♦	♦					●	
Eumea linearicornis (Zetterstedt, 1844)	700-1300	600-1350	hoes		♦	♦				●	●	●			
Eumea mitis (Meigen, 1824)		1300	hoes									●			

Table 2. Continued

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Zenillia libatrix (Panzer, 1798)		1300-1600	hoes									●	●		
Clemelis pullata (Meigen, 1824)	500-2400	900-2350	wcp	◆	◆	◆	◆	◆			●	●	●	●	
Pales pavida (Meigen, 1824)	400-1300	400-1350	hop	◆	◆	◆				●	●	●			
Pales pumicata (Meigen, 1824)	350-700	1300-1600	nm	◆								●			
Phryno vetula (Meigen, 1824)	500-700		des	◆											
Bothria frontosa (Meigen, 1824)	900-1300		hoes		◆	◆									
Ceromasia rubrifrons (Macquart, 1834)		800-1400	hoes								●	●			
Allophorocera ferruginea (Meigen, 1824)	700-1950	900-1950	hoes		◆	◆	◆				●	●	●		
Allophorocera pachystyla (Macquart, 1850)	2000	1800-2000	e, m				◆						●		
Eurysthaea scutellaris (Robineau-Desvoidy, 1848)	350-700	350-800	e	◆	◆					●	●				
Elodia ambulatoria (Meigen, 1824)	700-1300		wcp		◆	◆									
Sturmia bella (Meigen, 1824)	400-1400	900-1400	po	◆	◆	◆					●	●			
Blepharipa pratensis (Meigen, 1824)	350-1400	500-1400	tp, h*	◆	◆	◆				●	●	●			
Masicera pavoniae (Robineau-Desvoidy, 1830)	400-1000	400-1000	wp	◆	◆					●	●				
Masicera silvatica (Fallén, 1810)	350-1250	900-1000	e	◆	◆	◆					●				
Prosopea nigricans (Egger, 1861)	350-1300	800-1100	wcp	◆	◆	◆					●	●			
Gaedia connexa (Meigen, 1824)	700-1400		e		◆	◆									
Gaedia distincta Egger, 1861	900-1350		ess		◆	◆									
Baumhaueria goniaeformis (Meigen, 1824)	900-1350		wp		◆	◆									
Gonia bimaculata Wiedemann, 1819	350-900	400-1000	atm	◆	◆					●	●				
Gonia capitata (De Geer, 1776)	700-2000	500-1900	wcp		◆	◆	◆			●	●	●	●		
Gonia ornata Meigen, 1826	300-450		wcp	◆											
Gonia picea (Robineau-Desvoidy, 1830)	350-650		wcp	◆											
Pseudogonia parisiaca (Robineau-Desvoidy, 1851)	300-1300		ess	◆	◆	◆									
Pseudogonia rufifrons (Wiedemann, 1830)	350-700		ppta	◆											
Spallanzania hebes (Fallén, 1820)	300-700	400-600	ho	◆						●					
Tachina (*Tachina*) *grossa* (Linnaeus, 1758)	350-1400	350-1300	hoes	◆	◆	◆				●	●	●			
Tachina (*Tachina*) *magna* (Giglio-Tos, 1890)	300-650		sess	◆											
Tachina (*Eudoromyia*) *casta* (Rondani, 1859)	350-600	500-550	nm	◆						●					
Tachina (*Eudoromyia*) *fera* (Linnaeus, 1761)	300-1900	340-1900	hop	◆	◆	◆	◆			●	●	●	●		
Tachina (*Eudoromyia*) *magnicornis* (Zetterstedt, 1844)	300-1900	350-1900	hop	◆	◆	◆	◆			●	●	●	●		
Tachina (*Eudoromyia*) *nupta* (Rondani, 1859)	300-1750	300-1750	tp	◆	◆	◆	◆			●	●	●	●		
Tachina (*Servillia*) *lurida* (Fabricius, 1781)	300-600	350-660	wp	◆						●					
Tachina (*Echinogaster*) *praeceps* Meigen, 1824	350-1300	350-1300	wp	◆	◆	◆				●	●	●			
Nowickia (*Nowickia*) *marklini* (Zetterstedt, 1838)	1250-2300	1200-2300	h, ? bm			◆	◆	◆				●	●	●	

Table 2. Continued

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Nowickia (*Fabriciella*) *atripalpis* (Robineau-Desvoidy, 1863)	1250-2250	1150-2250	hoes, bm			♦	♦	♦				●	●	●	
Nowickia (*Fabriciella*) *ferox* (Panzer, 1809)	900-2300	900-2300	wes		♦	♦	♦	♦			●	●	●	●	
Nowickia (*Fabriciella*) *rondanii* (Giglio-Tos, 1890)	700-1600	700-1600	sess		♦	♦	♦				●	●	●		
Cnephaotachina danilevskyi (Portshinsky, 1882)	350-950		mca	♦	♦										
Peleteria abdominalis Robineau-Desvoidy, 1830	600-1300		nm	♦	♦	♦									
Peleteria ferina (Zetterstedt, 1844)	600-1300		hoes	♦	♦	♦									
Peleteria rubescens (Robineau-Desvoidy, 1830)	300-2000	400-2000	tp	♦	♦	♦	♦			●	●	●	●		
Peleteria ruficornis (Macquart, 1835)	350-500	350-500	msws	♦						●					
Peleteria varia (Fabricius, 1794)	300-1400	480-1450	ppta	♦	♦	♦				●	●	●			
Germaria ruficeps (Fallén, 1820)	700-1300		wcp		♦	♦									
Nemoraea pellucida (Meigen, 1824)	350-1500		tp	♦	♦	♦									
Linnaemya (*Linnaemya*) *comta* (Fallén, 1810)	400-1300	400-1300	ho	♦	♦	♦				●	●	●			
Linnaemya (*Bonellimyia*) *impudica* (Rondani, 1859)	350-1300	350-1300	cse	♦	♦	♦				●	●	●			
Linnaemya (*Ophina*) *haemorrhoidalis* (Fallén, 1810)	500-1850	500-1900	hoes, bm	♦	♦	♦	♦			●	●	●	●		
Linnaemya (*Ophina*) *helvetica* Herting, 1963	700-900	500-700	cse		♦					●					
Linnaemya (*Ophina*) *olsufjevi* Zimin, 1954	600-900		hoes	♦	♦										
Linnaemya (*Ophina*) *perinealis* Pandellé, 1895		400	hoes							●					
Linnaemya (*Ophina*) *picta* (Meigen, 1824)	500-1300	550-1250	po	♦	♦	♦				●	●	●			
Linnaemya (*Ophina*) *rossica* Zimin, 1954	700-1800		hoes		♦	♦	♦								
Linnaemya (*Homoeonychia*) *frater* (Rondani, 1859)		400	hom							●					
Linnaemya (*Homoeonychia*) *lithosiophaga* (Rondani, 1859)	350-700		hom	♦											
Chrysosomopsis aurata (Fallén, 1820)		900	hoes								●				
Ernestia laevigata (Meigen, 1838)	900-1430		hoes		♦	♦									
Ernestia puparum (Fabricius, 1794)		1200	hoes									●			
Ernestia rudis (Fallén, 1810)	750-1800	900-1750	tp		♦	♦	♦				●	●	●		
Eurithia anthophila (Robineau-Desvoidy, 1830)	700-1500		h		♦	♦	♦								
Eurithia caesia (Fallén, 1810)	900-1640	900-1700	hoes		♦	♦	♦				●	●	●		
Eurithia consobrina (Meigen, 1824)	1200-1400		hoes			♦									
Hyalurgus lucidus (Meigen, 1824)	1400-1800	1500-1800	wces, bm			♦	♦					●	●		
Zophomyia temula (Scopoli, 1763)	400-1750	600-1750	tp	♦	♦	♦	♦			●	●	●	●		
Cleonice callida (Meigen, 1824)	700-900		des		♦										
Loewia brevifrons (Rondani, 1856)	300-1200	400-900	nm	♦	♦	♦				●	●				
Loewia phaeoptera (Meigen, 1824)	500-900		e	♦	♦										
Pseudopachystylum gonioides (Zetterstedt, 1838)	900-1800	1350	hoes		♦	♦	♦					●			
Pelatachina tibialis (Fallén, 1810)	450-1300		hoes	♦	♦	♦									

Table 2. Continued

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Macquartia chalconota (Meigen, 1824)	500-1300	900-1300	wes	♦	♦	♦					●	●			
Macquartia dispar (Fallén, 1820)	500-1400	600-1400	ess	♦	♦	♦				●	●	●			
Macquartia grisea (Fallén, 1810)	500-800	600-700	e	♦	♦					●	●				
Macquartia praefica (Meigen, 1824)	300-1250	600-1250	hom	♦	♦	♦				●	●	●			
Macquartia tenebricosa (Meigen, 1824)	300-1800	400-1600	wcp	♦	♦	♦	♦			●	●	●			
Macquartia tessellum (Meigen, 1824)		1300-1400	mca									●			
Phytomyptera abnormis (Stein, 1924)		1000-1500	se								●	●			
Phytomyptera cingulata (Robineau-Desvoidy, 1830)	300-400		e	♦											
Graphogaster brunnescens Villeneuve, 1907		400	ess							●					
Actia crassicornis (Meigen, 1824)	800-1500	600-1500	ess		♦	♦				●	●	●			
Actia infantula (Zetterstedt, 1844)		400-1000	wcp							●	●				
Actia pilipennis (Fallén, 1810)	300-700		hoes	♦	♦										
Peribaea tibialis (Robineau-Desvoidy, 1851)	300-1000	550-1000	spat	♦	♦					●	●				
Siphona cristata (Fabricius, 1805)	350-1000	480-1150	h	♦	♦					●	●	●			
Siphona flavifrons Staeger, 1849	1700-1900		des, h*				♦								
Siphona geniculata (De Geer, 1776)	800-1300		hoes, h*		♦	♦									
Aphria latifrons Villeneuve, 1908		900	mss								●				
Aphria longirostris (Meigen, 1824)	350-2300	600-2000	wcp	♦	♦	♦	♦	♦		●	●	●	●		
Demoticus plebejus (Fallén, 1810)	1000-1950	900-1100	wes			♦	♦				●	●			
Bithia glirina (Rondani, 1861)	350-1450	360-1450	wes	♦	♦	♦				●	●	●			
Bithia modesta (Meigen, 1824)	300-1200	460-1200	hom	♦	♦	♦				●	●	●			
Leskia aurea (Fallén, 1820)	700-900	700-900	hoes		♦						●				
Mintho rufiventris (Fallén, 1817)	350-1000	350-900	tp	♦	♦					●	●				
Microphthalma europaea Egger, 1860	700-900	500-600	? om	♦	♦					●					
Dexiosoma caninum (Fabricius, 1781)	1100-1300		des			♦									
Trixa caerulescens Meigen, 1824		400	wes							●					
Trixa conspersa (Harris, 1776)		400	wes							●					
Billaea fortis (Rondani, 1862)	650-800	650-800	des		♦					●	●				
Billaea irrorata (Meigen, 1826)		330-550	e							●					
Billaea pectinata (Meigen, 1826)	350-1250	400-1200	mca	♦	♦	♦				●	●	●			
Billaea triangulifera (Zetterstedt, 1844)	1100-1700	1000-1200	hoes			♦	♦					●			
Dinera carinifrons (Fallén, 1817)	300-2400	400-2550	hoes	♦	♦	♦	♦	♦		●	●	●	●	●	●
Dinera ferina (Fallén, 1817)	500-1600	500-1600	wes	♦	♦	♦				●	●	●			
Dinera grisescens (Fallen, 1817)		400-500	esca							●					

Table 2. Continued

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Estheria bohemani (Rondani, 1862)	1000-1800		e			♦	♦								
Estheria cristata (Meigen, 1826)		1374	e									●			
Estheria petiolata (Bonsdorff, 1866)	400-1900	1000-1600	wces	♦	♦	♦	♦					●			
Estheria picta (Meigen, 1826)	300-1800	400-1600	wcp	♦	♦	♦	♦			●	●	●			
Dexia rustica (Fabricius, 1775)	350-1000	600-1100	hoes	♦	♦					●	●	●			
Prosena siberita (Fabricius, 1775)	500-1800	500-1600	hpta	♦	♦	♦	♦			●	●	●			
Zeuxia brevicornis (Egger, 1860)		400	nmca							●					
Zeuxia cinerea Meigen, 1826	500-1900	500-2000	wp	♦	♦	♦	♦			●	●	●	●		
Zeuxia erythraea (Egger, 1856)		400	nm							●					
Eriothrix apenninus (Rondani, 1862)	900-2450	1350-2350	wp		♦	♦	♦	♦	♦			●	●	●	
Eriothrix rufomaculatus (De Geer, 1776)	350-2450	1150-2300	tp	♦	♦	♦	♦	♦	♦			●	●	●	
Ramonda spathulata (Fallén, 1820)	400-1350	1350-1475	tp	♦	♦	♦						●			
Periscepsia carbonaria (Panzer, 1798)	350-700	600-700	ppt	♦	♦					●					
Athrycia impressa (Wulp, 1869)	1300		ess			♦									
Athrycia trepida (Meigen, 1824)	350-1200	400-1200	tp	♦	♦	♦				●	●	●			
Voria ruralis (Fallén, 1810)	700-1800	400-1800	k		♦	♦	♦			●	●	●	●		
Hyleorus elatus (Meigen, 1838)	350-1300		hoes	♦	♦	♦									
Phyllomya volvulus (Fabricius, 1794)	450-1750	1150-1200	hoes	♦	♦	♦	♦					●			
Thelaira nigripes (Fabricius, 1794)	350-1300	400-670	tp	♦	♦	♦				●					
Halidaya aurea Egger, 1856	350-900	900-1000	hoes	♦	♦						●	●			
Stomina caliendrata (Rondani, 1862)	350-1000	670-1100	mca	♦	♦					●	●				
Stomina iners (Meigen, 1838)		900-1000	hom								●				
Stomina tachinoides (Fallén, 1817)	350-950	400	wcp	♦	♦					●					
Rhamphina pedemontana (Meigen, 1824)	1800	800-1300	se, ? nm				♦				●	●			
Dufouria chalybeata (Meigen, 1824)	350-1300		dp	♦	♦	♦									
Dufouria nigrita (Fallén, 1810)	500-950	400-900	wcp	♦	♦					●	●				
Chetoptilia puella (Rondani, 1862)	600-900		des	♦	♦										
Eliozeta helluo (Fabricius, 1805)	300-700	400-800	tp	♦	♦					●	●				
Eliozeta pellucens (Fallén, 1820)	300-1000	400-900	des	♦	♦					●	●				
Clytiomya continua (Panzer, 1798)	350-1300	360-1000	tp	♦	♦	♦				●	●				
Ectophasia crassipennis (Fabricius, 1794)	300-1700	350-1200	tp	♦	♦	♦	♦			●	●	●			
Ectophasia leucoptera (Rondani, 1865)	300-450		nmt	♦											
Ectophasia oblonga (Robineau-Desvoidy, 1830)	300-1200	300-1150	wp	♦	♦	♦				●	●	●			
Gymnosoma clavatum (Rohdendorf, 1947)	350-1700	500-1500	tp	♦	♦	♦	♦			●	●	●			
Gymnosoma costatum (Panzer, 1800)	350-1000	800-1000	tp	♦	♦						●				
Gymnosoma desertorum (Rohdendorf, 1947)	350-1250		eeca	♦	♦	♦									
Gymnosoma dolycoridis Dupuis, 1961	350-1250	500-1200	ess	♦	♦	♦				●	●	●			

Table 2. Continued

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Gymnosoma inornatum Zimin, 1966	350-1250	380-1150	tp	♦	♦	♦				●	●	●			
Gymnosoma nitens Meigen, 1824	650-1400	1000	esca		♦	♦					●	●			
Gymnosoma nudifrons Herting, 1966	650-1300		hoes		♦	♦									
Gymnosoma rotundatum (Linnaeus, 1758)	350-1800	350-1600	tp	♦	♦	♦	♦			●	●	●			
Cistogaster globosa (Fabricius, 1775)	300-450		ess	♦											
Opesia cana (Meigen, 1824)	350-900		ess	♦	♦										
Elomya lateralis (Meigen, 1824)	350-1400	350-1400	tp	♦	♦	♦				●	●	●			
Phasia (*Phasia*) *aurulans* Meigen, 1824		400	hoes							●					
Phasia (*Phasia*) *hemiptera* (Fabricius, 1794)		400	hoes							●					
Phasia (*Phasia*) *obesa* (Fabricius, 1798)	750-1550	750-1500	tp		♦	♦					●	●			
Phasia (*Phasia*) *subcoleoptrata* (Linnaeus, 1767)	700-1300	400-1200	tp		♦	♦				●	●	●			
Phasia (*Hyalomya*) *pusilla* Meigen, 1824	350-1000	350-1100	tp	♦	♦					●	●	●			
Strongygaster globula (Meigen, 1824)	500-950		hoes	♦	♦										
Dionaea aurifrons (Meigen, 1824)	300-1250	450-600	tp	♦	♦	♦				●					
Leucostoma anthracinum (Meigen, 1824)	300-550		wces	♦											
Leucostoma tetraptera (Meigen, 1824)	350-1250	400-1300	wcp	♦	♦	♦				●	●	●			
Clairvillia biguttata (Meigen, 1824)	350-950	500-700	dp	♦	♦					●					
Labigastera forcipata (Meigen, 1824)	700-1300	900-1300	wes		♦	♦					●	●			
Labigastera pauciseta (Rondani, 1861)	350-1250		e, cse	♦	♦	♦									
Cylindromyia (*Cylindromyia*) *bicolor* (Olivier, 1812)	300-1400	400-1300	mca	♦	♦	♦				●	●	●			
Cylindromyia (*Cylindromyia*) *brassicaria* (Fabricius, 1775)	350-1800	350-1700	hop	♦	♦	♦	♦			●	●	●	●		
Cylindromyia (*Cylindromyia*) *brevicornis* (Loew, 1844)	380-1300	450-1200	des	♦	♦	♦				●	●	●			
Cylindromyia (*Cylindromyia*) *pilipes* (Loew, 1844)	500-900	480-900	wcp	♦	♦					●	●				
Cylindromyia (*Ocypterula*) *pusilla* (Meigen, 1824)		1200-1300	mss									●			
Cylindromyia (*Dupuisia*) *crassa* (Loew, 1845)	350-950	900	mss	♦	♦						●				
Cylindromyia (*Calocyptera*) *intermedia* (Meigen, 1824)	450-1250	400-1300	h	♦	♦	♦				●	●	●			
Cylindromyia (*Neocyptera*) *auriceps* (Meigen, 1838)	350-1000		tp	♦	♦										
Cylindromyia (*Neocyptera*) *interrupta* (Meigen, 1824)	500-1250		h	♦	♦	♦									
Hemyda vittata (Meigen, 1824)	600-700		hoes	♦											
Besseria anthophila (Loew, 1871)		1300	wcp									●			
Besseria dimidiata (Zetterstedt, 1844)	700-800		e		♦										
Besseria lateritia (Meigen, 1824)	300-600		? mt	♦											
Phania funesta (Meigen, 1824)	450-950	450-1000	e	♦	♦					●	●				

* – Species of Limoniidae and Pediciidae that are not included in the work concerning Pirin Mts. from 2015 (Hubenov, 2015b)

Table 3. Similarity of the Diptera fauna by vegetation belts in percentages

Vegetation belts of the Pirin Mts.	Vegetation belts of the Rila Mts.					
	1	2	3	4	5	6
1	40.8 (108)					
2		46.6 (163)				
3			40.9 (234)			
4				30.7 (83)		
5					25.7 (23)	
6						0 (0)

Note. 1 – Xerothermic oak forests, 2 – Mesophyllic and xeromesophyllic oak-hornbeam forests, 3 – Beech forests, 4 – Coniferous forests, 5 – Subalpine vegetation, 6 – Alpine vegetation; Common species are given in brackets.

ferences between the Pirin and Rila Mountains (from 11.3% to 18.3%) in the number of species in the first three vegetation belts (especially the beech belt). They are probably owing to the specific climatic conditions of the two mountains, the nature of the plant communities in the karst areas of the Pirin Mts. and the insufficient research of most families. The altitude of the localities, from which the most material was collected, is also important.

The upper limit of the coniferous zone passes into the subalpine vegetation zones with a mixture of regions at about 200 m a.s.l. Thus, most of the species were common for both vegetation belts and the number of taxa established in the subalpine belt of the two mountains increased (79 species or 10.6% in the Pirin Mts. and 99 species or 9.8% in the Rila Mts.). Among the species found in the alpine belt (29 species or 3.9% in the Pirin Mts. and 26 species or 2.6% in the Rila Mts.), only four taxa collected from the Rila Mts. were typical for this belt (*Molophilus lautereri* Stary – Bulgarian endemic of Limoniidae, *Micropsectra radialis* Goet. – Palaearctic-Oriental species of Chironomidae, *Eudorylas jenkinsoni* Coe – European species of Pipunculidae, and *Didea alneti* Fall. – Holarctic species of Syrphidae). All other species were established in the subalpine belt and most of them in other vegetation belts as well. In some cases, the finding of species at certain altitude takes place accidentally. The lack of systematic research on Diptera of the Pirin and Rila Mts., and the fragmentary data for most families do not allow explicit conclusions about the adherence of taxa to one or another vegetation zone to be made. The distribution of species in groups according to their presence in the vegetation belts had a relative character and depended on the specific features of taxa and research area, as well as on the duration of the research. There was a correlation between the horizontal and vertical distribution of Diptera. Species found in the subalpine and alpine zones (above 2200 m a.s.l.) have large areals (12 Superpalaearctic, nine Palaearctic, ten Eurosiberian and three Mediterranean species). In these two belts of the Pirin and Rila Mts. Holarctic-Oriental, Holarctic, Transpalaearctic, West and Central Palaearctic, West Palaearctic, European-North African, Holoeurosiberian, West and Central Eurosiberian, West Eurosiberian, Disjunct Eurosiberian and European species prevailed (Table 4). The differences of the taxa distribution in the subalpine and alpine zones were small: from 0.7 to 1.3% for both mountains. The differences between the separate areographical categories were higher and reached up to 5.4-7.5% (for the Holarctic species).

The zoogeographical categorisation of the species (Table 2) was made on the basis of current data about their distribution. Thus, the dipterans were divided into 92 areographical categories, combined into two main groups and six subgroups (Table 4).

Species distributed in the Palaearctic and beyond it. This group (156 species or 21.0% in the Pirin Mts. and 258 species or 25.7% in the Rila Mts.) included 29 categories, of which 24 combined species of northern type (widely distributed in the Holarctic and Palaearctic), and five – species of southern type (distributed only in the southern parts of the Palaearctic). The difference between the separate vegetation belts with respect to this group in the two mountains was from 0.4 to 23.9% (from 13 to 87 species) for the Pirin Mts., and from 0.4 to 16.1% (from 11 to 196 species) for the Rila Mts. There was a more significant difference of 10% between the mountains in the first vegetation belt. In the other vegetation belts this difference was small (0.2-5.3%). The establishment of other species of the group of the northern type in the last two vegetation belts is very likely, owing to their distribution and insufficient studies of the higher parts of the mountain. It is accepted that the species of the northern type have vast areas and ecological flexibility. In the Superpalaearctic complex the Holarctic species (72 species or 9.7% in the Pirin Mts. and 124 species or 12.4% in the Rila Mts.) prevailed as compared to the other areographical categories where the Holarctic-Oriental (23-31 species or 3.1%) and Palaearctic-Oriental (13-29 species or 1.7-2.9%) forms were present. The species of the southern type were represented in the first three vegetation belts (1-3 in the Pirin Mts. and 1-2 in the Rila Mts.). The group was not important for the zoogeographical characteristic of the dipterans in the studied region because of the small number of species (three – five species or 0.3-0.5%). Usually the species of the whole group, distributed in the Palaearctic and beyond it, were scantly presented and they were not determinant for the zoogeographical characteristic of taxa in the Bulgarian terrestrial fauna. Only in a highly mobile forms (such as Diptera), the group was well presented and could reach 20-25%. It was better represented in the Rila Mts. than in the Pirin Mts. In the two-winged insects significant numbers of synanthropic and synbovil forms with cosmopolitan or subcosmopolitan distribution occurred. They had anthropogenic areas, structured with the development of human civilisation (before the contemporary studies).

Species distributed only in the Palaearctic but in more than one subregion (**Palaearctic type**). Taxa, whose areas include more than one Palaearctic subregion in latitudinal direction, belong to this group. They were well represented in the high mobile groups and comprised about 25-35% of the species composition. Nineteen areographical categories were registered from both mountains (Table 4). A total of 204 species (27.5%) from the Pirin Mts. and 259 species (25.8%) from the Rila Mts. of this group have been established. Their character was determined by the Transpalaearctic (57 species or 7.8% from the Pirin Mts. and 78 species or 7.8% from the Rila Mts.), West Palaearctic (26 species or 3.5% from the Pirin Mts. and 46 species or 4.6% from the Rila Mts.) and European-North African (26 species or 3.5% from the Pirin Mts. and 35 species or 3.5% from the Rila Mts.) species. The correlation of these categories remained the same in the separate vegetation belts and ranged from 0.2 to 11.0% (from six to 117 species) in the Pirin Mts. and from 1.6% to 12.2% (from three to 196 species) in the Rila Mts. The Holopalaearctic, West and Central Palaearctic and Eurosiberian-Central Asian species (eight-24 species or 1.1-3.2% from the Pirin Mts. and 18-23 species or 1.8-2.3% from the Rila Mts.) were well presented. Thirteen species from the Pirin Mts. and eight species from the Rila Mts. had a longitudinal disjunction of the areas with regard to Siberia and Central Asia. Probably some of these species were represented with sparse populations and could be found as a result of further studies. Most often, a latitudinal disjunction of the areas of this group lacks (Gorodkov, 1984; Josifov, 1988; Hubenov, 2015a). Rarely single boreomontane forms are presented. A significant part of the species with wide vertical distribution (more than 25%) belonged to this group. It included from 20.7% to 37.0% (from six to 117 species) of the species composition of the separate vegetation belts of the Pirin Mts. and from 11.5% to 31.2% (from three to 196 species) of the species of the different vegetation belts of the Rila Mts. (Table 3). The vast areas and wide vertical distribution of the taxa of this group are an indication of the greater ecological flexibility of its species. This group was represented a little better in terms of relative abundance in the Pirin Mts. (with 1.7% more).

Species distributed within one subregion of the Palaearctic. This group (382 species or 51.5% from the Pirin Mts. and 486 species or 48.5% from the Rila Mts.) included species with Eurosiberian and Mediterranean type of distribution (36 areographical categories). Endemics were included in this group as well. The Mediterranean-Central Asian species are also included here according to Kryzhanovsky (1965) and Lopatin (1989) who combine the Mediterranean and Central Asian subregions. The species with Mediterranean type of distribution are accepted in a general way and include faunistic elements (Submediterranean, Subiranian and Pontian) that could be considered separately as well (Gruev & Kusmanov, 1994, 1999; Gruev, 1995, Gruev & Bechev, 2000).

The **Eurosiberian species** (combined into 13 areographical categories) were 328 (44.2%)

Table 4. Zoogeographical characteristic of Diptera (Insecta) from the vegetation belts of the studied mountains
Note. The percentage of main categories and these with more species is presented

Areographical categories	**Total number, % – Pirin Mts.**	**Total number, % – Rila Mts.**	**Vegetation belts of the Pirin Mts.**						**Vegetation belts of the Rila Mts.**					
			Xerothermic oak forests – up to 600-700 m a.s.l.	**Mesophyllic and xeromesophyllic oak-hornbeam forests – from 600-700 m to 900-1000 m**	**Beech forests – from 900-1000 to 1500-1600 m**	**Coniferous forests – from 1400-1600 m to 2000-2200 m**	**Subalpine vegetation – from 2000-2200 m to 2500 m**	**Alpine vegetation – over 2400-2500 m**	**Xerothermic oak forests – up to 500-700 m**	**Mesophyllic and xeromesophyllic oak-hornbeam forests – from 600-700 m to 900-1000 m**	**Beech forests – from 900-1000 to 1500-1600 m**	**Coniferous forests – from 1500-1600 m to 2000-2200 m**	**Subalpine vegetation – from 2000-2200 m to 2500 m**	**Alpine vegetation – over 2400-2500 m**
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Species distributed in Palaearctic and out of it	**156** **21.0**	**258** **25.7**	**57** **20.9**	**78** **22.3**	**87** **21.3**	**71** **26.8**	**28** **35.4**	**13** **44.8**	**79** **30.9**	**92** **26.2**	**196** **26.6**	**74** **26.7**	**31** **31.3**	**11** **42.3**
North type	**151** **20.3**	**255** **25.4**	**53** **19.4**	**74** **21.2**	**86** **21.0**	**71** **26.8**	**28** **35.4**	**13** **44.8**	**76** **29.7**	**90** **25.6**	**196** **26.6**	**74** **26.7**	**31** **31.3**	**11** **42.3**
Cosmopolitan (k)	6	7	3	4	5	6	2	1	6	7	6	5		
Semicosmopolitan (sk)	3	3	2	2	2	1	1	1	2	2	2	1	1	
Holarctic-Paleotropical-Neotropical (hptn)	1	3	1	1	1	1	1	1	1	2	1	2		
Holarctic-Paleotropical-Australian (hpta)	3	5	2	2	3	2	1	1	2	3	4	2		
Holarctic-Paleotropical (hpt)	1	2	1	1	1	1	1		1	1	2	1	1	
Holarctic-Neotropical-Oriental (hno)	5	9		2	2	4	2		4	3	6	1	2	1
Holarctic-Neotropical-Afrotropical (hnat)	2	2	1		1				2	1	1	1		
Holarctic-Oriental-Australian (hoa)		1									1			
Holarctic-Afrotropical-Australian (hata)		1									1			
Holarctic-Neotropical (hn)	3	4	1	1	1	3	1		2	3	2	2	2	1
Holarctic-Afrotropical (hat)	1	3	1	1	1	1	1	1	1	1	3	2		
Holarctic-Oriental (ho)	23 3.1	31 3.1	7 2.6	12 3.4	13 3.2	8 3.0	2 2.5	1 3.4	10 3.9	12 3.4	23 3.1	9 3.2	1 1.0	1 3.8
Holarctic-Australian (ha)	2	5		1		1			1	2	3			
Palaearctic-Paleotropical-Australian (ppta)	4	3	3	2	1		1		1	2	3	1		
Palaearctic-Afrotropical-Australian (pata)		1									1			
Palaearctic-Oriental-Australian (poa)		2							1	1	2			
Palaearctic-Paleotropical (ppt)	4	6	3	3	2	2	1		3	3	5	1		

Table 4. Continued

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Palaearctic-Afrotropical (pat)	3	2	1	2	2	1	1	1	2	2	2	1		
Palaearctic-Oriental (po)	13 1.7	29 2.9	5 1.8	8 2.3	9 2.2	5 1.9	2 2.5	2 6.9	11 4.3	12 3.4	26 3.5	9 3.2	3 3,0	2 7.7
Palaearctic-Australian (pa)	1	1				1	1					1	1	1
West Palaearctic-Oriental (wpo)	2	10		2					1	2	7	1		
Disjunct Palaearctic-Oriental (dpo)	1	1			1						1			
West Palaearctic-Afrotropical (wpat)	1			1	1									
Holarctic (h)	72 9.7	124 12.4	22 8.1	29 8.3	40 9.8	34 12.8	10 12.7	4 13.8	25 9.8	31 8.8	94 12.8	34 12.3	20 20.2	5 19.2
SOUTH TYPE	**5** **0.7**	**3** **0.3**	**4** **1.5**	**4** **1.1**	**1** **0.2**				**3** **1.2**	**2** **0.6**				
South Palaearctic-Paleotropical-Australian (sppta)	1			1	1									
South Palaearctic-Afrotropical (spat)	1	1	1	1					1	1				
Paleotropical-Mediterranean (ptm)	1		1											
Afrotropical-Mediterranean (atm)	1	1	1	1					1	1				
Oriental-Mediterranean (om)	1	1	1	1					1					
Species with Palaearctic distribution	**586** **79.0**	**745** **74.3**	**216** **79.1**	**271** **77.6**	**322** **78.7**	**194** **73.2**	**51** **64.5**	**16** **55.2**	**177** **69.1**	**259** **73.8**	**540** **73.4**	**203** **73.3**	**68** **68.7**	**15** **57.7**
PALAEARCTIC TYPE	**204** **27.5**	**259** **25.8**	**101** **37.0**	**112** **32.1**	**117** **28.6**	**65** **24.5**	**19** **24.0**	**6** **20.7**	**80** **31.2**	**103** **29.3**	**196** **26.6**	**75** **27.1**	**24** **24.2**	**3** **11.5**
Holopalaearctic (hop)	19 2.5	18 1.8	15 5.5	14 4.0	14 3.4	7 2.6	2 2.5	2 6.9	10 3.9	13 3.7	17 2.3	7 2.5		
Transpalaearctic (tp)	58 7.8	78 7.8	33 12.1	38 10.9	37 9.0	23 8.7	5 6.3	2 6.9	30 11.7	43 12.2	61 8.3	21 7.6	8 8.1	1 3.8
West and Central Palaearctic (wcp)	24 3.2	23 2.3	15 5.5	15 4.3	15 3.7	8 3.0	2 2.5		11 4.3	11 3.1	18 2.4	6 2.2	2 2.0	1 3.8
West Palaearctic (wp)	26 3.5	46 4.6	17 6.2	14 4.0	15 3.7	10 3.8	6 7.8	2 6.9	14 5.5	14 4.0	35 4.7	16 5.8	6 6.1	
Disjunct Palaearctic (dp)	13	8	6	5	6	2	3		4	2	4	1	1	1
South Palaearctic (sp)	2	3	1	1	1	1				1	3			
European-Anatolian-North African (eanna)		1												
European-North African (ena)	26 3.5	35 3.5	3 1.1	11 3.2	9 2.2	6 2.3			4 1.6	8 2.3	27 3.7	12 4.3	3 3.0	
Eurosiberian-Anatolian-Central Asian (esanca)		1									1			
Eurosiberian-Central Asian (esca)	8 1.1	22 2.2	5 1.8	4 1.1	3 0.7				3 1.2	5 1.4	13 1.8	5 1.8	1 0.1	

