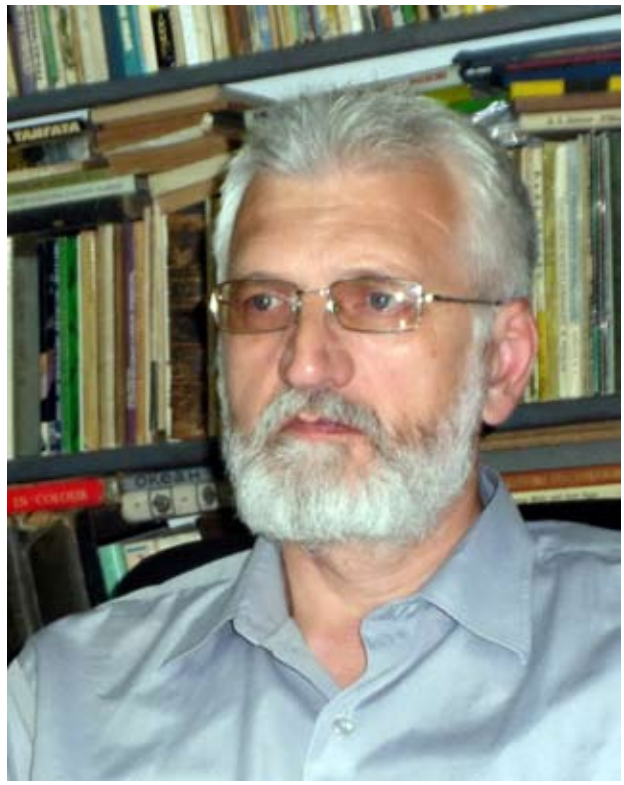
Настоящото издание
е посветено
на 60-годишнината от рождението на
видния български орнитолог
и палеоорнитолог
Професор д.б.н. ЗЛАТОЗАР БОЕВ

This issue
is dedicated to the prominent Bulgarian
Ornithologist and Palaeo-ornithologist
Prof. ZLATOZAR BOEV, D. Sc.
on the occasion of his 60th Birthday



Син на видния български орнитолог и природозащитник Николай Боев, проф. д. б. н Златозар Боев работи в Националния природонаучен музей при БАН (НПМ-БАН) вече в продължение на 37 години. В момента в музея той е ръководител на отдел „Гръбначни животни“. Роден е на 20 октомври 1955 г. в София. Завършил е Биологическия факултет на СУ „Св. Климент Охридски“. Стажувал е в Москва, Тбилиси и Лион при водещи световни специалисти. На него българската наука дължи едно ново направление – той полага основите на палеоорнитологията у нас. Благодарение на неговите усилия НПМ-БАН притежава днес най-богатата в Югоизточна Европа колекция от фосилни и субфосилни птици, сравнителна остеологична колекция от рецентни птици и научна библиотека по палеонтология и еволюция на птиците. Приносите на проф. Боев в палеоорнитологията са световно признати и той се нарежда между маститите европейски специалисти в тази област. Член е на 9 международни и чуждестранни научни организации. Неговата научна плодовитост е впечатляваща. Открил и описал е 4 рода, 31 вида и 1 подвид нови за науката изкопаеми птици от България и Гърция. Има отпечатани 317 публикации в научни издания и 309 – в научно-популярни. Автор е на 18 научно-популярни книги и учебници. З. Боев вложи и много усилия в уреждането на богатата експозиция от птици в НПМ.

Нека му пожелаем и занапред здраве и същата енергичност и вдъхновена работа в любимата му професия, на която е посветил живота си!

От колегите му

Historia naturalis bulgarica, 22: 5-30, 2015

The Arachnogeography and the "lines" (of Wallace, Lydekker, Weber)

Petar Beron

Abstract: The paper is an attempt to use the orders of Arachnida for checking the importance of the lines of Wallace, Lydekker and Weber for the distribution of these animals. From the orders of Arachnida some (Ricinulei and Solifugae almost) are missing from the analyzed area (Indomalayan and Australian regions). The distribution of the other orders relatively to the "lines" has been analysed. None of the orders of Acari (Opilioacarida, Prostigmata, Acaridida, Oribatida, Mesostigmata, Ixodida and Holothyrida) is limited by the "lines".

There is no order of Arachnida living only on one side of the "lines". Only the spider suborder Mesothelae seems to be limited to the Western side. It is to notice the Vachon's opinion (1953) ("linesOn peut cependant affirmer que la ligne Wallace pour certaines formes de Scorpions – est une frontière réellement existante") – it could be confirmed what concerns the scorpions. There are families and genera known only on one side, but it is a relatively low level of endemism. Nothing similar to the endemic orders and even subclasses in the vertebrates which are the base of the construction of the lines exists what concerns the Arachnida.

Key words: lines, Arachnozoogeography, Wallacea, Indomalayan Region, Australian Region

Evaluation of Wallace's Line and the other lines in South East Asia according to the Arachnida

Ref.: Audley-Charles (1981), Audley-Charles, Hurley & Smith (1982), Audley-Charles, Carter & Milson (1972), Clouse & Giribet (2007), Darlington (1957), George (1981), Gressitt (1956, 1959, 1967, 1982), Hachisuka (1936), Hall (1997, 1998, 2001, 2002, 2009), Hall & Holloway (eds)(1998), Hooijer (1975), Karig (1974), Katili (1971, 1975, 1978), Kayashima (1955), Krizhanovskij (1980, 2002), Lopatin (1980, 1989), Lydekker (1896, 1911), Mayr (1939, 1944, 1945), Mertens (1950), Simpson (1977), Stoddart (1992), Szymkowiak, Górski & Bajerlein (2007), Tikader & Bastawade (1983), Udvardy (1975), Voris (2000), Wallace (1860, 1869, 1876), Whitmore, ed. (1981, 1987).

"La frontière, en biogéographie, n'est pas, en général, une ligne, mais une zone complexe dont l'emplacement et la topographie ont subi de multiples variations au cours des temps géologiques... On peut cependant affirmer que la ligne Wallace – pour certaines formes de Scorpions – est une frontière réellement existante".

Max Vachon (1953)

Wallace's Line

In result of his studies of the nature of Australasia, Wallace (1860) concluded that "We may consider it established that the Strait of Lombok [between Bali and Lombok] (only 15 miles wide) marks the limit and abruptly separates two of the great zoological regions of the globe". This famous line, called by Huxley (1868) "Wallace's line", runs through Makassar Strait between Borneo and Sulawesi and than … The line was based mostly on mammals, but Mayr (1944) made the remark that "An equally pronounced faunal difference exists among birds, insects, and other groups of animals in the two regions".

When crossing the famous line in 1994 and 1995, I asked myself: "Is this statement true also for such zoogeographically interesting animals as Arachnida?". Meanwhile, a lot of new information was accumulated on the taxonomy of such groups

as Schizomida, Opiliones, Scorpiones and others and time has come to check how this zoogeographical "rift" (the term belongs to Prof. Vachon) reflects the past and present distribution of the various Arachnida. Some orders (the Ricinulei, almost the Solifugae) are not known in this area.

Lydekker's Line

The line proposed in 1895 by the British naturalist Richard Lydekker (1849-1915) separates Wallacea from the shelf of Australia – New Guinea.

Weber's Line

Max Weber (1852-1937) proposed a line passing between Sulawesi and Halmahera and marks the balance of the Indomalayan and Australian elements in the fauna. It is a line based on mammals and should be tested what concerns the invertebrates (Arachnida and others).

Wallacea

Observing for a long time the strange transition in the animal world of the islands of Malay Archipelago, Wallace presumed, "such facts could be explained only by major changes in the Earth's surface". Now we know that in the Pleistocene the major continental islands Borneo, Java, Sumatra and Bali have been connected with the Asian mainland. The rainforest existed by this time and the sea level was lower by 180 m. That is why on these islands we find the same animals like in Malaya (sometimes other subspecies) – elephants, rhinos, tapirs, tigers, leopards, primates. Some of them meanwhile have disappeared on the continent, but still live on the islands (the orangutans).

Crossing the narrow (only 25 km) Lombok Chanel between Bali and Lombok all these animals disappear. Cockatoo parrots appear, as well as some marsupials, different reptiles.

During his research between 1854 and 1862 Wallace found that the birds on Bali and Java are almost the same (97%), as soon as we cross the 25 km straight the picture changes abruptly – Bali and Lombok have only 50% of their bird species in common, one may think that the others were not capable to fly over this distance. Starts Wallacea, most interesting territory of a mix of fauna.

The ancestors of the present day animals and plants of Wallacea as a whole originate either from Asia or from Australia – New Guinea, but on the bigger islands occurred an active autochthonous speciation and there are many endemics. Some of the emblematic Indonesian endemics are actually inhabiting Wallacea (anoa, babirusa, "Komodo dragon"). Most islands have not been interconnected, they are separated by deep straights and this was important to explain the high endemism.

According to Conservation International, Wallacea has more than 10 000 species of plants, including ca. 1500 (15%) endemic. Among the terrestrial vertebrates the endemism is even higher: from 1142 species almost half (529) are endemics. In Wallacea live 223 species of native mammals, 126 of them endemics. Only bats count 124 species – almost one tenth of the world's bats.

The birds of Wallacea are extremely diverse (650 species, including 265 endemic). More than half of them live on Sulawesi alone (356 species, 96 endemic).

In Wallace's time the area has been covered by lush tropical forests. Only small fraction of them remains – 45% of the surface is covered by some sort of forest, but only on 52,017 km², or 15%, the forest is in its pristine state. From the total surface of Wallacea (347,000 km²) ca. 20,000 km² are protected (at least legally). The remaining forest is most often under concessions of powerful western or Japanese companies, which destroy not only the irreplaceable rainforest, but also hundreds of its described, semi-described and undescribed inhabitants.

Simpson (1977) critically reviewed the seven biogeographical lines assigned in the Malay Archipelago to mark the boundary of Indomalayan and Australian zoogeographic regions. In his conclusion, he suggested to (1) keep Huxley's line and Lydekker's line as they were clear-cut boundaries of Oriental, or Indomalayan (Sunda shelf) region and Australian (Sahul shelf) region respectively, and (2) not assign the intervening islands to any region or transitional zone.

For the invertebrates the importance of the "lines" seems less explored. One of the recent studies (Boudouresque, 2011) shows that "patterns of species diversity and diversity measured at higher taxonomic levels are not concordant".

Development of Wallacea and the surrounding lands of Southeast Asia and the Malayan archipelago

Principal geological events important to Wallace's line (partly after Audley-Charles, 1981)

years	Million Period
10	**Pleistocene**
20	**Pliocene**
30	**Miocene**
40	**Oligocene**
50	**Eocene**
60	**Palaeocene**
70	

Q – Quaternary

1. Australia/New Guinea splits from Antarctica (c. 53 Ma).

2. Formation of Philippines by collision of Asian continental fragment with an island arc (Oligocene)

3. Possible land connection(s) across Makassar Strait (mid-Miocene)

4. Collision between New Guinea and a Tertiary island arc (c.15 Ma).

5. Collision between Gondwana (Sula Peninsula) and Laurasia at or near east Sulawesi (c. 15 Ma) but submarine.

6. Island chain established between east Sulawesi and Australia (late Miocene to late Pliocene)

7. Collision between parts of Gondwanic Outer Banda Arc and Laurasian (volcanic) Inner Banda Arc (latest Miocene to early Pliocene).

8. Probable land connection(s) across south Makassar Strait (from late Pliocene).

The analysis of Moss & Wilson (1998) concerning the biogeographic implications of the Tertiary palaeogeographic evolution of Sulawesi and Borneo are worth quoting. Wallacea, according to them, is a biogeographic region, situated between areas with Asiatic and Australian floras and faunas, where organisms show a high degree of endemism. A land connection between Borneo and mainland SE Asia may have existed throughout much of the Tertiary and would have allowed migration of terrestrial biota. Western Sulawesi had been connected to eastern Borneo by the late Cretaceous and by the early Eocene with possibilities of dispersal of fauna between Borneo and western Sulawesi. The East Sulawesi ophiolite was accreted onto Sulawesi during or after the late Oligocene and resulted in the formation of more extensive land areas of Sulawesi. "Microcontinental fragments accreted onto eastern Sulawesi in the Miocene to Pleistocene may have been emergent as they drifted towards Sulawesi and allowed island hopping or rafting for biota of Australian affinity. Island hopping routes for the dispersal of organisms between Borneo-Sulawesi and the Philippines may have existed along volcanic arcs, such as the long-lived North Sulawesi arc, the Sulu and Sangihe arcs, and the Cagayan arc" (Moss & Wilson, 1998).

If we analyse the paleogeographical maps of Australasia in Hall (1998), we can make several observations. If we quote this article: "The period 30-0 Ma is of most interest to biogeographers; before then the separation between Asia and Australia was greater and the tectonic reconstructions are also more uncertain". More realistic and of importance for the recent fauna is the time of the last 20 Ma.

20 Ma (Early Miocene) Continent including most of Borneo. Only small parts of Sumatra, Java and Sulawesi were dry land as islands. Australia and New Guinea interconnected. Eastern New Guinea and Taiwan under water, Hainan part of the continent. Makassar Strait existed.

15 Ma (Middle Miocene) Similar situation. The Barisan of Sumatra cut into several islands, the remaining Sumatra, Java, Bali and Lombok under water, as well as Taiwan. Torres and Makassar Straits existing. Borneo part of continent, Sulawesi isolated.

10 Ma (Late Miocene) The Sumatran Barisan, Java, Timor, Sulawesi and the central part of New Guinea land. Strait between the larger Australia and central New Guinea existing. Continent largely connected with Borneo and very narrowly connected with Sumatra. Hainan part of the continent, Taiwan under water.

5 Ma (Early Pliocene) – in Continental Southeast Asia the land mass is almost as present, but is connected with Borneo and Sumatra. The shape of Borneo, Java and Sumatra is almost as it is now, the northern coast of Sumatra is covered by shallow sea between Sumatra and Malakka. In New Guinea only the northern part is land, Northern Australia reaches more to the north, but between northern New Guinea and the enlarged land on the present day Carpentaria Bay there was a large strait, much wider than than the Torres Strait. Hainan was under shallow water, Taiwan was connected with mainland China.

Arachnida and the lines

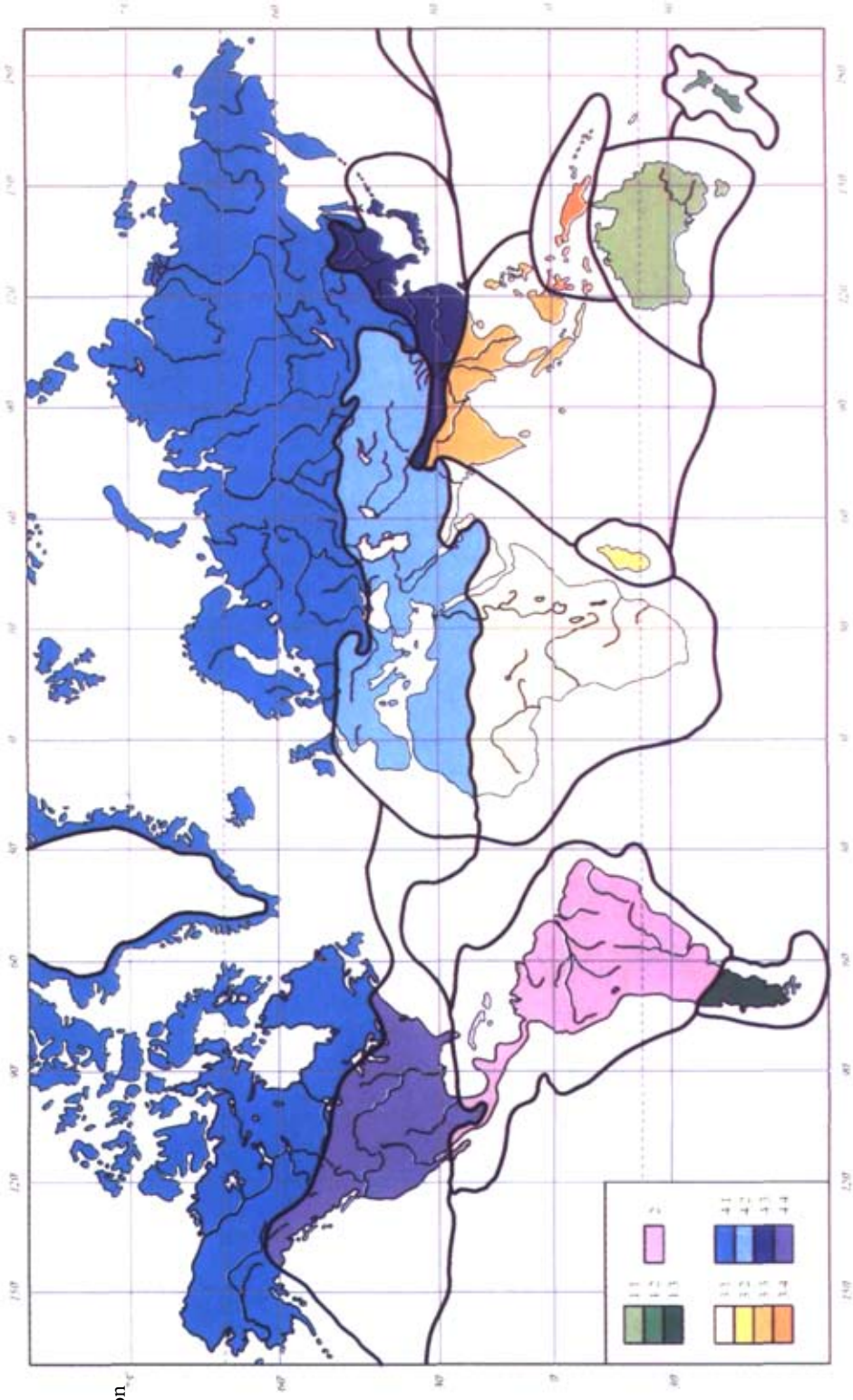
The order Ricinulei does not live in Southeast Asia and has no relations with the "lines". Solifugae is represented only by one species (*Dinorhax rostrumpsittaci* Simon) in Vietnam and Maluku Islands (both sides of Wallace's Line, but only on the West side of the Lydekker's Line). Practically the order is missing from both Indomalayan and Australian regions.

Palpigradi

Ref.: Condé (1980, 1981, 1984, 1988, 1989, 1990, 1992a, 1992b, 1994, 1996)

Two families (Eukoeneniidae and Prokoeneniidae) are represented in the area.

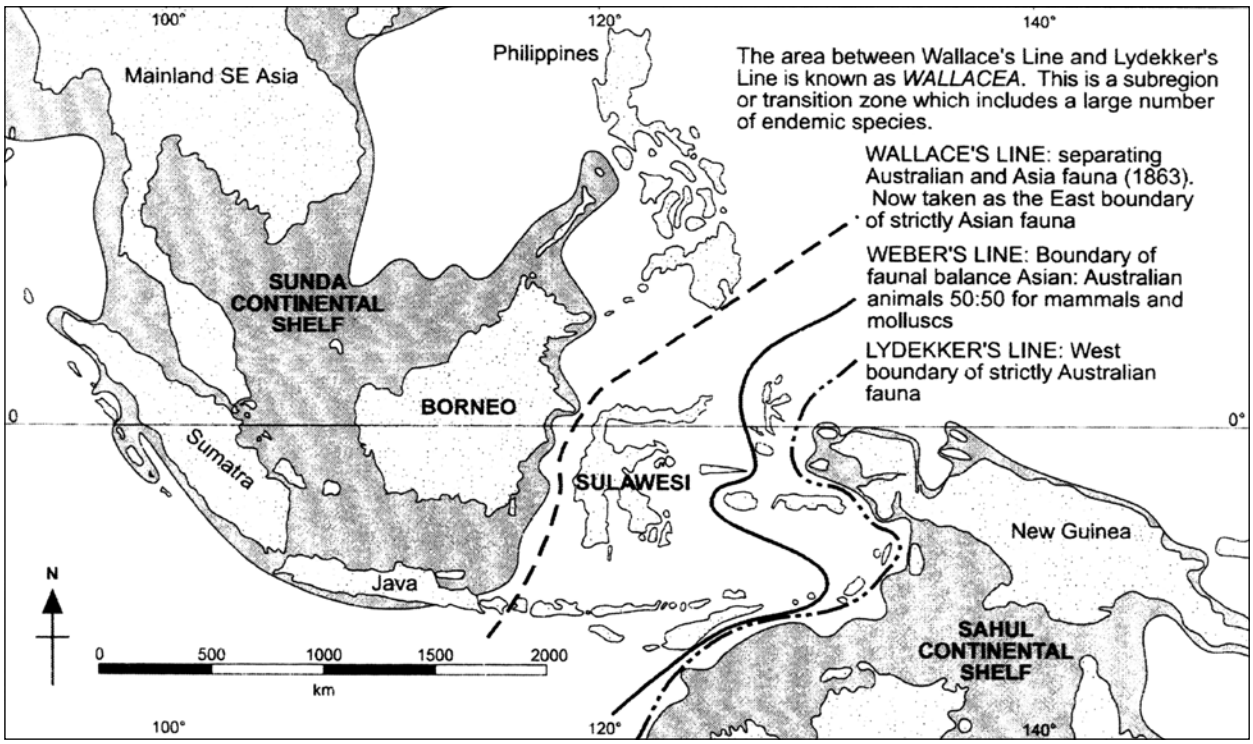
Only West of Wallace's line: In Thailand were found 8 sp. of Palpigradi: *Prokoenenia asiatica* Condé, 1994 (Prokoeneniidae), and 6 sp. of Eukoeneniidae – *Eukoenenia angusta* (Hansen, 1901), *E. deleta* Condé, 1992, *E. lyrifer* Condé, 1992, *E. siamensis* (Hansen, 1901) *E. thais* Condé, 1988, *Koeneniodes leclerci* Condé, 1992, and *K. spiniger* Condé, 1984. All of them are known only from this country (endemics). Condé (1992) recorded *Koeneniodes made-*



1 – Notogean Kingdom
1.1 – Australian Region
1.2 – New Zealand Region
1.3 – Chilean-Patagonian Region

2 – Paleotropical Kingdom
2.1 – Indo-Malayan Region
2.2 – Papuan Region
2.3 – Afrotropical Region
2.4 – Madagascan Region

Zoogeographical subdivision of the Earth (after Krizhanovskiy, 2002)



SE Asia and the continental shelves (in grey) after Moss & Wilson, 1998

cassus from Hong Kong (the first Palpigradi known from China).

Prokoenenia javanica Condé, 1991, is known from Java, *P. celebica* Condé, 1994.

After Condé (1996), "La région orientale semble avoir été un foyer d'évolution important dans l'histoire des Palpigrades: tous les genres actuels y sont représentés et leur dispersion, jusque dans la région madecasse, en particulier, est un fait bien établi".

Only West of Wallace's Line remain the family Prokoeneniidae and the genus *Prokoenenia*.

Only East of Wallace Line: In Papua New Guinea have been recorded only two sp.: *Eukoenenia* cf. *lawrencei* and *Koeneniodes* cf. *frondiger* (fam. Eukoeneniidae).

Both sides: fam. Eukoeneniidae (genera *Eukoenenia* and *Koeneniodes*).

Amblypygi

Ref.: Bastawade et al. (2005), Blick & Harvey (2011), Caporiacco (1947), Fage (1939, 1954), Giupponi & Miranda (2012), Gravely (1911, 1915), Harvey (2002, 2003, 2013), Harvey & West (1998), Karswch (1879), Kraepelin (1895, 1899), Pocock (1894), Quintero (1981, 1983, 1986), Rahmadi & Harvey (2008), Rahmadi et al. (2010), Roewer (1928), Rowland (1973), Seiter et al. (2015), Simon (1892), Thorell (1888, 1889).

Two families are widely represented in the area: Charinidae and Charontidae, both on both sides of the Wallace's Line. Special case is the only species of *Phrynus* (from the American family Phrynidae) from a cave on Flores (Indonesia). According to Weygold et al. (2010): ".. some details and other characters suggest that *P[hrynus] exsul* has no close relation with any of the Neotropical species of *Phrynus* Lamarck, 1793, probably having been evolutionary distinct for a long time from the Neotropical species of *Phrynus*. Its occurrence on the Indonesian Island Flores thus remains an enigma; is *P. exsul* a relic from a more global distribution of the genus *Phrynus* in the past or the result of prehistoric rafting across the ocean?".

Only West of Wallace's line: *Catageus* Thorell, 1889 – Burma

Only East of Wallace's line – none.

Both sides:

Charinus Simon, 1892 (= *Charinides* Gravely) – Australia, Andaman Isls, India, W. Samoa, Vanuatu, Indonesia (Java, Borneo), Singapore, Malaysia, Papua New Guinea, New Caledonia, Solomon Isls

Sarax Simon, 1892 (= *Phrynichosarax* Gravely) – Solomon Isls, Malaysia, Singapore, Philippines (Luzon), Indonesia (Java, Kalimantan), India, Andaman Isls, Papua New Guinea, New Britain, Vietnam, Laos, Cambodia, Borneo

Charon Karsch, 1879 – Australia (Northern Territory, Queensland, Christmas Isl.), Indonesia (Java, Maluku, Sumbawa), Malaysia (incl. Borneo), Palau, Papua New Guinea, Philippines, Singapore, Solomon Islands

Stygophrynus Kraepelin, 1895 – Solomon Islands (Guadalcanal), Burma, Thailand, Vietnam, Malaysia, Indonesia (Java, Sumatra, Kalimantan)

Uropygi (Thelyphonida)

Ref.: Haupt (2004, 2009a), Krehenwinkel et al. (2009), Pocock (1894), Rowland (1973), Speijer (1936), Strand (1928), Thorell (1889)

Many species of the two subfamilies of Uropygi are known from the area (from both sides of the Wallace's line): Thelyphoninae and Hypoctoninae.