Table 4. Continued

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
West Eurosiberian-Anatolian-Central Asian (wesanca)		1							1					
West Eurosiberian-Central Asian (wesca)	2	1	1	1		1					1	1		
West Eurosiberian-Iran-Turanian (wesit)		1										1	1	
European-Central Asian (eca)	3	2		3	3						1			
East European-Central Asian (eeca)	1		1	1	1									
European-West Central Asian (ewca)	5	4	1	2	3	3	1		1	1	4	1		
European-South-west Asian (eswa)	6	4	3	1	2	2			1	1	2	3	1	
European-Iran-Turanian (eit)	8	8		1	5	2				3	7	1	1	
European-Turanian (et)	3	3		1	3				1	1	2			
Eurosiberian type	**328** **44.2**	**429** **42.8**	**86** **31.5**	**139** **39.8**	**187** **45.7**	**117** **44.1**	**28** **35.4**	**9** **31.0**	**78** **30.5**	**139** **39.6**	**315** **42.8**	**119** **43.0**	**40** **40.4**	**11** **42.3**
Holoeurosiberian (hoes)	50 6.7	82 8.2	21 7.7	33 9.5	34 8.3	23 8.7	3 3.8	1 3.4	16 6.2	27 7.7	60 8.1	24 8.7	6 6.1	2 7.7
West and Central Eurosiberian (wces)	29 3.9	27 2.7	9 3.3	9 2.6	22 5.4	10 3.8	2 2.5	1 3.4	5 1.9	10 2.8	21 2.8	7 2.5	1 1.0	1 3.8
West Eurosiberian (wes)	27 3.6	42 4.2	9 3.3	11 3.2	15 3.7	11 4.1	2 2.5	1 3.4	8 3.1	14 4.0	31 4.2	8 2.9	2 2.0	
Disjunct Eurosiberian (des)	39 5.2	34 3.4	11 4.0	15 4.3	22 5.4	12 4.5	4 5.1	2 6.9	7 2.7	14 4.0	22 3.0	11 3.0	1 1.0	
European and South Siberian (ess)	11	6	5	9	8	1	1		4	4	5	1		
European-Anatolian (ean)	4	10	1	3	2	1			1	2	5	3	2	
European (e)	141 19.0	183 18.2	27 9.9	50 14.3	70 17.1	48 18.1	12 15.2	4 13.8	32 12.5	60 17.1	138 18.7	47 17.0	18 18.2	4 15.4
Central and East European (cee)		2									2			
Central and South European-Anatolian (csean) (csea)	3	5		1	3	1				1	5	4	2	2
Central and South-east European-Anatolian (cseean)		2							1	1	1	1	1	
Central and South-east European-Lebanonian (cseel)		1									1	1	1	1
Central and South European (cse)	18 2.4	25 2.5	2 0.7	5 1.4	8 2.0	7 2.6	3 3.8		2 0.8	4 1.1	18 2.4	9 3.2	4 4.0	1 3.8
Central and South-east European (csee)	6	10	1	3	3	3	1		2	2	6	3	2	
Mediterranean type	**41** **5.5**	**45** **4.5**	**28** **10.3**	**19** **5.4**	**11** **2.7**	**6** **2.3**	**3** **3.8**	**1** **3.4**	**19** **7.4**	**17** **4.8**	**23** **3.1**	**6** **2.2**	**2** **2.0**	
Mediterranean and South Siberian (mss)	1	3	1	1						2	1			

Table 4. Continued

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Mediterranean and South-west Siberian (msws)	1	1	1						1					
Mediterranean-Central Asian (mca)	6 0.8	6 0.6	5 1.8	4 1.1	3 0.7	1 0.4	1 1.3	1 3.4	4 1.6	3 0.8	3 0.3	1 0.4		
North Mediterranean-Central Asian (nmca)		1							1					
Mediterranean-West Central Asian (mwca)	2	2		2	1				1		1			
Northeast Mediterranean-Iran-Turanian (nemit)	1		1											
Mediterranean-Turanian (mt)	2	1	1	1										
North Mediterranean-Turanian (nmt)	3	1	1	2					1	1	1			
South European and South Siberian (sess)	2	1	1	1	1	1				1	1	1		
Central and South European-Iran-Turanian (cseit)	1	2	1								1			
Central and South-east European-Iran-Turanian (cseeit)	1				1									
Central and South European-North African (csena)	1	1		1	1					1	1	1		
South European-North African (sena)		1									1			
Holomediterranean (hom)	10 1.3	8 0.8	9 3.3	3 0.9	2 0.5	2 0.8	1 1.3		4 1.6	5 1.4	3 0.3			
North Mediterranean (nm)	4 0.5	6 0.6	4 1.5	2 0.6	2 0.5				4 1.6	1 0.3	2 0.3			
South European (se)	3 0.4	7 0.7	1 0.4			2 0.8	1 1.3		2 0.8	1 0.3	5 0.7	2 0.7	1 1.0	
South-east European (see)		1									1	1	1	
East Mediterranean (em)	1			1										
Balkan-Anatolian (ban)	2	3	2	1					1	2	2			
Endemics	**13** **1.7**	**12** **1.2**	**1** **0.4**	**1** **0.3**	**7** **1.7**	**6** **2.3**	**1** **1.3**				**6** **0.8**	**3** **1.1**	**2** **2.0**	**1** **3.8**
Balkan subendemic (Ebs)	1	2				1						1	1	
Balkan endemic (Eb)	4	1	1	1	3						1			
Bulgarian endemic (Ebg	6 0.8	7 0.7			3 0.7	4 1.5					5 0.7	1 0.4		1 3.8
Regional endemic (Er)	2	2			1	1	1					1	1	
Total 1351 species	**759** **56.2**	**1003** **74.2**	**273** **36.8**	**349** **47.0**	**409** **55.1**	**265** **35.7**	**79** **10.6**	**29** **3.9**	**256** **25.5**	**351** **35.0**	**736** **73.4**	**277** **27.6**	**99** **9.9**	**26** **2.6**

from the Pirin Mts. and 429 (42.8%) from the Rila Mts. The European species were most numerous (141 species or 19.0% from the Pirin Mts. and 183 species or 18.2% from the Rila Mts.), followed by the Holoeurosiberian (50 species or 6.7% from the Pirin Mts. and 82 species or 8.2% from the Rila Mts.) and the Disjunct Eurosiberian (39 species or 5.2% from the Pirin Mts. and 34 species or 3.4% from the Rila Mts.) species. The ratio of these categories was different for the specific families (the Holoeurosiberian, Disjunct Eurosiberian and European species of the family Tachinidae were almost equal in number as the Eurosiberian forms were 50% in total, while in other families the Central and South European species were better represented). The number of taxa from the mentioned categories in the separate vegetation belts ranged from 1.0% to 18.7% (one – 138 species) and increased (as a percentage) with height up to 2200 m a.s.l. The West and Central Eurosiberian, West Eurosiberian and Central and South European species were well represented. Most Eurosiberian species were found in the beech and coniferous forest belts (42.8-45.7%). In the subalpine and alpine zones of the Rila Mts., the Eurosiberian species predominated over the other zoogeographical categories (40.4-42.3%), whereas in the Pirin Mts. they were poorly represented (31.0-35.4%). The differences in the Eurosiberian species (as a percentage) in the other vegetation belts of the Pirin and Rila Mts. were smaller (2.9% for the beech belt). A number of disjunctive areas were represented: longitudinal disjunction for Siberia and Central Asia (Table 2, 4) and latitudinal disjunction with the typical for the Eurosiberian complex boreomontane, boreoalpine and arctic-alpine distribution (Gorodkov, 1984; Josifov, 1988; Hubenov, 2015a). Interesting is the significant presence of Eurosiberian species in the first two vegetation belts of the Pirin and Rila Mountains, which can be explained in two ways: 1) It is possible that a part of these species have unclear Palaearctic distribution; 2) It is supposed that the humid mountain valleys characterised with cooler climate have facilitated the migration of the above-mentioned forms to the lowlands. Finding Eurosiberian boreomontane forms at low altitudes has also been reported for other insect groups as Heteroptera, Cerambycidae (Coleoptera) and Tachinidae (Diptera) (Josifov, 1963, 1976; Georgiev & Hubenov, 2006; Hubenov, 1992, 2008b). For Cerambycide this fact is due to the deforestation of conifers in the first two vegetation belts. Probably because of this, many boreomontane and montane species that feed on conifers go down below 1000 m a.s.l.. The Eurosiberian species comprised from 31.0% to 45.7% (from nine to 187 species) and from 30.5% to 43.0% (from 11 to 315 species) of the species composition of the separate vegetation belts of the Pirin and Rila Mts., respectively (Table 4). There were no significant differences in the vertical distribution of this group in the two mountains, except that in the subalpine and alpine zones some areographical categories were differently represented.

Mediterranean species (combined into 19 zoogeographical categories). These were 41 species (5.5%) from the Pirin Mts. and 45 species (4.5%) from the Rila Mts. They were represented mainly in the first three vegetation belts and their number rapidly decreased with altitude. Most of the Mediterranean species occur only in one or two vegetation belts (Table 2). A significant percentage of these species and their relatively scarce populations were due to the lower ecological flexibility of the Mediterranean forms in comparison with the Eurosiberian species. Because of the big variety of the areas, this group was divided into many subgroups with different origin, distribution and ecological peculiarities of the taxa. This complexity contributes to using various zoogeographical classifications for Bulgaria (Josifov, 1981, 1986, 1988, 1999; Gruev, 1988, 1995, 2000a, 2000b, 2000c, 2002; Heiss & Josifov, 1990, Gruev & Kusmanov, 1994; Hubenov, 1996, 2008a; Gruev & Bechev, 2000; Popov, 2002). The Mediterranean species included from 2.0% to 10.3% (from one to 28 species) of Diptera of the separate vegetation belts of the two mountains (Table 4). The difference between the first vegetation belt of the Pirin (28 species – 10.3%) and Rila Mts. (19 species – 7.4%) was due to the fact that in the neighbouring region of the Pirin Mts., the Sandanski-Petrich Valley (the region with the strongest Mediterranean influence in Bulgaria), the Mediterranean forms in some Diptera families reached 17% (Beschovski & Hubenov, 1986). The Holomediterranean (ten species – 1.3% from the Pirin Mts. and eight species – 0.8% from the Rila Mts.) and Mediterranean-Central Asian (six species each or 0.8-0.6% from the two mountains) species were the most numerous. The South European forms in the Rila Mts. were more. In the subalpine belt four Mediterranean taxa were established: three from the Pirin and two from the Rila Mts. (*Prosimulium petrosum* Rubtsov – South-east European species of the family Simuliidae, *Ogcodes lautereri* Chvala – Holomediterranean species of the family Acroceridae, *Lamproscatella unipunctata* Becker – Mediterranean-Central Asian species of the family Ephydridae, also found in the alpine belt of the Pirin Mts., and *Sarcophaga porrecta* Böttcher – South European species of the family Sarcophagidae). These might be Montane Mediterranean forms or species with unclear distribution. When comparing with the Pirin Mts., there was a slightly higher percentage of the Mediterranean taxa which might be related to the specific natural conditions and geographical location of this mountain. There were no significant differences in the distribution of the well-represented areographical categories between the two mountains. Of the remaining categories, not all were presented in each of the mountains.

Endemics. This category included taxa, which were not distributed outside the Balkan Peninsula. The percentage of endemism was low in Diptera – 1.2-1.7% (13 species from the Pirin Mts. and 12 species from the Rila Mts.). The Bulgarian endemic forms prevailed. Endemic forms have not been established in the first two vegetation belts of the Rila Mts., unlike the Pirin Mts. The main part of the endemic species was related to the beech and coniferous belts (three – seven species or 0.8-2.3%). This suggests that these endemic species are postglacial neoendemics which are to be connected with the Eurosiberian forms. Local endemics have not been established among Diptera of the two mountains. The dipterans included rare and mostly newly described taxa (from the Pirin Mts. – one in 1862, two in 1940 and 1942, and the others after 1970; from the Rila Mts. – one in 1930, one – in 1940 and all the others after 1970).

Conclusions

A total of 1351 dipteran species from 63 families have been established in the two mountains so far. The species known from the Pirin Mts. are 759 (18.5% of the Bulgarian species) and the species known from the Rila Mts. are 1003 (25.1% of the Bulgarian species). The degree of similarity between the dipterans of the two mountains was low – 46.2%. The dipterous fauna could be divided into two main groups:

1) Species with Mediterranean type of distribution (49 species or 6.5% from the Pirin Mts. and 48 species or 4.8% from the Rila Mts.): more thermophilic and distributed mainly in the southern parts of the Palaearctic. Species of southern type, distributed in the Palaearctic and beyond it, can be formally related to this group, as well;

2) Species with Palaearctic and Eurosiberian type of distribution (710 species or 93.5% from the Pirin Mts. and 955 species or 95.2% from the Rila Mts.): more cold-resistant and more widely distributed in the Palaearctic. Species of northern type, distributed in the Palaearctic and outside of it, can be formally related to this group, as well.

The zoogeographical character of the dipteran fauna was determined by the second group. The percentage of the typical Mediterannean species of the two mountains were similar (4.5 and 5.5%). The ratio between the two main groups was different in the separate vegetation belts of the two mountains but without great percentage differences between the mountains themselves. The differences in the first vegetation belt of the two mountains were the biggest (10%).

Xerothermic oak forests (273 species or 36.8% from the Pirin Mts. and 256 species or 25.5% from the Rila Mts.). Of the species with Mediterranean type of distribution (32 species or 11.7% from the Pirin Mts. and 22 species or 8.6% from the Rila Mts.), the Holomediterranean, Mediterranean-Central Asian, North Mediterranean and South European species were the most numerous. Of the species with Palaearctic and Eurosiberian type of distribution (241 species or 88.3% from the Pirin Mts. and 234 species or 91.4% from the Rila Mts.) the Holarctic, Transpalaearctic, Holoeurosiberian and European species were best represented. Endemic forms have not been established yet in the Rila Mts.

Mesophyllic and xeromesophyllic mixed forests (349 species or 47.0% from the Pirin Mts. and 351 species or 35.0% from the Rila Mts.). Of the species with Mediterranean type of distribution (23 species – 6.6% from the Pirin Mts. and 19 species – 5.4% from the Rila Mts.), the Mediterranean-Central Asian and

Holomediterranean prevail, and of the species with Palaearctic and Eurosiberian type of distribution (326 species or 93.4% from the Pirin Mts. and 332 species or 94.6% from the Rila Mts.) the Holarctic, Transpalaearctic, Holoeurosiberian, and European species are best represented. The number of Holarctic-Oriental, Holarctic, Transpalaearctic, European-North African, Holoeurosiberian, West Eurosiberian, Disjunct Eurosiberian, and European species is increased. The percentage of the Mediterranean species decreases. Endemic forms have not been established yet in the Rila Mts.

Beech forests (409 species or 55.1% from the Pirin Mts. and 736 species or 73.4% from the Rila Mts.). Of the species with Mediterranean type of distribution (12 species or 2.9% from the Pirin Mts. and 23 species or 3.1% from the Rila Mts.), the Mediterranean-Central Asian and Holomediterranean were the most numerous, while of the species with Palaearctic and Eurosiberian type of distribution (397 species or 97.1% from the Pirin Mts. and 713 species or 96.9% from the Rila Mts.) the Holarctic, Transpalaearctic, Holoeurosiberian, and European species were best represented. The species of southern type distributed in the Palaearctic and beyond it were not presented in the Rila Mts. The number of Holarctic-Oriental, Palaearctic-Oriental, Holarctic, West Palaearctic, Holoeurosiberian, West and Central Eurosiberian, West Eurosiberian and European species has increased. Endemics have been established in the Rila Mts. Of the endemic taxa, the Bulgarian endemics prevailed. The percentage of the Mediterranean forms decreased.

Coniferous forests (265 species or 35.7% from the Pirin Mts. and 277 species or 27.6% from the Rila Mts.). Of the species with Mediterranean type of distribution (six species each – 2.3% from the Pirin Mts. and 2.2% from the Rila Mts.), the South European species were the most numerous, while of the species with Palaearctic and Eurosiberian type of distribution (259 species or 97.7% from the Pirin Mts. and 271 species or 97.8% from the Rila Mts.), the Holarctic, Transpalaearctic, Holoeurosiberian and European species prevailed. Of the areographical categories, 26 were not presented in the Pirin Mts. and 28 – in the Rila Mts. The Cosmopolitan, Holarctic-Oriental, Palaearctic-Oriental, West Palaearctic, European-North African and Disjunct Eurosiberian species were better represented. The percentage of the Mediterranean forms considerably decreased.

Subalpine vegetation (79 species or 10.6% from the Pirin Mts. and 99 species or 9.9% from the Rila Mts.). Of the species with Mediterranean type of distribution three species have been recorded from the Pirin Mts. and two – from the Rila Mts. Of the species with Palaearctic and Eurosiberian type of distribution (32 areographical categories of the Pirin Mts. and 31 – of the Rila Mts.), the Holarctic and European species were the most numerous. This part of the two mountains is poorly explored and excluding some families, the studies are fragmentary.

Alpine vegetation (29 species or 3.9% from the Pirin Mts. and 26 species or 2.6% from the Rila Mts.). One Mediterranean species (*Lamproscatella unipunctata* Becker of the family Ephydridae) were established from the Pirin Mts. and only species with Palaearctic and Eurosiberian type of distribution belonging to 16 areographical categories were established from the Rila Mts. The Holarctic and European taxa were the most numerous. The remaining categories were represented by one – two species each. One Bulgarian endemic (*Molophilus lautereri* Stary of the family Limoniidae) was recorded from the Rila Mts. With the exception of four families, studies on the two-winged insects in this vegetation belt of the Pirin and Rila Mountains are almost lacking.

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Вертикално разпространение и сравнителна зоогеографска характеристика на диптерната фауна (Insecta: Diptera) в растителните пояси на планините Пирин и Рила

Здравко Хубенов

(Резюме)

В двете планини са установени общо 1351 вида от 63 семейства (759 вида на Пирин и 1003 вида на Рила). Ниското сходство на фауната между тези планини (46.2%) е свързано с техните специфични природни особености и недостатъчно проучване. Най-много видове са намерени в пояса на буковите гори (409 – 55.1% на Пирин и 736 – 73.4% на Рила). Сходството на диптерната фауна между растителните пояси на двете планини се колебае от 0% до 46.6%. Диптерите са разпределени в 92 ареалографски категории, обособени в 2 надгрупи 1) видове с медитерански тип на разпространение (49 вида – 6.5% на Пирин и 48 вида – 4.8% на Рила) – по-топлолюбиви и разпространени предимно в южните части на Палеарктика, към които са прибавени и видовете от южен тип, разпространени и извън Палеарктика; 2) видове с палеарктичен и евросибирски тип на разпространение (710 вида – 93.5% на Пирин и 955 вида – 95.2% на Рила) – по-еврибионтни и по-широко разпространени в Палеарктика, към които формално са отнесени и видовете от северен тип, разпространени и извън Палеарктика. От първата група най-много са холомедитеранските и медитераноцентралноазиатските форми (0.6% до 1.3%). От втората група преобладават европейски, холарктични, холоевросибирски и транспалеарктични таксони (7.8% до 19.0%). Ендемични са 12-13 вида (1.2% до 1.7%). Разгледано е разпределението на зоогеографските категории в отделните растителни пояси на планините.

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Композиционни калцитови кристали от находище Сърнешко кладенче, Росенски руден район

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Abstract: We studied calcite crystals from the 'Surneshko Kladenche' deposit of the Rossen ore district. They were formed in the cavities of calcite-chalcopyrite ore veins. The largest crystals reached 40 cm in length and 4-5 cm in thickness along the c-axis. They were observed in the upper parts of the veins. Their formation begins with crystallisation of the papierspaths with a lot of gas fluids. Later on, an oriented growth of platy monocalcite follows between the papierspath platelets, with a periphery of r {1011} faces. An oriented growth continues with numerous small, mainly rhombohedral, crystals on the free pinacoidal face and an overgrowth at the periphery of the {1011} face. The process ends with a peripheral scalenohedral growth of the platy crystals with the {3142}, {2131} and {2134} forms. The temperature of formation of 145-63oC suggests a genesis of calcite from low temperature hydrothermal solutions.

Key words: calcite, crystal habit, crystallisation, inclusions, Rossen ore district

История на колекцията

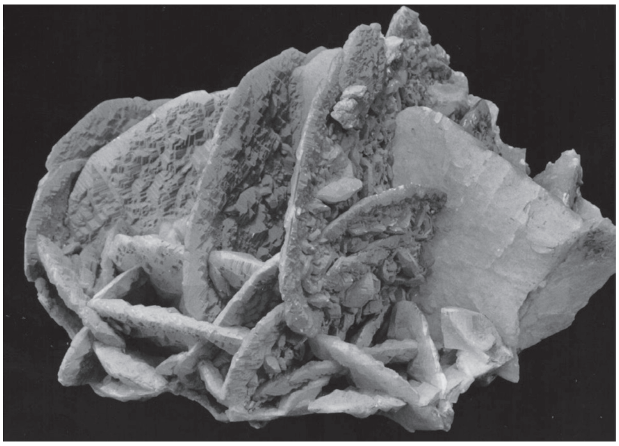
През 1982 г. Националният природонаучен музей при БАН получи като дарение голяма колекция от уникални плочести калцитови друзи от находище Сърнешко кладенче, Росенски руден район, Бургаско. Те са с необикновена големина на индивидите, интересна морфология и представляват особен научен интерес. Най-представителният образец е с размери 60/90/40 cm с 34 големи и множество малки кристали, с тегло около 300 kg. Останалите са с размери 50/52/60 cm и тегло около 200 kg, 71/45/45 cm и други подобни образци, всичко 25, с тегло над 2 тона. Всичките образци описани от това находище са 110 броя (Каров, 1996). Подобни калцитови образци притежават още Национален музей „Земята и хората", Музея по минералогия в Минно-геоложкия университет, Геологическия институт към БАН, а Природонаучният музей във Варна има представителна колекция от 9 подобни образеца.

Толкова големи плочести калцитови кристали с размери до 35-40 cm няма описани в специализираните минераложки издания. Това ги прави уникални и вече не могат да се намерят в този рудник, който отдавна е закрит и недостъпен – наводнен и обрушен.

Изследваните калцитови кристали притежават характерен плочест хабитус, но ясно са разграничени на тънкоплочести (тип папиршпат), и дебелоплочести индивиди- единични и срастъци. По-рядко се срещат самостоятелни скаленоедрични кристали. Обект на настоящите изследвания са само плочестите индивиди (Фиг. 1), а приложените снимки са на образци от фонда на музея.

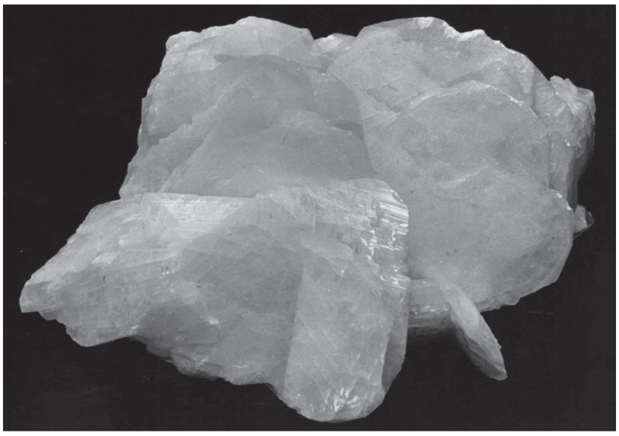
Геоложка обстановка и изученост на района

Находище Сърнешко кладенче от Росенския руден район е локализирано в приконтактови зони на диорит и сиенит порфирови дайки, разсичащи сенонски латитови и сиенит порфирови скали. По структурните си белези отговаря на прикалдеров тип рудни полета (Богданов, 1987). Рудната минерализация е представена от ранна халкопиритова, с малко пирит, спекуларит, кварц и др. и късна-калцитова. Благоприятни условия за образуване на големи калцитови друзи е наличието на множество кухини в рудоносната зона,



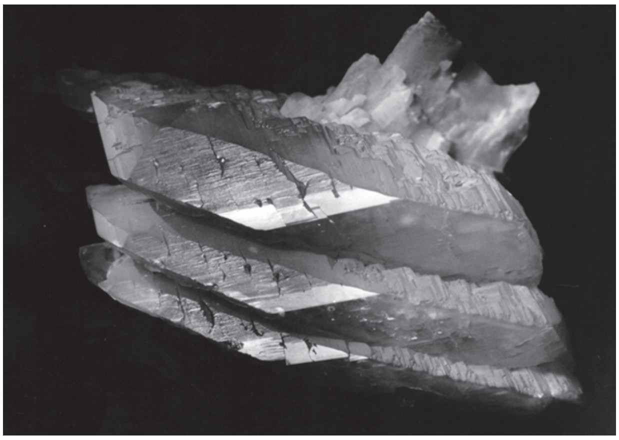
Фиг. 1. Характерна калцитова друза от находище Сърнешко кладенче
Fig. 1. Characteristic calcite aggregate from the 'Surneshko Kladenche' deposit

Фиг. 2. Папиршпатови кристали, натрошени от локални тектонски движения. (Фото С. Петрусенко)
Fig. 2. Papierspath crystals, broken from local tectonic movements. (Photo S. By Petrussenko)

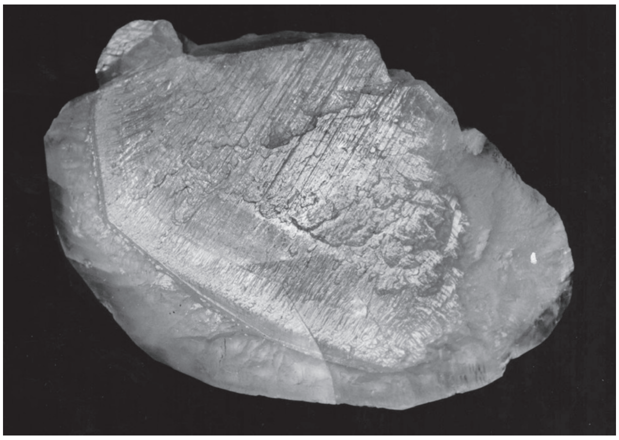


Фиг. 3. Дебелоплочест калцит, ориентирано изкристализирал между папиршпатови индивиди с характерен базопинакоидален облик.
Fig. 3. Thick tabular calcite, oriented grown between the papierspaths with a typical basal pinacoidal habit

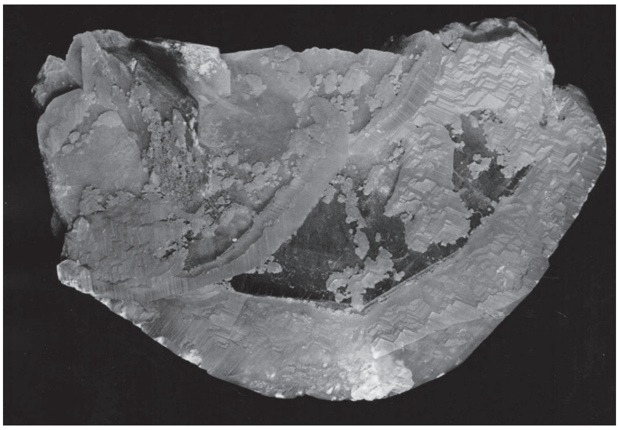
Фиг. 4. Отцепена пластинка на дебелоплочест калцит с нараснали ромбоедрични кристалчета {011}.(Фото С. Петрусенко)
Fig. 4. A cleavage platelet from a thick platy calcite with growth of small rhombohedral crystals {011}. (Photo S. Petrussenko)



Фиг. 5. Субпаралелни калцитови агрегати тип „хармоника шпат“ от ромбоедрични и скаленоедрични кристали.
Fig. 5. 5. Subparallel calcite aggregates of a 'harmonics-spath' type of rhombohedral and scalenohedral crystals



Фиг. 6. Стъпалчести нараствания на ромбоедричен калцит {011}, периферно покрити от късно развити скаленоедрични стени.
Fig. 6. Step-like overgrowths of rhombohedral calcite {011}, covered on the periphery by later developed scalenohedral faces



Фиг. 7. Ромбоедричният калцит нараства само в поясната зона, но частично покрива едната базична стена.
Fig. 7. The rhombohedral calcite grows only in the parallel zone but partly overgrows one of the basal faces

Фиг. 8. Скаленоедричен и ромбоедричен калцит, нараснали в поясната зона на плочест индивид.
Fig. 8. Scalenohedral and rhombohedral calcite, grown on the parallel zone of a platy individual

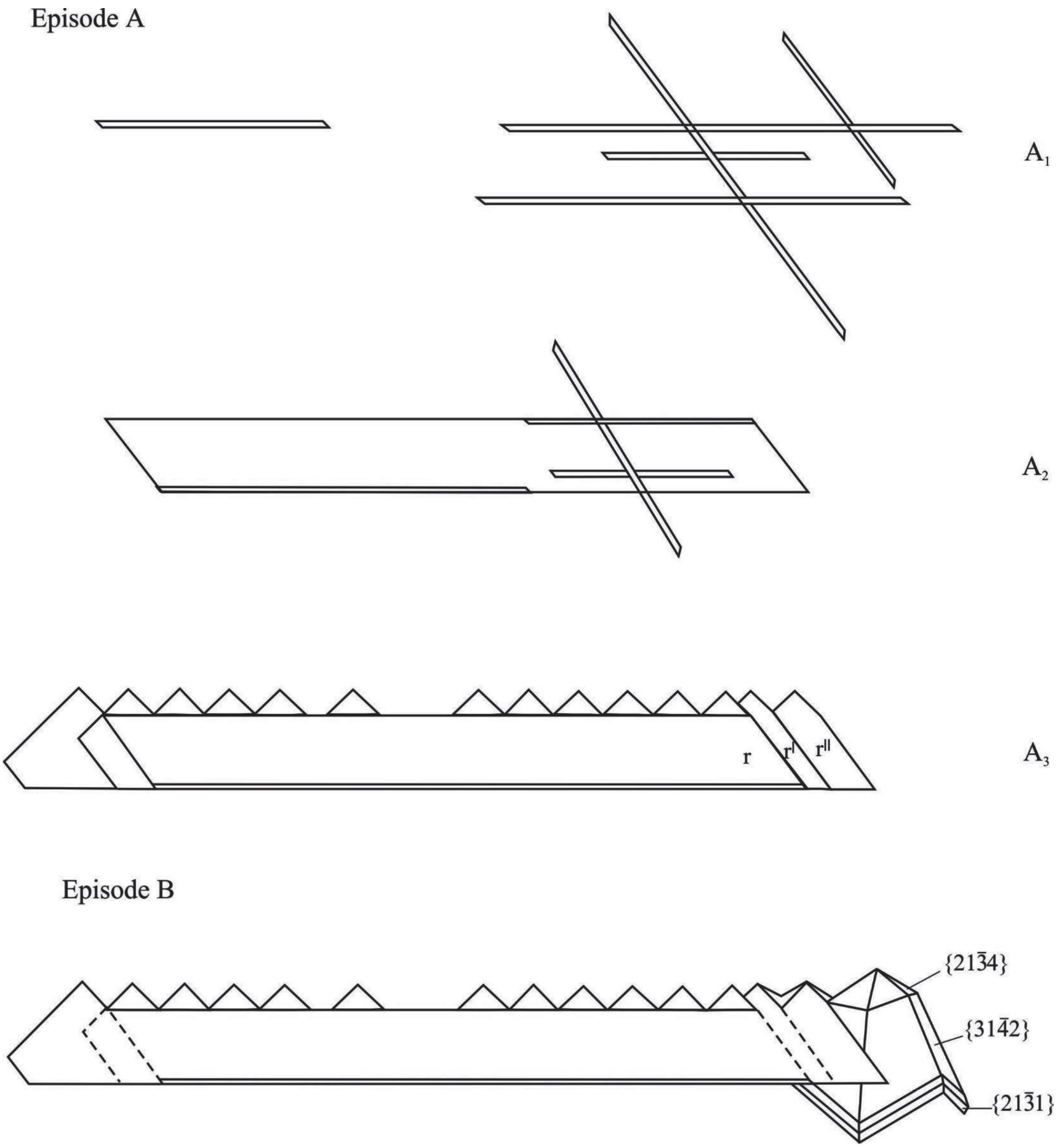
с размери от 10-12 cm до 60-70 cm. През 1982 г. по време на геолого-проучвателна работа в една голяма камера (с обем 10-12-m^3) се разкриват множество калцитови друзи и кристали, запълващи цялото пространство. С помощта на геолозите и миньорите от рудника са извадени и подарени на споменатите музеи.

През 1989 г. за първи път на Международен музеен семинар в Прага (Чехословакия) Петрусенко изнася доклад „Плочести калцитови кристали от находище Сърнешко кладенче, Бургаско (България)". За морфогенезиса на тези кристали беше докладвано на научна сесия „Развитие на българската минералогия" от проф. Йорданка Минчева-Стефанова и колектив (1993). Поради кончината на проф. Минчева, ръководител на проучванията на калцитите от Сърнешко кладенче, те временно бяха прекъснати. Настоящата работа е продължение на тези изследвания.

Типове кристали и морфологията им

Папиршпат. Той е най-широко разпространен кристален индивид, но често е „вграден" в дебелоплочестите кристали от единия или двата пинакоида на тези индивиди. Понякога образува закономерни срастъци по {101} или субпаралелно подредени кристали (Фиг. 2), между които пространството се „запълва" от последващото развитие на ориентираната калцитова кристализация. Размерите на отделните папиршпатови индивиди не могат с точност да се определят, тъй като често са натрошени от последващите тектонски разместванияи. Предполага се, че те са достигали минимум до 10 – 15 cm в диаметър, но дебелината им е от стотни от mm до 1 mm рядко. Кристалите са оформени от {0001} и {101}. Те са привързани предимно към високите части на жилните кухини. В сканиращ електронен микроскоп (СЕМ) се наблюдава мозайка от триъгълни фигури, показващи послойно развитие, с множество газово-течни включения. Те заемат значителен обем от негативните кухини, като определят дефектното послойно развитие на растящите папиршпатови индивиди. Притежават млечнобял цвят, със седефен отблясък.

Дебелоплочест калцит. Той определя облика на почти всички кристали, но в значителна степен се контролира от свободните пространства от рано образуваните папиршпатови индивиди, и определящи ориентираната кристализация. Заедно с това обуславят морфологическото значение на базичната пинакоидална стена {0001}. Наблюдава се по-добро очертаване на стените {101} и нарастване на пинакоидалните зони на растеж (Фиг. 3). Размерите на отделните кристали се колебаят от 4 cm до 40 cm в диаметър по оста „с" и дебелина от 1 cm до 8-10 cm. Първичните газово-течни включения са подредени по зоните на кристалния растеж, но тяхната гъстота и обем са твърде по-малки в сравнение с тези в папиршпата. Характерни са неговите прозрачни и безцветни кристали.



Фиг. 9. Морфогенезис на плочестите калцитови кристали, като част от кристализационния процес, в два епизода A и B. В епизод A_1- израстване на единичен и срастъчен папиршпат; A_2- доизрастване на плочест монокалцит; A_3- ориентирано нарастване на трите вида ромбоедрични стени r, r` и r``. В епизод B- ориентирано скаленоедрично доизграждане с формите {214}, {312} и {211}.

Fig. 9. Morphogenesis of the platy calcite crystals, as part of the crystallization process, in two episodes A and B: episode A_1 – growth of single and twinned papierspath; A_2 – additional growth of platy monocalcite; A_3 – oriented growth of the three types of rhombohedral faces r, r` и r``; episode B – oriented scalenohedral regrowth with the crystal forms {214}, {312} and {211}.

Основен ромбоедричен калцит – r {101}. Присъства само като ориентирано нараснали кристалчета по пинакоидалните периферни стени на дебелоплочестия калцит. Така се постига цялостно площно доизграждане на основния ромбоедър, водещо до успоредното им нарастване в двете посоки. Единични техни индивиди се наблюдават рядко върху пинакоидалните стени (Фиг. 4). Обикновено те образуват щоковидно субпаралелно подредени индивиди, формиращи блокове от типа „хармоникашпат“, успоредно на пинакоидалната стена (Фиг. 5). Големината на единичните кристалчета достига до 0,8 cm, а на блоковете – дължина до 6 cm. Ромбоедричният калцит обикновено нараства само в поясната зона, но частично или цялостно покрива едната пинакоидална стена, а другата остава незасегната или се виждат единични наравствания (Фиг. 6, 7). При последните добре се наблюдава запазената папиршпатова повърхнина. Ромбоедричният калцит е безцветен до бял или слабо виолетово оцветен, а газово-течните включения са малко.