Only West of Wallace's line:

Chajnus Speijer, 1936 – Sunda Islands (Lombok)

Ginosigma Speijer, 1936 – Sunda Islands, Thailand

Hypoctonus Thorell, 1889 – Burma (Myanmar), South China, Malaysia, Thailand, Bangladesh, Java, India

Typopeltis Pocock, 1894 (= *Teltus* Speijer, 1936) – China, Russia, Taiwan, Hainan, Japan, Thailand, Vietnam

Only East of Wallace's line:

Glyptogluteus Rowland, 1973 – Philippines (Panay)

Thelyphonoides Krehenwinkel et al., 2009 – Philippines (Panay)

Mimoscorpius Pocock, 1894 – Philippines

Both sides:

Thelyphonus Latreille, 1802 (=*Abaliella* Strand, 1928 = *Minbosius* Speijer, 1936 = *Tetrabalius* Thorell, 1889, fide Haupt, 2009a) – Indonesia, Singapore, Philippines, Vanuatu (New Hebrides), Fiji, Rennell, Solomon Islands, New Guinea, New Britain, Burma, Sri Lanka, India, Thailand, W. Samoa, Borneo, Mollucas

Schizomida

Ref.: Cokendolpher (1988), Cokendolpher & Reddell (2000), Cokendolpher et al. (1988), Fernando (1957), Gravely (1911a, 1911 b, 1911c, 1912, 1915), Harvey (1992, 2002, 2003), Pickard-Cambridge (1972), Pocock (1900), Reddell & Cokendolpher (1995), Shimojana (1981), Sissom (1980).

One family (Hubbardiidae) is represented in the area.

Only West of Wallace's Line:

Schizomus Pickard-Cambridge, 1872

Clavizomus Reddell et Cokendolpher, 1995 – Java, West Malaysia, Singapore

Trithyreus Kraepelin, 1899 – Burma (= Myanmar)

Zomus Reddell et Cokendolpher, 1995 – Malaysia (incl. Sarawak), Singapore; England (Kew Garden)

Only East of Wallace's Line:

Julattenius Harvey, 1992 – 2 sp. in Australia (Queensland)

Notozomus Harvey, 1992 – 17 sp. in Australia (Queensland)

Orientzomus Cokendopher et Tsurusaki, 1994 – Philippines (Luzon), Japan, Bonin Isl.

Hubbardiidae indet. – New Guinea, New Britain, New Ireland; "*Schizomus*" *modestus*

Both sides:

Apozomus Harvey, 1992 – Australia, Japan, Papua New Guinea, Taiwan, Sabah (Borneo), W. Malaysia, Vietnam

Bamazomus Harvey, 1992 – Thailand, Hong Kong, W. Malaysia, Ryukyu Isls, Papua New Guinea, Australia, Hawaii

Ovozomus Harvey, 2001 – Seychelles, Comoro Isl., Cook Isl., Ceylon, India. Christmas Isl., Reunion

From Sri Lanka are known the first Schizomid ever described: *Schizomus crassicaudatus* Pickard-Cambridge, 1872, and also several other "*Schizomus*" needing further study (*buxtoni* Gravely, *formicoides* Fernando, *greeni* Gravely, *perplexus* Gravely, *vittatus* Gravely). The species *Schizomus peradeniyensis* Gravely has been assigned to the genus *Ovozomus* by Harvey (2011). *Trithyreus suboculatus* Pocock is declared nomen dubium.

Scorpiones

Ref.: Di et al. (2011, 2013), Fage (1933, 1946), Fet (1988, 2003), Koch (1977, 1981), Kopstein (1921, 1923, 1926), Kovarik (1995), Lourenço (2003, 2007), Lourenço & Dinh-Sac Pham (2010), Monod (2011), Monod & Prendini (2015), Nenilin & Fet (1992), Shi & Zhang (2005), Takashima (1941, 1945, 1948, 1950), Vachon (1953, 1972, 1982), Zhu et al. (2004)

Seven families of scorpions are known from the area.

Only West side of Wallace's Line:

Fam. Chaerilidae – Bangladesh, India, Indonesia, Malaysia, Nepal, Singapore, Sri Lanka, Vietnam

Fam. Pseudochactidae – caves of Laos and Vietnam

Fam. Scorpiopidae – Southeast Asia, India, Indonesia, Malaysia

Fam. Scorpionidae – South and Southeast Asia, Indonesia

Only East side of Wallace's Line:

Fam. Urodacidae – Australia

Both sides:

Fam. Buthidae – all continents, tropical, subtropical countries and in some countries with moderate climate

Fam. Liochelidae – Australia, Southeast Asia, Pacific islands, Indian Ocean Islands

Pseudoscorpiones

Ref.: Beier (1940, 1951, 1965, 1966a, 1966 b, 1973, 1981), Ellingsen (1911a, 1911b), Harvey (1981, 1985, 1990, 1993, 1998, 2013), Murthi & Ananthakrishnan (1977), Redikorzev (1938), Schawaller (1994, 1995)

In the area have been registered representatives of 20 families. Most of them (18) are represented from both sides of Wallace's line, and usually also on other continents or worldwide.

Only West side of Wallace's Line:

Fam. Ideoroncidae – Malaysia, India, Cambodia, Thailand, Vietnam, Indonesia (Sumatra)

Only East side of Wallace's Line:

Fam. Pseudogarypidae – Tasmania (one extant species)

Both sides:

Fam. Chthoniidae – cosmopolitic

Fam. Tridenchthoniidae (= Dithidae) – Australia, New Caledonia, Lord Howe Isl., Caroline Islans, India, Vietman, Philippines, Indonesia (Mollucas, Sumatra, Java), New Guinea, Japan, Palau Isl., Bhutan, Nepal, Laos, Marcus Isl., Malaysia

Fam. Lechytiidae – Vietnam, Marshall Isls, Marcus Island

Fam. Hyidae – Philippine Islands, Indonesia (Java, Sumatra), Australia

Fam. Neobisiidae –Philippines, Vietnam, Thailand, Japan, Burma, China, Taiwan

Fam. Syarinidae – Bhutan, India, Sri Lanka, Nepal, Tuvalu, Philippines – Solomon Is., New Zealand, New Caledonia, New Guinea

Fam. Parahyidae – Caroline Islands, Singapore

Fam. Garypidae (= Synsphyronidae) – India, Japan, Indonesia (Krakatau, Nicobar Isl.), Maldive Isl., Sri Lanka – Marshall Isls, Australia (incl. Tasmania), New Zealand

Fam. Geogarypidae – Indonesia (Java), Malaysia, India, Sri Lanka, Thailand, Australia, New Guinea

Fam. Menthidae – Socotra; Australia (one endemic genus and species)

Fam. Cheiridiidae – China, Taiwan, Nepal, Philippines, Japan, Hawaii – Papua New Guinea, Salomon Isls, Mariana Isls, Australia, New Zealand

Fam. Olpiidae – Australia, New Zealand, Norfolk Is., Indonesia, India, Burma, Japan, Cambodia, Vietnam, Papua New Guinea, New Caledonia, Salomon Isls, Tuvalu, Samoa, Caroline Isls, Mariana Isls, Marshall Isls

Fam. Garypinidae – Solomon Isls, Australia, New Guinea, Hawaii, Indonesia, Thailand, Cambodia, Vietnam

Fam. Sternophoridae – Australia, Papua New Guinea, India, Sri Lanka, Laos, Cambodia, Vietnam

Fam. Withiidae – New Zealand, Lord Howe I., Vietnam, Indonesia, Christmas Isl., India, Cambodia, Malaysia, Thailand, Philippines, Solomon Isls, Nepal, China, Taiwan, Mariana Isls, Marshall Isls, Papua New Guinea

Fam. Cheliferidae – Indochina, India, China, Indonesia – Australia, New Zealand, Papua New Guinea,

Fam. Atemnidae (= Miratemnidae) – South East Asia, Philippines, Bhutan, Nepal, India, Nicobar Isls, Solomon Islands, Sri Lanka, Indonesia, China – New Caledonia, Lord Howe Isl, Caroline Isls, Mariana Isls, Christmas Island, Marquesas Isls, Marshall Isls, Papua New Guinea

Fam. Chernetidae (= Myrmochernetidae) – New Guinea, Solomon Isls,

Opiliones

Ref.: Šilhavý (1974a, 1974 b), Rambla (1994, 1991), Schwendinger (1992, 2006), Schwendinger & Giribet (2005), Sharma et al. (2012), Thorell (1876, 1883, 1889, 1891 b, 1891b)

All suborders are represented in the area (Dyspnoi is practically missing).

Cyphophthalmi

Only West of Wallace's Line: none

Only East of Wallace's Line:

Fam. Troglosironidae – New Caledonia

Both sides:

Fam. Stylocellidae – SE Asia (from India to New Guinea)

Fam. Pettalidae – New Zealand, Australia – Sri Lanka

Eupnoi

Only West of Wallace's Line:

Fam. Phalangiidae – Borneo

Only East of Wallace's Line:

Fam. Caddidae – Australia (incl. Tasmania), New Zealand (but also in North America, South America and South Africa, not living in Southeast Asia)

Fam. Sclerosomatidae – Europe, Asia, Africa, South, Central and North America, Antilleans, Australia, New Guinea, Solomon Isl. (not living in Southeast Asia)

Fam. Neopilionidae – Australia, New Zealand (but also in South Africa and South America, not living in Southeast Asia)

Both sides: none

Dyspnoi

Only West of Wallace's Line:

Fam. Nemastomatidae (Ortholasmatinae, *Cladolasma* Suzuki – Thailand (1 sp.)

Only East of Wallace's Line: none

Both sides: none

Laniatores

Only West of Wallace's Line:

Fam. Stygnommatidae – ? Neotropical family with two doubtful sp. from Malaya of genus *Stygnomimus* Roewer, 1927

Fam. Biantidae (*Biantes, Probiantes*) –Nepal, India, Burma, Sumatra, Malaya

Only East of Wallace's Line:

Fam. Synthetonychiidae – New Zealand (14 sp.)

Fam. Triaenonychidae – Australia, Tasmania, New Zealand, New Caledonia (but also in Madagascar, South Africa, South America)

Both sides:

Fam. Assamiidae – southern Asia; subfam. Dampetrinae to Indonesia, New Guinea and Australia

Fam. Samoidae – Australia (New South Wales), Samoa, Indonesia

Fam. Podoctidae (incl. Erecananinae and Ibaloniinae) – Palau, Taiwan, Indonesia, Malaysia, New Guinea, India, Philippines, Vanuatu

Fam. Sandokanidae [= Oncopodidae, praeoccup.] – Philippines, Sumatra, Borneo, Burma, Nepal, India, Malaysia, Singapore, Thailand

Fam. Epedanidae (incl. Dibuninae, Acrobuninae, Sarasiniciinae, Sarasinellinae) – Philippines, New Guinea, Thailand, Sulawesi, Borneo, Sumatra, Japan, Malaysia, India, Taiwan, China, Vietnam

Fam. Zalmoxidae (= Stygnoleptinae) – New Guinea, Solomon Islands, Fiji, Bismarck Archipelago, Philippines, Java, Sulawesi, Moluccas, Australia, Marianas, New Caledonia, Marshall Islands, Caroline Islands, Polynesia

Remarks concerning Opiliones. It seems strange that families, widespread in other parts of the world (Triaenonychidae s.str., Caddidae, Neopilionidae) are not represented in South Asia, but live East of Wallace's line (New Guinea, Australia, New Zealand, New Caledonia). What concerns the Laniatores (the dominant Opiliones in the tropical countries), they are well represented in tropical Asia, but much less East of Wallace's line. Exceptions are the Triaenonychidae (lacking in SE Asia), a few species of families living from both sides of the «lines« (Zalmoxidae, Assamiidae, Samoidae, Epedanidae, Podoctidae), and the endemic family in New Zealand Synthetonychiidae.

Araneae

Ref.: Baehr & Baehr (1987), Baehr & Baehr (1993), Baert (1979, 1980, 1982, 1984), Beatty et al. (2008), Berland (1928, 1930a, 1930 b, 1935, 1937, 1939, 1942), Bourne (1980), Brignoli (1981), Deeleman-Reinhold (1980, 1995, 2000), Dimitrov et al. (2013), Forster (1949, 1955a, 1955b, 1962, 1967, 1970a, 1970b, 1971, 1973, 1975, 1977, 1995), Forster & Blest (1979), Forster & Forster (1973, 1999), Forster & Gray (1979), Forster & Platnick (1977, 1984, 1985), Forster et al. (1987), Forster & Wilton (1968, 1973), Gillespie et al. (2000), Gray (1994), Hickman (1957, 1958, 1969), Hill (2010), Huber (2001, 2003, 2005), Jäger & Yin (2001), Jäger & Praxaysombath (2009), Jocqué (1991, 1993), Kayashima (1955), Legendre (1977, 1979), Lehtinen (1978, 1993), Lehtinen & Saaristo (1980), Main (1981a, 1981b, 1982), Marples (1955), Meng & Murphy (2008), Paik (1967), Paquin et al. (2010), Platnick (1976, 1977a, 1977b, 1981, 2000a, 2000b), Platnick & Gertsch (1976), Platnick & Forster (1993), Pocock (1903), Proszinsky (1980, 1996), Pugh (2004), Raven (1976, 1978, 1979, 1980a, 1980b, 1981a, 1981b, 1985, 1994), Raven & Platnick (1981), Rix (2006), Rix & Harvey (2010, 2011, 2012a, 2012b, 2012c), Rix & Roberts (2010), Robinson (1982), Roewer (1942), Shear (1978), Shinoyana (1977), Simon (1890), Taylor (2013), Ticader (1970, 1977), Versteirt et al. (2010), Wang et al. (2010), Wang & Martens (2009)

Only West of Wallace's Line (especially in Southeast Asia):

Suborder Mesothelae – Southeast Asia, China, Japan (87 species)

Fam. Liphistiidae – Southeast Asia, China, Japan (87 species)

Suborder Mygalomorphae – both sides

Fam. Atypidae – Asia

Suborder Araneomorphae – both sides

Fam. Eresidae – Eurasia

Subfam. Eresinae – Eurasia

Fam. Palpimanidae – South Asia, Sri Lanka (incl. many from S. America, Africa, etc.)