Скаленоедричен калцит. С него завършва формирането на плоските калцитови кристали в поясната зона и частично на ромбоедричните пинакоидални стени. Характерни са неговите матови стени на H{312}, както и тесните стени на K {211}, които са винаги гладки и блещиви. Развива се и трети тип скаленоедър {312}, като зигзагови блестящи ребра. В малките калцитови индивиди се открояват скаленоедрите {214}, {211}, заедно с негативния ромбоедър- {011}. В поясната зона скаленоедричният калцит е безцветен или светловиолетов, а газово-течните включения са малки с незначителни размери. Големината на кристалите достига до 4 cm в диаметър (Фиг. 8).

Плоскоромбоедричен калцит (?). Той макар и рядко се наблюдава по някои свободни пинакоидални калцитови стени като микрокристални образувания. Те притежават заоблени повърхнини с обли кристални ребра и хабитус близък до негативния ромбоедър {012}.

Според направените полуколичествени спектрални анализи виолетовото оцветяване на някои ромбоедрични скаленоедрични калцити се дължи на повишено съдържание на манган.

Температура на образуване и морфогенеза на калцитовите кристали

Според минералотермометричните изследвания, описаните кристали са образувани от нискотемпературни разтвори в температурния интервал 145^0 – 63^0C.

Температурата за хомогенизация на газово-течните включения в различните типове композиционни калцити показва следните резултати:

а) в папиршпатите – от 73^0 до 90^0C

б) в дебелоплочестите калцити- от 100^0 до 107^0C

в) в основно ромбоедричните наравствания и доизграждания- от 120^0 до 145^0C

г) в скаленоедричните наравствания- от 63^0 до 95^0C

Според тези резултати относително най-високотемпературен е основно ромбоедричният калцит, а скаленоедричният е най-нискотемпературен. Изменения има и отношението газова фаза-течна фаза. с отчетлива тенденция за намаляване на стойността от папиршпата към скаленоедричния пояс. Тези изменения се дължат на пресищане на подхранващите разтвори с понижение на тяхната температура, в резултат на което се променя и техния хабитус.

Калцититът е широко разпространен минерал с изключително многообразна морфология и характерен хабитус. Хабитусът се определя от процеса на кристализационните условия за повечето минерали (Kostov, I., Kostov R. I., 1999). При калцита това развитие е характерно и се проследява от плочест към ромбоедричен и скаленоедричен хабитус. Това изменение в морфологията на калцита е използвано от Костов в изображението на логото на XIII Конгрес на Международната минералогическа асоциация във Варна (1982), а по-късно и на поредицата „Геохимия минералогия и петрология“ на Геологическия институт на БАН.

Изследваните плочести калцитови кристали имат ясно проявено композиционно развитие на индивидите. Кристализационният процес е протекъл в два епизода с кратно прекъсване- А и В (Минчева и др., 1993).

Първият епизод А, който се дели на три подепизода, има важно морфогенетично значение: A_1- започва израстване на финоплочестия и срастъчен папиршпат; A_2- ориентирано доизрастване на плочест монокалцит по периферията на индивида и остенен от {101}; A_3- продължава ориентирано наравстване на многобройни основно ромбоедрични кристалчета и разрастване на периферията на ромбоедъра {101}, (Фиг. 9).

Епизод В – ориентирано скаленоедрично доизграждане на калцитовите кристали. По периферията се развиват формите {312}, {211} и {214}, (фиг. 9). В по-късен етап наравства кварц, пирит, халкопирит и др.

Генетични тълкувания

Минералого термометричните изследвания показват, че калцитът е образуван от нискотемпературни разтвори в интервала 145^0 – 63^0C. Кристализацията на папиршпата започва при 73^0 – 90^0C. Тя се повишава при дебелоплочестия калцит и достига своя максимум 145^0C при ромбоедричните индивиди. При това намалява съдържанието на газовите включения, както и тяхното процентно присъствие. Тези факти ни позволяват да тълкуваме условията на кристализация. По всяка вероятност хидротермалните разтвори при нахлуването им в големите кухини на рудните жили са били с повишено съдържание на CO_2. На места, където парциалното налягане е ниско, започва интензивно да се отделя CO_2, който се натрупва в горните части на камерите. Затова в тях се наблюдава най-голямо развитие на папиршпата и плочестите калцитови кристали. При такова високо съдържание на CO_2 – фаза става възможно образуването им. В дюншлифи на папиршпат се наблюдават микрокристалчета с плочест хабитус със стенички на ромбоедър {101}. Според Корникова (1975) тяхното плочесто развитие се благоприятства от съдържанието на $Ca(OH)_2$ фаза в разтворите.Тя образува фин епитаксиален слой в стуктурата на калцита, възпрепятстващ нарастването на кристалите по оста „c", поради което се развиват само папиршпатови индивиди. Дебелоплочестите кристали получават ориентировъчен растеж от предшестващия папиршпат, с тенденция за развитие по ромбоедъра {101}. Той не завършва, тъй като пинакоидалната стена {0001} е много голяма и става сравнително бърза кристализация, вследствие на което се образуват многочислени ромбоедрични кристалчета. Повишаването на температурата на кристализация от папиршпата до ромбоедричния калцит е неравномерно. Отначало разтворите изстиват, тъй като подгряват вместващите скали, но постепенно се загряват от новопостъпилите разтвори, в резултат на което се поддържа необходимата кристализационна температура. При тези условия се образува ромбоедричния калцит- {101}. В по-късните етапи, при по-ниска температура става доизграждането на уникалните композиционни калцитови кристали в находище „Сърнешко кладенче" в Росенския руден район.

В заключение, изследваните калцитови кристали са от находище Сърнешко кладенче на Росенския руден район. Образувани са в кухините на калцит–халкопиритови рудни жили. Най-големите индивиди достигат 40 cm в диаметър, при дебелина до 4-5 cm по оста „c". Наблюдават се в горните части на жилните кухини. Композиционният им процес започва с кристализация на папиршпатовите индивиди с много газови флуиди. Следва ориентирано израстване на монокристален плочест калцит между папиршпатови пластинки, с периферия от r {101} стени. Продължава ориентирано нарастване на многобройни дребни, основно ромбоедрични кристали по свободната пинакоидална стена и разрастване по периферията на {101}. Процесът завършва с периферно скаленоедрично доизграждане на плочестите кристали с формите {312}, {211} и {214}. Температурата на образуване е от 145^0 до 63^0C показва, че са възникнали от нискотемпературни хидротермални разтвори.

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Composite calcite crystals from the 'Surneshko Kladenche' deposit, Rossen ore district

J. Minčeva-Stefanova, S. Petrussenko, M. Krusteva, D. Sokerov

(Резюме)

Studied are calcite crystals from the 'Surneshko Kladenche' deposit of the Rossen ore district (see the abstract).

Historia naturalis bulgarica, 24: 127-130, 2017

Notes about the floristic diversity in the Triglav National Park and the vascular flora of the towns of Budva, Podgorica and Dubrovnik (Adriatic Coast of Croatia and Monte Negro)

Dimitar Dimitrov, Vassil Vutov

Abstract: This article describes the flora of the northern slopes of the Triglav Peak (Julian Alps). Further, we discuss the flora of Dubrovnik (the old town area) and the flora of the towns of Budva and Podgoritsa.

Key words: Julian Alps, Mediterranean flora, protected area

Introduction

During a ten day trip to the highest peak of the Julian Alps – Triglav, we studied the rich and diverse flora of this region and subsequently with the flora of the towns of Dubrovnik, Budva and Podgorica. The whole trip took place in the fall of 2006.

Material and Methods

We used the routing method for the description of the species. The determination of the species was done following Tutin et al. (1964-1980), Hayek (1924-1927; 1928-1931; 1932-1933), Pignatti (1982), Horvatic (1967), and Lauber & Wagner (1996). The habitats of European significance found in the surveyed territories are listed under EUNIS. Dakskobler & Surina (2017) who have conducted a phytosociological analysis of alpine swards and heathlands (pioneer patches) on ridges and peaks in the Julian Alps (Northwest Slovenia).

Results and Discussion

1.Triglav National Park

As a starting point for our trip to the Triglav peak, we chose the Mojstrana Village. We spent the first night in the Aljaz Lodge (1015 m a.s.l.). The lodge is located on the left bank of the Bistrica River. The river's karst spring can also be found about 2 km above the lodge. The vegetation between the village and the lodge is comprised of Fagetum sylvaticae. The forest underlayer is comprised of *Erica carnea* L., *Campanula rotundifolia* L., *Cyclamen hederifolium* Aiton, *Helleborus niger* L., *Aquilegia vulgaris* L. and *Eupatorium cannabinum* L. Right before the lodge, the type of vegetation changes and is now comprised of *Piceetum myrtillosum* and the subforest is comprised of *Fagus sylvatica* L., *Vaccinium myrtillus* L., *Prunella vulgaris* L., *Melampyrum sylvaticum* L., *Mycelis muralis* (L.) Dumort., *Asplenium trichomanes* L., *Daphne mezereum* L., *Dryopteris* filix-mas (L.) Schott, *Polypodium vulgare* L., *Oxalis acetosella* L., *Polystichum aculeatum* (L.) Roth, *Origanum vulgare* L., T*rientalis europaea* L., *Geranium robertianum* L., *Hepatica nobilis* Mill., *Euphorbia amygdaloides* L., *Stellaria media* (L.) Vill., *Arabis alpina* L., *Epipactis helleborine* (L.) *Crantz*, *Mercurialis perennis* L., *Hypericum perforatum* L., *Ranunculus acris* L., *Salix silesiaca* Willd., *Potentilla erecta* (L.) Raeusch, *Bellis perennis* L., *Plantago media* L., *Urtica dioica* L. The lodge is located on the left bank of the Bistrica river. The northern slopes of Triglav peak are very steep, almost vertical at some points. They are a part of the Triglav National Park, which has been a natural protected area since 1981. The Park covers 880 square km (4% of the territory of Slovenia). Sandyo Beschev, our guide, chose the Prag Route which crosses the whole northern slope. The terrain here is comprised mainly of karst rocks. There were some metal pegs stuck at some of the more vertical places together with parts of suspended metal ropes – done with the purpose of assisting climbers on their way up. After we spent the night at the lodge, we started our ascension towards the peak. Our transect started from 1074 m and finished at 2864 m. The arboreal and bush vegetation around the Bistrica river is comprised of *Salix caprea* L., *Sorbus aria* (L.) Crantz, *Lonicera nigra* L., *Pinus mugo* Turra, *Carpinus betulus* L., *Acer heldreichii* Orph., *Juniperus communis* L., *Rhamnus alpinus* L., *Ribes alpinum* L., *Rosa pendulina* L., *Clematis alpina* (L.) Mill. and *Rhamnus catharticus* L. The natural habitat of the wall on the the Prag Route is 8210 Calcareous rocky slopes with chasmophytic vegetation. We found the following grassy species in the area: *Euphrasia rostkoviana* Hayne, *Solidago virgaurea* L., *Parnassia palustris* L., *Cerastium alpinum* L., *Rhinanthus minor* L., *Toeffildia pusilla*, *Rhododendron ferrugineum* L., *Paris quadrifolia* L., *Lilium carniolicum* Bernh. ex W.D.J.Koch, *Silene alpina* (Lam.) Thomas, *Astrantia minor* L., *Globularia aphyllanthes* Crantz, *Aster alpinus* L., *Dryas octopetala* L., *Globularia cordifolia* L., *Gentianella ciliata* (L.) Borkh., *Silene pusilla* Waldst.& Kit., *Scrophularia heterophylla* subsp. *laciniata* (Waldst.et Kit.) Maire & Petitm., *Dianthus petraeus* Waldst. & Kit., *Selaginella selaginoides* (L.) Link, *Campanula cochlearifolia* Lam., *Gentiana asclepiadea* L., *Linum capitatum* Kit. ex Schult., *Carex kitaibeliana* Degen ex Bech., *Anthericum liliago* L. *Pseudorchis albida* (L.) A. & D. Love, *Biscutella laevigata* L., *Asperula capitata* Kit. Ex Schult., *Thesium alpinum* L., *Adenostyles alliariae* (Gouan) A. Kern., *Trollius europaeus* L., *Saxifraga bryoides* L., *Juncus trifidus* L., *Bartsia alpina* L., *Anthyllis aurea* Welden, *Prenanthes purpurea* L., *Iberis saxatilis* L., *Avenella flexuosa* (L.) Drejer, *Crepis viscidula* Froel, 1800 m a.s.l., *Saxifraga paniculata* Mill., *Arabis alpina* L., *Arctostaphylos alpinus* (L.) Sprengel, *Festuca rubra* L., *Festuca bosniaca* Kumm. & Sendtn., *Aquilegia alpina* L., *Salix reticulata* L., *Cystopteris alpina* (Lam.) Desv., *Achillea atrata* L., *Saxifraga stellaris* L., *Athamantha cretensis* L., *Bistorta vivipara* (L.) Gray, *Galium anisophyllon* Vill., *Poa alpina* L., *Pedicularis orthantha* Griseb., *Asplenium viride* Huds., *Polystichum lonchitis* (L.) Roth, *Cirsium spinosissimum* (L.) Scop.

Eventually, we reached the flat Kotel locality whose natural habitat is e 6170 Alpine and subalpine calcareous grasslands. The species we found here are: *Silene acaulis* (L.) Jacq., *Papaver sendtneri* A. Kern. ex Hayek, *Arabis bellidifolia* Crantz, *Alyssum ovirense* A. Kern., *Draba aizoides* L., *Pritzelago alpina* (L.) Kuntze, *Saxifraga aphylla* Sternb., *Saxifraga hohenwartii* Vest, *Potentilla nitida* L., *Sorbus chamaemespilus* (L.) Crantz, *Globularia nudicaulis* L., *Pinguicula grandiflora* Lam., *Scabiosa lucida* Vill., *Campanula zoyisii* Wulfen, *Phyteuma orbiculare* L., *Tofieldia calyculata* (.) Wahlenb., *Noccaea rotundifolia* (L.) Moench, *Iberis umbellata* L., *Rumex scutatus* L., *Cerastium alpinum* L., *Moehringia ciliata* (Scop.) D.T., *Scleranthus perennis* L., *Molinia arundinacea* Schrank. At the Triglav peak itself (2864 m) we managed to determine *Hutschinsia brevicaulis* Hoppe and *Thlaspi rotundifolium* (L.) Gaud. Next to the Triglav Lodge at Kredarica (2541 m), we found *Myosotis alpestris* F. W. Schmidt.

Dubrovnik

After we climbed down the Triglav peak, we took off south to the town of Dubrovnik. From Split to Dubrovnik, the vegetation is Mediterranean sclerophyllous forest and scrub. The rocks in this region are mostly calcareous. The arboreal and bush vegetation here is comprised of *Juniperus oxycedrus* L., *Pistacia terebinthus* L., *Pinus pinaster* Aiton, *Cedrus libani* A. Richt, *Cupressus sempervirens* L., *Pinus pinea* L., *Ficus carica* L., *Nerium oleander* L., *Chamaerops humilis* L., *Agave americana* L., *Capparis spinosa* L., *Olea europaea* L., *Smilax aspera* L. The grassy species found here were: *Tribulus terrestris* L., *Ecbalium elaterium* (L.) A. Rich., *Euphorbia peplis* L. and *Foeniculum vulgaris* Mill.

Within the old town of Dubrovnik there are many tropical species, such as: *Citrus limon* (L.) Osbek, *Phoenix dactylifera* L., *Chamaerops humilis* L., *Melia azedarach* L., and *Passiflora caerulea* L. We found also the following grassy species: *Crithmum maritimum* L. and *Parietaria lusitanica* L.

Budva

We spent more time researching the urban flora of Budva, where we stayed for 2 consecutive days. Here found the following arboreal and grassy species: *Punica granatum* L., *Wisteria sinensis* (Simk.) DC., *Ceratonia siliqua* L., *Cercis siliquastrum* L., *Celtis australis* L., *Spartium junceum* L., *Armeniaca vulgaris Lam.*, *Myrtus communis* L., *Ulmus minor* MilL., *Falopia japonica* (Houtt.) *Rouse Decr.*, *Partenocissus quinquefolia* (L.) *Planch.*, *Actinidia deliciosa* L.F., *Carpinus orientalis Mil*L., *Ailanthus altissima* (MilL.) *Swingle*, *Morus alba* L., *Paliurus spina-christi* MilL., *Juglans regia* L., *Coronilla emerus* L., *Colutea arborescens* L., *Magnolia grandiflora* L., *Evonymus japonica* Thunb., *Cornus sanguinea* L., *Bougainvillea glabra* Choisy, *Pistacia lentiscus* L., *Pittosporum tobira* (Tausch.) W. T. Aiton, *Arbutus unedo* L., *Castanea sativa* MilL., *Phillyrea latifolia* L., *Albizia julibris-*

sin Durazz., *Smilax aspera* L., *Crataegus monogyna* Jacq., *Lagerstreumia indica* L., *Quercus pubescens* Willd., *Acacia dealbata* L., *Cistus incanus* L., *Gleditsia triacanthos* L., *Campsis radicans* Seem, *Hedera helix* L. and *Rubus sanguineus* Friv.

It has to be noted that there are a lot of alien species found within the urban area of Budva: *Eleusine indica* (L.) Gaertn., *Sorghum halepense* (L.) Pers., *Sporobolus indicus* (L.) R. Br., *Disphania multifida* (L.) Mosyakin & Clements., *Ambrosia trifida* L., *Conyza bonariensis* (L.) Cronq., *Amaranthus deflexus* L.

We found the following grassy species on the town streets: Cynodon dactylon (L.) Pers., *Paspalum dilatatum Poir.*, *Dittrichia graveolens* (L.) Greuter, *Paspalum paspaloides* (Michx.) Scribn., *Setaria viridis* (L.) P. Beauv., *Koeleria nitidula* Velen., *Piptatherum miliaceum* (L.) Aschers.et Sch., *Cyperus rotundus* (L.) Mey., *Hyparrhenia hirta* (L.) Stapf., *Rorippa sylvestris* (L.) Bess., *Bupleurum praealtum* L., *Sonchus teneramus* L., *Calamintha nepeta* (L.) Savi, *Bidens tripartita* L., *Cannabis sativa* L., *Picris echioides* L., *Portulaca oleracea* L., *Trigonella coerulea* (L.) Ser., *Bituminaria bituminosa* (L.) Stirt., *Origanum vulgare* L., *Heliotropium europaeum* L., *Cichorium inthybus* L., *Dichanthium ischaemum* (L.) Roberty, *Linaria vulgaris* MilL., *Xanthium strumarium* L., *Bilderdykia convolvulus* (L.) Dumort., *Lythrum salicaria* L., *Solanum nigrum* L., *Daucus carota* L., *Pastinaca sativa* L., *Datura stramonium* L., *Cyclamen hederifolium* Aiton, *Gypsophila muralis* L., *Brachypodium sylvaticum* (Huds.) P. Beauv., *Lathyrus sylvestris* L., *Scolymus hispanicus* L., *Echinochloa crus-galli* (L.) P. Beauv., *Mirabilis jalapa* L., *Carlina vulgaris* L., *Phragmites australis* (*Cav.*) Trin.ex Steud., *Centaurium erythraea* Raf., *Chondrilla juncea* L., *Odontites serotina* (Lam.) *Dumort.*, *Echium italicum* L., *Melissa officinalis* L., *Centaurea calcitrapa* L., *Anagalis arvensis* L., *Tussilago farfara* L., *Dactylis glomerata* L., *Tordylium apulum* L., *Silene noctiflora* L., *Inula conyza* L., *Pteridium aquilinum* (L.) Kuhn, *Ruscus aculeatus* L., *Asplenium adianthum- nigrum* L., *Primula acaulis* (L.) L., *Geum urbanum* L., *Lapsana communis* L., *Selaginella helvetica* (L.) *Spring*, *Eryngium maritimum* L., *Odontites lutea* (L.) *Clairv.*, *Scilla autumnalis* L., *Teucrium polium* L., *Pallenis spinosa* (L.) Cass., *Clinopodium vulgare* L., *Glaucium flavum* Crantz., *Blackstonia perfoliata* (L.) Huds., *Satureja cuneifolia* Ten., *Eryngium amethhystinum* L., *Symphyotrichum squamatum* (Michx.) GL. Nesom, *Campanula trachelium* L., *Lactuca saligna* L., *Linaria angustifolia* Rchb., *Jacobaea maritima* (L.) Pelser & Melideu, *Selaginella denticulata* (L.) Spring, *Cephalaria ambrosioides* (Sm.) Roem.& Schult. The following species can be found on the rocks: *Seseli rigidum* Waldst. & Kit., *Asparagus acutifolius L.* and *Ephedra fragilis* Desf." *Seseli rigidum* Waldst. & Kit., *Asparagus acutifolius* L. and *Ephedra fragilis* Desf.

3. Podgorica

Finally, on the streets of Podgorica we found *Amaranthus hybridus* L.

Conclusion

We examined the floristic makeup of Alpine and Subalpine communities from Triglav peak. Ninety-eight species were found (trees, bush and grass species), out of which 4 species with a conservation status. Ninety-two species can be found in Bulgaria, while 26 species are typical only for the Julian Alps. In this area we also found for the first time in Montenegro – *Sporobolus indicus* (L.) R.Br.

In the city of Dubrovnik, we found 7 species (trees, bushes and grasses).

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Флористично разнообразие в Националния парк Триглав (Словения) и на флората на градовете Будва, Подгорица и Дубровник (Адриатическия бряг на Хърватско и Черна гора)

Димитър Димитров, Васил Вутов

(Резюме)

В статията се описва флората на северните склонове на връх Триглав (Юлийски Алпи), както и висшата флора на градовете Дубровник, Будва и Подгорица. По трансекта хижа Аляжев дом – връх Триглав са определени 128 вида висши растения за Националния парк „Триглав“. За град Дубровник са отбелязани 7 вида висши растения, за градската флора на Будва са отбелязани 125 вида висши растения и от град Подгорица е определен един вид. Инвазивният вид *Sporobolus indicus* (L.) R. Br. се съобщава за първи път за флората на Черна Гора.

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Acarorum Catalogus I – First supplement (2008–2016)

Petar Beron

Abstract. The monograph of Beron (2008) is completed with the data in 166 papers published between 2008 and 2016 (some of them in 2017), or omitted. Many new taxa have been published, other taxa have been synonymized or altered, mostly by specialists from Germany, Poland, Iran, Spain, Montenegro, Ukraine, Bulgaria, and other countries. Now (by August 2017) are recognized (some of them gen. or sp. inquir.) one genus and nine recent sp.of Calyptostomatidae, 10 genera and 56 sp. of Smarididae and 57 genera and more than 850 sp. of Erythraeidae.

Key words: Catalogus, supplements, Calyptostomatoidea, Calyptostomatidae, Erythraeoidea, Erythraeidae, Smarididae

Introduction

After the publication of the first volume of the series Acarorum Catalogus (Beron, 2008), many new papers have been published by R. Haitlinger, P. Beron, J. Mąkol, G. Gabryś, M. Kamran, J. Łaydanowicz, A. Wohltmann, J.G. Mayoral, P. Barranco, M. Šundić, A. Khaustov and especially by the very active Iranian group of researchers (A. Saboori, S. Ahmadi, H. Hajiqanbar, M. Khanjani, M. Akrami, M. Bagheri, M. Hakimitabar and others). New genera and species have been described (almost all based on larvae, mostly from Iran, Montenegro and Spain), several other taxonomic changes took place and new synonymes were created. A few papers have been omitted from the Bibliography. This situation requires an updating of my Catalogue. Meanwhile has been published the Checklist of terrestrial Parasitengonae of Mąkol & Wohltmann (2012, 2013).

The author is very grateful to Prof. Joanna Mąkol for the reading and correcting the MS of this supplement.

New genera (valid), described since 2008, or altered:

Collemboerythraeus Noei, Saboori et Hakimitabar, 2017

Makolia Saboori, Khaustov et Hakimitabar, 2009

Iraniella Karimi- Iravanlou, Kamali et Talebi, 2002

Neomomorangia Fain et Santiago-Blay – full generic status

Madinahustium Kamran et Alatawi, 2016

Marantelophus Haitlinger, 2011

Monteustium Haitlinger et Šundić, 2015

Nagoricanella Haitlinger, 2009

Pukakia Clark, 2014

Pararainbowia Dunlop, 2010

Synonymized genera (partly as a result of rearing of larvae):

Zhangiella Saboori, Cobanoglu et Bayram, 2007, syn. f *Curteria* Southcott, 1961

Abalakeus Southcott, 1994 = *Eatoniana* Cambridge, 1898

Hauptmannia Oudemans, 1910 = *Abrolophus* Berlese, 1891

Clipeosoma Southcott, 1948 = *Hirstiosoma* Womersley, 1934

Pilosoma Southcott, 1961 = *Fessonia* von Heyden, 1826

Guatustium Haitlinger, 2000 = *Balaustium* von Heyden, 1826

Palenqustium Haitlinger, 2000 = *Balaustium* von Heyden, 1826

As a result of the recent contributions, the number of genera and species in Calyptostomatoidea and Erythraeoidea (some of them uncertain status) is updated as follows:

Calyptostomatidae – one genus, nine sp.

Smarididae – 10 genera, 56 sp.

Erythraeidae – 57 genera, more than 850 sp.

New contributions to the Catalogue:
Fam. Calyptostomatidae

Calyptostoma giuliae Haitlinger et Šundić (larval)

Calyptostoma giuliae Haitlinger & Šundić, 2015: 920

Type locality: Cambodia

Distribution: Cambodia

Host: from herbaceous plants

Calyptostoma gorganica Saboori et Soukhtsaraii, in Saboori, Soukhtsaraii, Yazdanian, Golpayegani (2012)(larval)

Calyptostoma gorganica Saboori et Soukhtsaraii, in Saboori, Soukhtsaraii, Yazdanian & Golpayegani, 2012: 37

Type locality: Shast Kalateh forest, Gorgan City, Golestan prov.

Distribution: Iran

Host: *Limonia caucasica* (Diptera: Tipulidae)

Calyptostoma marantica Haitlinger et Šundić (larval)

Calyptostoma marantica Haitlinger & Šundić, 2015: 923

Type locality: Sulawesi

Distribution: Indonesia

Host: from herbaceous plants

Calyptostoma latiseta (Shiba, 1976) – New Caledonia, Tasmania (Mąkol & Wohltmann, 2013)

Calyptostoma velutinum (Müller, 1776) – Montenegro (Šundič & Haitlinger, 2015: 188); Serbia, Sicily (Haitlinger & Šundič, 2015)

Species inquirendae (see Mąkol & Wohltmann, 2013):

Calyptostoma exculpta (Berlese, 1916)

Calyptostoma neoguineana (Canestrini, 1897)

Fam. Smarididae
Smaridinae

Smaris maraghehiensis Saboori et Bagheri (ad.)

Smaris maraghehiensis Saboori & Bagheri, 2011: 105

Type locality: Maragheh, 1450 m, East Azarbaijan Province

Distribution: Iran

Hirstiosomatinae

Hirstiosoma latreillei (Grandjean, 1947) (syn. *Clipeosoma jupiter* Southcott, 1948) – Finland (Gabryś, Roland, Mąkol & Lehtinen, 2009); Iran (Noei, Saboori, etc., 2013)

Hirstiosoma amfilohijei Haitlinger et Šundić (larval)

Hirstiosoma amfilohijei Haitlinger & Šundič, 2017: 1411

Type locality: Korita Kučka (1200 m)

Distribution: Montenegro

Hirstiosoma Womersley, 1934 is the adult stage of *Clipeosoma* Southcott, 1948; *Pilosoma* Southcott, 1961 is the larval form of *Fessonia* von Heyden, 1826 (Wohltmann, 2010)

Fessonia papillosa (Hermann, 1804) – Iran (Noei, Saboori, etc., 2013); China (Li & Fan, 1997)

Fessonia torshizica Salarzehi et Hajiqanbar

Fessonia torshizica Salarzehi & Hajiqanbar, 2012: 18

Type locality: Torshiz, Khorasan Razavi province, 1215 m a.s.l.

Distribution: Iran

Sphaerotarsus baenai Mayoral et Barranco (larval)

Sphaerotarsus baenai Mayoral & Barranco, 2017: 623

Type locality: Vereda de los Labrados, Villa Manrique

Distribution: Spain

Host: on soil

Fam. Erythraeidae
Erythraeinae

Genus ***Collemboerythraeus*** Noei, Saboori et Hakimitabar

Collemboerythraeus Noei, Saboori & Hakimitabar, 2017:

Type species: *Collemboerythraeus vosoughae* Noei, Saboori et Hakimitabar, 2017

Collemboerythraeus vosoughae Noei, Saboori et Hakimitabar

Collemboerythraeus vosoughae Noei, Saboori & Hakimitabar, 2017:

Type locality: Jahrom City, Fars Province

Distribution: Iran

Host: undet. Collembola, Sminthuridae

Eatoniana gonabadensis (Ahmadi, Hajiqanbar et Saboori) (larval)

Abalakeus gonabadensis Ahmadi, Hajiqanbar & Saboori, 2012: 170

Type locality: Gonabad, Khorasan Razavi prov.

Distribution: Iran

Hosts: *Aphis craccivora* (Homoptera: Aphididae);

Dociostaurus cf. *tartarus* (Orthoptera: Acrididae)

Eatoniana plumipes (L. Koch, 1856)

Abalakeus jahromiensis Sedghi, Saboori & Hakimitabar, 2010: 432 (synonymized with *Eatoniana plumipes* by Mąkol & Sevsay, 2015)

Type locality: Jahrom

Distribution: Iran (for *A. jahromiensis*); Dumlu, Erzurum prov. (Turkey, for *E. plumipes*)

Host: undet. nymph of Pentatomidae (Heteroptera) and on soil (for *A. jahromiensis*)

Curteria episcopalis (C.L. Koch, 1837) – Finland (Gabryś et al., 2009)

The genus *Zhangiella* Saboori, Cobanoglu et Bayram, 2007 was synonymized with *Curteria* Southcott, 1961 by Saboori, Khaustov, Hakimitabar & Hajiqanbar (2009: 29).

Abalakeus Southcott, 1994 became junior synonym of ***Eatoniana*** Cambridge, 1898 (Mąkol & Sevsay, 2015). A female of ***Eatoniana plumipes*** (L. Koch, 1856) was selected as neotype.

Abalakeus jahromiensis Sedghi, Saboori et Hakimitabar, 2010 syn. of ***Eatoniana plumipes***

Abalakeus bambusae Zhang, Zhang et Lin, 2000 becomes ***Eatoniana bambusae*** (Zhang, Zhang et Lin)

Abalakeus chekei Southcott, 1994 becomes ***Eatoniana chekei*** (Southcott)

Abalakeus lorestanicus Saboori et Lachinani, 2003 becomes ***Eatoniana lorestanica*** (Saboori et Lachinani)

Abalakeus gonabadensis Ahmadi, Hajiqanbar et Saboori, 2012 becomes ***Eatoniana gonabadensis*** (Ahmadi, Hajiqanbar et Saboori)

All these species were transferred to *Eatoniana* at synonymization (note of J. Mąkol)

Erythraeus (Erythraeus) adanaensis Saboori et Cobanoglu (larval)

Erythraeus (Erythraeus) adanaensis Saboori & Cobanoglu, 2010: 250; Azimi, Saboori & Shirdel, 2011: 51

Type locality: Adana

Distribution: Iran, Turkey

Host: unknown

Erythraeus (Erythraeus) albanicus Haitlinger (larval)

Erythraeus (Erythraeus) albanicus Haitlinger, 2012: 340; Haitlinger & Šundić, 2015: 40

Type locality: Shënavasi nr. Sarandë

Distribution: Albania

Host: herbaceous plant

Erythraeus (Erythraeus) ankaraicus Saboori, Çobanoğlu et Bayram, 2004 – Montenegro (Saboori, Pešić & Hakimitabar, 2008)

Erythraeus (Erythraeus) aphidivorous Šundić, Haitlinger, Michaud et Colares (larval)

Erythraeus (Erythraeus) aphidivorous Šundić, Haitlinger, Michaud & Colares, 2015: 43

Type locality: Hays, Kansas

Distribution: USA (Kansas)

Host: *Melanaphis sacchari* (Hemiptera: Aphididae)

Erythraeus (Erythraeus) capeverdensis Haitlinger (larval)

Erythraeus (Erythraeus) capeverdensis Haitlinger, 2009a: 1154

Type locality: Sal Island, three km north of Espargos (16°47'N, 22°57')

Distribution: Cape Verde

Host: Unknown; collected from herbaceous plants

Erythraeus (Erythraeus) cinereus (Dugès) = *E. similis* (Canestrini)

Erythraeus (Erythraeus) chrysoperlae Khanjani, Mirmoayedi, Fayaz et Sharifian (larval)

Erythraeus (Erythraeus) chrysoperlae Khanjani, Mirmoayedi, Fayaz & Sharifian, 2012: 63

Type locality: Shahanjarin, Razan, Hamedan Province

Distribution: Iran

Host: *Chrysoperla kolthoffi* (Neuroptera: Chrysopidae)

Erythraeus (Erythraeus) elmalicus Haitlinger (larval)

Erythraeus (Erythraeus) elmalicus Haitlinger, 2010: 53

Type locality: Elmali, 1200 m

Distribution: Turkey

Host: from herbaceous plants

Erythraeus (Erythraeus) etnaensis Heitlinger

Erythraeus (Erythraeus) etnaensis Heitlinger, 2011: 291

Type locality: Etna

Distribution: Sicily

Erythraeus (Erythraeus) gertrudae Haitlinger, 1987 – Austria (Haitlinger, 2009a). Syn. of *E. regalis* (C.L. Koch), acc. to Stålstedt et al., 2016.

Erythraeus (Erythraeus) gorcensis Gabryś

Erythraeus (Erythraeus) gorcensis Gabryś,

2016: 1 (pro E. acis sensu Schweizer, 1951)
Type locality: Switzerland
Distribution: Switzerland

Erythraeus (Erythraeus) hilariae Haitlinger (larval)
Erythraeus (Erythraeus) hilariae Haitlinger, 2010: 50
Type locality: Elmali, 1200 m
Distribution: Turkey
Host: from herbaceous plants

Erythraeus (Erythraeus) jowitae Haitlinger, 1987 – Sweden (Haitlinger, 2008c), Romania, Macedonia (Haitlinger, 2009d). Syn. of *E. cinereus* (Dugès), acc. to Stålstedt et al., 2016.

Erythraeus (E.) kuyperi (Oudemans, 1910) – Estonia, Lithuania (Haitlinger, 2010a). Syn. of *E. regalis* (C.L. Koch), acc. to Stålstedt et al., 2016.