Subfam. Chediminae -South Asia, Sri Lanka (also many from Africa and the Seychelles)

Fam. Phyxelididae – Sumatra, Borneo (2 sp.) (plus another 62 from Africa and Madagascar)

Fam. Cithaeronidae – Africa, India, Malaysia, Greece, introduced to Australia and Brazil (6 sp.)

Only East of Wallace's line (not living in SE Asia):

Fam. Migidae – Australia, New Zealand

Subfam. Calathotarsinae – Australia

Subfam. Miginae – New Zealand, Australia

Fam. Actinopodidae – Australia

Fam. Austrochilidae – Tasmania (1 sp.)(but the other 8 sp. live in Chile and Argentina)

Subfamily Hickmaniinae 1967 (as family Hickmaniidae)

Fam. Gradungulidae – New Zealand, Australia (A.C.T., Queensland, New South Wales, Victoria)(16 sp.)

Fam. Periogopidae – Australia (Queensland), New Zealand (2 sp.)

Fam. Orsolobidae – Australia, New Zealand, Tasmania (but living also in Africa and South America)

Fam. Lamponidae – Australia, New Zealand, New Caledonia (genus *Centrocalia*)

Subfam. Centrothelinae – Australia, New Caledonia

Subfam. Lamponinae – Australia, New Zealand

Subfam. Pseudolamponinae – Australia

Fam. Holarchaeidae – Tasmania, New Zealand (2 sp.)

Fam. Mecysmaucheniidae – New Zealand

Subfam. Mecysmaucheniinae Simon, 1895 – New Zealand

Subfam. Zearchaeinae Forster et Platnick, 1984 – New Zealand

Fam. Micropholcommatidae – New Zealand, Australia, Tasmania, New Guinea

Fam. Pararchaeidae – Australia (incl. Tasmania), New Zealand, New Caledonia

Fam. Huttoniidae – New Zealand (1 sp.)

Fam. Malkaridae – Australia, incl. Tasmania (one genus in Argentina and Chile)

Fam. Cyatholipidae – Australia, New Zealand, Lord How I. (but also Africa, Madagascar and Jamaica)

Fam. Synotaxidae – Australia, Tasmania, New Zealand

Subfam. Pahorinae — endemic to New Zealand

Subfam. Physogleninae – Australia, Tasmania, New Zealand

Subfam. Synotaxinae – Australia

Fam. Amphinectidae – Australia, Tasmania, New Zealand, Chile, South America

Fam. Nicodamidae – Australia, Tasmania, New Zealand, New Guinea

Fam. Tengellidae – New Zealand (one genus *Haurokoa* Koçak et Kemal, 2008 with one sp.), but living also in North and South America and Madagascar

Fam. Ammoxenidae – Australia, Tasmania, southern Africa

Both sides:

Suborder Mygalomorphae

Fam. Hexathelidae – New Zealand, Australia, Tasmania, Asia (*Macrothele*)

Subfam. Hexathelinae – Australia, New Zealand

Subfam. Macrothelinae – Asia, New Zealand

Fam. Dipluridae – Australia, Oceania, Taiwan, Thailand, New Caledonia

Subfam. Euagrinae – Australia, Taiwan, New Caledonia

Subfam. Masteriinae – Oceania, Australia

Fam. Nemesiidae – Burma, India, China, Australia, New Zealand, Ryukyu Islands, SE Asia

Fam. Theraphosidae – Australia, South and SE Asia, New Guinea

Fam. Barychelidae – Australia, New Caledonia, SE Asia, New Guinea, Sri Lanka, Oceania, Fiji

Subfam. Barychelinae – Australia, New Caledonia

Subfam. Sasoninae – Australasia

Fam. Cyrtaucheniidae – Australia, Thailand

Subfam. Aporoptychinae – Australia

Fam. Idiopidae – Australia, New Zealand, India, Sri Lanka, South Asia, Thailand,

Subfam. Arbanitinae – Australia (9 genera), New Zealand (1 genus)

Fam. Ctenizidae – Taiwan, China, Thailand, Australian region, New Guinea,

Subfam. Ctenizinae – Thailand, China, Taiwan, Australian region

Subfam. Ummidiinae (repl. name for Pachylomerinae praeocc.) – SE Asia

Suborder Araneomorphae

Fam. Filistatidae – Australia, New Guinea, Europe, Asia, North and South America

Fam. Scytodidae – worldwide, except of the Far North

Fam. Sicariidae – worldwide, except of the Far North

Fam. Ochyroceratidae – South Asia, China, Pacific Islands, New Guinea

Fam. Telemidae – Sumatra, Malaysia, China, Vietnam, New Caledonia, New Guinea

Fam. Pholcidae – worldwide

Fam. Tetrablemmidae – Southeast Asia, Borneo, India, Indonesia (Sulawesi), Samoa, Caroline Islands

Fam. Dysderidae – *Dysdera* – worldwide

Subfam. Dysderinae – *Dysdera* – worldwide

Fam. Oonopidae – Philippines, Southeast Asia, Australia, Tasmania, New Zealand, New Caledonia, Hawai'i, Sri Lanka

Subfam. Gamasomorphinae – Bhutan, Nepal, China, Philippines, Southeast Asia, Australia, New Zealand, Hawai'i

Subfam. Oonopinae – New Caledonia, Tasmania, Sri Lanka

Fam. Segestriidae – Asia, Australia, New Zealand

Fam. Lamponidae – Australia, New Zealand, New Caledonia (genus *Centrocalia*)

Subfam. Centrothelinae – Australia, New Caledonia

Subfam. Lamponinae – Australia, New Zealand

Subfam. Pseudolamponinae – Australia

Fam. Prodidomidae – all continents

Fam. Hersiliidae – Australasia, India, Sri Lanka, Australia, Borneo

Fam. Oecobiidae – Asia; *Oecobius* is cosmopolitan (102 sp.)

Fam. Stenochilidae – Thailand, Malaysia, Singapore, Burma, Philippines, Bali, New Guinea, Fiji, Borneo, Vietnam, India

Fam. Mimetidae – Palearctic, Africa, Principe, Central and South America, USA, Asia, Australia; *Ero* and *Mimetus* – worldwide

Subfam. Mimetinae – worlwide

Fam. Deinopidae – all continents, except Europe and Antarctica

Fam. Uloboridae – Philippines, Samoa, Fiji, Vanuatu, New Guinea, Oceania, Australia, New Zealand; *Uloborus* is spread wordwide, *Zosis* is pantropical

Fam. Anapidae – New Caledonia, Australia, Tasmania, New Zealand, New Guinea, China, Taiwan

Fam. Araneidae – worldwide

Fam. Linyphiidae – worldwide

Fam. Mysmenidae – Samoa, New Caledonia, Tasmania

Fam. Nesticidae – worldwide

Fam. Sinopimoidae – China (1 sp.)

Fam. Symphytognathidae – in the tropics of Central and South America and the Australian region (with Oceania), with three species (*Anapistula benoiti*, *A. caecula*, *Symphytognatha imbulunga*) found in Africa and one (*Anapistula ishikawai*) in Japan. *Anapistula jerai* occurs in Southeast Asia

Fam. Nephilidae – Pantropical,

Fam. Theridiidae – cosmopolitic

Fam. Theridiosomatidae – Australia, China, Malaysia, Sri Lanka, Philippines, Sumatra, Samoa, Taiwan

Fam. Ctenidae – Australia, China, Sumatra, New Guinea

Fam. Lycosidae – cosmopolytic

Fam. Oxyopidae – cosmopolytic

Fam. Pisauridae – Africa, South America, North America, Asia, New Caledonia, Canary Isls, Madagascar, New Guinea, Cuba, Chatham Islands, Australia, etc. (328 sp.)

Fam. Psechridae – China, India, Nepal, Sri Lanka, South East Asia, Nicobar Islands, Philippines, Australia

Fam. Stiphidiidae – Australia, Tasmania, New Zealand, Madagascar, Mauricius

Fam. Trechaleidae – South and Central America, Mexico, U.S.A.

Fam. Zoridae – Central and South America, Australia, Tasmania, New Zealand, Israel, Guatemala; *Zora* – Palearctic

Fam. Zorocratidae – Sri Lanka, Madagascar, Africa, U.S. to Panama

Fam. Zoropsidae – Autralia, New Zealand, Sri Lanka, China, Korea, Japan, Cyprus, Mediterranean, South Africa

Fam. Agelenidae – Mediterranean, Europe to Central Asia, U.S.A. to Chile, New Zealand, Socotra, Himalaya, Cuba, Bahamas, Cyprus, China; *Tegenaria* – worldwide

Fam. Amaurobiidae – Russia, Korea, China, Japan, Argentina, Paraguay, Chile, Taiwan, Australia, New Zealand, U.S.A., Canada, Falkland Islands, India, Laos, Thailand, Vietnam, Balkans, Greece, Crete, Germany, Switzerland, Italy, Micronesia, Ethiopia, Lybia, Nepal, Bhutan, Pakistan, Tajikistan, etc.

Fam. Anyphaenidae – Australia, New Zealand, India, etc.

Fam. Cybaeidae – America, Europe, Japan,

Korea, China, Turkmenistan, Tadjikistan, Uzbekistan, Sumatra, Venezuela, Colombia

Fam. Desidae – Australia, Tasmania, New Zealand, New Caledonia, Oceania, Korea, Japan, USA, Paraguay, Chile

Fam. Dictynidae – Europe, China, Mongolia, India, Algeria, Kazakhstan, Canary Islands, New Zealand, Australia, Sri Lanka, South Africa, USA, Canada, Mexico, Kyrgyzstan, West Indies, Hawaii, South America, St. Helena, Andaman Islands, Galapagos Isl., New Caledonia, etc.

Fam. Hahniidae – Oceania, Australia, Tasmania, New Zealand, India, Philippines, Sumatra

Fam. Sparassidae – worldwide, except of the Far North

Fam. Selenopidae – Asia (incl. India, Philippines and Thailand), Africa, Australia and South America

Fam. Zodariidae – Australia, New Zealand, New Guinea, SE Asia and worldwide

Fam. Clubionidae – Lord Howe Island, Asia, Australia, Oceania, Sri Lanka

Fam. Cycloctenidae – New Zealand, Australia, Indonesia (Java)

Fam. Miturgidae – Thailand, Indonesia, Australia, New Zealand, New Guinea

Subfam. Eutichurinae – Australia, Thailand, Indonesia (both sides)

Subfam. Miturginae – Australia, New Guinea, Africa, Mediterranean, North and South America (both sides)

Subfam. Systariinae – Southeast Asia (only West)

Subfam. Diaprograptinae – Timor, Australia, New Zealand (only East)

Fam. Titanoecidae – India, Sri Lanka to China, New Guinea, Marquesas Islands, Europe, Mexico, South America

Fam. Gallieniellidae –Australia, Argentina, Madagascar, South Africa, Kenya

Subfam. Meedoinae – Australia (only East of the Line)

Fam. Gnaphosidae – worldwide

Fam.Trochanteriidae – Australia, Sulawesi, Christmas Island, China, India, New Caledonia, New Guinea, South America, Africa, Madagascar

Fam. Philodromidae – India, New Guinea, Southeast Asia, and worldwide

Fam.Thomisidae – worldwide

Fam. Salticidae – worldwide

Fam. Corinnidae – all continents, incl. Australia

Fam. Liocranidae – Burma, Thailand, Borneo, Sumatra, Australia, Sri Lanka, New Guinea and all continents

Remarks concerning Araneae. From the three suborders of spider one (Mesothelae) does not live east of Wallace's Line, but is known from SE Asia. From 112 families of spiders in the world 19 are known from Australasia east of this line, but not from SE Asia. Some are endemic for Australia, New Zealand or New Caledonia, others live also in far away parts of the world, mostly in South Africa, Chile or Argentina. Typical are Austrochilidae, Orsolobidae, Malkaridae, Cyatholipidae, Amphinectidae, Tengellidae, Ammoxenidae, also subfam. Prithinae of fam. Filistatidae (one genus in New Guinea, two in Australia, seven in Africa, North and South America). Some subfamilies of widespread families are endemic for the area east of Wallace's Line: Hexathelidae (Hexathelinae), Dipluridae (Masteriinae), Cyrtaucheniidae (Aporoptychinae), Idiopidae (Arbanitinae), Miturgidae (Diaprograptinae), Gallieniellidae (Meedoinae), and others.