Erythraeus (Erythraeus) layyahensis Kamran, Afzal et Bashir (larval)
Erythraeus (Erythraeus) layyahensis [Kamran, 2009: 48] Kamran, Afzal & Bashir, 2013: 35
Type locality: Punjab, 22 km east of district Layyah
Distribution: Pakistan
Host: from grass

Erythraeus (Erythraeus) loomerus Kamran (larval)
Erythraeus (Erythraeus) loomerus Kamran, 2009: 55
Type locality: Punjab
Distribution: Pakistan

Erythraeus (Erythraeus) mirabi Khanjani, Ueckermann et Ul-Hassan (larval)
Erythraeus (Erythraeus) mirabi Khanjani, Ueckermann & Ul-Hassan, 2012: 52
Type locality: Iran
Distribution: Iran

Erythraeus (Erythraeus) picaforticus Haitlinger, 2002 – Sicily (Haitlinger & Łupicki, 2013)

Erythraeus (Erythraeus) pistacicus Haitlinger, Mehrnejad et Šundić (larval)
Erythraeus (Erythraeus) pistacicus Haitlinger, Mehrnejad & Šundić, 2016: 804; Haitlinger R., Mehrnejad M. Reza, 2017: 320
Type locality: Rafsanjan, Raviz
Distribution: Iran
Hosts: [collected from *Pistacia atlantica mutica* (Anacardiaceae)]; *Agonoscena pistaciae* (Homoptera, Psyllidae); *Farsiana pistaciae* (Hemiptera: Miridae)

Erythraeus (Erythraeus) populi Khanjani, Mirmoayedi, Fayaz et Sharifian (larval)
Erythraeus (Erythraeus) populi Khanjani, Mirmoayedi, Fayaz & Sharifian, 2012: 54
Type locality: Hamedan, 1828 m, Hamedan Province
Distribution: Iran
Host: *Stephanitis pyri* (Heteroptera: Tingidae)

Erythraeus (Erythraeus) serbicus Šundić, Haitlinger et Hakimitabar
Erythraeus (Erythraeus) serbicus Šundić, Haitlinger & Hakimitabar, 2015: 788
Type locality: Serbia
Distribution: Serbia

Erythraeus (Erythraeus) shojaii Babolmorad et Saboori, 2000 – Pakistan (Kamran, 2009)
Erythraeus (Erythraeus) sicilicus Haitlinger
Erythraeus (Erythraeus) sicilicus Haitlinger, 2011: 291
Type locality: Sicily
Distribution: Sicily

Erythraeus (Erythraeus) smolyanensis Haitlinger (larval)
Erythraeus (Erythraeus) smolyanensis Haitlinger, 2009d: 52; Haitlinger & Šundić, 2015: 40
Type locality: Smolyan, Bulgaria
Distribution: Bulgaria, Montenegro
Host: from herbaceous plants

Erythraeus (Erythraeus) southcotti Goldarazena et Zhang, 1998 – Montenegro (Haitlinger & Šundić, 2015)

Erythraeus (Erythraeus) uhadi Kamran et Alatawi (larval)
Erythraeus (Erythraeus) uhadi Kamran & Alatawi, 2014a: 79
Type locality: Uhad Mt, Al-Madina
Distribution: Saudi Arabia
Host: *Opseius* sp. (Hemiptera: Cicadellidae)

Erythraeus (Erythraeus) walii Kamran (larval)
Erythraeus (Erythraeus) walii Kamran, 2009: 41
Type locality: Punjab

Distribution: Pakistan

Erythraeus (Zaracarus) adrianicus Haitlinger
Erythraeus (*Zaracarus*) *adrianicus* Haitlinger, 2012: 137
Type locality: Palazzo Adriano n. Sciacca
Distribution: Sicily
Host: from herbaceous plants

Erythraeus (Zaracarus) arminouensis Haitlinger et Łupicki
Erythraeus (*Zaracarus*) *arminouensis* Haitlinger & Łupicki, 2011: 405
Type locality: Arminou
Distribution: Cyprus
Host: from herbaceous herbs

Erythraeus (Zaracarus) aydinicus Saboori, Cakmak et Nouri-Gonbalani, 2004 – Montenegro (Haitlinger & Šundić, 2015)

Erythraeus (Zaracarus) bibadakiensis Haitlinger
Erythraeus (Zaracarus) bibadakiensis Haitlinger, 2011: 48
Type locality: Bibadaki Island n. Labuan Bajo, Flores
Distribution: Indonesia
Host: from herbaceous herbs

Erythraeus (Zaracarus) budapestensis Fain et Ripka, 1998 – Montenegro (Saboori, Pešić & Hakimitabar, 2008), Turkey (Haitlinger, 2010b); Serbia (Haitlinger, 2012); Albania (Haitlinger & Šundić, 2015)
E. (*Z.*) *preciosus* Goldarazena & Zhang, 1998; **syn.** by Haitlinger & Šundić, 2015: 585
E. (*Z.*) *ueckermanni* Saboori, Nowzari et Bagheri-Zenouz, 2004; **syn.** by Haitlinger & Šundić, 2015: 585

Erythraeus (Zaracarus) coleopterus Mortazavi, Hajiqanbar et Saboori
Erythraeus (*Zaracarus*) *coleopterus* Mortazavi, Hajiqanbar & Saboori, 2012: 110
Type locality: Ghanat Chenar village, Sirjan city, Kerman province, southeastern Iran (29° 52‘ 33“ N, 55° 43‘ 56“ E, 2253 m a.s.l.)
Distribution: Iran
Host: *Cyphonoxia* sp. (Coleoptera: Scarabaeidae)

Erythraeus (Zaracarus) eleonorae Haitlinger, 1987 – Poland, neotype (Haitlinger & Šundić, 2015)

Erythraeus (Zaracarus) hafezi Saboori, Hakimitabar et Mahmoudi (larval)
Erythraeus (Zaracarus) hafezi Saboori, Hakimitabar & Mahmoudi, 2014: 80
Type locality: Shiraz city, Fars Province
Distribution: Iran
Host: undet. (Heteroptera: Cicadidae)

Erythraeus (Zaracarus) hamedanicus Khanjani, Mirmoayedi, Nahad et Fayaz (larval)
Erythraeus (Zaracarus) hamedanicus Khanjani, Mirmoayedi, Nahad & Fayaz, 2010: 26
Synonyme of *E. (Z.) ueckermanni* Saboori, Nowzari et Bagheri-Zenouz, 2004 (syn. by Mahmoudi et al., 2011)
Type locality: Hamedan
Distribution: Iran
Host: *Pyrrhocoris apterus* (Heteroptera: Pyrrhocoridae)

Erythraeus (Zaracarus) lancifer Southcott, 1995 – Saudi Arabia (Kamran & Alatawi, 2014a)

Erythraeus (Zaracarus) longipedus Saboori et Nowzari, 2001 – Pakistan (Kamran, 2009)

Erythraeus (Zaracarus) monrealicus Haitlinger
Erythraeus (Zaracarus) monrealicus Haitlinger, 2012: 140
Type locality: Monreale n. Palermo
Distribution: Sicily
Host: from herbaceous plants

Erythraeus (Zaracarus) passidonicus Haitlinger, 2006 – Turkey (Haitlinger, 2010b)

Erythraeus (Zaracarus)* cf. *ueckermanni Saboori, Nowzari et Bagheri-Zenouz, 2004 – Montenegro (Saboori, Pešić & Hakimitabar, 2008)

Erythraeus (Zaracarus) perpusillus Kamran, Afzal, Raza, Irfanullah, Bashir et Ahmad (larval)
Erythraeus (Zaracarus) perpusillus Kamran, Afzal, Raza, Irfanullah, Bashir & Ahmad, 2009: 358
Type locality: 5 km south of district Okara (Punjab)
Distribution: Pakistan
Host: *Pyrilla perpusilla* (Homoptera: Lophopidae)

Erythraeus (Zaracarus) ruizporterae Mayoral et Barranco (larval)

Erythraeus (Zaracarus) ruizporterae Mayoral & Barranco, 2008: 114
Type locality: Yeso de Sorbas (Almeria)
Distribution: Spain

Erythraeus (Zaracarus) soleimanii Khanjani, Mirmoayedi, Nahad et Fayaz (larval)
Erythraeus (Zaracarus) soleimanii Khanjani, Mirmoayedi, Nahad & Fayaz, 2010: 21
Type locality: Razan, Hamedan
Distribution: Iran
Host: *Chrysoperla kolthoffi* (Neuroptera: Chrysopidae)

Erythraeus (Zaracarus) tuzicus Haitlinger et Šundić
Erythraeus (Zaracarus) tuzicus Haitlinger & Šundić, 2015: 190
Type locality: Tuzi near Podgorica
Distribution: Montenegro
Host: from herbaceous plants

Erythrites otamahua Clark
Erythrites otamahua Clark, 2013: 394
Type locality: New Zealand
Distribution: New Zealand

Forania sendrai Mayoral et Barranco (larval)
Forania sendrai Mayoral & Barranco, 2010: 62
Type locality: Sierra Alhamilla, T.M. Turrilas, Almeria
Distribution: Spain
Host: *Tapinoma* sp. (Hymenoptera: Formicidae)

Kamertonia polonica Gabryś – Finland (Gabryś et al., 2009)

Lasioerythraeus cardonensis Haitlinger (larval)
Lasioerythraeus cardonensis Haitlinger, 2008b: 63
Type locality: Cardon, Margerita Island
Distribution: Venezuela
Host: from herbaceous plants

Lasioerythraeus saboorii Khanjani, Raisi et Izadi (larval)
Lasioerythraeus saboorii Khanjani, Raisi & Izadi, 2011: 546
Type locality: Boshrowyeh, Ferdous City, South Khorassan Prov.
Distribution: Iran
Host: *Aphis punicae* (Homoptera: Aphididae)

Lasioerythraeus setarius Kamran et Bashir (larval)
Lasioerythraeus setarius Kamran & Bashir, 2013: 722
Type locality: 22 km east of district Layyah (Punjab, Pakistan)
Distribution: Pakistan
Host: from foxtail grass (*Setaria viridis L.*)

Genus ***Makolia*** Saboori, Khaustov et Hakimitabar (larval)
Makolia Saboori, Khaustov & Hakimitabar, 2009: 23
Type species: *Makolia crimeaensis* Saboori, Khaustov et Hakimitabar, 2009

Makolia crimeaensis Saboori, Khaustov et Hakimitabar (larval)
Makolia crimeaensis Saboori, Khaustov & Hakimitabar, 2009: 24
Type locality: Crimea, Ay-Petri mountain pasture
Distribution: Crimea
Host: *Lasius* sp. (Hymenoptera: Formicidae)

Phanolophinae – according to Welbourn (1991), Beron (2008), Wohltmann (2010), belongs to Erythraeidae

Phanolophus oedipodarum André, 1927 – Yemen, Germany (Wohltmann (2010)

Genus ***Iraniella*** Karimi Iravanlou, Kamali et Talebi
Iraniella Karimi Iravanlou, Kamali & Talebi, 2002: 124
Type species: *Iraniella moharramipuri* Karimi Iravanlou, Kamali et Talebi, 2002

Iraniella moharramipuri Karimi Iravanlou, Kamali et Talebi (larval)
Iraniella moharramipuri Karimi Iravanlou, Kamali & Talebi, 2002: 124
Type locality: Iran
Distribution: Iran

Leptinae

Mąkol, Gabryś & Łaydanowicz (2011) "resurrected" and re-described *Leptus phalangii* (De Geer, 1778)(the type-species of genus *Leptus* Latreille) and synonymized under this species *Leptus nemorum* (C.L. Koch, 1836) and *L. beroni* Fain, 1991.

Leptus (L.) aphidus Kamran (larval)

Leptus (L.) aphidus Kamran, 2009: 66
Type locality: Punjab
Distribution: Pakistan

Leptus (L.) astrubali Haitlinger, 1999 – Nepal (Haitlinger, 2009d)

Leptus (L.) biljanae Šundić et Haitlinger (larval)
Leptus (L.) biljanae Šundić & Haitlinger, 2015: 188
Type locality: Župa, Nikšić, Montenegro
Distribution: Montenegro
Host: from Orthoptera indet.

Leptus (L.) brasilicus Haitlinger, Šundić et Pompermaier (larval)
Leptus (L.) brasilicus Haitlinger, Šundić & Pompermaier, 2017: 879
Type locality: 30 km NE of Brasilia
Distribution: Brazil

Leptus (L.) cabareticus Haitlinger, 2004 – Guadeloupe (Haitlinger, 2011b)

Leptus (L.) canaricus Haitlinger (larval)
Leptus (L.) canaricus Haitlinger, 2009b: 148
Type locality: Tenerife, Las Cañadas, Fuente Joco
Distribution: Canary Islands
Hosts: *Laparocerus crassifrons, L. tessellates* (Coleoptera: Curculionidae)

Leptus (L.) chiusicus Haitlinger et Šundić (larval)
Leptus (L.) chiusicus Haitlinger & Šundić, 2014b: 1509
Type locality: Sicilia
Distribution: Sicilia

Leptus (L.) danelli Southcott, 1992 raised to species (formerly *L. ignotus danelli*)(Łaydanowicz & Mąkol, 2010)

Leptus (L.) delijanensis Khademi, Saboori et Hakimitabar (larval)
Leptus (L.) delijanensis: Khademi, Saboori & Hakimitabar, 2015: 929
Type locality: Delijan
Distribution: Iran
Host: Acrididae indet. (Insecta: Orthoptera)

Leptus (L.) edwini Haitlinger (larval)
Leptus (L.) edwini Haitlinger, 2009b: 145
Type locality: Tenerife, Fuente Joco
Distribution: Canary Islands
Host: *Laparocerus tessellates* (Coleoptera: Curculionidae)

Leptus (L.) eslamizadehi Saboori, 2002 – Montenegro (Haitlinger & Šundić, 2015)

Leptus (L.) hammameticus Haitlinger, 1998 – Sicily (Haitlinger, 2012)
Syn. ***Leptus ignotus*** (Oudemans, 1903) = ***L. molochinus*** (C.L. Koch, 1837) (Łaydanowicz & Mąkol, 2010)

Leptus (L.) josifovi Beron, 1975 – Albania, Montenegro (Haitlinger, 2012)

Leptus (Leptus) kattikus Haitlinger (larval)
Leptus (Leptus) kattikus Haitlinger, 2009e: 61; Mąkol et al., 2012: 67
Type locality: Nepal,
Distribution: Nepal, Vietnam
Hosts: from herbaceous plants; Phasmida

Leptus (L.) korneli Haitlinger (larval)
Leptus (L.) korneli Haitlinger, 2009a: 1152
Type locality: Sal Island, 3 km north of Espargos
Distribution: Rep. of Cape Verde
Host: from herbaceous plants

Leptus (L.) longipilis (Berlese, 1910) – Finland (Gabryś, Roland, Mąkol & Lehtinen, 2009)

Leptus (L.) lugenus Kamran (larval)
Leptus (L.) lugenus Kamran, 2009: 81
Type locality: Punjab
Distribution: Pakistan

Leptus (L.) mariae Haitlinger, 1987 – Estonia, Latvia (Haitlinger, 2010a), Macedonia (Haitlinger,)

Leptus (L.) maxorata Haitlinger (larval)
Leptus (L.) maxorata Haitlinger, 2009b: 141
Type locality: Fuerteventura, Malpais Grande
Distribution: Canary Islands
Host: *Herpisticus calvus* (Coleoptera: Curculionidae)

Leptus (L.) multanensis Kamran (larval)
Leptus (L.) multanensis Kamran, 2009: 89
Type locality: Punjab
Distribution: Pakistan

Leptus (L.) millipedius Southcott, 1992

Madeira. Known from this island on Diplopoda, but recorded by Haitlinger (2009b) from *Laparocerus (Atlantis) lamellipes* and *L. (A.) noctivagans* (Coleoptera: Curculionidae).

Leptus (L.) molochinus (C.L. Koch, 1837) – Montenegro (Haitlinger & Šundić, 2015)

Leptus (L.) multisolenidiae Mayoral et Barranco

Leptus (L.) multisolenidiae Mayoral & Barranco, 2011b: 413

Type locality: Kaw mountain, Cayenne

Distribution: French Guiana

Host: *Episomacris gruneri* (Orthoptera: Acrididae)

Leptus (L.) nikanori Haitlinger, 1998 – Costa Rica (Mayoral & Barranco, 2011a), French Guiana (Mayoral & Barranco, 2011b)

Leptus (L.) pakistanensis Kamran, Afzal, Bashir, Raza et Saeed Khan (larval)

Leptus pakistanensis Kamran, Afzal, Bashir, Raza & Saeed Khan, 2009: 17

Type locality: five km south of district Okara (Punjab)

Distribution: Pakistan

Host: *Aphis* sp. (Homoptera: Aphididae)

Leptus (L.) phalangii (De Geer, 1778)(larval, postlarval)

Acarus phalangii De Geer, 1778 – 117

Leptus phalangii: Gabryś, 1991: 104;

Rhyncholophus nemorum C.L. Koch, 1836: fasc.1, t.4

Leptus nemorum: Oudemans, 1914: 16 (more synonyms in Mąkol, Gabryś & Łaydanowicz, 2011)

Leptus beroni Fain, 1991: 109

Leptus holmiae Southcott, 1992: 60

Leptus (L.) planaltensis Haitlinger, Šundič et Pompermaier (larval)

Leptus (L.) planaltensis Haitlinger, Šundič & Pompermaier, 2017: 879

Type locality: 30 km NE of Brasilia

Distribution: Brazil

Leptus (L.) salicus Haitlinger (larval)

Leptus (L.) salicus Haitlinger, 2009a: 150

Type locality: Sal Island

Distribution: Rep. of Cape Verde

Host: Orthoptera indet.

Leptus (L.) sulawesicus Haitlinger (larval)

Leptus (L.) sulawesicus Haitlinger, 2011: 53

Type locality: Sulawesi, Kietekiesu, n. Rantepao

Distribution: Indonesia (Sulawesi)

Host: from herbaceous plants

Leptus (L.) tenerificus Haitlinger (larval)

Leptus (L.) tenerificus Haitlinger, 2009b: 147

Type locality: Tenerife, Granadilla, Las Vegas

Distribution: Canary Islands

Host: *Laparocerus fernandezi* (Coleoptera: Curculionidae)

Leptus (L.) veletae Mąkol et Wohltmann, 2012 (nom. nov. pro *Leptus incertus* Gabryś , 2000)

Callidosomatinae

According to Wohltmann & Mąkol (2012), *Abrolophus* Berlese, 1891 is the adult form of *Hauptmannia* Oudemans, 1910.

Caeculisoma argus Vitzthum, 1926 – species status by Mąkol & Wohltmann, 2013: 17 (for *C. argus argus*)

Caeculisoma carmenae Haitlinger (larval)

Caeculisoma carmenae Haitlinger, 2008d: 139

Caeculisoma (C.) carmenae Haitlinger: Beron, 2008: 128

Type locality: Rep. of South Africa, Port Elizabeth

Distribution: South Africa

Host: from herbaceous plants

Caeculisoma io Southcott, 1961

Formerly *Caeculisoma argus io*, full status as species by Mąkol & Wohltmann, 2013: 17

Callidosoma selmae Costa, Klompen, Dos Santos, Favretto et Pepato

Callidosoma selmae Costa, Klompen, Dos Santos, Favretto & Pepato, 2017: 42

Type locality: Brazil

Distribution: Brazil

Callidosoma susanae Clark

Callidosoma susanae Clark, 2014: 177

Type locality: Southern Alps

Distribution: New Zealand

Host: from recent glacial outwash in a braided river bed

Momorangia binaloudensis Noei et Saboori

Momorangia binaloudensis Noei & Saboori, 2015: 790

Type locality: Khorasan Razavi province, Binaloud Mountain, Shirbad

Distribution: Iran

Host: *Apamea impedita* (Christoph) (Lepidoptera: Noctuidae)

Momorangia chambersi Clark

Momorangia chambersi Clark, 2014: 186

Type locality: Southern Alps

Distribution: New Zealand

Host: from recent glacial outwash in a braided river bed

Neomomorangia Fain et Santiago-Blay, 1993 – full genus status (Clark, 2014)

Abrolophinae Witte, 1995

Abrolophus aitapensis (Southcott, 1948) – Guadeloupe (Haitlinger, 2011b); Lombok (Haitlinger, 2011: 48)

Abrolophus alfalfus Kamran (larval)

Abrolophus alfalfus Kamran, 2009: 127

Type locality: Punjab

Distribution: Pakistan

Abrolophus angustum (Evans, 1953)

Formerly *Balaustium angustum,* transfered in *Abrolophus* by Mąkol & Wohltmann, 2013: 16

Abrolophus anzelmi Haitlinger et Łupicki (larval)

Abrolophus anzelmi Haitlinger & Łupicki, 2013: 682

Type locality: Sicily

Distribution: Sicily

Abrolophus artemisiae (Schrank, 1803) – Finland (Gabryś, Roland, Mąkol & Lehtinen, 2009)

Abrolophus balkanicus Haitlinger et Šundić

Abrolophus balkanicus Haitlinger & Šundić, 2015: 1019

Type locality:

Distribution: Montenegro

Abrolophus bipilum (Meyer et Ryke, 1959)

Formerly *Balaustium bipilum,* transferred in *Abrolophus* by Mąkol & Wohltmann, 2013: 16

Abrolophus bohadani Kamran (larval)

Abrolophus bohadani Kamran, 2009: 135

Type locality: Punjab

Distribution: Pakistan

Abrolophus faisalabadensis Kamran

Abrolophus faisalabadensis Kamran, 2009: 136

Type locality: Punjab

Distribution: Pakistan

Abrolophus hieronimi Haitlinger et Łupicki

Abrolophus hieronimi Haitlinger & Łupicki, 2013: 42; Mąkol & Wohltmann, 2013: 16

Type locality: San Martin nr. Palermo, Sicily

Distribution: Italy (Sicily)

Abrolophus kazimierae (Haitlinger, 1986) – Austria, Italy (Haitlinger, 2009a)(new comb.), Montenegro (Haitlinger & Šundić, 2015)

Abrolophus khanjanii (Haitlinger et Saboori, 1996) – Pakistan (Kamran, 2009)

Abrolophus kotorensis (Haitlinger, 2007) – Albania, Montenegro, Sicily (Haitlinger, 2012) = *Abrolophus silesiacus* (Haitlinger, 1986) = *Abrolophus norvegicus* (Thor, 1900)

Abrolophus montenegrinus Saboori, Šundić et Pešić

Abrolophus montenegrinus Saboori, Šundić & Pešić, 2012: 54

Type locality: bank of Krupac Lake, Nikšić

Distribution: Montenegro

Host: off host on grasses

Abrolophus norvegicus (Thor, 1900) – Neotype from N. Germany (Wohltmann & Mąkol, 2012)

Syn. *Hauptmannia silesiacus* Haitlinger, 1986: 189; Type locality: Wrocław – Swojec, Poland. Syn. by Wohltmann & Mąkol (2012).

Syn.*Hauptmannia amilberti* Haitlinger, 2010b: 5 (Type locality: Altnyaka n. Kemer; 7 km N of Cavus Koy, 11 km N Olympus; Kemer, Turkey)

Syn. *Hauptmannia dagmarae* Haitlinger, 2012: 42; Type locality: Lago di Pian del Leone (Sicily), from herbaceous plants and from larva of undet. Hemiptera. Syn. by Wohltmann & Mąkol (2012).

Syn. *Hauptmannia striata* Saboori, Šundić & Pešić, 2011: 64; Type locality: Vranjske Njive, bank of Zeta River, Podgorica (Montenegro). Syn. by Wohltmann & Mąkol (2012).

Syn. *Abrolophus neobrevicollis* Zhang et Goldarazena, 1996: 127; Type locality: Pitillas, Navarra, Spain. Syn. by Wohltmann & Mąkol (2012).

Supplement to distribution: Belgium (Haitlinger, 2008), Romania (Haitlinger, 2009d), Estonia, Latvia (Haitlinger, 2010), Sicily (Haitlinger & Łupicki, 2015b), Montenegro (Saboori, Šundić, Pešić & Hakimitabar, 2011, sub *Hauptmannia striata*).

Abrolophus nymindegabicus Haitlinger
Abrolophus nymindegabicus Haitlinger, 2008c: 53
Type locality: Denmark, Nymindegab
Distribution: Denmark, Sweden

Abrolophus petanovicae Saboori, Šundić et Pešić
Abrolophus petanovicae Saboori, Šundić & Pešić, 2012: 57; Haitlinger & Šundić, 2015: 584
Type locality: Skadar Lake, Murići (Montenegro)
Distribution: Montenegro, Serbia
Host: on grasses .

Abrolophus pyrillus Kamran (larval)
Abrolophus pyrillus Kamran, 2009: 144
Type locality: Punjab
Distribution: Pakistan
Abrolophus quisquiliarus (Hermann, 1804) – Serbia (Haitlinger, 2012); Finland (Gabryś et al., 2009)

Abrolophus quisquiliarus kiejstuti (Haitlinger, 2007) – Romania (Haitlinger, 2009d)

Abrolophus stanislavae (Haitlinger, 1986) – Serbia (Haitlinger, 2012)(comb. in Mąkol & Wohltmann, 2013: 16)

Abrolophus thripsus Kamran (larval)
Abrolophus thripsus Kamran, 2009: 151
Type locality: Punjab
Distribution: Pakistan

Abrolophus vignae (Meyer et Ryke, 1959)(for *Balaustium vignae*, see Mąkol & Wohltmann, 2013: 16)

Abrolophus wratislaviensis (Haitlinger, 1986) – Austria, Bulgaria, Estonia, Italy, Latvia, Romania (Haitlinger, 2009a, 2009d, 2010a); Montenegro (Haitlinger & Šundić, 2015)

Charletonia bahaensis Kamran et Alatawi (larval)
Charletonia bahaensis Kamran & Alatawi, 2014: 85
Type locality: Saudi Arabia
Distribution: Saudi Arabia
Charletonia baluchestanica Tashakor et Hakimitabar (larval)
Charletonia baluchestanica Tashakor & Hakimitabar, 2015: 198
Type locality: Behshahr City, Ghalehpayan village
Distribution: Iran
Host: *Ochrilidia* sp. (Orthoptera: Acrididae)

Charletonia behbahanensis Haitlinger et Saboori (larval)
Charletonia behbahanensis Haitlinger & Saboori, 2008: 74
Type locality: Behbahan
Distribution: Iran
Host: *Dociostaurus maroccanus* (Orthoptera: Acrididae)

Charletonia behshahriensis Hakimitabar et Saboori (larval)
Charletonia behshahriensis Hakimitabar & Saboori, 2014: 295
Type locality: Behshahr City, Ghalehpayan village
Distribution: Iran
Host: *Tettigonia* sp. (Orthoptera: Tettigoniidae)

Charletonia bojnordensis Haitlinger et Saboori (larval)
Charletonia bojnordensis Haitlinger & Saboori, 2008: 77
Type locality: Bojnord
Distribution: Iran
Host: indet. (Coleoptera: Buprestidae)

Charletonia bucephalia Beron, 1975 – Montenegro (Šundić & Pajović, 2013, redescription)
Charletonia cameroonensis Haitlinger et Kekeunou (larval)
Charletonia cameroonensis Haitlinger et Kekeunou, in Haitlinger, Kekeunou & Łupicki, 2014: 40
Type locality: Cameroon,
Distribution: Cameroon
Host: *Zonocerus variegatus* (Orthoptera: Pyrgomorphidae)

Charletonia cardinalis (Pallas, 1772) – Latvia, Lithuania (Haitlinger, 2010a), Serbia (Haitlinger, 2012)

Charletonia domawiti Haitlinger, 2004 – Costa Rica (Mayoral & Barranco, 2011a), French Guiana (Mayoral & Barranco, 2011b)

Charletonia elbasani Šundić, Haitlinger et Milošević (larval)
Charletonia elbasani Šundić, Haitlinger & Milošević, 2017: 564
Type locality: Elbasan
Distribution: Albania
Host: from herbaceous plants

Charletonia farajii Noei, Saboori et Hajizadeh (larval)
Charletonia farajii Noei, Saboori & Hajizadeh, 2015: 442
Type locality: Lowshan, Rudbar, Rostamabad cities, Guilan Province
Distribution: Iran
Host: Orthoptera indet.

Charletonia gabini (Haitlinger, 2004) – Kenya (Clark, 2014, for *Momorangia gabini* Haitlinger)

Charletonia jolantae Haitlinger, 1986 = *Ch. volzi* (Oudemans, 1910)(Haitlinger, 2007c)

Charletonia kosensis Haitlinger (larval)
Charletonia kosensis Haitlinger, 2016: 1010
Type locality: Kos
Distribution: Greece

Charletonia kovalamensis Haitlinger (larval)
Charletonia kovalamensis Haitlinger, 2007c: 76
Type locality: India, Kovalam; Sri Lanka, Mount Lavinia
Distribution: India, Nepal, Sri Lanka
Host: Orthoptera indet.

Charletonia krendowskii (Feider, 1954) – Italy, Macedonia (Haitlinger, 2009a), Albania (Haitlinger & Šundić, 2015)

Charletonia lankensis Southcott, 1988 from India (Haitlinger, 2007c) and from Sri Lanka (= *Ch. keralicus* Ramaraju & Mohanasundaram, 1998)

Charletonia postojnensis Haitlinger (larval)
Charletonia postojnensis Haitlinger, 2011: 28
Type locality: Postojna
Distribution: Slovenia

Charletonia ramoni Haitlinger (larval)
Charletonia ramoni Haitlinger, 2007: 78
Type locality: Nepal
Distribution: Nepal

Charletonia salazari Mayoral et Barranco
Charletonia salazari Mayoral & Barranco, 2011: 223
Type locality: Colonia Palmareña, San Ramón, Alajuela
Distribution: Costa Rica
Host: *Scopiorinus mucronatus* (Orthoptera, Tettigoniidae, Pseudophyllinae).

Charletonia shahriari Saboori, Azimi et Shirdel (larval)
Charletonia shahriari Saboori, Azimi & Shirdel, 2012: 34
Type locality: Dizaj Olia village (38º 8.043´ N, 46º 13.041´ E, ~1470 m a.s.l.), Tabriz, East Azarbaijan province.
Distribution: Iran
Host: undetermined cercopid (Homoptera: Cercopidae)

Charletonia shiroyama Yaita, Kato et Toriyama, 1961 – Laos, Thailand (Haitlinger, 2007c); Java (Haitlinger, 2011)
Syn.: ***Charletonia sureshi*** (Ramaraju et Mohanasundaram, 1998) = *Ch. volzi* (Oudemans, 1910)(Haitlinger, 2007c)

Charletonia stekolnikovi Hakimitabar et Saboori (larval)
Charletonia stekolnikovi Hakimitabar & Saboori, 2011: 40
Type locality: Taleghan city, 214 m, Tehran province
Distribution: Iran
Host: from herbaceous plants

Charletonia talebii Sedghi, Saboori et Hakimitabar (larval)
Charletonia talebii Sedghi, Saboori & Hakimitabar, 2010: 335
Type locality: Jahrom
Distribution: Iran
Host: undet. Cicadellidae (Heteroptera)

Charletonia terianae Hakimitabar, Saboori et Seiedy
Charletonia terianae Hakimitabar, Saboori & Seiedy, 2013: 164
Type locality: Tehran, Karaj

Distribution: Iran

Host: undet. Phalangiidae (Opiliones), undet. Cheliferidae (Pseudoscorpiones), Araneae

Charletonia villingensis Haitlinger (larval)

Charletonia villingensis HAITLINGER, 2007c: 73

Type locality: Villingi

Distribution: Maledives

Host: from herbaceous plants

Charletonia volzi (Oudemans, 1910) – Laos, Malaysia, Thailand (HAITLINGER, 2007c)

[***Grandjeanella bella*** Zhang, 1996 is considered part of genus *Nagoricanella* Haitlinger by SABOORI et al. (2016)

Grandjeanella londaensis Haitlinger

Grandjeanella londaensis HAITLINGER, 2011: 50

Type locality: Londa n. Rantepao

Distribution: Indonesia

Host: from herbaceous plants

Grandjeanella macfarlanei Clark

Grandjeanella macfarlanei CLARK, 2014: 191

Type locality: Southern Alps

Distribution: New Zealand

Host: from recent glacial outwash in a braided river bed

Grandjeanella multisetosa Zhang et Goldarazena, 1996 – Hungary,

Romania, Macedonia, San Marino (HAITLINGER, 2009a, 2009d, 2012)

Genus ***Marantelophus*** Haitlinger

Marantelophus HAITLINGER, 2011: 50

Type species: *Marantelophus alaperti* Haitlinger, 2011

Marantelophus ainae (Haitlinger, 2002) – transferred from *Grandjeanella* by HAITLINGER, 2011 (Mallorca)

Marantelophus alaperti Haitlinger

Marantelophus alaperti HAITLINGER, 2011: 50

Type locality: Sulawesi, Marante n. Rantepao

Distribution: Indonesia (Sulawesi)

Marantelophus bella (Zhang, 1996) – transferred from *Grandjeanella* by HAITLINGER, 2011 (Iran and Turkey); Turkey, ex *Parlatoria oleae* (Homoptera: Diaspididae)(SABOORI & COBANOGLU, 2010), transferred to *Nagoricanella* by SABOORI et al. (2016)

Marantelophus dubifurcatus Xu, Yi et Jin

Marantelophus dubifurcatus XU, YI & JIN, 2017:

Type locality: China

Distribution: China

Hosts: *Cacopsyllus* sp. (Homoptera: Psyllidae), Psocoptera

Marantelophus emanueli (Haitlinger)

Grandjeanella emanueli HAITLINGER, 2010b: 56

Marantelophus emanueli (Haitlinger): KAMRAN & ALATAWI, 2015:

Type locality: Elmali, 1200 m

Distribution: Turkey

Host: from herbaceous plants

Marantelophus haitlingeri (Goldarazena et Zhang, 1997) – transferred from *Grandjeanella* by HAITLINGER, 2011 (Spain)

Marantelophus kamalii (Saboori et Atamehr, 2000) – transferred from *Grandjeanella* by HAITLINGER, 2011 (Iran). Montenegro (HAITLINGER & ŠUNDIĆ, 2014: 40)

Marantelophus multisetosa (Zhang et Goldarazena, 1996) – transferred from *Grandjeanella* by HAITLINGER, 2011 (Croatia, Greece, Hungary, Romania, San Marino, Spain, Turkey and Ukraine)

Marantelophus ostovani (Haitlinger et Saboori, 1996) – transferred from *Grandjeanella* by HAITLINGER, 2011 (Iran)

Marantelophus rudaensis (Haitlinger)

Hauptmannia rudaensis HAITLINGER, 1986: 182

Rudaemania rudaensis Haitlinger: HAITLINGER, 2000: 386

Abrolophus rudaensis (Haitlinger): MĄKOL & WOHLTMANN, 2012:

Marantelophus rudaensis (Haitlinger, 1986) – Montenegro (HAITLINGER & ŠUNDIĆ, 2014: 40)

Marantelophus sanandajensis Hakimitabar et Saboori

Marantelophus sanandajensis Hakimitabar et Saboori, in: HAKIMITABAR, GHOBARI & SABOORI, 2015: 226

Type locality: Koushk Bala village, Chalous road, Karaj

Distribution: Iran

Host: from unidentified Thysanoptera and Aphididae (Homoptera)

Genus ***Nagoricanella*** Haitlinger (larval)

Nagoricanella Haitlinger, 2009c: 40
Type species: *Nagoricanella egoni* Haitlinger, 2009

Nagoricanella arabellae Haitlinger (larval)
Nagoricanella arabellae: HAITLINGER, 2009c: 41
Type locality: 3 km north of Espargos, Sal Island
Distribution: the Republic of Cape Verde
Host: from herbaceous plants

Nagoricanella bella (Zhang,1996) – combination created by SABOORI et al. (2016) from *Grandjeanella bella* Zhang, 1996 = *Marantelophus bella* (Zhang)