Opilioacarida (both sides of the "Line")

Ref.: Beron (1914), Das & Bastawade (2007), Leclerc (1989), Walter & Proctor (1998)

Only one family (Opiliocaridae) in the world.

Only West side of Wallace's line:

End. genus *Indiacarus* Das & Bastawade, 2007 – India

End. genera *Siamacarus* Leclerc, 1989 and *Vanderhammenacarus* Leclerc, 1989 – Thailand (caves)

East side of Wallace's line:

Indet. Opilioacarida from Australia (Walter & Proctor, 1998).

Holothyrida (both sides of the Line)

Ref.: Berlese (1923), Beron (1914), Domrow (1955), Lehtinen (1981, 1991, 1995), Thorell (1882), Van der Hammen (1961, 1983), Womersley (1935)

Only West side of Wallace's line: none in Southeast Asia

East side of Wallace's line:

Fam. Allothyridae – Australia, New Zealand (2 gen., 3 sp.)

Both sides:

Fam. Holothyridae – New Guinea, Seychelles, New Caledonia, Mauricius, Sri Lanka, Lord-Howe Isl. (23 sp.)

Remarks: it seems interesting that in New Caledonia and Lord-Howe Is. live Holothyrids of genera (*Lindothyrus* Lehtinen, 1995 and *Haplothyrus* Lehtinen, 1995) of fam. Holothyridae and not of Allothyridae.

The Arachnida and the Wallace's Line (family level)

Only West of the Line (living in Southeast Asia)		**Only East of the Line** (not living in Southeast Asia)
Palpigradi		
Prokoeneniidae		none
	On both sides	
	Eukoeneniidae	
Amblypygi		
none		none
	On both sides	
	Charinidae	
	Charontidae	
Uropygi		
none (different genera)		none
	On both sides	
	Theliphonidae	
Schizomida		
None		none
	On both sides	
	Hubbardiidae	
Scorpiones		
Chaerilidae		Urodacidae
Pseudochactidae		
Scorpiopidae		
Scorpionidae		
	On both sides	
	Buthidae	
	Liochelidae	
Pseudoscorpiones		
Ideoroncidae		Pseudogarypidae
	On both sides	
	18 families	
	Chthoniidae	
	Tridenchthoniidae	
	Lechytiidae	
	Hyidae	
	Neobisiidae	
	Syarinidae	
	Parahyidae	
	Garypidae	
	Geogarypidae	
	Menthidae	
	Cheiridiidae	
	Olpiidae	
	Garypinidae	
	Sternophoridae	
	Withiidae	
	Cheliferidae	
	Atemnidae	
	Chernetidae	
Opiliones		
Cyphophthalmi		
None		Troglosironidae
	On both sides	
	Stylocellidae	
	Pettalidae	
Eupnoi		
Phalangiidae		Caddidae
		Sclerosomatidae
		Neopilionidae
	On both sides	
	none	
Dyspnoi		
Nemastomatidae		none
	On both sides	
	none	
Laniatores		
Stygnommatidae		Synthetonychidae
Biantidae		Triaenonychidae
	On both sides	
	Assamiidae	
	Samoidae	
	Podoctidae	
	Sandokanidae	
	Epedanidae	
	Zalmoxidae	
Araneae		
Mesothelae		none
Liphistiidae		
	On both sides	
	none	
Mygalomorphae		
Atypidae		
Hexathelidae		

On both sides
Dipluridae
Nemesiidae
Theraphosidae
Barychelidae
Cyrtaucheniidae
Idiopidae
Ctenizidae

Suborder Araneomorphae
Araneomorphae
Eresidae
Palpimanidae
Phyxelidae
Cithaeronidae
Migidae
Actinopodidae
Austrochilidae
Gradungulidae
Periogopidae
Orsolobidae
Lamponidae
Holarchaeidae
Mecysmaucheniidae
Micropholcommatidae
Tengellidae
Ammoxenidae

On both sides:
(59 fam.)
Filistatidae
Scytodidae
Sicariidae
Ochyroceratidae
Telemidae
Pholcidae
Tetrablemmidae
Dysderidae
Oonopidae
Segestriidae
Lamponidae
Prodidomidae
Hersiliidae
Oecobiidae
Stenochilidae
Mimetidae
Deinopidae
Uloboridae
Anapidae
Araneidae
Linyphiidae
Mysmenidae
Nesticidae
Sinopimoidae
Symphytognathidae
Nephilidae
Theridiidae
Theridiosomatidae
Ctenidae
Lycosidae
Oxyopidae
Pisauridae
Psechridae
Stiphidiidae
Trechaleidae.
Zoridae
Zorocratidae
Zoropsidae
Agelenidae
Amaurobiidae
Anyphaenidae
Cybaeidae
Desidae
Dictynidae
Hahniidae
Selenopidae
Zodariidae
Clubionidae
Cycloctenidae
Miturgidae
Titanoecidae
Gallieniellidae
Gnaphosidae
Trochanteriidae
Philodromidae
Thomisidae
Salticidae
Corinnidae
Liocranidae

Exemple among Acari
Holothyrida
none (in SE Asia)
Allothyridae
On both sides:
Holothyridae

Some Arachnida and the Lydekker's Line.

Palpigradi – both sides of Lydekker's Line (LL)

Amblypygi – Charinidae and Charontidae live on both sides (usually the same genera), the only species of Phrynidae from Flores is west of LL.

Uropygi – only one widespread genus (*Thelyphonus* Latreille s. lato) is found East of LL (in New Guinea), species of seven genera live in Southeast Asia, Indonesia or the Philippines.

Schizomida – the only family (Hubbardiidae)

and some of it's genera are represented on both sides of LL, with some endemic genera on either side.

Pseudoscorpiones – as with the Wallace's Line, only one family (Ideoroncidae) is known only from the West side, one family (Pseudogarypidae, relict in Tasmania) – only from the East side and 18 families of Pseudoscorpiones live on both sides of LL.

Opiliones Cyphophthalmi – only the relict family Troglosironidae is known from the East sidew of LL (New Caledonia), no family is known only from the western side, two families (Stylocellidae and Pettalidae) have been recorded from both sides (as with Wallace's Line).

Opiliones Dyspnoi – practically missing in the area (one sp. in Thailand)

Opiliones Eupnoi – Fam. Neopilionidae is found in Australia, New Zealand (but, similarly to Triaenonychidae, also in South Africa and South America)

Opiliones Laniatores – Synthetonychiidae is endemic for New Zealand, Triaenonychidae is known East of LL, but has representatives also in South Africa, South America and Madagascar. Six families are distributed on both sides of LL.

Scorpiones – as with the Wallace's Line, only one family (Urodacidae) is typical for the Australian side, four families are known only on the West and two (Buthidae and Ischnuridae) live on both sides.

Araneae – suborder Mesothelae lives only West of all "lines". Suborders Mygalomorphae and Araneomorphae are crossing all "lines", many families are restricted to the land East of Lydekker's Line (see the coments above).

Acari – all orders are found on both sides of Lydekker's Line. Allothyridae (Holothyrida) is confined to Australia and New Zealand.

The "Lines" and some other groups

In their Atlas of Diplopoda Shelley & Golovatch (2011) conclude that "From present records, the hypothetical borders separating Asian and Australian faunas in Indonesia (Wallace's, Weber's, and Lydekker's "lines") hold little relevance for diplopods. Of the four exclusively Laurasian orders, only Glomerida and Platydesmida (…) expand into the East Indies/Indonesia, as Julida and Callipodida (…) terminate on the southeast Asian continent. In the north, Glomerida spread eastward to Weber's line, between Sulawesi and Halmahera, while the southern edge conforms roughly to Wallace's line. Platydesmida, however, extend to Wallace's line between Borneo and Sulawesi while the southern border passes between Sumatra/Java and corresponds to nothing. We would not expect these "lines" to be operative for the Gondwanan representatives, which were carried passively to southeast Asia by the terranes, and this is indeed the case. The only taxon conforming precisely to one of these hypothetical boundaries is Spirostreptidea, derived from Gondwana I, whose eastern border matches Lydekker's line completely. While future discoveries may alter East Indian taxon borders, hypotheses like these lines may not apply to low vagility organisms like millipeds, whose geographies are so dependent on geological events; conformity of Spirostreptidea may therefore be coincidence".

In a recent analysis of the caddisfies (Trichoptera) of Lombok, Bali and Java Malicky et al. (2014) conclude that "The caddisfly fauna of the three islands is of Asiatic origin, no Australian influence was noted. The well-known Wallace's line does not act as a faunistic border between Bali and Lombok for Trichoptera".

It is interesting to compare this analysis with our data concerning the Arachnida – other non-insect group of relatively small animals with (mostly) low vagility. Of course, there are differences – almost all Arachnida are predators, not living so much in rotten logs, some are balooning, other are small and relatively easy to be dispersed by air or otherwise (at least, it seems so).

Conclusions

From the orders of Arachnida some (Ricinulei and almost Solifugae) are missing from the analyzed area (Indomalayan and Australian regions). The situation with the other orders is as follows.

Palpigradi – fam. Eukoeneniidae is found on both sides (the same genera), fam. Prokoeneniidae found in Thailand, not living East of Wallace Line

Amblypygi – endemism on species level, all families and almost all genera are found on both sides.

Uropygi (Thelyphonida) – low level of endemism (only genera), one family on both sides.

Schizomida – low level of endemism (only genera), one family on both sides.

Scorpiones – four families live only West of the "Line", only one (Urodacidae) is known only East of it. Two families are known on both sides.

Solifugae is represented only by one species (*Dinorhax rostrumpsittaci* Simon) in Vietnam and Maluku Islands (both sides of Wallace line).

Pseudoscorpiones – one family (Ideoroncidae) only West of Wallace's Line**,**

one family (Pseudogarypidae) only East of the

Line (relict in Tasmania), 18 families on both sides.

Opiliones – Cyphophthalmi

Two families live on both sides, one (the relict Troglosironidae in New Caledonia) – only on East side, none only on West side

Opiliones – Eupnoi

One widespread family (Phalangiidae) is known on West side (Borneo), three families live on the East side, but are recorded also from far away countries.

Opiliones – Dyspnoi

One family (Nemastomatidae) is represented in Thailand with one species, none is known from the East side or from both sides (practically the suborder is absent in the whole area)

Opiliones – Laniatores

Two families are known only from the West side, two others are known only from the East side, but one of them (Triaenonychidae) is recorded also from Madagascar, South Africa, South America (but not found in Southeast Asia). The other (Synthetonychiidae) is endemic for New Zealand. Six families live on both sides.

Araneae

Mesothelae – only West of the "Lines".

Mygalomorphae – both sides of the "Lines".

Araneomorphae – worldwide distributed suborder, living on both sides of the "Lines".

Only on the West side of Wallace's Line are known five families.

Only on the East side are known 19 families. Some are endemic for Australia, New Zealand or New Caledonia, others live also in far away parts of the world, mostly in South Africa, Chile or Argentina, but not in Southeast Asia.

On both sides are recorded at list 70 families (out of the 112 families of spiders in the world), mostly widespread.

Opilioacarida – the only family of the order Opilioacaridae is known from both sides of the „Line". Two endemic genera live in India and Thailand, from Australia the order is recorded, but without further data.

Parasitiformes – we shall consider here only the zoogeographically interesting suborder Holothyrida, living on both sides of „Line". The family Holothyridae is known with endemic genera from both sides of the „Line" (not recorded in Southeast Asia, but living in India, Seychelles, Mauricius and Sri Lanka). Only East of the „Line" (Australia and New Zealand) is known the family Allothyridae.

None of the higher groups of Acari (Opilioacarida, Sarcoptiformes, Prostigmata, Acaridida, Oribatida, Parasitiformes, Mesostigmata, Ixodida and Holothyrida) is limited by the „lines".

According to Lehtinen (1980), in a paper on the „Arachnological zoogeography of the Indo-Pacific Region", dealing only with spiders. His conclusion was that: „Various lines limiting and dividing the Wallacea seem to have no equivalents in the arachnological zoogeography ". This very experienced author thinks also that „The spider fauna of Melanesia, Micronesia, and Polynesia, with the exception of New Caledonia, Lord Howe Island and surrounding small archipelagoes, is simply an impoverished Oriental fauna ".

In general, as a whole the analysis of the Arachnida on both sides of Wallace's Line confirms the conclusion of Shelley & Golovatch (2011), that "… the hypothetical borders separating Asian and Australian faunas in Indonesia (Wallace's, Weber's, and Lydekker's "lines") hold little relevance for diplopods". The "lines" seem to „hold little relevance" also for the Arachnida. There is no order of Arachnida living only of one side of the "lines". Only the spider suborder Mesothelae seems limited to the Western side. Some confirmation of the Vachon's opinion („On peut cependant affirmer que la ligne Wallace – pour certaines formes de Scorpions – est une frontière réellement existante") could be confirmed what concerns the scorpions. There are families and genera, known only on one side, but the level of endemism is relatively low. Within Arachnida we cannot detect anything similar to the endemic orders and even subclasses in the vertebrates which are the base of the construction of the „lines".

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Арахногеографията и „линиите" (на Уолес, Лидекер и Вебер)

Петър Берон

(Резюме)

Обект на настоящия преглед е да се види как разпространението на зоогеографски важни животни като разредите на Arachnida се отнася към прокараните въз основа на разпространението на гръбначните животни линии на Уолес, Лидекер и Вебер.

От разредите на Arachnida някои (Ricinulei и почти изцяло Solifugae) не се срещат в анализирания район (Индомалайската и Австралийската области). При другите разреди положението е следното.

Palpigradi – сем. Eukoeneniidae се среща от двете страни на Уолесовата линия (едни и същи родове), сем. Prokoeneniidae е намерено в Тайланд, но не и на изток от Уолесовата линия (УЛ).

Amblypygi – ендемизмът е на ниво вид, всички семейства и почти всички родове се срещат от двете страни

Uropygi (Thelyphonida) – ниско ниво на ендемизъм (само родове), едно семейство от двете страни на УЛ.

Schizomida – ниско ниво на ендемизъм (само родове), едно семейство от двете страни на УЛ.

Scorpiones – четири семейства живеят само на запад от УЛ, само едно (Urodacidae) е познато само на изток от нея. Две семейства са познати от двете страни.

Solifugae е представен само от един вид (*Dinorhax rostrumpsittaci* Simon) във Виетнам и Молукските острови (от двете страни на Уолесовата линия, но само на запад от Линията на Лидекер).

Pseudoscorpiones – едно семейство (Ideoroncidae) само на запад от Уолесовата линия, едно семейство (Pseudogarypidae) е само на изток от УЛ (реликт в Тасмания), 18 семейства от двете страни.

Opiliones – Cyphophthalmi

Две семейства живеят от двете страни на УЛ, едно (реликтните Troglosironidae в Нова Каледония) – само от източната страна, никое само от западната страна.

Opiliones – Eupnoi

Едно широкоразпространено семейство (Phalangiidae) е познато то западната страна (Борнео), три семейства живеят от източната страна, но също и в далечни континенти, без да се срещат в ЮИ Азия.

Opiliones – Dyspnoi

Едно семейство (Nemastomatidae) е представено в Тайланд с един вид, никое не е познато от източната страна или от двете страни (практически подразредът Dyspnoi липсва в целия район)

Opiliones – Laniatores

Две семейства са познати само от западната страна, две други се срещат само от източната страна, но едно от тях (Triaenonychidae) е съобщено от Мадагаскар, Южна Африка, Южна Америка (но не са намерени в Югоизточна Азия). Друго семейство (Synthetonychiidae) е ендемично за Нова Зеландия. Шест семейства живеят от двете страни.

Araneae

Mesothelae – Само западно от Уолесовата линия.

Mygalomorphae – от двете страни на "линиите".

Araneomorphae – световно разпространен подразред, разпространен от двете страни на "линиите".

Само западно от Уолесовата линия са известни шест семейства.

Само източно са познати 19 семейства. Някои от тях са ендемични за Австралия, Нова Зеландия или Нова Каледония, други живеят също и в далечни краища на света, главно в Южна Африка, Чили или Аржентина, но не и в Югоизточна Азия.

От двете страни са съобщени поне 70 семейства (от общо 109 семейства паяци в света), повечето от тях широкоразпространени.

Opilioacarida – единственото семейство в разреда (Opilioacaridae) е ,познато от двете страни на „линиите“. Два ендемични рода се срещат в Индия и Тайланд, в Австралия разредът е съобщен, без по-нататъшни данни.

Parasitiformes – тук разглеждаме само зоогеографски интересния разред Holothyrida, който се среща от двете страни на „линиите“. Семейство Holothyridae е познато с ендемични родове от двете страни на „линиите“ (не е известно от Югоизточна Азия, но ги има в Индия, Сейшелските острови, Маврций и Шри Ланка). Само на изток от „линиите“ (Австралия и Нова Зеландия) е познато семейството Allothyridae.

Никой от разредите на Acari (Opilioacarida, Prostigmata, Acaridida, Oribatida, Mesostigmata, Ixodida и Holothyrida) не е ограничен от „линиите“.

Като цяло, анализът на Arachnida от двете страни на Уолесовата линия потвърждава заключението на Shelley & Golovatch (2011), че “… хипотетичните граници, които разделят азиатската и австралийската фауни в Индонезия (“линиите“ на Уолес, Лидекер и Вебер) имат малко отражение върху диплоподите”. Няма разреди от Arachnida, които да живеят само от едната страна на “линиите“. Само подразред Mesothelae от паяците изглежда ограничен до Западната страна на УЛ. По отношение на скорпионите, както отбелязва Vachon (1953), се наблюдава известно значение на линиите. Има семейства и родове, познати само от едната страна, но това е относително ниско ниво на ендемизъм. Разликата е голяма с ендемичните разреди и даже подкласове на гръбначните, въз основа на които е възникнала самата идея за тези “линии“.

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Embiids (Insecta: Embioptera) in the collections of the National Museum of Natural History (Sofia), identified by E.S. Ross

Petar Beron

Abstract: A collection of Embioptera, or Embiidina (P. Beron leg.) was sent to Dr Ross (California), identified and returned with some taxa indicated as "new", but this material has not been published. Here is a list of the collection (16 sp. from 10 genera and two families) from 17 countries (Bulgaria, Greece (incl. Rhodes, Kassos, Crete, Samotraki), Libya, Nigeria, Cameroon, Senegal, Zimbabwe, Tunisia, France (Corsica), Italy (Sardinia), India, Afghanistan, Mozambique, Papua New Guinea, Cuba, Mexico, USA).

Key words: Embiidina, list, Museum Sofia

During my travels in many countries, I collected some Embiidina and have sent them to Dr E.S. Ross in California. He returned the material identified, indicating some specimens as new taxa, but they have not been published (in litt.). I think that it would be interesting to publish these identifications, for information to the specialists about the availability of this group in the National Museum of Natural History in Sofia.

The collection consists of 16 species of 10 genera and the families Embiidae and Oligotomidae. They originate from 17 countries: Bulgaria, Greece (incl. Rhodes, Kassos, Crete, Samotraki), Libya, Nigeria, Cameroon, Senegal, Zimbabwe, Tunisia, France (Corsica), Italy (Sardinia), India, Afghanistan, Mozambique, Papua New Guinea, Cuba, Mexico, USA.

Order Embioptera (Embiidina)

Fam. **Embiidae**

Berlandembia berlandi (Navás, 1922)

Nigeria, Plateau State, Pai River Game Reserve, Sabon Gida Guard Post, 9.04.1978, light

Nigeria, idem, 10.04.1978

Nigeria, idem, 18.04.1978

Nigeria, Plateau State, Wase Rock Game Res., 1.06.1978

Cleomia guareschi Stefani, 1953

Tunisia, Tabarka, 10.05.1971, E.S. Ross leg. et det. (donation)

Embia josensis Ross (topotype)

Embia ramburi Rimsky-Korsakow, 1905

Corsica, Caporalino, 17.10.1967 (Ny)

Tunisia, 10 km from Maktar, Sept. 1970, E.S. Ross leg. et det. (donation)

Embia n.sp. MS

Nigeria, Plateau State, Wase Rock Game Res., 1.06.1978

Embia sp. (f, Ny, difficult to identify)

Sardinia, Distr. Sassari, Laerru, 17.10.1980

Sardinia, Bonorva, 16.10.1980

Sardinia, Cagliari

Cameroon, 70 km E Nanga Eboko, 2.01.1977 (♀♀, ny)

Zimbabwe, Great Zimbabwe Ruins, 20.08.1983

Leptembia furcata Ross, n.sp. MS

Nigeria, Plateau State, Jos Wildlife Park, 1350 m, 24.03.1978

Nigeria, idem, 27.03.1978

Nigeria, idem, 12.04.1977

Leptembia protruda Ross, n.sp. MS

Nigeria, Plateau State, Pai River Game Reserve, Sabon Gida Guard Post, 9.04.1978

Nigeria, idem, 16.04.1977

Leptembia sp. (♀, ny.)

Nigeria, Plateau State, Wase Rock Game Reserve, 4.09.1978

Leptembia sp. (♂, ny.)

Nigeria, Pandam Wildlife Park, 14.02.1977

Parembia valida (Hagen, 1885)

India, Delhi, 24.06.1981

Parembia persica (McLachlan, 1877)

Afghanistan, Kabul, 2-19.06.1986, 1800 m

Plesioembia gen., n., sp. n., MS

Nigeria, Plateau State, Jos, July 1978

Nigeria, Plateau State, Jos, 1350 m, 25.05.1978 (adult ♀♀)

Fam. **Oligotomidae**

Aposthonia minuscula (Enderlein, 1912)

Mozambique, Cabo Delgado Prov., Mecufi, 6 – 15.07.1983

Aposthonia n.sp.? "nr. *davisi* - Ross, in litt."

Papua New Guinea, Telefomin, West Sepik Prov., 1660 m, 22.07.1975

Haploembia solieri (Rambur, 1842)

Bulgaria, Rhodopes, Mezek, 29.03.1986

Greece, Crete, Psiloritis, 1600-2000 m, 11.05.1984

Greece, Crete, Psiloritis, nr. Zoniana, 700-900 m, 13.05.1984

Greece, Distr. Evros, Avas Village, 17.05.1987

Greece, Samotraki, Chora Village, 20.05.1984

Greece, Rhodes, Laerma, 1.05.1984 (juv. ♀)

Corsica, Cargèse, Orchino Peninsula, 10 m alt., 12.11.1967

Sardinia, Capo Caccia, nr. Alghero, 18.10.1980

USA, California, Redwood City, matured, 1.06.1969, E.S. Ross leg. et det., donation

Haploembia megacephala Krauss, 1911

Greece, Kassos, Aghia Marina, 6.05.1984

Greece, Rhodes, Archangelos Village, 2.05.1987

Oligotoma humbertiana (Saussure, 1896)

Mozambique, Cabo Delgado Prov., Mecufi, 28 -31.07.1983

Mozambique, idem, 28-31.07.1983

Mozambique, Catuane Prov., Maputu, 24.06.1983

Tanzania, Moshi, 800 m, 7.09.1983

Oligotoma saundersii (Westwood, 1837)

Cuba, Santiago de Cuba, 24.02.1982

Cuba, idem, 10.03.1982

Nigeria, Plateau State, Jos, 1300 m, February 1978

Senegal, Ile de Gorée, 14.08.1977

Mozambique, Cabo Delgado Prov., Mecufi, 6 – 15.07.1983

Papua New Guinea, New Britain, Rabaul, 18.11.1975, under bark

Many ♀♀ and nymphes of several species

Nigeria, Plateau State, Jos, 12-30. Sept. 1976

Non-identified material:

Libya, Sabratha, 0-20 m, 19.04.1998, P. Beron leg.

Mexico, Ciudad Victoria, Tamaulipas, 26.01.1982, Gen., sp. (♂, ny, seen by Dr Ross)

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Ембии (Insecta: Embioptera) в колекциите на Националния природонаучен музей (София)

Петър Берон

(Резюме)

В колекциите на НПМ (София) има значителна серия от ембии (16 вида от 10 рода и две семейства), между които нови за науката видове и род от Афганистан, България, Гърция, Зимбабве, Индия, Камерун, Корсика, Куба, Ливан, Мексико, Мозамбик, Нигерия, Папуа Нова Гвинея, Сардиния, Сенегал, Танзания, САЩ. Материалът е събран от П. Берон и е определен частично от Dr Edward S. Ross от Калифорнийската академия на науките (Сан Франциско). По-късно е постъпил и материал от Либия, който не е определян.

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Spiders from High Atlas Mountains, Morocco (Arachnida: Araneae)

Christo Deltshev

Abstract: A small collection of spiders collected by P. Beron in May 2012, provides the opportunity to follow better the distribution of spiders in the Toubkal National Park (High Atlas, Morocco), to raise the known altitude records for some species, to establish new species for the spider fauna of Morocco and to present a check-list of the spiders known from Atlas Mountains above 2000 m.

Key words: Araneae, Morocco, High Atlas, alticolous fauna

Introduction

The highest part of the Atlas Mountains (High Atlas) is situated in Morocco, with several peaks above 4000 m and many others above 2600 m. Paulian & Villiers (1939) determined that the beginning of the high altitude fauna of Atlas is above 2500 m. Several araneologists: Fage (1938), Denis (1954, 1961, 1968), Jocqué (1977), Alderweireldt & Jocqué (1992), Bosmans (1985, 1996), Bosmans & Blick (2000) have contributed to the study of spiders from the High Atlas. Most of the altitude records are below 3000 m, with the exceptions of *Araeoncus toubkal* Bosmans, 1996 (3200 m), *Pardosa proxima* (C.L. Koch, 1847) (3000 m), *Drassodes lapidosus* (Walckenaer, 1802) (3200 m), *Euophrys rufibarbis* (Simon, 1868) (3200 m), *Salticus modicus* (Simon, 1875) (3000 m) and *Gnaphosa tigrina* Simon, 1878 – 4000 m. All these data are summarized by Beron (2008), who announced 22 species of 13 families above 2000 m in the Atlas Mountains. The accumulation of new data, due to faunistic material collected by Bulgarian arachnologist Petar Beron enabled this contribution.