Nagoricanella egoni Haitlinger (larval)
Nagoricanella egoni HAITLINGER, 2009c: 46
Type locality: Staro Nagoričane n. Kumanovo
Distribution: the Republic of Cape Verde
Host: from herbaceous plants

Nagoricanella salehi Kamran et Alatawi (larval)
Nagoricanella salehi KAMRAN & ALATAWI, 2015: 196
Type locality: Saudi Arabia
Distribution: Saudi Arabia

Genus ***Pukakia*** Clark
Pukakia CLARK, 2014: 198
Type species: *Pukakia aoraki* Clark, 2014

Pukakia aoraki Clark
Pukakia aoraki CLARK, 2014: 198
Type locality: Southern Alps
Distribution: New Zealand
Host: from recent glacial outwash in a braided river bed

Balaustiinae
Genus ***Balaustium*** von Heyden, 1826
= *Guatustium* Haitlinger, 2000 – synonymized by MĄKOL & WOHLTMANN, 2013
= *Palenqustium* Haitlinger, 2000 – synonymized by FUENTES QUINTERO et al., 2014

Balaustium biljanae (Haitlinger, 2000)
Formerly *Guatustium biljanae,* synonymized by MĄKOL & WOHLTMANN, 2013: 17
Balaustium biscutalae Mayoral et Barranco (larval)
Balaustium biscutalae MAYORAL & BARRANCO, 2009: 1161
Type locality: Amoladeras. P.N. Cabo de Gata Nijar. T.M. de Nijar, Almeria
Distribution: Spain

Balaustium hernandezi Mąkol, Arijs et Wäckers
Balaustium hernandezi Mąkol, Arijs & Wäckers, 2012: 2
Type locality: Spain
Distribution: Spain

Balaustium kacperi Haitlinger, 1996 – Latvia (HAITLINGER, 2010a)

Balaustium leanderi (HAITLINGER, 2000) – formerly *Palenqustium* Haitlinger, 2000 – synonymized by FUENTES QUINTERO et al., 2014, 2015

Balaustium nikae Haitlinger, 1996 – Bulgaria (HAITLINGER, 2009d), Italy (HAITLINGER, 2009a), Serbia (HAITLINGER, 2012)

Balaustium yousifi Kamran et Alatawi (larval)
Balaustium yousifi KAMRAN & ALATAWI, 2014a: 90
Type locality: 5 km Taif Road, Baha
Distribution: Saudi Arabia

Genus ***Madinahustium*** Kamran et Alatawi
Madinahustium Kamran & Alatawi, 2016: 79
Type species: *Madinahustium acaiaum* Kamran & Alatawi, 2016

Madinahustium acaciaum Kamran et Alatawi
Madinahustium acaciaum Kamran & Alatawi, 2016: 79
Type locality: Saudi Arabia
Distribution: Saudi Arabia

Moldoustium haitlingeri Noei, Saboori et Šundić (larval)
Moldoustium haitlingeri NOEI, SABOORI & ŠUNDIĆ, 2013: 264
Type locality: Loshan city, 1339 m, Guilan Province; paratypes from Montenegro, Plavnica, nr. Shkodar Lake
Distribution: Iran, Montenegro
Host: soil

Genus ***Monteustium*** Haitlinger et Šundić
Monteustium Haitlinger & Šundić, 2015:
Type species: *Monteustium* Haitlinger & Šundić, 2015

Monteustium marezensis Haitlinger et Šundić

Monteustium marezensis Haitlinger & Šundić, 2015: 1108
Type locality: Montenegro
Distribution: Montenegro

Pollux jhangensis Kamran
Pollux jhangensis Kamran, 2009: 108
Type locality: Punjab
Distribution: Pakistan

Pollux kovalamicus Haitlinger, 2002 – Pakistan (Kamran, 2009), Indonesia (Haitlinger, 2010)
Syn. *Pollux walii* Kamran, Afzal & Raza, 2010
Type locality: Punjab
Distribution: Pakistan

Pollux okaraensis Kamran
Pollux okaraensis Kamran, 2009: 100
Type locality: Punjab,
Distribution: Pakistan

Pollux punctatus Kamran
Pollux punctatus Kamran, 2009: 115
Type locality: Punjab
Distribution: Pakistan

Pollux workandae Southcott, 1961 – Pakistan (Kamran & Bashir, 2013)

Fossil Calyptostomatoidea and Erythraeoidea

Calyptostomatidae
Calyptostoma katyae Konikiewicz, Wohltmann et Mąkol
Calyptostoma katyae Konikiewicz, Wohltmann & Mąkol, 2016: 337
Type locality: Baltic Amber

Smarididae

Fessonia grabenhorsti Bartel, Konikiewicz, Mąkol, Wohltmann et Dunlop
Fessonia grabenhorsti Bartel, Konikiewicz, Mąkol, Wohltmann & Dunlop, 2015: 653
Type locality: Baltic and Bitterfeld Amber

Fessonia groehni Bartel, Konikiewicz, Mąkol, Wohltmann et Dunlop
Fessonia groehni Bartel, Konikiewicz, Mąkol, Wohltmann & Dunlop, 2015: 655
Type locality: Baltic and Bitterfeld Amber

Fessonia wunderlichi Bartel, Konikiewicz, Mąkol, Wohltmann et Dunlop
Fessonia wunderlichi Bartel, Konikiewicz, Mąkol, Wohltmann & Dunlop, 2015: 649
Type locality: Baltic and Bitterfeld Amber
Erythraeidae

Genus ***Pararainbowia*** Dunlop
Pararainbowia Dunlop, 2007: 96
Type species: *Pararainbowia martilli* Dunlop, 2007

Pararainbowia martilli Dunlop
Pararainbowia martilli Dunlop, 2007: 96 – Brazil, from the Early Cretaceous (Aptian) Crato Formation from Ceará Stat.

Distribution of Calyptostomatoidea and Erythraeoidea (suppl.)

EUROPE

Albania (Haitlinger, 2012a; Haitlinger & Šundić, 2014, 2015; Šundić, Haitlinger & Milošević, 2016) – *Erythraeus (Erythraeus) albanicus, Abrolophus kotorensis, Leptus (L.) josifovi, Charletonia elbasani, Ch. krendowskyi*

Austria (Haitlinger, 2007d, 2009a) – *Abrolophus pseudolongicollis, A. kazimierae, A. wratislaviensis, Balaustium nikae, Erythraeus (E.) gertrudae, Leptus (L.) mariae*

Belgium (Haitlinger, 2008c) – *Abrolophus norvegicus*

Bulgaria (Haitlinger, 2009d) – *Balaustium nikae, Charletonia cardinalis, Erythraeus (E.) smolyanensis, E. (Zaracarus) budapestensis, Abrolophus kazimierae, A. wratislaviensis*

Crimea (Saboori, Khaustov, Hakimitabar & Hajiqanbar, 2009) – *Makolia crimeaensis*

Denmark (Haitlinger, 2008c) – *Abrolophus nymindegabicus*

Estonia (Haitlinger, 2010a) – *Abrolophus norvegicus, A. wratislaviensis, Leptus (L.) mariae, L. (L.) molochinus, L. (L.) miromiri, Erythraeus (E.) kuyperi*

Finland (Gabryś, Roland, Mąkol & Lehtinen, 2009) – **Smarididae**: *Hirstiosoma latreillei*; **Erythraeidae**: *Abrolophus artemisiae, A. miniatus, A. norvegicus, A. brevicollis, A. quisquiliarus, Charletonia cardinalis, Curteria episcopalis, Erythraeus cinereus, Kamertonia polonica, Leptus longipilis, L. rubricatus, L.molochinus (= L. ignotus)*

Germany (Wohltmann, 2010, Wohltmann & Mąkol, 2012) – *Abrolophus norvegicus* (neotype), *Phanolophus oedipodarum*

Greece (Antonatos & Emmanouel, 2014) – Erythraeidae

Hungary (Haitlinger, 2007d, 2009a) – *Grandjeanella multisetosa*

Italy (Haitlinger, 2007d, 2009a, 2012) – *Abrolophus mirabelae, A. kazimierae, A. wratislaviensis, Balaustium nikae, Charletonia austiensis, Ch. krendowskyi, Ch. berlesiana, Ch. cardinalis, Erythraeus (E.) malwinae, Leptus (L.) phalangii (*syn. *L. beroni), L.(L.) molochinus, L.(L.) slivovi, Marantelophus multisetosa*

Sicily (Haitlinger, 2012b, Haitlinger & Šundić, 2014b, 2015, Haitlinger & Łupicki, 2013a, b, 2015) – **Calyptostomatidae**: *Calyptostoma velutinum*; **Erythraeidae**: *Abrolophus anzelmi, A. norvegicus (=Hauptmannia dagmarae), Leptus hammameticus, L. chiusicus, Erythraeus (Zaracarus) adrianicus, E. (Z.) monrealicus*

Latvia (Haitlinger, 2010a) – *Abrolophus norvegicus, A. wratislaviensis, Charletonia cardinalis, Erythraeus (E.) kuyperi, Leptus (L.) mariae, Balaustium kacperi*

Lituania (Haitlinger, 2010a) – *Charletonia cardinalis, Erythraeus (E.) kuyperi*

Luxemburg (Haitlinger, 2008c) – *Leptus (L.) trimaculatus*

Macedonia (Haitlinger, 2009d, 2012a) – *Charletonia krendowskyi, Erythraeus (E.) cinereus (= jowitae), Leptus (L.) mariae, L. (L.)molochinus* (= *ignotus*)

Montenegro (Saboori, Pešić & Hakimitabar, 2008; Saboori et al., 2011, 2012; Haitlinger, 2012a; Noei, Saboori et al., 2013; Šundić & Pajović, 2012, 2013; Šundić, 2014; Šundić & Haitlinger, 2015; Haitlinger & Šundić, 2014a, 2015a, 2015c, 2016, 2017) – Smarididae: *Hirstiosoma amfilohijei*; Erythraeidae: *Abrolophus montenegrinus, A. balkanicus, A. norvegicus* (=*Hauptmannia striata*), *A. kotorensis, A. petanovicae, A. wratislaviensis, Balaustium nikae, Charletonia bucephalia, Erythraeus (Z.) aydinicus, E.(E.) budapestensis, E. (Z.)* cf. *ueckermanni, E. (Z.) tuzicus, E.(E.) ankaraicus, E.(E.) smolyanensis, E.(E.) southcotti, Leptus (L.) josifovi, L. (L.) biljanae, L.(L.) eslamizadehi, L.(L.) molochinus, Italustium eframi, Marantelophus kamalii, M. rudaensis, Moldoustium haitlingeri, Monteustium marezensis*

Poland (Gabryś & Mąkol, 1997; Klosińska, Felska, Łaydanowicz & Mąkol, 2009) – *Abrolophus norvegicus*

Portugal

Azorean Islands (McNeil & Treat, 1992; Lorenzo – Carballa et al., 2011) – *Leptus killingtoni*

Romania (Hatlinger, 2009d) – *Abrolophus quisquiliaris kiejstuti, A. norvegicus, Balaustium nikae, Erythraeus (E.) jowitae, E.(E.) monikae, Grandjeanella multisetosa, Abrolophus kazimierae, A. wratislaviensis, Leptus (L.) mariae*

San Marino (Haitlinger, 2007d, 2009a) – *Balaustium nikae, Grandjeanella multisetosa, Leptus (L.) molochinus (= ignotus)*

Serbia (Haitlinger, 2012; Šundić, 2014; Šundić, Haitlinger, Petanović, Jovicić & Hakimitabar, 2015; Haitlinger & Šundić, 2015) – **Calyptostomatidae**: *Calyptostoma velutinum*; **Erythraeidae**: *Abrolophus petanovicae, A. quisquiliarus, A. stanislavae, Balaustium nikae, Charletonia cardinalis, Erythraeus (Zaracarus) budapestensis*

Slovenia (Haitlinger, 2011b) – *Charletonia postojnensis, Abrolophus podoresensis*

Spain (Mayoral & Barranco, 2008, 2009, 2010, 2017; Wohltmann, 2010; Mąkol, Arijs & Wäckers, 2012) – *Erythraeus (Zaracarus) ruizporterae, Forania sendrai, Balaustium biscutalae, B. hernandezi, Phanolophus oedipodarum*; Smarididae: *Sphaerotarsus baenai*

Canary Islands (Haitlinger, 2009b) – *Leptus (L.) canaricus L.(L.) edwini, L.(L.) maxorata, L.(L.) tenerificus*

Sweden (Haitlinger, 2008b, 2008c) – *Erythraeus (E.) jowitae, Leptus trimaculatus, Abrolophus nymindegabicus*

Turkey (entire) (Haitlinger, 2010b; Saboori & Cobanoglu, 2010) – *Erythraeus (E.) adanaensis, E.(E.) elmalicus, E.(E.) hilariae, E. (Zaracarus) budapestensis, E.(Z.) passidonicus, Nagoricanella bella, Marantelophus emanueli, Abrolophus amilberti, Zhangiella* (= *Curteria*); *Zhangiella duzgunesae* Saboori et al., 2007 = *Curteria duzgunesae* (syn. by Saboori et al., 2009)

AFRICA

Cameroon (Haitlinger, Kekeunou & Łupicki, 2014) – *Charletonia cameroonensis, Ch. justynae*

Cape Verde (Haitlinger, 2009a, 2009c) – *Erythraeus (E.) capeverdensis, Leptus (L.) korneli, L. (L.) salicis*

Kenya (Clark, 2014) – *Charletonia gabini,* for *Momorangia gabini* Haitlinger, 2004

ASIA

Cambodia (Haitlinger & Šundić, 2015) – **Calyptostomatidae:** *Calyptostoma giuliae*

China (Li & Fan, 1997; Zhang, 2010; Xu, Yi & Jin, 2017) – **Smarididae**: *Fessonia papillosa*; **Erythraeidae:** *Marantelophus dubifurcatus*

Cyprus (Haitlinger & Łupicki, 2011) – *Erythraeus* (*Zaracarus*) *arminouensis*

India (Haitlinger, 2007c; Agarwal, Dhiman & Agarwal, 2009) – *Charletonia kovalamensis, Ch. lankensis, Leptus* sp.

Indonesia (Haitlinger, 2010c, 2011c; Haitlinger & Šundić, 2015) – **Calyptostomatidae**: *Calyptostoma marantica;* **Erythraeidae**: *Leptus (L.) sulawesicus, Pollux kovalamicus*

Iran (Khanjani, Ueckermann & Ul-Hassan, 2007; Khanjani, Mirmoayedi, Nahad & Fayaz, 2010; Sedghi, Saboori, Akrami & Hakimitabar, 2010; Sedghi, Ravan, etc., 2010; Khanjani, Raisi & Izadi (2011); Saboori, 2011; Hakimitabar & Saboori, 2011; Ahmadi, Hajiqanbar & Saboori, 2012; Saboori, Azimi & Shirdel, 2012; Azimi, Saboori & Shirdel, 2011; Saboori, Soukhtsaraii et al., 2012; Khanjani, Mirmoayedi, Fayaz & Sharifian, 2012; Hakimitabar, Saboori & Seiedy, 2013; Hakimitabar, Ghobari & Saboori, 2013; Noei, Saboori et al., 2013; Noei, Saboori & Hajizadeh, 2013; Hakimitabar, Saboori, Samanipour & Jalalizand, 2014; Mahmoudi et al., 2014; Noei & Saboori, 2015; Khademi, Saboori, Ahadiyat & Hakimitabar, 2015; Haitlinger, Mehrnejad & Sundić, 2016) – **Calyptostomatidae**: *Calyptostoma gorganica* **Smarididae**: *Fessonia papillosa, Smaris maraghehiensis* ; **Erythraeidae**: *Eatoniana gonabadensis, Eatoniana plumipes [= Abalakeus jahromiensis], Charletonia baluchestanica, Ch. behbahanensis, Ch. behshahriensis, Ch. bojnordensis, Ch. shahriari, Ch. stekolnikovi,Ch. talebii, Ch. terianae, Collemboerythraeus vosoughae, Erythraeus (E.) adanaensis, E. (E.) chrysoperlae, E. (E.) mirabi, E. (E.) pistacicus, E. (E.) populi, Erythraeus (Zaracarus) hafezi, E. (Z.) ueckermanni (= hamedanicus), E.(Z.) coleopterus, E. (Z.) soleimanii, Iraniella moharramipouri, Leptus dilijanensis, Lasioerythraeus saboorii, Marantelophus sanandajensis, Momorangia binaloudensis, Moldoustium haitlingeri, Nagoricanella bella*

Laos (Haitlinger, 2007c) – *Charletonia shiroyama, Ch. volzi*

Malaysia (Haitlinger, 2007c) – *Charletonia volzi*

Maledives (Haitlinger, 2007c) – *Charletonia villingensis*

Nepal (Haitlinger, 2009e) – *Charletonia ramoni, Ch. kovalamensis, Leptus (L.) astrubali, L.(L.) katticus*

Pakistan (Kamran, 2009; Kamran, Afzal, Raza, Irfanullah, Bashir & Ahmad, 2009; Kamran, Afzal, Bashir, Raza & Saeed Khan, 2009; Kamran, Afzal & Bashir, 2013; Kamran & Bashir, 2013) – *Abrolophus alfalfus, A. bohadani, A. faisalabadensis, A. khanjanii, A. pyrillus, A. thripsus, Erythraeus (E.) layyahensis, E.(E.) loomerus, E.(E.) shojaii, Erythraeus (Zaracarus) longipedus, E. (Z.) perpusillus, Lasioerythraeus setarius, Leptus aphidius, L. eslamizadehi, L. hospeticus, L. lugenus, L. nearcticus, L. multanensis, L. pakistanensis, Pollux jhangensis, P. kovalamicus (= P. walli), P. okaraensis, P. punctatus, P. workandae*

Saudi Arabia (Kamran & Alatawi, 2014, 2015, 2016) – *Abrolophus rudaensis, Balaustium yousifi, Charletonia bahaensis, Erythraeus (E.) uhadi, E. (Z.) lancifer, Madinahustium acaciaum, Marantelophus emanueli, Nagoricanella salehi*

Sri Lanka (Haitlinger, 2007c) – *Charletonia kovalamensis, Ch. ramoni*

Thailand (Haitlinger, 2007c) – *Charletonia shiroyama, Ch. volzi*

Vietnam (Mąkol et al., 2012, Haitlinger, 2013) – *Leptus (L.) kattikus, L. holgeri*

Yemen (Wohltmann, 2010) – *Phanolophus oedipodiarum*

NORTH AMERICA

USA (Šundić, Haitlinger, Michaud & Colares, 2015) – *Erythraeus (Erythraeus) aphidivorous*

Alaska (Mąkol, 2010)

SOUTH and CENTRAL AMERICA

Brazil (Dunlop, 2007; Pereira, Fadini, Pikart, Zanuncio & Serrão, 2012; Clark, 2014; Salvatierra & Almeida, 2017; Haitlinger, Šundić & Pompermaier, 2017; Costa, Klompen, Dos Santos, Favretto & Pepato, 2017) – *Leptus brasilicus, L. planaltensis, Leptus* sp., *Callidosoma selmae, Neomomorangia asphaerae.* Fossil: *Pararainbowia martilli*

Colombia (Muñoz et al., 2009, Muñoz-Cárdenas et al., 2014, Fuentes-Quintero, 2015) – *Balaustium leanderi*

Costa Rica (Mayoral & Barranco, 2011a) – *Charletonia domawiti, Ch. salazari, Leptus nikanori*

French Guiana (Mayoral & Barranco, 2011b) – *Charletonia domawiti, Leptus multisolenidiae, L. nikanori*

Guadeloupe (Haitlinger, 2011a) – *Abrolophus aitapensis, Leptus cabareticus*

Trinidad (Townsend et al., 2008) – *Leptus* sp.

Venezuela (Haitlinger, 2008b) – *Lasioerythraeus cardonensis*

OCEANIA

Papua New Guinea (Beron, in prep.) – *Caeculisoma (Papuacaeculisoma) chapmani, C.(P.) novaeirlandiae, C.(C.) plantacionis, C.(C.) darwiniense*

New Zealand (Clark, 2013, 2014) – *Erythrites otamahua, Callidosoma susanae, Momorangia cham-*

bersi, Grandjeanella macfarlanei, Pukakia aoraki

Hosts
Arachnida
Opiliones
Fam. Cranaidae – Erythraeidae
Fam. Manaosbiidae – Erythraeidae
Fam. Phalangiidae – *Charletonia terianae*
Pseudoscorpiones
Fam. Cheliferidae – *Charletonia terianae*
Araneae
Mygalomorphae
Fam. Actinopodidae – *Leptus* sp.
Araneae indet. – *Charletonia terianae*
Insecta
Collembola
Fam. Sminthuridae undet. – *Collemboerythraeus vosoughae*
Orthoptera
Fam. Acrididae
Abracris flavolineata – Charletonia domawiti
Dociostaurus cf. *tartarus – Eatoniana gonabadensis*
Dociostaurus maroccanus – Charletonia behbahanensis
Episomacris gruneri – Leptus multisolenidiae
Ochrilidia sp. – *Chartetonia baluchestanica*
Schistocerca nitens – Charletonia domawiti
Fam. Proscopiidae
Pseudoproscopia scabra – Leptus nikanori
Fam. Tettigoniidae
Anaulacomera sp. – *Leptus nikanori*
Neoconocephalus triops – Charletonia domawiti
Scopiorinus mucronatus – Charletonia salazari
Tettigonia sp. – *Charletonia behshahriensis*
Fam. Pyrgomorphidae
Zonocerus variegatus – Charletonia cameroonensis, Ch. justynae
Orthoptera indet.
Leptus (L.) salicus, L.(L.) biljanae
Mecoptera
Fam. Apteropanorpidae
Apteropanorpa tasmanica – Leptus agrotis
Odonata
Fam. Coenagrionidae
Ischnura hastata – Leptus killingtoni
Homoptera
Fam. Aphididae
Aphis craccivora – Eatoniana gonabadensis
Aphis sp. – *Leptus pakistanensis*
A. punicae – Lasioerythraeus saboorii
Melanaphis saccari – Erythraeus (E.) aphidivorous
Aphididae undet**.** – *Marantelophus sanandajensis*
Fam. Lophopidae
Pyrilla perpusilla – Erythraeus (Zaracarus) perpusillus
Fam. Psyllidae
Agonoscena pistaciae – Erythraeus (E.) pistacicus
Cacopsylla sp. –*Marantelophus dubifurcatus*
Fam. Cicadidae
Undet. – *Erythraeus (Zaracarus) hafezi*
Fam. Cicadellidae
Undet. – *Charletonia talebii*
Fam. Diaspididae
Parlatoria oleae – Nagoricanella bella
Fam. Cercopidae
Undet. – *Charletonia shahriari*
Heteroptera
Fam. Pyrrhocoridae
Pyrrhocoris apterus – Erythraeus (Zaracarus) ueckermanni (= *hamedanicus*)
Fam. Coreidae
Cletus signatus – Leptus sp.
Fam. Nabidae
Undet. – *Erythraeus (Zaracarus) hafezi*
Fam. Pentatomidae
Undet. – *Eatoniana plumipes* (= *Abalakeus jahromiensis*)
Fam. Miridae
Farsiana pistaciae – Erythraeus (E.) pistacicus
Thysanoptera undet. – *Marantelophus sanandajensis*
Neuroptera
Fam. Chrysopidae
Chrysoperla kolthoffi – Erythraeus (E.) chrysoperlae, Erythraeus (Zaracarus) soleimanii
Undet. – *Erythraeus (Zaracarus) hafezi*
Hymenoptera
Fam. Formicidae
Lasius sp. – *Makolia crimeaensis*
Tapinoma sp. – *Forania sendrai*
Lepidoptera
Fam. Noctuidae
Apamea impedita – Momorangia binaloudensis
Pseudaletia unipuncta – Leptus killingtoni
Coleoptera
Fam. Scarabaeidae
Cyphonoxia sp.– *Erythraeus (Z.) coleopterus*
Fam. Buprestidae
Undet. – *Charletonia bojnordensis*
Fam. Tenebrionidae
Eupezus rufipes – Charletonia justinae
Diptera
Fam. Tachinidae
Undet. – *Erythraeus (Zaracarus) hafezi*

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Acarorum Catalogus I – Първо допълнение (2008–2016)

Петър Берон

(Резюме)

След публикуването на първия том на Acarorum Catalogus (Beron, 2008), бяха публикувани много нови данни за надсем. Calyptostomatoidea и Erythraeoidea (Erythraeidae, Smarididae) от мен и от мнозина полски, германски, ирански, черногорски, пакистански, испански и други колеги. Бяха описани нови таксони и извършени таксономични промени, както и допълнения в географското разпространение на тези акари. Бяха добавени 10 нови рода и повече от 120 нови вида, някои видове и 7 рода отпаднаха като синоними. Вследствие на това беше актуализиран броят на родовете и видовете в семействата: един род и девет вида Calyptostomatidae, 10 рода и 56 вида Smarididae и 57 рода и повече от 850 вида Erythraeidae. Библиографията на настоящото първо допълнение на Каталога включва 166 нови и пропуснати заглавия за периода 2008-2016 (някои от тях през 2017 г.).

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Bulgarian Zoologists in Africa – results of the research and material remaining for study. Supplement to the article about Indomalayan Region (2013–2016)

Petar Beron

Abstract. Practically the participation of Bulgarian Zoologists in the exploration of African fauna started in 1962, and since 1976 many new collecting activities took place in several African countries. Bulgarian authors are identifying also African material sent by other museums. Most of the material, collected by us in Africa, is still unidentified.

Key words: Bulgarians, Zoology, Africa

Before World War II African countries have been visited by Dr I. Buresch (1927, Egypt and Sudan) and Nenko Radev in Ethiopia (1935). Nikola Deliradev spent 55 years in Ethiopia, hunting different animals.Part of the trophies have been brought to Bulgaria (the museums of Sofia and Panagyurishte).

Practically the participation of Bulgarian Zoologists in the exploration of African fauna started in 1962 – 1963 with the work of V. Golemansky in Guinea. Large collections (most of them still unidentified) have been made by me during my three years of work in Nigeria (1976 – 1979), my travels in DR Congo, Equatorial Guinea, Canary Islands, Senegal, Kenya, Uganda, Tanzania, Ethiopia, Zimbabwe, Zambia, Botswana, Egypt, Sudan, Libya, Cameroon, Morocco, the expedition of NMNH – Sofia in Mozambique (1983, with participation of V. Beshkov, M. Josifov, N. Spassov and V. Zlatarski). High mountains and caves have been also explored (P. Beron, V. Beshkov, B. Petrov and others). P. Stoev visited Tunisia in 2008. He and B. Guéorguiev published descriptions of new cave animals.

In the present paper is followed the development of Bulgarian zoological studies in Africa and are enumerated papers, written on the basis of material collected by Bulgarians or sent from foreign museums. The aim of this publication is to put together the results obtained so far and to announce the material still awaiting identification. Bulgarian contributions are modest compared to what has been done by the Zoologists from the former colonial countries, but are still more than the contributions from the other Balkan countries.

The chronology of the field work done in Africa by Bulgarian Zoologists is as follows:

1927. Iv. Buresch in Egypt and Sudan.

1935. N. Radev and N. Deliradev in Ethiopia.

1962 – 1963 and 1973. V. Golemansky in Guinea.

1976 – 1979. P. Beron in Nigeria, Togo, Cameroon, DR Congo, Equatorial Guinea, Senegal

1977. P. Beron in the Canary Isands.

1983. P. Beron, V. Beshkov, M. Josifov, N. Spassov, V. Zlatarski in Mozambique.

1983. P. Beron and V. Beshkov in Zimbabwe, Zambia, Tanzania (incl. Zanzibar).

1993. P. Beron and V. Beshkov in Kenya and Uganda.

1996. P. Beron in Libya.

1999. P. Beron in Libya.

2000. P. Beron in Sudan.

2008. P. Stoev in Tunisia.

2009. B. Georgiev in Gabon

2012. P. Beron in Morocco. In June 2012 was collected material in several areas, from Tangiers (sea level) to the top of Nort Africa (Jebel Tubkal, 4167 m), as well as in the cave of Friouato.

2013. Boyko Georgiev in Madagascar

2016. P. Beron in Kenya

2017. M. Langourov in Morocco.

Terrain work in different countries

Canary Islands. P. Beron

Morocco. P. Beron, T. Lyubomirov, M. Langourov, D. Chobanov

Guinea. V. Golemansky

Nigeria. P. Beron

Cameroon. P. Beron

Equatorial Guinea. P. Beron

Togo. P. Beron

DR Congo. P. Beron

Zambia. P. Beron, V. Beshkov

Zimbabwe. P. Beron, V. Beshkov

Tanzania. P. Beron, V. Beshkov

Uganda. P. Beron, V. Beshkov

Kenya. P. Beron, V. Beshkov, V. Sakalyan

Mozambique. P. Beron, V. Beshkov, M. Josifov, N. Spassov, V. Zlatarski

Madagascar. Boyko Georgiev

Egypt. P. Beron

Sudan. P. Beron

Libya. P. Beron

Tunisia. P. Stoev, S. Beshkov

Ethiopia. N. Radev, N. Deliradev, B. Georgiev

Senegal. P. Beron

Malawi. A. Hubancheva

The groups studied and the state of the remaining material:

Protozoa

Rhizopoda

New taxa:

(Golemanski, 1979)

Cestoda

New taxa:

(Dimitrova, Mariaux & Georgiev, 2013)

Pseudangularia gonzalezi Dimitrova, Mariaux et Georgiev, 2013

Gibsonilepis swifti Dimitrova, Mariaux et Georgiev, 2013

Crustacea

Amphipoda. The material is not yet identified.

Isopoda Oniscidea. Most of the large collections of Oniscidea, collected by P. Beron, are still not identified. A series of Isopods has been sent to the Italian colleague in Florence (S. Taiti, F. Ferrara and others), who published papers with data from Africa (Taiti & Ferrara, 1981, and others). They described new species from Nigeria (the types are in Sofia). Part of the material is still in Florence, another part remains in Sofia.

New taxa:

Microcercus beroni Taiti et Ferrara (Eubelidae) – Nigeria (Taiti & Ferrara, 1981)

Arachnida

Pseudoscorpiones. Many Pseudoscorpions from various countries still stay with us unidentified.

Opiliones. Our collection of Opilions from Africa is still to be identified.

Amblypygi. In our collection there are many specimens (not yet identified) from Africa (Tanzania)

Schizomida. In the collection of NMNH we have specimens (not yet identified) from Nigeria,

Scorpiones. The Scorpions, collected by us in Africa (P. B.) have been identified by F. Kovařik (Prague) and are published by Kovařik & Beron (2015). They belong to 15 species from Egypt, Algeria, Morocco, Tunisia, Tanzania, Zambia, Mozambique, Nigeria, and Zimbabwe.

Araneae. The bulk of the spider collection was sent to Prof. P.M. Brignoli in Italy. Unfortunately, he died before finishing the identification of the spiders sent by me from many countries. The collection is still in Italy. Meanwhile, in all visited countries have been collected new materials, most of them still in Sofia.

Deltshev (2015) identified the spiders collected by P. Beron in Moroccan Atlas up to the summit of Djebel Tubkal (2167 m). Dimitrov & Ribera (2005b) published from Morocco the new species *Pholcus vachoni*, Dimitrov & Ribera (2005b) described from the Canary Islands the new genus *Ossinissa* (Pholcidae).

New taxa

Pholcus vachoni Dimitrov et Ribera (Pholcidae) – Morocco (Dimitrov & Ribera, 2005b)

Ossinissa Dimitrov et Ribera (Pholcidae) – Canary Islands (Dimitrov & Ribera, 2005a)

Acari. As this is group of my particular interest, many mites have been collected, but the bulk of the collection is still to be identified. Only articles on Erythraeoidea have been or will be published shortly (Beron, in prep.). The members of Trombidiidae s. lato have been sent for identification to Dr J. Mąkol. Several new species of Trombiculidae from Egypt, Tunisia, Liberia, Gabon, Tanzania, DR Kongo, Namibia, Mozambique, sent by foreign museums, have been identified and described by Kolebinova (1980 b, c, 1981a, 1984a) and Kolebinova & Vercammen-Grandjean (1978).

New taxa

Caeculisoma haussa Beron (Acariformes, Erythraeidae) – Nigeria (Beron, 2002)

Cecidopus nigeriae Beron (Acariformes, Erythraeidae) – Nigeria (Beron, 2002)

Beronium coiffaiti (Beron)(described as *Hoplothrombium coiffaiti*) (Acariformes, Trombidiidae) – Morocco (Beron, 1973)

Herpetacarus (Lukoschuskaaia) makokoui Kolebinova (Trombiculidae) – Gabon (Kolebinova & Vercammen-Grandjean, 1980)(new subgenus)

Neotrombicula (Neotrombiculoides) elegantissima Kolebinova (Trombiculidae) – Tanzania (Kolebinova, 1981)

Gerbillicula deserta Kolebinova (Trombiculidae) (new genus) – Tunisia (Kolebinova, 1984a)

Afrotrombicula [new genus] *(A.) gabonica* Kolebinova & Vercammen-Grandjean (Trombiculidae) – Gabon (Kolebinova, 1981)

Afrotrombicula (A.) vanbreei Kolebinova & Vercammen-Grandjean (Trombiculidae) – Gabon (Kolebinova & Vercammen-Grandjean, 1981)

Leptotrombidium (Ericotrombidium) spatzi Kolebinova (Trombiculidae) – Tunisia (Kolebinova, 1980b)

Neotrombicula (Tauffliebicula, new subgenus*) lophuromyia* Kolebinova et Vercammen -Grandjean (Trombiculidae) – Liberia (Kolebinova & Vercammen-Grandjean, 1978).

Neotrombicula (Tauffliebicula) lophuromyia Kolebinova et Vercammen -Grandjean (Trombiculidae) – DR Congo (Kolebinova & Vercammen-Grandjean, 1978).

Walchia (*Kepkaia*)[new subgenus]

Schoengastiella (Radfordiella)[new subgenus]

Schoengastiella (Elasmoproctiella)[new subgenus]

Schoengastiella (Dureniella)[new subgenus] *ocellata* Kolebinova et Vercammen – Grandjean (Trombiculidae) – Liberia (Kolebinova & Vercammen -Grandjean, 1978)

Schoengastiella (Dureniella) ocellata Kolebinova et Vercammen -Grandjean (Trombiculidae) – Liberia (Kolebinova & Vercammen-Grandjean, 1978).

Schoengastiella (Dureniella) subcaeca Kolebinova et Vercammen -Grandjean (Trombiculidae) – Liberia (Kolebinova & Vercammen-Grandjean, 1978)

Gahrliepia (Gateria) megaspis Kolebinova et Vercammen -Grandjean (Trombiculidae) – Liberia (Kolebinova & Vercammen-Grandjean, 1978)

Gahrliepia (Gateria) liberiensis Kolebinova et Vercammen -Grandjean (Trombiculidae) – Liberia (Kolebinova & Vercammen-Grandjean, 1978)

Gahrliepis (Ozosetiella)[new subgenus]

Schoengastia (Schoengastiella) teras Kolebinova (Trombiculidae) – Gabon (Kolebinova, 1984b)

Schoengastia (Schoengastia) mozambica Kolebinova (Trombiculidae) – Mozambique (Kolebinova, 1984b)

Schoengastia (Schoengastia) erinacei Kolebinova (Trombiculidae) – "Centreafrique" (Kolebinova, 1984b)

Euschoengastia (Brunehaldia) aegypti Vercammen-Grandjean et Kolebinova (Trombiculidae) – Egypt (Vercammen-Grandjean & Kolebinova, 1966)

Myriapoda.