Study area and materials

In May 2012 Petar Beron from the National Museum of Natural History in Sofia has collected spiders in Morocco, including in the transect from the entrance of the Toubkal National Park to the very summit of Toubkal (4167 m). The identification of this small collection provides the opportunity to follow better the distribution of spiders in the Park, to raise the known altitude records for some species, to establish new species for the spider fauna of Morocco and to present a check-list of the spiders known from Atlas Mountains above 2000 m. The distribution of the species follows WSC (2015).

Results and Discussion

The study comprises 11 species from 6 families: Gnaphosidae – 2 species, Linyphiidae – 4 species, Lycosidae – 1 species, Phrurulithidae – 1 species, Salticidae – 2 species, Theridiidae – 1 species. Ten species are new for the spider fauna of the mountain, 5 of these are also new for the fauna of Morocco (marked in the list with 2 and 1 asterisks). The new species for the spider fauna of Morocco are:

Nomisia exornata (C. L. Koch, 1839) – The range of the species covers Europe to Central Asia. The new data enlarge significantly the distribution of the species. The material is collected in the region of Taza, 540 m.

Agyneta rurestris (C. L. Koch, 1836) – widespread in the Palearctic region.

Erigone dentipalpis (Wider, 1834) - widespread in the Holarctic region.

Maso sundevali (Westring, 1851) - widespread in the Holarctic region. The material is collected in a small artificial cave under the wall of Medina.

Phrurlithus prope *minimus* C. L. Koch, 1839 – establishing genus *Phrurulitus* in Morocco is an interesting fact. The new locality is the southernmost point of the range.

A check-list of spiders known from Atlas Mountains above 2000 m

Agelenidae

Lycosoides subfasciata (Simon, 1870)
Massif of Ayachi, 3800 m (Denis, 1954)
Lycosoides instabilis Denis, 1954
Massif of Ayachi, 2500 m (Denis, 1954)

Araneidae

Araneus angulatus Clerck, 1757
Imlil, 2000 m (Jocqué, 1977).
Larinioides sclopetarius (Clerck, 1757)
Ifrane 1600; Imlil, 2500 m (Jocqué, 1977)
Mangora acalypha (Walckenaer, 1802)
Imlil, 2000 m (Jocqué, 1977).

Dysderidae

Dysdera atlantea Denis, 1954
Ayachi, 2500 m (Denis, 1954).
D. crocata C.L. Koch, 1838
Ighil Mgoun, 2000-2500 m (Denis, 1961).
D. ravida Simon, 1909
Bougmez, 2000-2500 m (Denis, 1961).

Gnaphosidae

Drassodes lapidosus (Walckenaer, 1802)
Massif of Toubkal, 3200 m (Jocqué, 1977)
Drassodes lutescens (C. L. Koch, 1839)
Massif of Ayachi, 2500 m (Denis, 1954).
New data: Massif of Toubkal, Mouflons Refuge, 3000-3200 m.
Gnaphosa tigrina Simon, 1878
Massif of Toubkal, 3200 m (Jocqué, 1977, Fage 1938)
New data: Massif of Toubkal, 3500-3800 m; the summit, 4000-4167 m.
Micaria coarctata (Lucas, 1846)
Massif of Tizi 'n Tichka– 2260 m (Bosmans & Blick, 2000)
Micaria cherifa Jocqué, 1977
Imlil, 2000 m (Jocqué, 1977).

Linyphiidae

***Agyneta rurestris* (C. L. Koch, 1836)
New data: Massif of Toubkal, Sidi Chamharoudh, ca 2350 m.
Araeoncus toubkal Bosmans, 1996
Massif of Toubkal, 3200 m (Fage, 1938, Denis, 1968, Jocqué, 1977, Bosmans, 1996)
***Erigone dentipalpis* (Wider, 1834)
New data: Massif of Toubkal, Mouflons Refuge, 3000-3200 m.
Lepthyphantes longihamatus Bosmans, 1985
Imilchil, grotte Achia inz Rebi, alt. 2500 m (Bosmans, 1985).
**Tenuiphantes tenuis* (Blackwall, 1852)
New data: Massif of Toubkal, the Refuges, 3250- 3500 m.
**Walckenaeria erithrina* (Simon, 1884)
New data: Massif of Toubkal, the hut, ca 2800 m; Mouflons Refuge, 3000-3200 m.

Lycosidae

Arctosa lacustris (Simon, 1876)
Imlil, 2000-2200 m (Alderweireldt & Jocqué, 1992).
Hogna radiata (Latreille, 1817)
Imlil, 2000 m (Alderweireldt & Jocqué, 1992).
Pardosa proxima (C.L. Koch, 1847)
Imlil, 2000-3000 m (Alderweireldt & Jocqué, 1992).
New data: Massif of Toubkal, the Refuges, 3250-3500 m.

Palpimanidae

Palpimanus sp
Massif of Toubkal, 3200 m (Jocqué, 1977)

Philodromidae

Philodromus aureolus (Clerck, 1757)
Imlil, 2000 m (Jocqué, 1977).

Phrurulithidae

*** Phrurlithus* prope *minimus* C. L. Koch, 1839
New data: Massif of Toubkal, the hut, ca 2800 m.

Segestriidae

Segestria florentina (Rossi,1790)
High Atlas – 2000-2500 m (Denis, 1961).

Salticidae

**Euophrys gambosa* (Simon, 1868)
New data: Massif de Toubkal, 3000 m
Euophrys rufibarbis (Simon, 1868)
Massif de Toubkal, 3200 m (Jocqué, 1977)
**Euophrys* sp.
New data: Massif of Toubkal, the hut, ca 2800 m; above the hut ca 3500 m; the summit, 4000-4167 m.
Menemerus semilimbatus (Hahn, 1829)
Massif de Toubkal, 2100 m (Jocqué, 1977)
Salticus modicus (Simon, 1875)
Massif of Toubkal, 3000 m (Jocqué, 1977)

Theridiidae

Phylloneta impressa (L. Koch, 1881)
Imlil, 2000 m (Jocqué, 1977).
**Steatoda triangulosa* (Walckenaer, 1802)
New data: Massif of Toubkal, the hut, ca 2800 m; Mouflons Refuge, 3000-3200 m.

Tetragnathidae

Tetragnatha extensa (Linnaeus, 1758)
Imlil, 1600-2200 m (Jocqué, 1977).

Fam. Thomisidae

Xysticus erraticus (Blackwall, 1834)
Imlil, 2000 m (Jocqué, 1977).

X. kochi Thorell, 1872
Imlil, 2000 m (Jocqué, 1977).

Uloboridae

Uloboros walckenarius Latreille, 1806
Imlil, 2000 (Jocqué, 1977).

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Паяци от Високия Атлас – Мароко (Arachnida: Araneae)

Христо Делчев

(Резюме)

Малка колекция от паяци, събрани от П. Берон май 2012, дава възможност да се проследи тяхното разпространение в Националния парк Тубкал (Високия Атлас, Мароко) до неговата най-високата точка на в. Тубкал, Освен това са установени нови видове, както за паяковата фауна на планината, така и нови видове за фауната на Мароко. Представен е чек лист на известните видове паяци, срещащи се над 2000 метра във Високия Атлас.

„Загадки на зоогеографията”

от д-р ПЕТЪР БЕРОН

Тази книга трябваше да бъде написана от Петър Берон и той, слава Богу, я написа. Написването на книга за загадките в зоогеографията е сериозно предизвикателство пред зоолога и изисква широка зоологична култура. Няма спор за това, че зоогеографията е една от „надстройките” на зоологичната наука, едно от най-интересните й направления. В нея се преплитат знанията, натрупани от систематиката, от географията и геологията, а също от палеонтологията, еволюцията и екологията на животните. През годините, докато работехме с Петър Берон врата до врата и мечтаехме за пътешествия по далечни и диви места, неведнъж сме обсъждали много от странните факти или парадокси на разпространението на различни видове животни. За много от тях има логични обяснения, но дори и те често са спорни, а други и до днес остават неизяснени от съвременната наука. На тези загадки, спорове и обяснения се спира Петър Берон в „Загадки на зоогеографията”. И това, че книгата е издадена от издателството Изток-Запад, е логично. Тя е увлекателно четиво, написано на жив и достъпен език, но материята, разглеждана в нея си е чисто научна. Това е четиво от този род, което неусетно въвлича читателя в лоното на науката. Всеки един от нас, от тези които са свързали живота си с изследователското поприще, си спомня няколко подобни книги, които са впечатлили дотолкова юношеското му съзнание, че са го накарали да се посвети на научното изследване, на разгадаването на тайните и загадките на заобикалящия ни свят. Разрешени или разрешими са много от загадките и разбулването на тайните на природата е всъщност смисълът на науката, но много от тях остават. Загадки винаги ще има. А това е гаранция, че ще има и учени, защото тяхното призвание е да търсят и да намират отговорите на безкрайните въпроси, поставяни от необятния, заобикалящ ни свят пред търсещия човешки ум.

Книгата е с достатъчен обем, за да представлява завършен труд, обхващащ както основни въпроси на зоогеографията така и множество любопитни моменти, без да подминава нито една част на земното кълбо. Първите десетина глави на книгата запознават с историята на тази наука: с учените, имащи основен принос в развитието й, с понятията в зоогеографията, зоо- и биогеографските подялби, начините на разпространение на видовете, а също с геоложките теории, стоящи в основата на съвременните зоогеографски обяснения за разпространението на животинския свят. Обяснявайки явления в зоогеографията, авторът дава огромен брой интересни примери от най-разнообразни групи животни и от различни части на света. Тези глави са едно сериозно и обхватно въведение в зоогеографията и благодарение на тях книгата може с успех да бъде използвана и за учебник по зоогеография. По-нататък читателят неусетно навлиза в историята на всевъзможни животни, на удивителните обитатели на различните кътчета на света и тяхното разселване и всичко това, често с примери от пътешествията на самия автор. Всъщност, независимо от лекия стил и атрактивните описания, пълни със загадките на изчезнали или съвременни обитатели на острови и континенти, и тези глави продължават да ни обучават по зоогеография с множеството систематизирани данни за всякакви групи обитатели, характерни за различните области. Тази книга ще види бял свят и на английски език за много по-широка публика.

В заключение бих искал да кажа, че Издателство Изток – Запад трябва да бъде поздравено, за това, че е приело да издаде тази книга. Научна по съдържание, популярна по стил, четивна и интригуваща, тя ще намери много читатели.

проф. Николай Спасов
(НПМ-БАН)

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A checklist of the scorpions (Arachnida, Scorpiones) in the collections of the National Museum of Natural History (Sofia)

František Kovařik, Petar Beron

Abstract: The scorpions deposited in the collection of NMNH (Sofia) are identified and revised. The collection contains 61 species of 34 genera and ten families (Bothriuridae, Buthidae, Chaerilidae, Diplocentridae, Euscorpiidae, Liochelidae, Iuridae, Caraboctonidae, Scorpionidae, and Vaejovidae), incl. the holotype and paratypes of *Euscorpius deltshevi,* the holotype and paratypes of *Euscorpius drenskii,* the holotype and paratypes of *Euscorpius popovi* Tropea et al., paratype of *Chaerilus tyznai* Kov., holotype and paratype of *E. beroni* Fet, 2000, topotypes of *Butheoloides charlotteae* Lourenço, 2000 and specimens of the recently described *Euscorpiops problematicus* (Kovařík, 2000). They were collected mostly by P. Beron and identified mostly by F. Kovařík and V. Fet and come from 34 countries: Bulgaria, Macedonia, Albania, Romania, Greece, Montenegro, Turkey, Italy (incl. Sardinia), France (incl. Corsica), USA, Mexico, Cuba, Dominican Republic, Peru, Chile, Bolivia, Ecuador, Algeria, Morocco, Tunisia, Egypt, Nigeria, Mozambique, Tanzania, Zambia, Zimbabwe, Indonesia, Iran, China (incl. Tibet), Malaysia, Nepal, Thailand, Afghanistan and Papua New Guinea.

Key words: Scorpiones, Museum Sofia, collections

History of the Collection

Until the beginning of our (mostly P. Beron) collecting of scorpions in foreign countries (by 1964), most of the scorpions in the National Museum of Natural History in Sofia were mounted in glass cylinders and displayed in the Museum exposition. Some of them were collected in Bulgaria, Macedonia, Greece, Iran and Egypt by I. Buresch, B. Kurzius and Y. Tsonkov. Some other samples were donated by foreign individuals or institutions (Prof. J. C. Uphof from Florida, E. Holub from South Africa, the Berlin Museum). The scorpions bear labels with the original identifications.

Some other scorpions in the older collection were preserved in tubes with alcohol and were collected by I. Buresch, D. Papazov, (almost all from Bulgaria, Greece and Macedonia).

The recent material from different Balkan countries was collected by P. Beron, B. Petrov, P. Stoev and other Bulgarians. These scorpions (*Mesobuthus gibbosus, Iurus dufoureius* and several species of *Euscorpius*) were studied first by Max Vachon and then by Viktor Fet and his American colleagues. Several papers have been published (Fet, 2000; Tropea et al., 2015), with descriptions of new species (*Euscorpius beroni, E. deltshevi, E. drenskii, E. solegladi, E. birulai*). Fet & Soleglad (2002) established the fact that the "widespread" *Euscorpius carpathicus* (L.) should be restricted to South Romania and that numerous other species of *Euscorpius* inhabit the countries south of the Danube.