Symphyla. Collections not yet identified.

Diplopoda.

Large collection of Diplopoda has been brought to the NMNH in Sofia by P. Beron. So far one article by Mauriès & Heymer (1996) described several new *Sphaeroparia* (Diplopoda) from Ruwenzori (Uganda), the highest found Diplopoda in Africa. Another article (Mauriès, 1989) announced one new species collected by me in Nigeria. Other materials from Africa still stay in Sofia unidentified, including the material brought by P. Beron from Kenya in 2016.

P. Stoev contributed to the collecting of many Diplopoda from Tunisia and described new species from Algeria, Libya and Tunisia (Golovatch et al., 2009, Akkari et al., 2013, Akkari, Stoev, Enghoff & Nouira, 2009). The last article contains also faunistic data on Diplopoda from Algeria and Morocco.

New taxa:

Glomeris troglokabyliana Golovatch, Mauriès, Akkari, Stoev et Geoffroy (Glomerida, Glomeridae) – cave in Algeria (Golovatch, Mauriès, Akkari, Stoev & Geoffroy, 2009)

G. monostriata Golovatch, Mauriès, Akkari, Stoev et Geoffroy (Glomerida, Glomeridae) – cave in Libya (Golovatch, Mauriès, Akkari, Stoev & Geoffroy, 2009)

G. colorata Golovatch, Mauriès, Akkari, Stoev et Geoffroy (Glomerida, Glomeridae) – Tunisia (Golovatch, Mauriès, Akkari, Stoev & Geoffroy, 2009)

Ommatoiulus shambiensis Akkari, Koon-Bong Cheung, Enghoff & Stoev (Julida, Julidae) – Tunisia (Akkari, Koon-Bong Cheung, Enghoff & Stoev, 2013)

Ommatoiulus crassinigripes Akkari, Koon-Bong Cheung, Enghoff & Stoev (Julida, Julidae) – Tunisia (Akkari, Koon-Bong Cheung, Enghoff & Stoev, 2013)

Ommatoiulus kefi Akkari, Koon-Bong Cheung, Enghoff & Stoev (Julida, Julidae) – Tunisia (Akkari, Koon-Bong Cheung, Enghoff & Stoev, 2013)

Ommatoiulus khroumiriensis Akkari, Koon-Bong Cheung, Enghoff & Stoev (Julida, Julidae) – Tunisia (Akkari, Koon-Bong Cheung, Enghoff & Stoev, 2013)

Ommatoiulus xerophilus Akkari, Koon-Bong Cheung, Enghoff & Stoev (Julida, Julidae) – Tunisia

(Akkari, Koon-Bong Cheung, Enghoff & Stoev, 2013)

Ommatoiulus xenos Akkari, Koon-Bong Cheung, Enghoff & Stoev (Julida, Julidae) – Tunisia (Akkari, Koon-Bong Cheung, Enghoff & Stoev, 2013)

Ommatoiulus zaghouani Akkari, Koon-Bong Cheung, Enghoff & Stoev (Julida, Julidae) – Tunisia (Akkari, Koon-Bong Cheung, Enghoff & Stoev, 2013)

Sphaeroparia petarberoni Mauriès et Heymer (Polydesmida, Trichopolydesmidae) – Uganda (Mauriès & Heymer, 1996)

S. beshkovi Mauriès et Heymer (Polydesmida, Trichopolydesmidae) – Uganda (Mauriès & Heymer, 1996)

Stemmiulus (Diopsiulus) beroni Mauriès (Stemmiulida, Stemmiulidae) – Nigeria (Mauriès, 1989)

Chilopoda. The large collections of Chilopoda have been sent to Dr Z. Matic in Cluj, stayed longtime with him and were returned (partly damaged) to NMNH Sofia. The material, collected later, is under the care of Dr P. Stoev. Many Scolopendrids, collected by us in Mozambique, Zambia, Zimbabwe, Nigeria, Tanzania, and DR Congo have been published by Lewis (2001). Some others have been collected by P. Beron in Morocco (2012).

P. Stoev contributed to the collecting of many Chilopoda from Tunisia and to a publications on them (Akkari, Stoev & Lewis, 2008; Stoev et al., 2010).

New taxa

Eupolybothrus kahfi Stoev et Akkari, 2010 – Tunisia (Stoev et al., 2010)

Insecta s.l.

Collembola – still under study.

Diplura. Some Campodeidae have been sent to B. Condé and a few found place in one article (Condé, 1989). Many Japygidae (some of them sent to J. Pagés) await identification.

Thysanura. Non identified**.**

Blattodea, Mantodea. In the Museum collection there is some material from Nigeria and other countries, still unidentified. The same is the fate of the **Neuroptera** (Myrmeleontidae) and some other Insect groups.

Embidiina. The material preserved in NMNH Sofia (16 sp. identified by E.S. Ross and published by Beron, 2015) contains species from Nigeria, Tunisia, Cameroon, Zimbabwe, Mozambique, Libya, Senegal, and Tanzania, collected by P. Beron or donated.

Dermaptera. Many earwigs have been collected but only one paper by Brindle (1982) has been published. The material (partly seen by Brindle) is in Sofia. The earwigs identified by Brindle (30 sp.) have been published by Beron (2015).

New taxa:

Diplatys beroni Brindle (Diplatyidae) – Nigeria (Brindle, 1982)

Coleoptera. Many beetles from different families have been collected, but only part of them (Carabidae, Dytiscidae, Haliplidae, Chrysomelidae) have been published by V. Guéorguiev, B. Guéorguiev, V. Tomov and B. Gruev. Other material (Pselaphinae, etc.) is under study by R. Bekchiev and other colleagues. Collection of Staphylinidae has been sent to V. Assing.

New taxa

Haliplus maculipennis capensis V. Guéorguiev (Haliplidae) – South Africa (V. Guéorguiev, 1967)

Hyphydrus bertrandi V. Guéorguiev (Dytiscidae) – Guinea (V. Guéorguiev, 1965)

H. legrosi V. Guéorguiev (Dytiscidae) – Guinea (V. Guéorguiev, 1965)

H. omercooperae V. Guéorguiev (Dytiscidae) – Guinea (V. Guéorguiev, 1965)

H. guignoti V. Guéorguiev (Dytiscidae) – Guinea (V. Guéorguiev, 1965)

Laemostenus (Sphodroides) tiouirii B. Guéorguiev (Carabidae) – Tunisia (B. Guéorguiev, 2012)

Antipa urikkana Tomov, 1983 (Chrysomelidae) – Morocco (Tomov, 1983)

Lachnaia (*Barathraea*) *padillai* Tomov, 1982 – Tunisia (Tomov, 1982)

Heteroptera

During our expedition in Mozambique (1983) have been collected some Heteroptera, but only one new genus and species have been described by Josifov & Štusak (1987). Another species has been described in the same paper from Libya, Algeria, Nigeria, Chad, and Ivory Coast.

New taxa:

Gampsoacantha beroni Josifov et Štusak (Berytidae) – Mozambique (Josifov & Štusak, 1987, new genus)

Gampsoacantha pumilio Josifov et Stusak (Berytidae) – Nigeria, Chad and Ivory Coast (Josifov & Štusak , 1987)

Phytocoris (*Ribautomiris*) *dichrooscytoides* Josifov (Miridae) – Libya (Josifov, 1974).

Phytocoris (*Ribautomiris*) *pseudoscytulus* Josifov (Miridae) – Algeria (Josifov, 1974).

Hymenoptera

Material from Ethiopia, collected by N. Radev and identified by T. Ljubomirov (2006).

Trichoptera. The only collection partly identified, but not published, was the one from Sudan (Jebel Marra). Kumanski (pers. comm.) started describing some new species, but his untimely death was the end of this interesting study. The collection is in Sofia, together with some other African material (Nigeria, etc.).

Diptera. The material collected is still in Sofia, not identified. Papers by Bechev (1994a – Tanzania, 1994b - Madagaskar).

Mammalia

Chiroptera. Some material is in Sofia

Pholidota. Spassov (1990). Published data about *Manis temmincki* from North Mozambique.

Carnivora. Collection from Mozambique under study.

Hyracoidea. SPASSOV (1988). Published data about *Procavia* from Mozambique.

Exploration of high mountains

I had the chance to visit several of the highest mountains in Africa and to collect zoological material:

Kilimandjaro (to the top, 5895 m) – 1983 (together with V. Beshkov)

Ruwenzori (to the top, 5109 m) – 1995 (together with V. Beshkov)

Elgon (up to 2000 m) – 1995 (together with V. Beshkov)

Jebel Tubkal (to the top, 4167 m) – 2012

Mt. Cameroon (to the top, 4040 m) – 1977

Mt. Kenya (to 4985 m) – 2016

In 2009 Boyan Petrov also visited Kilimanjaro, Ruwenzori and Mt. Kenya and collected zoological material.

Most of the animals, collected by us, stay unidentified. MAURIÈS & HEYMER (1996) described from Ruwenzori the highest Diplopoda, found in Africa. I wrote a review of the high altitude Arachnida, Isopoda and Myriapoda in Africa (BERON, 2000a) and they were analyzed in details in my monograph on these animals in the Old World (BERON, 2008) and with its supplement (BERON, 2016).

Exploration of caves

Bulgarian cavers have been in the deep pot holes of Algeria (1989), but no fauna was collected. The only zoological collectings in African caves have been the following:

1977 – P. Beron collected material in the cave Pannini in Nigeria.

1983 – P. Beron and V. Beshkov visited the well known Kulumuzi caves in Tanzania.

1995 – P. Beron and V. Beshkov explored some caves in Kenya.

1989 – P. Beron explored Sinoya Caves in Zimbabwe.

2008 – P. Stoev collected cave fauna in Tunisia and published articles.

2012 – P. Beron collected cave fauna in Friouto (Morocco).

New taxa, discovered with Bulgarian participation, for:

Morocco. BERON (1973, 2017), TOMOV (1983)

Tunisia. KOLEBINOVA (1980c), B. GUÉORGUIEV (2012), TOMOV (1982), STOEV (2009), STOEV et al. (2010), AKKARI, ENGHOFF, STOEV & MAURIÈS (2010)

Algeria. JOSIFOV (1974), STOEV (2009)

Libya. JOSIFOV (1974), STOEV (2009)

Egypt. VERCAMMEN-GRANDJEAN & KOLEBINOVA (1966)

Guinea. V. GUEORGUIEV (1975)

Mozambique. KOLEBINOVA (1984b), JOSIFOV & ŠTUSAK (1987), BERON (1986, in prep.), SPASSOV (1988, 1990)

Nigeria. TAITI & FERRARA (1981), MAURIÈS (1989), BRINDLE (1982), BERON (2000b)

Kenya. KOLEBINOVA & VERCAMMEN-GRANDJEAN (1980); BERON (2016)

Uganda. MAURIÈS & HEYMER (1996)

Zambia. BERON (in prep.)

Tanzania. KOLEBINOVA (1981a), BECHEV (1994a)

Madagascar. BECHEV (1994b)

Gabon. KOLEBINOVA & VERCAMMEN-GRANDJEAN (1980, 1981); KOLEBINOVA (1984b)

South Africa. V. GUÉORGUIEV (1967)

Somalia. BERON (in prep.)

Liberia. KOLEBINOVA & VERCAMMEN-GRANDJEAN (1978)

DR Congo. KOLEBINOVA & VERCAMMEN-GRANDJEAN (1978)

Many other taxa were new for the countries explored by Bulgarians.

Bulgarian Zoologists in South Asia and Melanesia – results of the research and material remaining for study – I supplement (2013 – 2016)

After publishing the review of the activities of Bulgarian zoologists in South Asia and Melanesia (BERON, 2013), occurred some more terrain works, new publications appeared and a few have been ommited. Here we add these data.

Terrain work in different countries

China. P. Stoev, B. Petrov

Laos. P. Beron

Indonesia. P. Stoev, L. Penev

Philippines. P. Stoev, L. Penev

Cambodia. P. Stoev, L. Penev

Nepal. B. Petrov

Thailand. P. Stoev

Malaysia. B. Georgiev

Vietnam. B. Georgiev, V. Golemansky

The groups studied and the state of the remaining material:

Rhizopoda

Testacea

Cryptodifflugia brevicolla Golemansky – Vietnam (Golemansky, 1979)

Crustacea

Harpacticoida

Apostolov (2007) from Vietnam.

Arachnida

Scorpiones

Among the list of 61 species of Scorpiones, collected mostly by P.Beron and preserved in the National Museum of Natural History in Sofia (Kovařik & Beron, 2015) are species from Indonesia, Malaysia, Nepal, Thailand, and Papua New Guinea (additional material from Laos).

Araneae. Many new spiders have been collected and are under study.

Acari

Overlooked were the publications of Kolebinova (1980, 1984) on Trombiculidae from the Philippines

New taxa

Leptotrombidium (L.) imphalum philippinense Kolebinova (Trombiculidae) – Philippines (Kolebinova, 1980)

Leptotrombidium (L.) subobscurum Kolebinova (Trombiculidae) – Philippines (Kolebinova, 1980)

Walchiella philippinensis Kolebinova (Trombiculidae) – Philippines (Kolebinova, 1984)

Walchiella oudemansi katangladensis Kolebinova (Trombiculidae) – Philippines (Kolebinova, 1984)

Myriapoda.

Chilopoda.

New paper (Shileyko & Stoev, 2016) includes data on Scolopendromorphs collected by P. Beron in New Guinea and New Britain.

Diplopoda.

New papers (Golovatch, 2014, 2016, Golovatch et al., 2012, 2013, 2014, Golovatch & Stoev, 2013, 2014a, 2014b) published papers based on my collections from China, Burma, Laos, Nepal, Papua New Guinea and Malaysia. From the visit of P. Stoev in a cave in Luzon (Philippines) has been described a new species by Golovatch & Stoev (2013). Stoev & Enghoff (2011) published descriptions of four new species from Laos and Vietnam.

New taxa:

Trachyjulus beroni Golovatch, Geoffroy, Mauries et VandenSpiegel (Spirostrepsida, Cambalopsidae) – Malaysia (Golovatch, Geoffroy, Mauries & VandenSpiegel, 2012)

Eustrongylosoma penevi Golovatch et Stoev (Paradoxosomatidae) – Luzon, Philippines (Golovatch & Stoev, 2013)

Eustrongylosoma curtipes Golovatch et Stoev (Paradoxosomatidae) – Papua New Guinea (Golovatch & Stoev, 2011)

Eustrongylosoma liklik Golovatch et Stoev (Paradoxosomatidae) – Papua New Guinea (Golovatch & Stoev, 2011)

Eustrongylosoma maculatum Golovatch et Stoev (Paradoxosomatidae) – Papua New Guinea (Golovatch & Stoev, 2011)

Eustrongylosoma masalai Golovatch et Stoev (Paradoxosomatidae) – Papua New Guinea (Golovatch & Stoev, 2011)

Eustrongylosoma mirabile Golovatch et Stoev (Paradoxosomatidae) – Papua New Guinea (Golovatch & Stoev, 2011)

Eustrongylosoma pallidum Golovatch et Stoev (Paradoxosomatidae) – Papua New Guinea (Golovatch & Stoev, 2011)

Eustrongylosoma papua Golovatch et Stoev (Paradoxosomatidae) – Papua New Guinea (Golovatch & Stoev, 2011)

Eustrongylosoma tifalmin Golovatch et Stoev (Paradoxosomatidae) – Papua New Guinea (Golovatch & Stoev, 2011)

Silvattia perplexa Golovatch et Stoev (Paradoxosomatidae) – Papua New Guinea (Golovatch & Stoev, 2014)

Silvattia petarberoni Golovatch et Stoev (Paradoxosomatidae) – Papua New Guinea (Golovatch & Stoev, 2014)

Silvattia jeekeli Golovatch et Stoev (Paradoxosomatidae) – Papua New Guinea (Golovatch & Stoev, 2014)

Dendrogonopus beroni Golovatch et Stoev (Paradoxosomatidae) – Papua New Guinea (Golovatch & Stoev, 2014a)

Opisotretus beroni Golovatch, Geoffroy, Stoev et Vanden Spiegel (Opisotretidae) – Papua New Guinea (Golovatch, Geoffroy, Stoev & Vanden Spiegel, 2013)

Nothrosoma crassipes Golovatch et Stoev (Paradoxosomatidae) – Papua New Guinea (Golovatch & Stoev, 2014a)

Nothrosoma mediapes Golovatch et Stoev (Paradoxosomatidae) – Papua New Guinea (Golovatch & Stoev, 2014a)

Nothrosoma longipes Golovatch et Stoev (Paradoxosomatidae) – Papua New Guinea (Golovatch & Stoev, 2014a)

Caloma pallipes Golovatch et Stoev (Paradoxosomatidae) – Papua New Guinea (Golovatch & Stoev, 2014a)

Delarthrum beroni Golovatch (Paradoxosomatidae) – Nepal (Golovatch, 2014)

Delarthrum typicum Golovatch (Paradoxosomatidae) – Nepal (Golovatch, 2014)

Delarthrum curtum Golovatch (Paradoxosomatidae) – Nepal (Golovatch, 2014)

Delarthrum tenuitergale Golovatch (Paradoxosomatidae) – Nepal (Golovatch, 2014)

Delarthrum andreevi Golovatch (Paradoxosomatidae) – Nepal (Golovatch, 2014)

Delarthrum heterotergale Golovatch (Paradoxosomatidae) – Nepal (Golovatch, 2014)

Delarthrum setosum Golovatch (Paradoxosomatidae) – Nepal (Golovatch, 2014)

Beronodesmus pallidus Golovatch (Paradoxosomatidae) – Nepal (Golovatch, 2014) [new genus]

Sinocallipus deharvengi Stoev et Enghoff (Sinocallipodidae) – Vietnam (Stoev & Enghoff, 2011)

Sinocallipus jaegeri Stoev et Enghoff (Sinocallipodidae) – Laos (Stoev & Enghoff, 2011)

Sinocallipus steineri Stoev et Enghoff (Sinocallipodidae) – Laos (Stoev & Enghoff, 2011)

Sinocallipus catba Stoev et Enghoff (Sinocallipodidae) – Vietnam (Stoev & Enghoff, 2011)

Tylopus beroni Golovatch, VandenSpiegel et Semenyuk (Paradoxosomatidae) – Laos (Golovatch, VandenSpiegel & Semenyuk, 2016)

Desmoxites simplex Golovatch, VandenSpiegel et Semenyuk (Paradoxosomatidae) – Laos (Golovatch, VandenSpiegel & Semenyuk, 2016)

Diplura

Lepidocampa (L.) weberi nepalensis Condé (Campodeidae) – Nepal (Condé, 1993)

Orthoptera

Large collection of cave Orthoptera from China, Vietnam, Papua New Guinea and Indonesia have been sent to Dr Gorochov in Sanct Peterburg. Results are expected. Meanwhile new Orthoptera have been collected in caves in Laos by P. Beron.

Embidiina. The material (identified by Ross and published by Beron, 2015) contains species from India and Papua New Guinea, collected by P. Beron.

Dermaptera. The material (partly seen by Brindle) is in Sofia. The earwigs identified by Brindle (30 sp.) have been published by Beron (2015b)[Nepal, New Ireland, New Britain, Sri Lanka, Burma].

Coleoptera

Ommited were the papers of Guéorguiev V. B. (1968, 1972). His son B.V. Guéorguiev is publishing actively on Coleoptera from China, Indonesia and Papua New Guinea. R. Bekchiev contributed to the description of a new species of Pselaphinae from a cave in Nepal, collected by P. Beron.

New taxa:

Lesticus beroni Dubault, Lassalle et Roux (Carabidae) – Indonesia, Lombok (Dubault, Lassalle & Roux, 2012)

Agabus (Dichonectes) freudei V. Guéorguiev (Dytiscidae) – Nepal (V. Guéorguiev, 1975)

Lacconectus freyi V. Guéorguiev (Dytiscidae) – South India (V. Guéorguiev, 1968)

Stictogabus nepalensis V. Guéorguiev (Dytiscidae) – Nepal (V. Guéorguiev, 1968)

Eustra petrovi B.V. Guéorguiev (Carabidae) – South China (Yunnan)(B.V. Guéorguiev, 2014)

Metabacetus willi B.V. Guéorguiev (Carabidae) – Java (Indonesia)(B.V. Guéorguiev, 2013)

Pseudophanias spinitarsis Yin, Coulon et Bekchiev (Staphylinidae, Pselaphinae) – Nepal (Yin, Coulon & Bekchiev, 2015)

Exploration of caves

P. Stoev visited a cave in Luzon (Philippines) in 2012 and four caves in North China in 20 (together with Hr. Deltshev). Many new species were contributed with Bulgarian participation from S. China, Laos, Vietnam, Malaysia, Philippines, Papua New Guinea and Nepal.

P. Beron visited 12 caves in Laos and collected biological material.

Exploration of high mountains

Visits to Himalaya and Karakorum by B. Petrov brought back extensive collections which are being identified. Golovatch (2014) started identifying our collection of Diplopoda from the Himalaya.

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Български зоолози в Африка – резултати от проучванията и състояние на оставащия материал

Петър Берон

(Резюме)

Български зоолози са посещавали африкански страни и преди Втората световна война (Египет, Етиопия), но научният им принос започва с работата на В. Големански в Гвинея през 1962-1963 г. П. Берон прекарва три години (1976-1979) в Нигерия и участва в много други пътувания из Африка. През 1983 г. Националният природонаучен музей при БАН организира самостоятелна експедиция в Мозамбик. Теренна работа е извършена от български зоолози в Египет, Судан, Тунис, Алжир, Мароко, Канарските острови, Гвинея, Нигерия, Того, ДР Конго, Камерун, Мозамбик, Кения, Танзания, Уганда, Етиопия, Габон, Екваториална Гвинея, Зимбабве, Замбия, Либия.

Български зоолози са определяли и зоологически материали от Африка, изпратени им от различни музеи. Нови таксони са описани от българи или с българско участие от Нигерия, Мозамбик, Тунис, Мароко, Алжир, Либия, Египет, Габон, Танзания, Замбия, Уганда, Замбия, Кения, Канарските острови, Намибия, Много от събраните материали остават все още неопределени.

Българските зоолози в Южна Азия и Меланезия – резултати от проучванията и състояние на оставащия материал – Първо допълнение

След първия преглед на приноса на българските зоолози за изследването на фауната на Южна Азия и Меланезия (Beron, 2013) бяха публикувани нови данни от Р. Бекчиев, С. Головач, П. Стоев, Б. Георгиев и други автори, а се оказа, че са пропуснати публикации на А. Апостолов, В. Йорданова, В. Георгиев и М. Колебинова. В настоящото допълнение се третира фауната на Непал, Виетнам, Филипините, Индонезия, Малайзия, Папуа Нова Гвинея, Бирма, Лаос, южен Китай, Индия, нови данни от Д. Бечев, Р. Бекчиев....”

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IN MEMORIAM of our colleagues
Nikolay Tzankov, Andrey Stoyanov and Dobrin Dobrev

Fossil and subfossil records of Reptiles (Reptilia Laurenti, 1768) in Bulgaria

Zlatozar Boev

Abstract: The paper summarizes and evaluates all scattered and scanty data on the fossil and subfossil records of reptiles from Bulgaria. A complete list of the 72 localities and the taxonomic composition and kind of reptilian findings are presented for the first time. Data cover at least 98 taxa (25 identified up to species level) of 26 genera, 22 families and 6 orders at least. Chronostratigraphically they range from the Kimmeridgian (Late Jurrasic) to the Late Holocene (subrecent), i. e. last 157.3 Ma. Two families (Varanidae and Elapidae) and one subfamily (Lygosominae) of the skinks today include only representatives of exotic fdistribution. About one fifth of all taxa are fossil. Three of the fossil taxa are described as new to the science. Apart from herpetologists from Bulgaria, experts from Poland and Germany have contributed most to exploration of fossil and subfossil reptiles in the country.

Key words: Reptilia, Fossil record, Bulgaria, Paleozoology, Herpetology, Fossil/subfossil vertebrate faunas

Introduction

The recent reptilian fauna of Bulgaria is relatively rich and varied. At present Bulgaria has one of the richest herpetofaunas in Europe. It contains of 39 species: Testudines Batsch, 1788 – 6 species (including one allochton species), Squamata Oppel, 1811: 14 species of Sauria Macartney, 1802 and 18 species of Serpentes Linnaeus, 1758 (Gasc, 1997; Beshkov & Nanev, 2002; Biserkov, 2007; Stoyanov et al. 2011).

The fossil and subfossil record of reptiles in Bulgaria is insufficiently studied. Only several publications deal with fossil/subfossil reptilian remains from Bulgarian paleontological and archaeological sites so far. Newertheless, some of them described new reptilian taxa, e. g. von Huene & Nikoloff, 1963, Khosatsky et al. (1983), Amiranashvili & Chkhikvadze (2000). Other publications report on first records of some species (or higher taxa) in the country (Tzankov, 1939; Stojanov, 2009; Godefroit & Motchurova-Dekova, 2010; Mateus et al., 2010, etc.). Several species (mainly snakes) have been reported by Mlynarski (1982), and Szyndlar, 1991 a, b).

Author's personal unpublished data, as well as the scattered data of incompletely determined reptilian remains and the available published information is gathered and presented here in a summarized format for the first time. Taxonomical determination (re-examination and synonimization) of the reptilian findings remains beyond of the scope of present paper.

Material and Methods

We follow the systematics of the recent European reptiles after Gasc (1997), the chronostratigraphy for the Neogene (MN 01 – MN 18) of Mein (1990), and that for the Quaternary (MNQ 19 – MNQ 27) of Guerin (1990). For this study we used the term "reptiles" as a synonym for the group of the cold-bloodied amniots including Testudines (see Schoch & Sues, 2015).

Abbrebiations: AMUP – Adam Mickiewicz University (Poznań); c. – century; MNI – minimum number of individuals; MPHG – Museum of Paleontology and Historical Geology of the "St. Kliment Ohridski" University of Sofia (Sofia);

NMNHS – National Museum of Natural History, Bulgarian Academy of Scienses (Sofia) – Vertebrate Animals Department; PMA – Paleontological Museum, a subsidiary of the NMNHS in the town of Asenovgrad (Plovdiv Rerion); R – region [administrative unit of Bulgaria]; t. – town; v. – village.

Localities account

Mesozoic

Late Jurassic

1. **Oreshets.** (Vidin R). Rocks near the Oreshets r/w station near t. of Belogradchik. Late Jurassic (Malm, i. e. Kimmeridgian). *Plesiosaurus* Conybeare, 1821 sp. – 1: – 10 vertebrae (vertebral) and several rib parts (35.5 to 37.0 mm long and 34 to 45.5 mm in diameter), as well as some "slender small bones, possibly of the abdominal ribs" (Bakalov & Filkov, 1954, p. 76.).

Cretaceous

Late Cretaceous

2. **Unknown locality** – **1.** Upper Maastrichtian. *Carinodens belgicus* (Woodward 1891) – the smallest mosasaur (Tzankov, 1939; 1963; cited after Dinosauria, 2007).
3. **Drashan.** (Vratsa R). Marine limestones ca. 200 m east of the Labirinta Cave between v. Drashan and v. Breste. The material was collected by Zdravko Iliev in 1985 (Mateus et al., 2010). Uppermost Cretaceous – Upper Maastrichian, Kaylaka (Kajlâka) Formation, 66-63 Ma (Mateus et al., 2010). *Mosasaurus* Conybeare, 1822 sp. – 1 (mandibular fragment with teeth) and Ichthyosauria Blainville, 1835 fam. indet (a tooth), collected by Stoycho Breskovski and Z. Iliev and identified by Nikolay Spassov (N. Spassov – unpubl. data); Ornithomimosauria Barsbold, 1976 fam. indet. – 1 (humerus sin., diaphysal fragment of an adult individual) (Mateus et al., 2010); Hadrosauroidea Cope, 1869 indet. (disarticulated bones – femur sn. dist., tibia dex., fibula dex. prox., metatarsalia II sin., phalanx 2(3) dig. 4 pedis, metacarpalia II prox., caudal centrum (Godefroit & Motchurova-Dekova, 2010). NMNHS.
4. **Unknown locality – 2.** Ichthyosauria Blainville, 1835 fam. indet. – 2 (BG Paleoworld, 2008).
5. **Kreta.** (Pleven R). Upper Maastricht (Kajlăka Formation) (N. Mochurova-Dekova – unpubl. data). *Mosasaurus* sp. – 2 (Detelin Datchev, unpubl. comm.). Recently a special chek-up of Plamen Ivanov showed that such remains are absent from its collections (N. Mochurova-Dekova – unpubl. data).
6. **Riben.** (Pleven R). "… fossils of marine reptiles are most abundant" (Plamen Tzankov – upubl. data).
7. **Komarevo.** (Vratsa R). Lower Paleocene, s. c. Komarevo suite (Dachev, 1975). "… fossils of marine reptiles are most abundant" (Plamen Tzankov – upubl. data).
8. **Varbeshnitsa – 1** (Vratsa R). A limestone quarry near the Varveshnitsa v. Upper Cretaceous (Maastrichtian). *Mosasaurus* sp. – 3 (part of spinal column, containing 15 vertebrae with the articulated ribs, collected in 1961, and 3 tooth, collected in 1975). All finds were identified as Mosasauridae, "probably ... *Mosasaurus*". They were referred to MNI 2 adult specimens. The finds represent the first Upper Cretaceous marine reptiles of the region of the Balkan Mountains (Nikolov & Westphal, 1976). NMNHS.
9. **Breste.** (Vratsa R). Labirinta Cave, between Drashan and Breste v.s (east of Cherven Bryag t.). Maastrichtian. Late Maastrichtian, Kaylaka Formation (Jagdt et al., 2006). Deposits are dated at 65-70 Ma, while the age of the cave is much younger, 300 000 – 400 000 BP (Genov, 1985). More exact dating (66-63 Ma) is given by Mateus et al. (2010). *Mosasaurus* sp. – 4 finds of ?MNI 1 – part of semi-mandibule with one thoot, 63 mm long (total estimated length 71 mm; 65 mm long after Ilcheva et al. (2007) (No MOS 20, and MOS 60, both numbered latter No 11 897), a "bone of the fore fin" (a diaphysal fragment of ?radius 25 cm long (No MAS 50), a complete ulna dex. (No MOS 61, and No 11 899), a fragment of ?forelimb phalanx (MOS 50). Material came in 1985 from the Maastrichtian limesones of the cave. They represent a partial skeletons of a marine large reptile (mandibles, long bones, vertebrae, and theeth 7.5 cm long), and have been collected by the team of the "Stalakton" Cave Club (Stoyanov, 1985). On 19.06.1985 fossils of 2 new individuals have been collected, but it is suspected that all finds belong to MNI 3. I addition, some pelvic bones were collected (BTA, 1984). Later Nicolay Spassov (NMNHS) preliminary examined some of the finds and determined them as *Mososaurus* sp., i. e. deferring from the Dinosauria group, as they erroneously advertised by Stoycho Breskovsky (NMNHS), the scientific leader of the "Dinosaur-85" Cave Expedition. Among the remains was a 7-cm-long tooth (Genov, 1985). The total body length of each of the examined specimens was over 10 m, estimated by the size of the vertebrae. On 22.06.1985, 10 vertebrae and tooth, several pedal phalanges and other bones have been collected. The total number of the finds exceeds 100 items. All finds have been included in the matrix of a rock volume of 3 m^3. St. Beskovski suggested that all finds belonged to a new undescribed species and even, a new genus of Mosasauridae (Genov, 1985).

Mosasaurus cf. *hoffmanni* (Mantell, 1829) – fragmentary lower jaw, No NMNHS 11897/1, 2 teeth (Jagdt, 2006; Ilcheva et al., 2007); Mosasauridae gen. – "?skull and appendicular skeleton" (Jagdt, 2006); "?Elasmosaurid plesiosaurs" – (Jagdt, 2006); ?*Plesiosaurus* sp. – 2 – "some of the other bones", i. e. except vertebrae and the mandible (Plamen Tzankov – upubl. data). Ilcheva et al. (2007) listed also "definetely identified remains, belonging to ... Plesiosauria" (p. 187). A review of these (and from other Bulgarian localities) was given by Tzankov, 2004. Latter on Jagdt et al. (2006), Godefroit & Motchurova-Dekova (2010) and Mateus et al. (2010) published first dinosaous' remains from Bulgaria. Part of material stored at NMNHS. Whereabouts unknoun of the remaining (much bigger) part of fossils.

10. **Unknown locality – 3.** (NW Bulgaria). ?Maastrichtian. Late Maastrichtian. Mosasauridae gen. – a tooth, collected along with finds of bones and teeth of *Ursus spelaeus* in a cave by Georgi Markov in the late 1940s in the W Stara Planina (W Balkan). The specimen was identified by N. Spassov (unpubl. data).
11. **Nikopol.** (Pleven R). Late Maastrichtian. *Mosasaurus* sp. – 5 (N. Spassov – unpubl. data).
12. **Somovit.** (Pleven R). ?Maastrichtian. Late Maastrichtian. Mosasauridae: *Leiodon* (*Liodon*) *anceps* (Owen, 1845) – "Several teeth well preserved", *Mosasaurus giganteus* Sömmering, 1820 (i. e. *M. hoffmannii* Mantell, 1829) – teeth of smaller ("younger") specimen, *Globidens fraasi* Dollo, 1913 – a tooth; "Crocodylians" – a tooth 62 mm long and 32 mm wide that resembles to *Dyrosaurus phosphaticus* (Thomas, 1893) (Tzankov, 1939; 1952) MPHG; a thooth (No 1226) of *Mosasaurus* sp. – 6 (Jagdt et al., 2006); *Mosasaurus* sp. (D. Dachev – unpubl. comm.); *Mosasaurus* sp. (listed as "*Mososaurus*/ Cretaceous") – a tooth (3 cm long and 2 cm wide, No 1226. A photograph of the find is provided in the Internet site (Anonym., 2006). "Teeth from Mosasauridae" have been listed by Plamen Tzankov (upubl. data). Regional Historical Museum of Pleven (Anonym., 2006).

Neozoic
Paleogene
Late Eocene

13. **Nikolaevo.** (Stara-Zagora R). Vicinity of the Nikolaevo v. Preabonian (Upper Eocene) (Khosatsky et al. 1983). *Trionyx* (*Amyda*) *capellini* Negri 1892 (*T.* (*A.*) *c. bulgaricus* Khosatsky 1983) – a complete carapace (two thirds of the sheets are missing) (Khosatsky et al. 1983). Institute of Zoology, BAS (No 1/1959) (Khosatsky et all. 1983). Later the specimen has been transmitted to the NMNHS, where it is kept in the "Historical Geology and Paleontology" exposition hall.

Oligocene

14. **Brezhani.** (Blagoevgrad R). Near the Brezhani v. Steinkohl (i. e. Middle – Late Oligocene; Mlynarski & Beschkov, 1985). *Testudo* (*Protestudo* sp.) – a complete carapax of 560-570 m depth (Mlynarsky & Beschkov, 1985). NMNHS (No E 2815) (Mlynarski & Beschkov, 1985). Later on Amiranashvili & Chkhikvadze (2000) described the specimen as *Testudo bulgarica* Amiranashvili & Chkhikvadze, 2000.
15. **Oranovo.** (present part of t. of Simitli; Blagoevgrad R). Near the former Oranovo v. Oligocene. *Testudo* (*Protestudo*) sp. – a plastron and a carapace of one adult specimen. NMNHS.

Neogene
Miocene
Middle Miocene

16. **Varna.** (City Center; Varna R.) Middle Miocene, depth 2 m. The excavations were performed during the building works in Varna; end of October 2008. 15 eggs of Testudines fam. indet. – 1, matrix of marine sediments. Received from: Kristalina Stoykova (Geological Institute, BAS) (Z. Boev – unpubl. data).
17. **Unknown locality – 4.** Tertiary. Exact date is unknown. *Protestudo.* The specimen is still "temporarily" (for 20 years!) deposited in the Institute of Paleobiology of the Georgian Academy of Sciences in Tbilisi, waiting for examination by the Georgian paleoherpetologist Svyatoslav Chikvadze. (Institute of Paleobiology, Georgian Academy of Sciences, Tbilisi).
18. **Sinagovtsi.** (Vidin R). Limestone quarry near the Sinagovtsi v. (near t. of Vidin). Miocene. "*Trionyx* s. l.", i. e. cf. *Trionyx* sp. (Pamouktchiev et al., 1998).
19. **Maritsa-Iztok.** (Stara Zagora R). Coal mines near t. of Galabovo. Oligocene (?)-Miocene (Martin Ivanov – Sofa University "St. Kliment Ohridski). Testudinidae gen. indet. – 1 (2/3 of a plastron), collected in the 1950-s; total length – ca. 25 cm (Nikolay Tzankov – NMNHS).

Late Miocene

20. **Hadzhidimovo.** (Blagoevgrad R). Vicinity of t. of Hadzhidimovo. Excavations of Dimitar Kovachev in 1980s. Late Miocene (Turolian – Meotian, lower part; MN 11-12; ca. 7 Ma). The sediments belong to the Nevrokop Formation (Vatsev, 1980; Nikolov, 1985). Testudinidae gen. indet. – 2, Testudinidae gen. indet. – 3 (N. Spassov – unpubl. datsa); Serpentes fam. indet.

1 – complete skeleton (total lenth 95 cm; missing skull), collected ca. 1996 by D. Kovachev (D. Kovachev – unpubl. data). PMA.

21. **Stanyantsi.** (Sofia R). Vicinity of the Stanyantsi v. near t. of Godech. Messinian (M. Böhme – unpubl. data), Valesian – Late Turolian (N. Spassov – unpubl. data). *Testudo* sp. "many" fragments of plastron, carapaces and bones, collected in 04.-08.04.2005 by M. Böhme (M. Böhme – unpubl. data). "reptiles" (Late Miocene (Turolian, 5.80-5.35 Mya /Miocene-Pliocene boundary/) (Bohme et al., 2013). NMNHS.
22. **Nova Nadezhda.** (Haskovo R). A coal mine near the Nova Nadezhda v. "Levant (Middle Pliocene)" (von Huene & Nikoloff, 1963). Alligatoridae Graym 1844: *Diplocynodon levantinicum* Huene, 1963 (dentale dex., dentale sin., maxilla sin., pubis sin., 3 dentes, 6 shield plates). The site is type locality of the species (von Huene & Nikoloff, 1963).

Early Pliocene

23. **Radnevo.** (Stara Zagora R). A coal mine near t. of Galabovo. 5-6 Ma; Pliocene (Dikov, 1961); Meotian (Miocene) (Geopraktika, 2003). Crocodilia fam. indet., Cheloniidae fam. indet. – 1 (Dikov, 1961).
24. **Sofia – 1.** (Sofia City R). The Juzhen Park of Sofia City. Former brick factories. Excavations in 1910-1914 (Popov et al., 1921). Early Ruscinian (N. Spassov – unpubl. data). Terrapins (?Emydidae) – several plates of a carapace (Popov et al., 1921); *Emys* sp. (aff. *orbicularis*) – fore part of the plastron (xiphyplastron) (N. Tzankov – unpubl. comm.). NMNHS.
25. **Muselievo – 1.** (Pleven R). The locality is a rock shelter up to 1.5 m depth in a destroyed Pliocene cave in ?Sarmatian limestones, about 1 km SE of Muselievo v. 2nd half of the Middle Ruscinian (MN 15; 3.3-3.1 Ma) (Popov & Delchev, 1997). Two pieces of the carapace of Testudinidae gen. indet. – 4 (A. Stoyanov – unpubl. comm.), collected in 1988 by Mr. Georgi Hristov; Testudinidae gen. indet. (several pieces of the plastron and carapace found in the samples of G. Hristov); Serpentes fam. indet. – 2 vertebral fragments and two complete vertebrae collected in 1988 by G. Hristov. NMNHS and the G. Hristov's private collection.
26. **Unknown locality – 5.** *Testudo* sp. [*Paleotestudo*/*Protestudo* sp.] proximal half of a plastron. NMNHS.
27. **Sofia – 2.** (Sofia City R). Sofia City. The find comes from at 6.00-6.50 m depth collected by Raycho Shumanov in 1995. Early Pliocene (Ruscinian, MN 14; 5.0-4.5 Ma); Lozenets Formation; Testudines fam. indet. 2 – several pieces of the plastron and carapace of a large turtle (over 70 cm length) (Boev, 2000, 2014). NMNHS.
28. **Dorkovo.** (Pazardzhik R). Vicinity (1 km S of Dorkovo v.). Excavations in 1983-1985 of Herbert Thomas and N. Spassov. Early Pliocene (Russcinian; MN 14; 5.0 – 4.5 Ma) (Thomas et al., 1986). *Natrix* sp. (Thomas et al., 1986 a, b; Szyndlar, 1991 a). Elapidae gen. indet. (N. Tzankov – unpubl. data; Boev, 2014). NMNHS.
29. **Tenevo.** (Yambol R). A sand quarry near the Tenevo v. Late Ruscinian (N. Spassov – unpubl. data). *Geochelone* sp. – incomplete and damaged plastron and carapax of a one adult specimen (M. Böhme – unpubl. data; Stojanov, 2009; Stoyanov & Tzankov 2010). Formerly the find has been referred to *Testudo* ex gr. *atlas* (Boev, 2008). NMNHS.
30. **Kalimantsi.** (Blagoevgrad R). Near the Kalimantsi v. (near t. of Sandanski). Pontian-Romanian (Pamouktchiev et al., 1998), Meotian after Kovachev (2005). Testudines (Kovachev, 1984); (1) *Testudo* (*Protestudo*) sp. – a carapace of an adult specimen, aged 4-5 years (No K_{1-2}-495). Collected at 247 m a. s. l. (2) *Testudo* cf. *antigua* Bronn (No K-496) – part of the right half of a carapace. Individual age is estimated at 15 years. Total fragment length – 165 mm, total width – 170 mm. Collected in the Belovodski Road locality at 372 m a. s. l. (3) *Clemidopsis* cf. *sopronensis* Boda, 1927 (No K-497) – caudal half of the carapace and almost complete plastron. The individual age has been estimated at 7-8 years. Total length – less than 20 cm (?); plastron length – 135 mm. Collected in the yard of the Cooperative farm of the Kalimantsi v. (4) *Testudo* (*Protestudo*) sp. (No K-498) – two thirds of a carapace of an adult specimen, aged 15-16 years. Length – 195 cm, width – 166 cm. Collected in the Peshternyak locality at 272 m a. s. l. (5) *Testudo* (*Protestudo*) sp. – a complete humeral bone (No K-499), 53 mm total length. Collected in the Tapana locality at 247 m a. s. l. (Kovachev, 2005). PMA.
31. **Kromidovo.** (Blagoevgrad R). As Bakalow (1933) notes, several localities of the Pontian limestone-clay and hard sandstones in the vicinities of the Kalimantsi and Kromidovo v.s have been discovered [between 1930-1933]. According to Spassov (2002), two localities have been uncovered near the Kromidovo v. They both reveal the Sandanski formation, dated "Early or most probably Mid. Turolian", p. 71). The same author writes that four localities are known in the vicinity of the Kalimantsi v., all from the Kalimantsi formation of Early/Middle Turolian age (MN 12?). Sandanski formation, Middle Turolian, Early/Middle Turolian age (MN 12?)

(Spassov, 2002). *Testudo* aff. *marmorum* Gaudry, 1862 – an incomplete carapace.

32. **Kovachevo.** (Stara Zagora R). The site lies in the coal mines “Maritsa – Iztok”, near v. of Kovachevo. Maeotian – Miocene. “A turtle” find, collected in 2001 by D. Kovachev (Kovachev, 2005). PMA

Quaternary
Early Pleistocene

33. **Varshets.** (Montana R). A ponor in a rocky hill, 6 km NNE of t. of Varshets. Late Pliocene (Middle Villafranchian; Villanyian; MN 17) 2.3-2.5 m. a. (N. Spassov, V. Popov – unpubl. data). Eight species of Squamata (Sauria and Serpentes) and one species of Testudines (*Testudo* sp., cf. *graeca/hermanni*) (Z. Boev – unpubl. data; Stojanov, 2009) – several humeral bones and carapce and plastron plates; *Anguis* cf. *fragilis*, Serpentes fam. indet. 3, Serpentes fam. indet. 4 (det. M. Böhme; Spassov, 1999). M. Böhme determined “7 amphibian and reptile species” (Spassov, 2003); *Lacerta* sp. (large), *Lacerta* sp. (small), *Eremias* sp., *Testudo* sp., Colubridae, Viperidae, *Natrix* sp., *Eryx* sp., *Anguis* sp. (det. M. Böhme – 2008; unpubl. data). Boidae (*Eryx* sp. indet.), Varanidae gen. indet. (N. Tzankov – unpubl. data; Boev, 2014, 2016). *Trachylepis* cf. *aurata* (Linnaeus, 1758), “*Mabuya*” Fitzinger, 1826 gen. indet., *Lacerta* s. l. sp. – 1, *Lacerta* s.l. sp. – 2, *Anguis fragilis* Linnaeus, 1758, *Pseudopus* aff. *apodus* (Pallas, 1775), Colubrinae gen. indet.– 1, Colubrinae gen. indet. – 2, Natricinae gen. indet. – 1, Viperidae gen. indet., ?Erycinae Bonaparte, 1831 gen. indet., *Testudo* Linnaeus, 1758 gen. indet., *Emys* Duméril, 1805 gen. indet. (N. Tzankov – unpubl. data; Boev, 2016). (As recently the Old World species of mabuyas are placed in the genera *Chioninia* Gray, 1845, *Eutropis* Fitzinger, 1843, and *Trachylepis* Fitzinger, 1843, the finds of “*Mabuya*” from Varshets could be referred to one of them.). NMNHS.
34. **Slivnitsa.** (Sofia R). Destroyed cave in a rocky hill, now a stone quarry in the “Kozyaka” locality, 3 km WNW from t. of Slivnitsa (Sofia R). Late Pliocene (the final of the Middle Villafranchian; Villanyian; first half of MNQ 18 a; ca. 1.85 Ma (Spassov, 1997). Laceritae gen. indet., Serpentes indet. Uundetermined bone remains of snakes and lizards (Boev, 1998 b); *Lacerta* s. l. sp., Colubridae indet. (large form), Natricinae gen. indet. – 2 – a total of 35 vertebrae, 8 mandibulae, 5 other bones (det. M. Böhme – 2008; unpubl. data). NMNHS.
35. **Kunino.** (Pleven R). Destroyed cave in a limestone quarry, 2 km NW of of Kunino v. The locality has been discovered in 1998 by Mr. Georgi Hristov. Early Pleistocene (Vaalian – Menapian), Biharian – the middle of the *Microtus savini/ M. pusillus* biozone, i. e. 1.2-1.0 Ma. *Testudo* sp. cf. *graeca/hermanni* – several plastron and carapax plates, several limb bones (long bones) (Z. Boev – unpubl. data). 1 humerus sin. prox. – *Testudo* sp. (det. M. Böhme – 2008; unpubl. data). NMNHS.
36. **Tsareva Tsarkva.** (Pernik District). 3 km NW of the Zelenigrad v. Cave. Collected material originates from the cave anteroom. Late Pleistocene. 1 mandibula dex. – *Lacerta* sp. (collected by Z. Boev on 19.03.1994) (det. M. Böhme – 2008; unpubl. data). NMNHS.

Middle Pleistocene

37. **Varbeshnitsa – 2** (Vratsa R). A limestone quarry near the Varveshnitsa v. Middle Pleistocene. *Coluber caspius* Gmelin, 1789 (i. e. *Dolichophis caspius* Nagy et al., 2004) – 4 trunk vertebrae; *Coronella* aff. *austriaca* Laurenti, 1768 – 5 trunk vertevrae; *Elaphe longissima* (Laurenti, 1768) (i. e. *Zamenis longissimus* (Laurenti, 1768))– 7 trunk vertebrae; *Elaphe quatuorlineata* (Lacépède, 1789) – 3 trunk vertebrae; cf. *Elaphe situla* (i. e. *Zamenis situla* (Linnaeus, 1758)) – 8 trunk vertebrae; *Telescopus* sp. – 2 trunk vertebrae (Szyndlar, 1991 a); *Natrix* sp. – 7 precaudal vertebrae; Vipera sp. – 1 fragmentary precaudal vertebra (Szyndlar, 1991 b). Institute of Zoology – BAS (Szyndlar, 1991 a).

Late Pleistocene

38. **Bacho Kiro Cave.** (Gabrovo R). A settlement of *Homo sapiens* Linnaeus, 1758 and feeding places of *Bubo bubo* (Linnaeus, 1758) in the Bacho Kiro Cave near t. of Dryanovo. Wurm (Middle Paleolothic) (50 000-10 000 BP). *Lacerta agilis* Linnaeus, 1758, *Lacerta viridis* (Laurenti, 1768), *Coronella* aff. *austriaca*, *Natrix* aff. *natrix*, *Vipera* sp. (“*berus*” group) – 12 vertebrae (Mlynarski, 1982; Kowalski, 1982; Szyndlar, 1991 b). Intitute of Systematics and Evolution of Animals, PAS – Cracow (Szyndlar, 1991 b).
39. **Golyamata Cave.** (Veliko Tarnovo R). Cave near t. of Veliko Tarnovo. Late Pleistocene. *Testudo graeca* – several carapace plates (Popov, 1904).
40. **Muselievo – 2.** (Pleven R). Paleolithic cave, inhabited by *H. sapiens*, about 0.5 km SW of Muselievo v. ca. 45 000 BP. Material has been collected by G. Hristov in 1990-s. Serpentes fam. indet: 11 vertebrae of 1(2) species (Z. Boev – unpubl. data).
41. **Madara.** (Shumen R). Rock niche in a 60 m high rock massive of W exposition, 2 km NE of Madara v. 300 m a. s. l. The niche is positioned at

20 m from the foothills of the rock and about 150 above the river level. Dimensions: 1 m width, 5 m height, 3 m length. Old (subfossil) site of *B. bubo* rich in accumulated bones of preys. At 1 m of the niche edge the layer with bones was tick up to 50 cm. Excavations in 1994, 1995 and 2001 of I. Mitev. Late Pleistocene to Early Holocene. Part of material is of Late Holocene age. *Testudo graeca/hermani* (recent; Mitev, 1996; 2005; Mitev & Boev, 2006), *Lacerta/Podarcis* sp. (7 semi-mandibbles of 3 species at least, collected from 0-30 cm depth by I. Mitev). I. Mitev's collection (Ruse).

42. **Stoilovo.** (Burgas R). Late Pleistocene. *Coluber caspius* Gmelin, 1789 (i. e. *Dolichophis caspius* Nagy et al., 2004) – 2 trunk vertebrae; *Elaphe quatuorlineata* (Lacépède, 1789) – 2 trunk vertebrae (Szyndlar, 1991 a); *Natrix natrix* (Linnaeus, 1758); *Vipera* cf. *V. ammodytes* – 8 precaudal vertebrae (Szyndlar, 1991 b). Institute of Zoology, BAS (Szyndlar, 1991 a, b).
43. **Karlukovo 4.** (Lovech R). Karlukovo 4 Cave near the Karlukovo v. Excavations in 1976, 1979, some 50 m above the Iskar River (Mlikovský, 1997). Late Pleistocene. "1 lizard" (Mlikovský, 1997) (?Lacertidae gen. indet.). ?National Museum, Prague.
44. **Kozarnika.** (Vidin R). Kozarnika Cave, 5 km NW of t. of Belogradchik, 3 km from Oreshets r/w station. Late Pleistocene (Wurmian), Paleolithic (80000-16000 BP) (V. Popov – unpubl. comm.). Deposits are dated as the beginning of the Late Paleolithic (the transition from the Interpleniglacial 2 to the Pleniglacial 2) (N. Sirakov – unpubl. data). Guadelli et al. (1999) referred collected finds to the IV and III cultural layers (Gravettian), i.e. 26 000 to 19 000 BP Latter lower layers have been excavated and they have dated Early Pleistocene (1 400 000 – 130 000 BP) (Marinov, 2007). Lacertidae gen. indet. (M. Marinska – unpubl. data).

Early Holocene

45. **Shirokovo.** (Ruse R). Rock niche in the Cherni Lom River canyon in a 20 m high rock massive of W exposition. 2 km N of Shirokovo v. 150 m a. s. l. The cave is situated at 8 m of the rock foothill and 60 m above of the present river level. Dimensions: width – 1 m, height – 1 m, depth – 3 m. Old locality (feeding place) of *B. bubo*. Excavations in 2002 of I. Mitev and Ilcho Kolev. Early Holocene. Testudines (*Testudo graeca/hermanni* – 6 plates, 1 mandibula; Emididae gen. indet. – 15 plates), *Lacerta/Podarcis* sp. (5 semi-mandibles, 3 maxillae, 2 os coxae of 3 species at least), Serpentes fam. indet. – 5 (1 maxilla sin.) – all collected from 0-30 cm depth by I. Mitev (Mitev, 2005, 2016; Z. Boev – unpubl. data). I. Mitev's collection (Ruse).

Middle Holocene

46. **Malak Preslavets.** (Silistra R). Intramural funeral in the Early Neolithic settlement near the Malak Preslavets v. 50 m a. s. l. Excavations of Yordan Yordanov and Ivan Panayotov in 1985-1986. 6000 BC. *Testudo* sp. (Ribarov, 1992).
47. **Chavdarova Cheshma.** (Haskovo R.). Late Bronze Age (4900-4850 BC) settlement on the former bank of Maritsa River at the northern part of town of Simeonovgrad. *Testudo graeca/hermanni* – 3 bone plates, collected by Nadezhda Karastoyanova (NMNHS-BAS) on 16.05.2015.
48. **Zelenigradska Cave.** (Pernik R.) A total of 9 bones of *Anguis fragilis*, Colubrinae gen. indet. – 3 (large species), Colubrinae gen. indet. – 4 (small species), Natrinidae indet. (det. M. Böhme – 2008; unpubl. data). NMNHS.
49. **Sozopol – 1.** (Burgas R.) Submerged settlement in the Sozopol Bay of the Black Sea Coast, NE of t. of Sozopol. The settlement was situated on a former island, now 12 m under water (Geshakova & Toshev, 1994). Excavations in 1987-1990 of Mihail Lazarov, Veselin Draganov and Hristina Angelova. Final Chalcolithic (end of the 5th and the beginning of the 4th millenium BC) to the Early Bronze Age (2800 – 2400 BC; Spassov & Iliev, 1994). *Emys orbicularis* – 3 bones of MNI 1 of the Late Chalcolithic, *Testudo graeca* – 9 bones of MNI 4 of the Late Chalcolithic, and 1 bone of MNI 1 of the Early Bronze Age) (Spassov & Iliev, 1994). NMNHS.
50. **Sozopol – 2.** (Burgas R.) Late Holocene (subrecent, before 1585; 1898). *Caretta caretta.* Nankinov (1998) referrs to Loggerhead turtle the observation of the French noble Francois de Pavie, Baron de Fourquevaux in 1585), *Chelonia mydas* (Nankinov (1998) lists a specimen, caught on 16 November 1898. *Chelonia mydas* – NMNHS. In addition Georgiev (1979) also cites Francoise de Pavie, who in his voyage along the Bulgarian Black Sea Coast in 1585 writes about numerous large "edible sea turtles (of the size of a ship boat) between towns of Sozopol and Balchik. They were often hunted for food by the crew. Georgiev (1979) supposes that the disappearance of the sea turtles in Black Sea is possibly caused by the overhuntig by man in subrecent times, i. e. during the late Medieval ages. No known bone finds.
51. **Galabovo.** (Stara Zagora R.). Chalcolithic-Midle Bronze Age settlement mound near t. of

Galabovo. Excavations in 1989. Chalcolithic – Middle Bronze Age. *Testudo* sp. (Georgi Ribarov – unpubl. data).

52. **Durankulak – 1.** (Dobrich R.). Settlement on the Golemiya Ostrov Island in the Durankulak Lake near the Durankulak v. Excavations of Henrieta Todorova in 1994-1996. Neolithic – Early Chalcolithic, ca. 4500 BC. "reptiles" (Spassov & Iliev, 2002).
53. **Urdoviza.** (Burgas R.). Submerged settlement on the former Black Sea coast Near the Kyten v. Excavations of M. Lazarov, Krasimir Porozhanov and Vasil Popov. Chalcolithic-Early Bronze Age (3000-2000 BC). Reptilia – 2 (3) species (Ribarov, 1991 b), 242 reptilian bone finds (Boev & Ribarov, 1990).

Late Holocene

54. **Nisovo.** (Russe R). Rock shelter in the Beli Lom River in a 30 m high rock massive, 3 km S of Nisovo v. 1000 m a. s. l. It is located 5 m from the above rock edge and at about 30 m above the present river level. Dimensions: width – 3 m, height – 2 m, depth – 1 m. Bone-containing leyer was 20 thick. Material was collected in 1990 by I. Mitev and numbers over 2318 finds. Late Holocene. *Lacerta/Podarcis* sp. – 1 maxilla sin., collected from 0-20 cm depth (Mitev, 2005, 2016; Z. Boev – unpubl. data). NMNHS.
55. **Pisanets.** (Russe R). Rock shelter in the Beli Lom River in a 40 m high rock massive, 4 km W of Pisanets v. 100 m a. s. l. It is situated about 20 of the foothills of the rock massive. Dimensions: width – 4 m, heigh – 3 m, depth – 2 m. Excavations of I. Mitev in 1992 and 2004. Late Holocene. *Lacerta/Podarcis* sp. – 5 maxilae, 3 semi-mandibles, radius dex., ulna dex., os coxae dex. of 2 species) – all collected from 0-20 cm depth by I. Mitev (Mitev, 2005, 2016; Z. Boev – unpubl. data). NMNHS.
56. **Isperih.** (Dobrich R). Rock niche in the base of 15 m high rock massive in the Chernodlannitsa River in the Sboryanovo locality, 7 km NE of t. of Isperih 150 m a. s. l. and ca. 60 above the present river level. Dimensions: width – 3 m, heigh – 7 m, depth – 2 m. Old (subfossil) and recent locality of *B. bubo*. Excavations of I. Mitev in 2001 and 2002. Late Holocene. *Lacerta/Podarcis* sp. (1 maxilla from 10-20 cm depth, 1 maxilla from 20-30 cm depth), Serpentes (1 mandibula sin. from 10-20 cm depth) – all collected by I. Mitev) (Mitev, 2005, 2016; Z. Boev – unpubl. data). NMNHS.
57. **Popmartinova Cave.** (Ruse R). Caave in a 20 m high rock massive near the Danube river bank, 9 km SW of t. of Ruse. 10 m above the river level. 50 m depth, 5 m in height and 3 m wide. Excavations of I. Mitev in 1993 and 2003. Material came from the 0-30 cm layer. Late Holocene. Lacerinae gen. indet. (1 mandible sin., 1 maxilla sin., collected from 0-20 cm depth by I. Mitev) (Mitev, 2005, 2016; Z. Boev – unpubl. data). NMNHS.
58. **Petrol Base – Ruse.** (Ruse R.). Rock hollow in a 7 m high rock massive, 10 km SW of Popmartinova Cave at 20 m above the river level. Depth – 1 m, heighr and width – 0.5 m. 30 cm tick layer of deposited bones at 20 cm from the rock edge. Excavation of I. Mitev in 1994. Late Holocene. *Lacerta/Podarcis* sp. (4 mandibulae dex., 4 mandibulae sin. from 10-20 cm depth, 1 maxilla from 20-30 cm depth), Colubridae (?*Natrix natrix/tessellata* sp. – 1 mandibula dex.), Viperidae (?*Vipera* sp. – 2 mandibulae dex., 1 mandibula sin.), Serpentes fam. indet. – 6 (1 mandibula dex., 2 mandibulae sin., 2 maxillae) from 10-20 cm depth) – all collected by I. Mitev. (Mitev, 2005, 2016; Z. Boev – unpubl. data). NMNHS.
59. **Strelkovo.** (Silistra R). Rock niche in a 15 m high rock massive at 15 m above the bottom of dry river bed, 2 km SW of Strelkovo v. 100 m a. s. l. 2 m high, 2 m deep, and 0.5 m wide. Excavation in 2002 of I. Mitev. Late Holocene. *Lacerta/Podarcis* sp. (1 maxilla dex., collected from 0-20 cm depth by I. Mitev). (Mitev, 2005, 2016; Z. Boev – unpubl. data). NMNHS.
60. **Karapelit.** (Dobrich R**).** Rock niche in a 30 m high rock massive in the valley of the Suhata Reka River, 2 km W of the Karapelit v. 150 m a. s. l., at 10 m above the rock base and 20 avove the river bed. Dimensions: height – 1 m, width – 1.5 m, depth – 1.5 m. Bone-containing leyer is 20 cm thick at 1 m from the rock edge. Excavations of I. Mitev in 2002. Late Holocene. *Lacerta/Podarcis* sp. (1 semi-mandible), *Testudo graeca/hermanni* (1 plastron plate) – both collected from 0-20 cm depth by I. Mitev (Mitev, 2004). (Mitev, 2005, 2016; Z. Boev – unpubl. data). NMNHS.
61. **Basarbovo.** (Ruse R). Rock niche in a 40 m high rock massive, 2 km SE of Basarbovo v. 30 m above the foothills of the rock. Width – 3 m, heighr – 2 m, depth – 2 m. The layer with bones is 20 cm tick. Former and recent site of *B. bubo* Excavations of I. Mitev in 1990-1992. ?Late Holocene. *Lacerta/Podarcis* sp. (1 semi-mandible) (I. Mitev – unpubl. data) (Mitev, 2005, 2016; Z. Boev – unpubl. data). NMNHS.
62. **Kabile.** (Yambol R). Ancient t. of the Hellenic period to the Early Medieval Ages, 2 km N of Kabile v. 150 m a. s. l. Excavations (1972-1989) of Velizar Velkov. Hellenic period (2700 BC) and Early Medieval Ages (up to 6th c. AD). *Testudo* sp., *Lacerta* sp. (Ribarov, 1982; 1991 c). Numerous finds of terrestrial turtles (*Testudo*

sp.) suggest their utilization for food (befinning of 1st millenium BC to the end of the Hellenic period) (Ribarov, 1991 c). NMNHS

63. **Zaychi Vrah.** (Yambol R). A Hellenic sanctuary on the Zaychi Vrah peak of the Sredna Gora Mountain, near v. of Kabile. Hellenic period, 1st millenium BC (Ribarov, 1991 c). *Testudo* sp. (Ribarov, 1991 c). NMNHS
64. **Karanovo.** (Stara Zagora R). Settlement and citadell near t. of Nova Zagora. Excavations of V. Ignatov. Late Antiquity (2nd-6th c. AD) and Medieval Ages (11th-12th c.). *Testudo* sp. (2-6 c. AD); *Testudo* sp. (11th-12th c.). NMNHS
65. **Nicopolis-ad-Istrum.** (Veliko Tarnovo R). Roman t. (1th – 6th c. AD), 3 km SE of Nikyup v. Excavations of Andrew Poulter (1985-1991). Late Roman period (250-450 AD; Beech (1993, 1997) for the find of *Testudo graeca. Testudo graeca* (two bone finds – “single carapace fragment” and “an almost complete ... carapace”, Beech, 1993, 1997; 2007). University of Nottingham, United Kingdom.
66. **Durankulak – 2.** (Dobrich R.). Ancient and medieval settlement. 20 m a. s. l. Excavations of H. Todorova (1990-1995). Testudines fam. indet.
67. **Novae.** (Veliko Tarnovo R). A Roman t. of 1st – 7th c. AD near t. of Svishtov. Excavations in 1972 by a Polish team of AMUP. Reptilia ordo indet. – “single examples of reptiles” (p. 292, Schramm, 1975). AMUP (Schramm, 1975); 14 remains of “turtles” (Makowiecki, 1999).
68. **Ratiaria.** (Vidin R). Roman t. (3rd-4th c. AD), 1.5 km NW of Archar v. Excavations of the Bulgarian-Italian archaeological expedition, 1957-1961, and 1975-1980. *Testudo* sp. (Iliev et al., 1993), *Emys orbicularis* (Boev, 1999).
69. **Iskritsa.** (Stara Zagora R). Middle Ages settlement (11th-12th c. AD) near the Istkitsa v. Excavations in 1991-1992. Depth 0.5-0,9 m, squares L17-K17, M15-N15. 11th-12th c. AD *Testudo* sp. (G. Ribarov – unpubl. data).
70. **Kapitan-Andreevo – 1.** (Haskovo R.). Early Medieval Ages (Byzantian period) (N. Spassov – unpubl. report: Analysis of the animal bone remains of the site Kapitan-Andreevo, early Medieval Ages (excavations of Hr. Popov)). *Testudo* / (*Eurotestudo*) sp. – 6 plate fragments of the carapase of an individual (N. Spassov – unpubl. data).
71. **Kapitan-Andreevo – 2.** (Haskovo R.). Neolithic to Medieval settlement (7200 BP – 10th centyry AD) (Bachvarov et al., 2013). *Testudo* / (*Eurotestudo*) sp. – humerus dex., tibia sin., fibula sin., coracoid sin. Material handled by N. Karastoyanova in 2016. (Z. Boev – unpubl. data). NMNHS.
72. **Hisarlaka.** (Sliven R). Early Byzanian (5th-6th c. AD) and medieval (10th-12th c. AD) settlement in the town of Sliven. Reptilia ordo indet. (Ribarov, 1990); 59 reptilian bone remains (Boev & Ribarov, 1989). All these remains belonged to Testudines (G. Ribarov – unpubl. data).

Conclusions

The reptilian fossil and subfossil fauna of Bulgaria is rich and diversified. Its exploration was accidental and the obtained data have been scattered in numerous less accesive bibliographic sources. In their great majority, data are incomplete, as the taxonomic identification remained incomplete. Only one fouth of the established taxa (25 of a total of 98) were identified up to species level. All the rest taxa are determined up to genus/family level.

The chronostratigraphic range of the reptilian fossil record of the country is “Late Jurassic (Malm, i. e. Kimmeridgian) – Late Holocene”. The most abundant fossil/subfossil record came from the Late Holocene and the Pliocene localities. The site near Varshets is the richest reptilian site in Bulgaria, where at least 8 taxa have been established. It is followed by the site near Somovit and the Bacho Kiro Cave (5 taxa each). Five localities are actually unknown, i. e. no data for the locality of the collected bone finds of reptiles were reported.

The 72 known localities provided fossil record of 98 taxa: 25 species, 26 genera, 22 families and 6 orders at least.

Two families include taxa of exotic distribution, i. e. they are not part of recent herpetofauna of Bulgaria, Balkan region and Europe: Varanidae, Elapidae. The recent representatives of the subfamily Lygosominae Mittleman, 1952 are also exotic for the present territory of Bulgaria.

Over 19 taxa represent fossil species/groups, covering a period of 157.3 to 5.3 Ma.

Most of the data came from researches of foreign specialists (from Georgia, Germany, Czechia, France, Poland, United Kingdom, etc.).

None of the reprilian localities has been protected by the Bulgarian environmental legislation. The most abundant samples of fossil and subfossil cold-bloodied amniots are currently kept at the NMNHS. Three of the Bulgarian finds of fossil reptiles has been described as holotype.

The most numerous bone finds are vertebrae of snakes, followed by the plastrons/carapaces and bone sheets of land tortoises.

The fossil and subfossil material of reptiles, collected in Bulgaria, is kept at least in 5 Bulgarian collections (Asenovgrad, Pleven, Ruse, Sofia (the

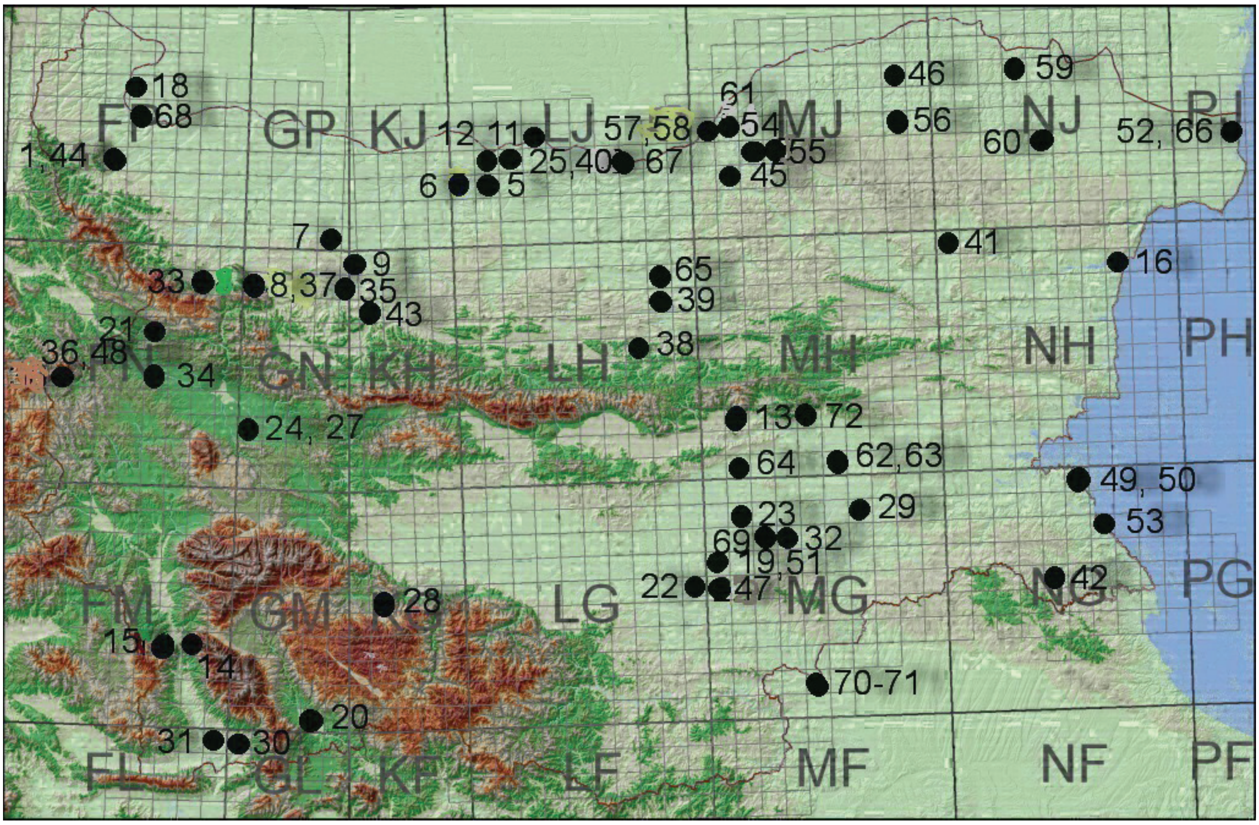

Fig. 1. Location of the localities of fossil/subfossil reptilian record of Bulgaria (Locality number corresponds to text). Late Jurassic: Oreshets (1): Late Cretaceous: Unknown locality – 1 (2; not marked), Drashan (3), Unknown locality – 2 (4; not marked), Kreta (5), Riben (6), Komarevo (7), Varbeshnitsa – 1 (8), Breste (9), Unknown locality – 3 (10; not marked), Nikopol (11), Somovit (12); Neozoic: Paleogene: Late Eocene: Nikolaevo (13); Oligocene: Brezhani (14), Oranovo (15); Neogene: Miocene: Middle Miocene: Varna (16), Unknown locality – 4 (17; not marked), Sinagovtsi (18) Maritsa-Iztok (19): Late Miocene: Hadzhidimovo (20), Stanyantsi (21), Nova Nadezhda (22); Early Pliocene: Radnevo (23), Sofia – 1 (24), Muselievo – 1 (25), Unknown locality – 5 (26; not marked), Sofia – 2 (27), Dorkovo (28), Tenevo (29), Kalimantsi (30), Kromidovo (31), Kovachevo (32); Quaternary: Early Pleistocene: Varshets (33), Slivnitsa (34), Kunino (35), Tsareva Tsarkva (36); Middle Pleistocene: Varbeshnitsa – 2 (37); Late Pleistocene: Bacho Kiro Cave (38), Golyamata Cave (39), Muselievo – 2. (40), Madara (41), Stoilovo (42), Karlukovo 4 (43), Kozarnika (44); Holocene: Early Holocene: Shirokovo (45); Middle Holocene: Malak Preslavets (46), Chavdarova Cheshma (47), Zelenigradska Cave (48), Sozopol – 1. (49), Sozopol – 2. (50), Galabovo (51), Durankulak – 1 (52), Urdoviza (53); Late Holocene: Nisovo (54), Pisanets (55), Isperih (56), Popmartinova Cave (57), Petrol Base – Ruse (58), Strelkovo (59), Karapelit (60), Basarbovo (61), Kabile (62), Zaychi Vrah (63), Karanovo (64), Nicopolis-ad-Istrum (65), Durankulak – 2 (66.), Novae (67), Ratiaria (68), Iskritsa (69), Kapitan-Andreevo – 1. (70), Kapitan-Andreevo – 2. (71). Hisarlaka (72).

NMNHS and Sofia University), and ?Vidin. The whereabouts of many finds remains unknown and possibly the information have been lost. Some foreign collections also possess fossil and subfossil reptiles, collected in Bulgaria. They are located in 6 European countries – Czehia (Prague), France (Paris), Georgia (Tbilisi), Germany (Tübingen), Poland (Cracow, Poznan), United Kingdom (Nottingham). Apart from herpetologists from Bulgaria, experts from Poland and Germany have contributed most to exploration of fossil and subfossil reptiles in the country.

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Appendix I.
Systematic list of the fossil/subfossil reptiles in Bulgaria

Reptilia Laurenti, 1768

Dinosauromorpha Benton, 1984
Dinosauriformes Novas, 1992
Dinosauria Owen, 1842

Ornithishia Seeley, 1888
Ornithopoda Marsh, 1881
1. Hadrosauroidea Cope, 1869 fam. indet.

Saurischia Seeley, 1888
Theropoda Marsh, 1881
2. Ornithomimosauria Barsbold, 1976 fam. indet.

Archosauromorpha von Huene, 1946
Archosauriformes Gauthier, 1986
Pseudosuchia Zittel, 1887
Suchia Krebs, 1974
Paracrocodylomorpha Parrish, 1993
Crocodilomorpha Hay, 1930
Eusuchia Huxley, 1875
Crocodilia Owen, 1842

Crocodilidae Cuvier, 1807
3. Crocodilia fam. indet.
4. Crocodilidae gen. indet.

Alligatoroidea Gray, 1844
Diplocynodontinae Brochu, 1999
5. *Diplocynodon levantinicum* Huene, 1963
Neosuchia Gervais, 1871
Dyrosauridae de Stefano, 1903
6. *Dyrosaurus phosphaticus* (Thomas, 1893)

Sauropterygia Owen, 1860
Pistosauroidea Baur, 1887-90
Plesiosauria de Blainvile, 1835

Plesiosauridae Gray, 1825
7. *Plesiosaurus* Conybeare, 1821 sp.
8. *Plesiosaurus* sp. – 1
9. ?*Plesiosaurus* sp. – 2

Elasmosauridae Cope, 1869
10. Elasmosauridae gen. and sp. indet.

Pantestudines Klein, 1760
Testudinata Klein, 1760
Testudines Batsch, 1788
11. Testudines fam. indet. – 1
12. Testudines fam. indet. – 2

Cryptodira Cope, 1868
Testudinidae Batsch, 1788
13. *Testudo* Linnaeus, 1758 sp.
14. *Testudo bulgarica* Amiranashvili & Chkhikvadze, 2000
15. *Testudo graeca* Linnaeus, 1758
16. *Testudo* (*Protestudo* sp.) – 1
17. *Testudo* (*Protestudo* sp.) – 2
18. *Testudo* (*Protestudo* sp.) – 3
19. *Testudo* (*Protestudo* sp.) – 4
20. *Testudo* (*Protestudo* sp.) – 5
21. *Testudo* cf. *antigua* Bronn
22. *Testudo graeca/hermanni*
23. *Testudo* aff. *marmorum* Gaudry, 1862
24. *Testudo* sp., cf. *graeca/hermanni*
25. *Testudo* sp. – 1
26. *Testudo* sp. – 2
27. *Geochelone* s. l. Gray, 1872 sp. / *Testudo* ex gr. *atlas*
28. *Paleotestudo/Protestudo* sp.
29. Testudinidae gen. indet. – 1
30. Testudinidae gen. indet. – 2
31. Testudinidae gen. indet. – 3
32. Testudinidae gen. indet. – 4

Emydidae (Rafinesque, 1815)
33. *Emys* Duméril, 1805 sp.
34. *Emys orbicularis* (Linnaeus, 1758)
35. *Emys* sp. (aff. *orbicularis*)
36. *Clemmidopsis* cf. *sopronensis* Boda, 1927

Cheloniidae Oppel, 1811
37. *Chelonia mydas* (Linnaeus, 1758)
38. Cheloniidae fam. indet. – 1

Trionychidae Fitzinger, 1826
39. *Trionyx* (*Amyda*) *capellini* Negri 1892 (*T.* (*A.*) *c. bulgaricus* Khosatsky 1983)
40. *Trionyx* sp.

Ichthyosauromorpha Motani et al., 2014
Ichthyosauriformes Motani et al., 2014
Ichthyopterygia Owen, 1840
41. Ichthyosauria Blainville, 1835 fam. indet. – 1
42. Ichthyosauria fam. indet. – 2

Sauria Macartney, 1802
Lepidosauromorpha Benton, 1983
Lepidosauria Haeckel, 1866
Squamata Oppel, 1811

Mosasauridae Gervais, 1853
43. *Mosasaurus* cf. *hoffmanni* (Mantell, 1829)
44. *Mosasaurus giganteus* Sömmering, 1820
45. *Mosasaurus* Conybeare, 1822 sp. – 1
46. *Mosasaurus* sp. – 2
47. *Mosasaurus* sp. – 3
48. *Mosasaurus* sp. – 4
49. *Mosasaurus* sp. – 5
50. *Mosasaurus* sp. – 6
51. *Globidens fraasi* Dollo, 1913
52. *Leiodon* (*Liodon*) *anceps* Owen, 1841
53. *Carinodens belgicus* (Woodward, 1891)

Scincomorpha Camp, 1923

Scincidae Gray, 1825
54. *Trachylepis* cf. *aurata* (Linnaeus, 1758)
55. “*Mabuya*” Fitzinger, 1826 sp.

Anguimorpha Fürbringer, 1900

Anguidae Gray, 1825
56. *Anguis fragilis* Linnaeus, 1758
57. *Anguis* cf. *fragilis* Linnaeus, 1758
58. *Pseudopus* aff. *apodus* (Pallas, 1775)
Lacertidae Oppel, 1811
59. *Lacerta* s. l. sp. – 1
60. *Lacerta* s.l. sp. – 2
61. *Lacerta agilis* Linnaeus, 1758
62. *Lacerta viridis* (Laurenti, 1768)
63. *Lacerta* sp. indet.
64. *Lacerta/Podarcis* sp. – 1
65. *Lacerta/Podarcis* sp. – 2
66. *Lacerta/Podarcis* sp. – 3
67. *Lacerta/Podarcis* sp. – 4
68. *Lacerta/Podarcis* sp. – 5
69. *Lacerta/Podarcis* sp. – 6
70. *Lacerta/Podarcis* sp. – 7
71. ?Lacertidae gen. indet.

Varanidae Merrem, 1820
72. Varanidae gen. indet.

Serpentes Linnaeus, 1758
Colubridae Oppel, 1811
73. *Coronella* aff. *austriaca* Laurenti, 1768
74. *Dolichophis caspius* Nagy et al., 2004
75. *Elaphe quatuorlineata* (Lacépède, 1789)
76. *Zamenis longissimus* (Laurenti, 1768
77. *Zamenis situla* (Linnaeus, 1758)
78. Colubrinae sp. – 1
79. Colubrinae sp. – 2
80. Colubrinae sp. – 3
81. Colubrinae sp. – 4

Natricinae Bonaparte, 1838
82. Natricinae gen. indet. – 1
83. Natricinae gen. indet. – 2
84. ?*Natrix natrix/tessellata* sp.
85. *Natrix* sp.
86. *Natrix* cf. *tessellata* Laurenti, 1768
87. *Natrix* aff. *natrix* (Linnaeus, 1758)

Typhlopidae Merrem, 1820
88. *Telescopus* sp.

Elapidae F. Boie, 1827
89. Elapidae gen. indet.

Boidae Gray, 1825
Erycinae Bonaparte, 1831
90. ? Erycinae gen. indet.

Viperidae Oppel, 1811
91. ?*Vipera* sp.
92. Viperidae gen. indet.
93. Serpentes fam. indet. – 1
94. Serpentes fam. indet. – 2
95. Serpentes fam. indet. – 3
96. Serpentes fam.indet. – 4
97. Serpentes fam. indet. – 5
98. Serpentes fam. indet. – 6

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Фосилната и субфосилна летопис на влечугите (Reptilia Laurenti, 1768) в България

Златозар Боев

(Резюме)

Обобщени са всички разпръснати и оскъдни данни за фосилните и субфосилни останки от влечуги в България. За първи път е представен пълният списък от 72 находища, таксономичният състав и видът на намерените останки. Събрани са сведения за 98 таксона, 25 от които са определени до вид. Установеният в страната състав на влечугите се отнася към най-малко 26 рода, 22 семейства и 6 разреда. Хроностратиграфски фосилната летопис на Reptilia в България обхваща последните 157,3 млн. г. – от кимеридж (късна креда) до късен холоцен. Около 1/5 от таксоните са фосилни. Три фосилни таксона са описани като нови за науката. Две семейства (Varanidae и Elapidae) и едно подсемейство (Lygosominae) от сцинковите днес включват само представители с екзотично за страната разпространение. Освен херпетолози от България, най-голям принос в изучаването на фосилните влечуги от страната имат специалисти от Полша и Германия.

Historia naturalis bulgarica, 24: 179-186, 2017

New data on the subfossil fauna from "Forum Serdica" (Sofia City, Bulgaria; 3rd-19th century AD)

Zlatozar Boev

Abstract: Presented are the results of the excavations in the central Sofia circus of 3rd-4th to 16-19th c. AD from 2016, deposited over the Roman "Forum Serdica". They number 8313 bone/shell finds of 47 taxa (at least 36 species and domestic forms) of invertebrates (mollusks – land snails and freshwater mussels) and vertebrate animals (bony ray-finned fishes, birds and mammals /incl. man/). One species, the Aurochs, is globally extinct and 1 disappeared from the recent fauna of Bulgaria (Great bustard). Seven species are listed in the country's Red Data Book: European carp, Great bustard, Eurasian lynx, Gray wolf, Red deer, Brown bear, and Wildcat.

Keywords: Medieval animal husbandry and hunting, Last Aurochs on the Balkans, Late-medieval poultry, Means of livelihood in the Ottoman period of Sofia

Introduction

The continuation of the "Forum Serdica" project (Archaeological excavations and exploration of "St Nedelya Circus") revealed a lots of new archaeozoological materials in 2016. It remains unexamined and unpublished, as the previous study of Boev (2016) covered the animal remains only of 2015. The new excavations, as before, were carried out by the Sofia Municipality by the same team of the National Archaeological Institute and Museum of the Bulgarian Academy of Sciences (NAIM-BAS), leaded by Assist. Prof. Dr. Veselka Katsarova.

Material and Methods

The handed animal remains (October 2016) for archaeozoological examination numbered 8313 pieces of bone/dental fragments and mollusk shells (Table 1). They were identified through the osteological collections of the National Museum of Natural History at the Bulgarian Academy of Sciences (Department of Vertebrate Animals).

The material provided was collected in a total of 367 collections/samples in 2016 and according to its date was divided into 3 groups: (1) antiquity – 3rd-4th c. AD, (2) late antiquity – 4th-6th c. AD (more often 5th-6th c. AD) and (3) Ottoman period – 16th-19th c. AD (more often 17th-19th c. AD). When collected, the materials of a total of 37 collection samples were dated as "mixed". The chronological distribution of each species/sample is given in Table 1. The finds from the Ottoman period make up the vast majority (over 85%) of the material. All avian bone material (562 findings) has been inventoried in the Fossil and subfossil birds collection of the National Museum of Natural History, Bulgarian Academy of Sciences (NMNHS-BAS): No 16820; 16833; 17056-17057; 17170; 17197; 17229; 17302-17860). In addition a small part of the mammalian finds (lynx, brown bear) have been deposited in the mammalian osteological collections of the museum.

General composition of the established wild and domestic vertebrates

The species composition is rather varied. The examined bone, teeth and shell remains belong to 47 taxa (at least 36 species and domestic forms) of invertebrates (mollusks) – land snails (Fig. 1) and freshwater mussels (Fig. 2) and vertebrate animals (bony ray-finned fishes /Actinopterygii/, birds and mammals /incl. man/) (Table 1).

A significant part of the collected remains because of their bad and fragmentary preservation is inappropriate for taxonomic determination. A total of 3649 finds (43.9 %) represent unidentifiable frag-

Table 1. Animal representation in the collected archaeozoological material from "Forum Serdica" (pr. Sofia City) in 2016

No	Taxa	English Name	Total number of finds	Number of processed finds	Number of burnt finds
		MOLLUSCA			
		Gastropoda			
		Heterobranchia			
1	*Helix lucorum* Linnaeus, 1758	Turkish snail	17		
	Total		17		
		Bivalvia			
		Unionoida			
2	*Unio crassus* Philipsson, 1788	Thick shelled river mussel	1		
	Total		1		
		OSTEYCHTHYES			
		Siluriformes			
3	*Silurus glanis* Linnaeus, 1758	Wels catfish	1		
	Total		1		
		Cypriniformes			
4	*Cyprinus carpio* Linnaeus, 1758	European carp	1		
5	Cyprinidae fam. indet	Cyprinid fishes	2		
	Total		3		
	Bony fishes total		4		
		AVES			
		Anseriformes			
6	*Anas platyrhynchos domestica*	Domestic duck	12		3
7	*Anas platyrhynchos* Linnaeus, 1758	Mallard	5		
8	*Anser anser domestica*	Domestic goose	123	2	9
	Total		140		
		Ciconiiformes			
9	*Ciconia ciconia* Linnaeus, 1758	White stork	4		
	Total		4		
		Galliformes			
10	*Gallus gallus domestica*	Domestic hen	410	3	84
11	*Pavo cristatus domestica*	Domestic peafowl	3		
12	*Perdix perdix* (Linnaeus, 1758)	Grey partridge	2		
	Total		415		
		Accipitriformes			
13	*Buteo buteo* (Linnaeus, 1758)	Common buzzard	1		
	Total		1		
		Otidiformes			
14	cf. *Otis tarda* Linnaeus, 1758	?Great bustard	1		
	Total		1		
		Passeriformes			
15	*Corvus cornix* (Linnaeus, 1758)	Hooded crow	1		
	Total		1		
	Birds total		562		
		MAMMALIA			
		Erinaceomorpha			
16	*Erinaceus roumanicus* Barrett-Hamilton, 1900	Northern white-breasted hedgehog	4		
	Total		4		

Table 1. Continued

No	Taxa	English Name	Total number of finds	Number of processed finds	Number of burnt finds
		Rodentia			
17	*Rattus rattus* (Linnaeus, 1758)/ *Rattus norvegicus* (Berkenhout, 1769)	Black rat/ Brown rat	1		
	Total		1		
		Lagomorpha			
18	*Lepus europaeus* (Pallas, 1778)	European hare	25		
19	*Oryctolagus cuniculus* (Linnaeus, 1758)	European rabbit	11		
	Total		36		
		Carnivora			
20	*Ursus arctos* Linnaeus, 1758	Brown bear	1		
21	*Vulpes vulpes* (Linnaeus, 1758)	Red fox	19		
22	*Canis familiaris* (Linnaeus, 1758)	Domestic dog	65		
23	*Canis lupus/familiaris*	Grey wolf / Domestic dog	9		
24	*Meles meles* (Linnaeus, 1758)	European badger	2		
25	*Lynx lynx* (Linnaeus, 1758)	Eurasian lynx	1		
26	*Felis silvestris* Schreber, 1777	Wildcat	16		
27	*Felis catus/silvestris*	Domestic cat / Wildcat	1		
28	*Felis catus* Linnaeus, 1758	Domestic cat	33		
29	*Felis* cf. *catus*	?Domestic cat	3		
30	*Canis lupus* Linnaeus, 1758	Gray wolf	32		
31	*Canis* cf. *lupus*	Gray wolf	2		
	Total		184		
		Artiodactyla			
32	*Sus scrofa domestica*	Domestic pig	322	6	11
33	*Sus scrofa scrofa* Linnaeus, 1758	Wild boar	242		4
34	*Capra hircus* (Linnaeus, 1758)	Domestic goat	881	5	2
35	*Ovis aries* Linnaeus, 1758	Domestic sheep	518	7	7
36	Ovicaprinae	Small ruminants	203		3
37	*Bos taurus* Linnaeus, 1758	Domestic cattle	1328	20	6
38	cf. *Bos taurus*	?Domestic cattle	33		
39	*Bos primigenius* (Bojanus, 1827)	Aurochs	10		
40	*Bos* cf. *primigenius*	?Aurochs	29		
41	*Bos taurus/primigenius*	Domestic cattle / Aurochs	47		
42	*Cervus elaphus* Linnaeus, 1758	Red deer	48		
43	*Capreolus capreolus* (Linnaeus, 1758)	European roe deer	66		
	Total		3727		
		Perissodactyla			
44	*Equus ferus caballus* Linnaeus, 1758	Domestic horse	63	2	2
45	*Equus africanus asinus* Linnaeus, 1758	Domestic donkey	34		
46	*Equus* cf. *asinus*	?Domestic donkey	1		
	Total		98		
		Primates			
47	*Homo sapiens* Linnaeus, 1758	Wise man	30		
	Total		30		
	Mammals – bone splinters		3649		6
	Mammals total		7729		
	Vertebrates total		8295	45	137
	Animal remains total		8312	45	137

Fig. 1. *Helix lucorum*: shell. (Photo: Z. Boev)

Fig. 3. *Silurus glanis*: os frontalis ad. (Photo: Z. Boev)

Fig. 2. *Unio crassus*: shell. (Photo: Z. Boev)

ments (s. c. bone splinters) without preserved diagnostic features for their osteological identification.

Partly unidentified are also 203 bone fragments, listed as "small ruminants, Ovicaprinae"– sheep/goat; Table 1.).

Fishes and fishing

Three species of bony fishes at least have been recorded (Table 1). The Welsh catfish (Fig. 3) occurs in the lower and middle reaches of the large rivers (Karapetkova, Zhivkov, 1995). Similarly, at present the European carp (*Cyprinus carpio*) is spread in the Danube River and the lowermost reaches of its larger tributaries (Karapetkova, Zhivkov, 1995).

Domestic animals and animal husbandry

Among the new materials from 2016, the composition of the farmed domestic animals again is rather varied. Domestic animals are represented by 13 forms – cattle, goat, sheep, pig, horse, donkey, rabbit, dog, cat, as well as the chicken, goose, duck, and peacock (Fig. 4, 5). "Forum Serdica" is the second site of *Pavo cristatus* in Bulgaria. So far this valuable decorative bird was known only from the Roman town of Nicopolis-ad-Istrum (4th-6th c. AD; Boev, Beech, 2007). The present 3 finds (leg bones) originated from deposits of 17-19th c. AD.

Domestic chicken dominates (410 finds), followed by domestic goose (123) (Table 1).

A total of 4080 animal finds (49.18 % of all vertebrate animals remains) belonged to domestic animals, i. e. almost half of the collected finds. In addition 57 bones (0.69 %) have been incompletely identified both as belonging to wild or corresponding domestic forms.

The cattle was most commonly spread domestic animal. Its remains have been uncovered in 256 of the total 367 samples from the excavations. A small brachycerous breed (Fig. 6) was most commonly bred. Here we do not present special measurements of numerous finds, but the conclusion about predominant small (and brachycerous) cattle breed is undoubtfull. The domestic goat was present at 133 samples, and domestic sheep – in 99 samples.

The collected new material (as that of 2015) confirms practicing of 3 main livelihoods – fishing, hunting and animal husbandry. We also could add and fourth one – gathering, as we have found shell remains of gathered freshwater river mussel and land snails, widely used for food resources until recently.

The animal husbandry was divided into avi-

Fig. 4. *Pavo cristatus domestica*: NMNHS 17 405 tarsometatarsus sin. ♂ ad. (Photo: Z. Boev)

Fig. 5. *Pavo cristatus domestica*: NMNHS 17 625 tarsometatarsus dex. ♀ sad. (Photo: Z. Boev)

Fig. 7. *Rattus rattus/ norvegicus*: incissuvum ad. (Photo: Z. Boev)

Fig. 6. *Bos taurus*: skull of a brachycerous specimen ad. (Photo: Z. Boev)

culture, cuniculture, as well as pig-breeding, cattle (stock)-breeding, horse- and donkey-breeding, and dog- and cat-breeding. As in the material of 2015, the domestic rabbit is rare – only 11 bones of *Oryctolagus cuniculus* have been collected.

It is undisputedly proven by the material that the hen has been represented by at least 3 breeds, based on bone size measurements. At least 10.5% of the finds are referred to the so-called "bantam" breed – small non-meat (more often decorative) breeds, slightly larger than a domestic pigeon. Very large hens are very rarely presented, and the most widely distributed breed is a medium-sized breed. The donkey was 2 times less bred than the horse.

Fig. 8. *Bos taurus* (above) and *Bos primigenius* (bellow): compared cranial fragments with horn shafts (Photo: Z. Boev)

Fig. 9. *Lynx lynx*: left mandible (Photo: Z. Boev)

Fig. 10. *Cervus elaphus*: cut antler ad. (Photo: Z. Boev)

Wild animals

The wild fauna is represented by some valuable hunting mammals and birds, as well as of some species of uncertain direct significance to man as Black/Brown rat (Fig. 7), Northern white-breasted hedgehog, as in the material of 2015). The presence of the White stork could be explained by the species' aptitude to synanthropization since ancient times.

The same could be the reason for the record of the Hooded crow.

One species, the Aurochs (Fig. 8) is globally extinct since 1627, and one other, the Great bustard is disappeared as breeding species in the country since 1970-s. The finds of the Aurochs deserve special attention. According Prof. NIKOLAY SPASSOV (NMNHS – Sofia) at least some of the bones of 16th-19th century could be referred to a large primigene breed of cattle, showing almost undistinguishable osteometric features as the Aurochs. In general, we also do not exclude completely such a probability, but we consider it rather impossible. As *B. primigenius* was established in the material of 2015-2016 in the same site (BOEV, 2016) and the surviving of the Aurochs until 16th century in Bulgaria in other site – Veliki Preslav (only 290 km from Sofia) and the presence of large suitable habitats on the CW Bulgaria (present Kyustendil, Pernik and Sofia Regions) the possibility of surviving of the Aurochs must not be excluded.

The found mandible of lynx (Fig. 9) is an extremely important record of this disappeared (1941) and reappeared (2008) rare carnivore. "Forum Serdica" is the 11th site in Bulgaria where subfossil finds of *L. lynx* are found. It is dated Late Medieval Ages (16th-19th century AD) (Boev, 2017).

Data of 2016 also confirm the wide diversity and richness of the wild fauna in the Sofia region. The remains of Aurochs again confirm our statement (Boev, 2016) for the last Aurochs in Bulgaria from Sofia region. Present finds originated from two different sections of the excavated area of different dating: (1) late antiquity (3rd-4th c. AD) and (2) late medieval (16th-19th c. AD).

Seven species are now endangered or vulnerable in the Bulgarian nature. They have been listed in the country's Red Data Book: European carp, Great bustard, Eurasian lynx, Gray wolf, Red deer, Brown bear, Wildcat.

Large carnivores are well represented. Besides species mentioned above, the red fox and European badger are also established among the remains.

The five aquatic species (Thick-shelled river mussel, European carp, Wels catfish, White stork, and Mallard) suggests a large water body with open surface. We remind that at present both rivers, Perlovska and Suhodolska lie at a distance of only ca. 2 km (see Boev, 2016).

Traces on bones

The trace analysis shows that 45 bones bear traces of cutmarks (complete cuts – cutting off) or only cutmarks (Table 1). In addition 137 bones show evident traces of burning, i. e. the all are completely or partially burnt.

Most often burning traces could be noticed on chicken bones (84), but also meat of some other animals, e. g. domestic ducks, geese, pigs, goat, sheep, and even horses, had been roasted.

We have found cut antlers of the Red deer, which were cut through a saw (Fig. 10) for secondary utilization of their antlers. Analogous processing was also found for the horns of some adult rams and he-goats.

In general 137 bones (1.65 % of the finds) bear traces, left by man.

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Нови данни за субфосилната фауна от „Форума на Сердика“ (София, България, 3-19 в. н. е.)

Златозар Боев

(Резюме)

Представени са резултатите от археологическите разкопките през 2016 г. на централния площад на София („Св. Неделя“) от 3-4 до 16-19 в. н. е., отложени върху “Forum Serdica”. Материалът наброява 8313 останки от 47 таксона (най-малко 36 вида и домашни форми) от безгръбначни (мекотели – сухоземни охлюви и сладководни миди) и гръбначни животни (костни риби, птици и бозайници /вкл. и човешки останки/). Част от находките на извънредно едри бовиди са отнесени към изчезналото диво говедо (тур) – допускане заради отнасянето на всички останали останки от домашни говеда към дребни брахицерни породи. Един вид (голямата дропла) е изчезнал (като гнездещ) от съвременната фауна на страната. За 7 вида от „Червената книга на Р България“ се допълват сведенията за тяхното разпространение в миналото: европейски шаран, голяма дропла, евроазиатски рис, сив вълк, благороден елен, кафява мечка и дива котка.

Установено е, че на пряк огън (опичане) е било приготвяно за храна месото на домашни патици, гъски, кокошки, свине, кози, овце и дори и коне. Рогата на някои животни (благородни елени, домашни кози) са били отсичани с брадва или отрязвани с трион за вторичната им употреба.

Historia naturalis bulgarica, 24: 187, 2017

International team of scientists presents evidence that the oldest pre-humans lived 7.2 Ma ago on the Balkans

On May 22 2017, the well-known scientific journal PLOS ONE published two joined papers, which present a new viewpoint on the time and place of the first steps of humankind.

Sofia – Tübingen – Toronto, 22.5.2017

An international scientific team from Germany, Bulgaria, Greece, Canada, France and Australia, headed by Professor Madelaine Böhme (The Senckenberg Centre for Human Evolution and Palaeoenvironment at the University of Tübingen) and Professor Nikolai Spassov (National Museum of Natural History at the Bulgarian Academy of Sciences), presents evidence that the first hominins (first pre-humans) rose on the Balkans 7.2 Ma ago.

The present-day chimpanzees are humans' nearest living relatives. Where and when the last chimp-human common ancestor lived is a central and highly debated issue in paleoanthropology. Researchers have assumed up to now that the lineages diverged five to eight million years ago and that the first pre-humans developed in Africa.

The recent research published in PLOS ONE presents another scenario about the origin of humankind. The new view point is based on two fossil remains, discovered in Greece at (at Pyrgos Vassilissis near Athens) and in Bulgaria (the area of Azmaka near Chirpan).

In one of the papers the authors demonstrate that both finds refer to the same species, the fossil hominid *Graecopithecus freibergi*. They point out that its features give ground to consider *Graecopithecus* a pre-human (hominin).

The other paper sets the geological age of *Graecopithecus* using biochronological and geophysical methods. The rather dry savannah paleoenvironment of this pre-human is also restored. The determined remains of the mastodont *Anancus* sp., the bovid *Tragoportax macedoniensis* and several other newcomers in the local fossil fauna indicate that the age of the *Graecopithecus* localities is younger that the one of the well-known paleontological locality of Pikermi in Greece. The precise analyses show an age of 7.24 Ma for the find from Azmaka and respectively 7.175 for the one from Pyrgos Vassilissis.

All of this characterizes *Graecopithecus*, nicknamed El Graeco, the oldest potential hominin, whose age exceeds by several hundred thousands of years that of *Sahelanthropus*, found in Chad and considered until now to be the oldest hominin.

Thus, the appearance of pre-humans possibly occurred in the Eastern Mediterranean and not – as customarily assumed – in Africa.

In 1994 the eminent French paleontologist Yves Coppens emphasized the role of droughting of the East African landscapes in the evolution and the straightening of the pre-humans and called it the East Side Story. Today we have more reason to relate this process with a North Side Story.

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Prof. Denis Geraads at 65

At the very end of last year the eminent paleontologist Prof. D. Geraads turned 65. For us, his colleagues and friends, who know of his extraordinary energy and the intensity of his research in the field of his favourite paleontology, the news was somewhat unexpected.

After graduating from the Paris University, Denis Geraads began working in MNHN, Paris. Afterwards, during his entire research career, he worked at CNRS (long years at the Lab. Dynamique de l'évolution humaine (UPR2147) and in recent years within a unit of CNRS, again in the NMNH (Lab. of Paleontology). Exceptionally active in research, he is the author of over 300 publications in the field of systematics, phylogeny and paleoecology of large mammals (above all of perissodactyls, artiodactyls, carnivores, primates), evolution and paleozogeography of continental fauna, paleoanthropology (especially the early evolution of the hominins).

His entire career is related not only with the study of fossil fauna but also with active field work – paleontological excavations and field research in the Eastern Mediterranean (Bulgaria, Greece, Turkey) as well as in Northern, Equatorial and Eastern Africa. Without exaggeration we can say, that his name is known to every active researcher in the field of the paleontology of Neogene and Quaternary mammals of the old world. Undoubtedly, his contributions make him one of the distinguished researchers of our time in this field.

I started working together with Denis Geraads 18 years ago and we have many more ideas and plans for the future. He was the project leader of the French side of the CNRS and the Bulgarian Academy of Sciences project: Mammal faunas of the late Miocene of Bulgaria 2000-2007. He has greatly contributed to the development of the Bulgarian school on paleontology of the Miocene Mammal Fauna. For his contributions in this respect he was awarded with "Acad. Ivan Buresch" prize of the National Museum of Natural History (Sofia) at the Bulgarian Academy of Sciences.

This year Dennis retired at the height of his scientific career, such are labour laws in France. This will not reduce his enormous energy, his desire for future work and his plans for new studies.

Let us wish him health, successes, and new discoveries!

Prof. Nikolai Spassov

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Една необикновена книга

Когато през 1998 г. Боян Петров стана член на колектива на Националния природонаучен музей, вече проличаваха някои от качествата, толкова необходими за един изследовател на планините и пещерите. С възхита и най-топло чувство следехме стремителния му път (той още продължава) към световната слава на суперапинист, радвахме се и се радваме на успехите му като изследовател. Нашият Съни – гордост на Музея и на България, Мъж на годината за 2016 г.!

Един ден бях поканен да представя в претъпкания от почитатели Голям салон на БАН една от най-забележителните книги за пътешествия, скромно наречена от автора „Първите седем“, а също и Наръчник за изкачване на високи върхове. Кой можеше да напише такава книга? Човек, който не само беше изкачил седем (а вече и десет) от 14-те световни осемхилядника. Който се беше преборил и с много други страшилища – не осемхилядници, но не по-малко трудни – Денали, Аконкагуа, върховете на Тяншан, на Африка, ледени стени и какво ли не. Човек, който удиви световните асове, като за по-малко от 100 дни изкачи три от най-трудните осемхилядници. Без кислородна маска, без височинни носачи, с тежки здравословни проблеми. Но и човек, който е съумял да си води записки при трудни условия и да обобщи много систематизирано натрупания огромен опит. Книгата е истински незаменим учебник, но не е лишена и от чисто литературни достойнства – увлекателен разказ за това как какъв човек се изгражда крачка по крачка, как се е опазил при толкова опасности, защото знаем, че най-добрият алпинист е живият алпинист. Да се изкачиш е само половината от работата – останалото свършва, когато стъпиш на летище „София“ и попаднеш в прегръдките на близките си.

За нас, когато мислим за Боян, изкачванията са само част от работата му. Не по-малко важен е Боян – изследователят. Той е обогатил Музея със стотици екземпляри от редките обитатели около горната граница на живота. При тежкия си багаж трябва да намериш място и за тях, да ги събереш, консервираш, изнесеш от страната, да разпределиш и етикетираш материала, да го направиш достояние на специалистите. Който го е правил, той знае. Няма съмнение, че всред тази уникална колекция от обитатели на висините се крият много нови видове и родове, но описанието им иска време и специалисти, а те не са много и са презаети. Но това не е обикновена колекция – та колко алпинисти събират научен материал? Спомням си само един – моят приятел Милан Даниел, от чиято книга „Живот и смърт по върховете на света“ всички сме се учили. Е, и някои от нас, но не като алпинисти, а като планинари, високопланински изследователи.

В „Наръчника“ на Боян не са пропуснати и глави, които отразяват добрата му подготовка и интереси като зоолог. Това личи от главата „Към върховете с епруветки в багажа“. Радвам се, че Боян подкрепя старата моя инициатива (аз пък я описах доста отдавна, следвайки М. Даниел) – да се включват в експедициите зоолози, ботаници, геолози и други изследователи – те ще осигурят добър разултат от експедицията, независимо от височината, достигната от алпинистите. Но изследователите трябва да бъдат с добра физическа и психическа форма, защото на 5-6000 м няма кой да ви дундурка.

Все пак, особено важни са напътствията за етапите на подготовката – нещо, придобито от дълъг личен опит. Тази книга трябва не просто да се чете, а да се изучава!

Остават още 4 осемхилядника, но има и други интересни обекти – 6 и 7 хилядници в Пакистан, Боливия, Перу, къде ли не.

Кураж, Бояне!

Петър Берон