Collections of scorpions were due mostly to P. Beron (sometimes accompained by V. Beshkov, S. Andreev and other colleagues). Some scorpions have been donated to the Museum by P. Reveillet, H. Coiffait and F. Kovařik.

Presently (2015) the collection of scorpions of the National Museum of Natural History in Sofia consists of 61 species, 34 genera and 10 families (Bothriuridae, Buthidae, Chaerilidae, Diplocentridae, Euscorpiidae, Liochelidae, Iuridae, Caraboctonidae, Scorpionidae, and Vaejovidae) from 35 countries: Bulgaria, Macedonia, Albania, Romania, Greece, Montenegro, Turkey, Italy (incl. Sardinia), France (incl. Corsica), USA, Mexico, Cuba, Dominican Republic, Peru, Chile, Bolivia, Ecuador, Algeria, Morocco, Tunisia, Egypt, Nigeria, Mozambique, Tanzania, Zambia,

Zimbabwe, Indonesia, South Africa, Iran, China (incl. Tibet), Malaysia, Nepal, Thailand, Afghanistan and Papua New Guinea. Preserved in the Museum are also some type specimens: incl. the holotype and paratypes of *Euscorpius deltshevi, E. solegladi, E. beroni* and *E. birulai*, paratype of *Chaerilus tyznai* Kov., topotypes of *Butheoloides charlotteae* Lourenço, 2000 and specimens of the recently described *Euscorpiops problematicus* (Kovařík, 2000).

Most of the material has been identified by F. Kovařik (sent by P. Beron) and returned to the NMNH (Sofia). The numbers of samples are numbers of tubes in the collection.

Material and Methods

The work was conducted in 1999 – 2003. All specimens are preserved in alcohol. The first author was concerned chiefly with determinations and the second author with catalogization of specimens, a majority of which he had collected. Specimen data are given as they appear on the original labels. All examined specimens received labels in Ariel or Times New Roman font produced on a laser printer. The labels contain the generic and species name, author and year of the original description, whether the specimen was determined (det.) or revised (rev.), and the reviser's name and date (year) of the examination. Specimens determined by Fet (see Fet, 2000, p. 47-60) were not re-examined and did not receive additional labels. The complex of *Euscorpius* (*Euscorpius*) "*carpathicus*" (Linné, 1767) includes specimens from Turkey determined by the first author and specimens which Fet currently recognizes as several distinct groups (see Fet, 2000: 47-60); they cannot receive species names until the entire complex is revised.

Meanwhile, V. Fet returned most of the scorpions entrusted to him, together with the type material of several new Balkanic *Euscopius*, described in the papers of Fet et al. (2014a, 2014b) and Tropea et al.(2015a, 2015b). Other papers are being prepared (Fet, in litt.).

Results

Fam. Bothriuridae Simon, 1880

Orobothriurus cf. *paessleri* (Kraepelin, 1911)

Bolivia, La Paz, 3600 m, 19.VI.1979, 1♀, 2 juvs, leg. P. Beron (P.B.), No. 52.

Fam. Buthidae Simon, 1879

Alayotityus nanus Armas, 1973

Cuba, Siboney, Sant. de Cuba, Cueva de los Majaes, 37 m, 26.II.1982, 1♂, 2 ♀ ♀ 2 juvs, leg. P. B., No. 30.

Androctonus crassicauda (Olivier, 1807)

Turkey, Halfeti, 6.VII.1994, leg. M. Kaftan

Butheoloides charlotteae Lourenço, 2000

Nigeria, v. Kabwir, Plateau State, 20.IX.1978, 2♂, 1 juv. (topotypes), leg. P. B., No. 10.

Buthus occitanus (Amoreux, 1789)

Morocco, Tuisgui Remus, 25.X.1971, 2 im., leg. H. Coiffait, No. 47; Oued Tigsert, 26.X.1971, 1 ♂, leg. H. Coiffait, No. 46; Tan - Tan Pluga, 28.X.1971, 2 juvs, leg. H. Coiffait, No. 44. **Nigeria**, Pai River Game Reserve, Sabon Gida, 3.IX.1978, 1♂, leg. P. B., No. 53; Wase Rock, Game Reserve, 4.IX.1978, 1 ♀, leg. P. B., No. 14.

Centruroides exilicauda (Wood, 1863)

USA, California, Borrego Spring, 19.V.1981, 1 ♀, leg. V. Beshkov.

Centruroides gracilis (Latreille, 1804)

Cuba, Pinar del Rio, 1.XII.1981, 1 ♀ (im.), leg. P. B., No. 38; La Habana, 11-16.XII.1981, 1 juv., leg. P. B., No. 28; Prov. Pinar del Rio, v. Ceja de Francisco, Arroyo, 150 m, 9.XII.1981, 1 ♂, 1 ♀, leg. P. B.; La Habana, Casa Blanca, ca. 20 m, 22.II.1982, 3 ♀ ♀, leg. P. B., Nos 17, 23 and 27; Prov. Santiago de Cuba, Forestal „La Francia", 6.III.1982, 1 juv., leg. P. B., No. 32. **Mexico**, Tamaulipas, Quintero (near C. Mante), Merida, 7.II.1982, 1 ♀, leg. P. B., No. 43; Yucatan, Chichen Ytza, 13.II.1982, 1 ♀, 1 juv., leg. P. B., Nos 16 and 25.

Centruroides guanensis Franganillo, 1931

Cuba, Pinar del Rio, Pica Pica Valey, 26.XI.1981, 1♂, 1 ♀, leg. P. B., No. 63.

Centruroides ochraceus (Pocock, 1898)

Mexico, Yucatan, Chichen Ytza, 13.II.1982, 2 ♀ ♀, leg. P. B., Nos 19 and 20.

Centruroides vittatus (Say, 1821)

Mexico, Tamaulipas, Ciudad, Victoria, 26.I.1982, 1 ♀, 1 juv., leg. P. B., Nos 21 and 24.

Hottentotta alticola (Pocock, 1895)

Afghanistan, Kabul, Sherdarwasa, 2000-2200 m, 3.VI.1986, 1 ♀,1 juv., leg. P. B., Nos 123 and 129; Kabul, 1800 m, 2-19.VI.1986, 1 ♀, 2 juvs, leg. P. B., Nos 121 and 122; Kabul, Bagh-i-Bala, 1900 m, 8.VI.1986, 1 ♀, leg. P. B., No. 118; Kabul, Nadir Shah Mausoleum, 1850 m, 18.VI.1986, 1 juv., leg. P. B., No. 276.

Hottentotta hottentotta (Fabricius, 1787)

Nigeria, Wase Rock, Game Reserve, 4.IX.1978, 1 juv., leg. P. B., No. 14; v. Kabwir, Plateau St., 20.IX.1978, 1 juv., leg. P. B., No. 10.

Hottentotta trilineatus (Peters, 1861)

Tanzania, Moshi, 800 m, 7.IX.1983, 1 ♀, leg. P. Beron & V. Beshkov, No. 84. **Zimbabwe**, Victoria Falls, 23.VIII.1983, 1♂,1 juv., leg. P. Beron & V. Beshkov, No. 77.

Leiurus quinquestriatus (Hemprich et Ehrenberg, 1828)

Egypt, Luxor, right bank, 16.X.1977, 2 juvs, leg. P. B., No. 33.

Lychas burdoi (Simon, 1882)

Mozambique, Provincia Maputo, Catuane, 24.VI.1983, 2 juvs, leg. P. Beron & V. Beshkov, No. 65.

Lychas mucronatus (Fabricius, 1798)

China, Hainan Dao Qingdao, 200-300 m, 14.X.1988, 2 ♀, 2 juvs, leg. P. B., No. 151. **Indonesia**, Sumatra, Padang the hill with the Chinese cemetery, 21.V.1994, 2 im., leg. P. Beron & V. Beshkov, No. 173; Flores, Borong, 21.VI.1994, sub cort., 1 ♀, leg. P. Beron & V. Beshkov

Lychas nigristernis (Pocock, 1899)

Nepal, Bagmati Zone, Betrawati, 650-700 m, 12.IX.1984, 1 ♀, leg. P. Beron & St. Andreev, No. 106.

Lychas variatus (Thorell, 1876)

Papua New Guinea, New Ireland, Lelet Plateau, v. Lenkamin, under bark, 2.XII.1975, 1 ♀, leg. P. B., No. 338.

Mesobuthus gibbosus (Brullé, 1832)

Albania, Ionian Sea, Dhermi, 24.I.1993, 2 ♀, 1 juv., No. 132, leg. P. B. **Greece**, Peloponnesos, IX.1981, 1 ♀, No. 48, leg. P. B.; Kythira, near airfield, 30.IV.1987, 1♂, 1 ♀, No. 166, leg. P. B.; Kithinos, Dryopis, 15.V.1984, 1 ♂, 1 ♀, No. 99, 9.V.1987, 1 ♀,1juv., No. 159, 16.V.1987, 1 ♀, No. 92, leg. P. B.; Serifos, Coutalas, 0-300 m, 22.IV.1984, 1♂, 1 ♀, Nos. 91 and 93, leg. P. B.; Tinos, 1.X.1974, 2 ♀ ♀, 2 im. ♂, Nos. 35 and 54, leg. P. Beron & V. Beshkov; Chios, Passa Limani, 14.V.1987, 2 ♀, Nos. 160 and 165, leg. P. B.; Chios, Nea Moni, 13.V.1987, 1 juv., No. 154, leg. P. B.; Karpathos, Archangel Michail, 800-1000 m, 4.V.1984, 1 ♀, No. 89, leg. P. B.; Rhodes, Lindos, 30.IV.1984, 1 ♀, No. 94, leg. P. B.; Rhodes, Lardos, 1.V.1984, 1 ♀, No. 97, leg. P. B.; Rhodes, Archangelos, 1.V.1987, 1 juv. ♀, No, 167, leg. P. B.; Crete, Psiloritis, 1600-2000 m, 11.V.1984, 1♂, No. 116, leg. P. B.

Mesobuthus eupeus (C. L. Koch, 1839)

Afghanistan, Kabul, Bagh-i-Bala, 1900 m, 8.VI.1986, 1 ♀, leg. P. B., No. 120; Kabul, Nadir Shah Mausoleum, 1850 m, 18.VI.1986, 5 ♂, 13 ♀ ♀, leg. P. B., Nos 119, 124 - 127; Kabul, 1800 m, 2-19.VI.1986, 1♂, leg. P. B., No. 121.

Turkey, Eastern Anatolia, Dogubayazit, Ishak Pasha Sarayi, 2000 m,

27.VIII. 2000, B. Petrov leg. (V. Fet det.)

Mesobuthus martensii (Karsch, 1879)

China, Beijing Mun., Fangshan Co. Zhoukoudian, 12.VIII.1993, 1 ♀, 3 juvs, leg. P. B., No. 130.

Orthochirus innesi Simon, 1910

Morocco, Valle de Dra, Maades Anzez, 20.X.1971, 2♂, leg. H. Coiffait, No. 50.

Rhopalurus junceus (Herbst, 1800)

Cuba, Prov. Pinar del Rio, Pica Pica Valey, Cueva Oscura, 26.XI.1981, 1 juv., leg. P. B.; Sierra Maestra, Pico Cuba, 1600 -1800 m, 28.II.1982, 1 im., leg. P. B., No. 22.

Tityopsis inaequalis Armas, 1974

Cuba, Cueva de Murcielagos, Rancho galera, 25 km E Habana, 2 juvs, leg. P. B., No. 12; Pinar del Rio, v. Ceja de Francisco, 26.X.1980, 1 ♀, 1juv., leg. P. B., No. 5; Pinar del Rio, v. Ceja de Francisco, Cueva del Cafetal, 23.XI.1981, 1 juv., leg. P. B., No. 60.

Uroplectes flavoridis Peters, 1862

Mozambique, Provincia Maputo, Catuane, 25.VI.1983, 1♂,1 ♀, leg. P. Beron & V. Beshkov, No. 78; Provincia Cabo Delgado, Mazeze, near Pemba, 1.VII.1983, 2 juvs, leg. P. Beron & V. Beshkov, No. 72; Provincia Cabo Delgado, 10 km S Namapa, 26.VII.1983, 1♂,1 ♀, leg. P. B., No. 73; Provincia Cabo Delgado, v. Muaguide, 94 km from Pemba, 28.VII.1983, 2 ♀ ♀, leg. P. Beron & V. Beshkov, No. 75.

Zambia, Kafue, 28.VIII.1983, 1 ♀ (im.), leg. P. Beron & V. Beshkov, No. 64. **Zimbabwe**, Great Zimbabwe ruins, 20.VIII.1983, 2♂, 2 ♀ ♀, leg. P. Beron & V. Beshkov, No. 71.

Uroplectes formosus Pocock, 1890

Mozambique, Provincia Maputo, Catuane, 24.VI.1983, 1 ♀, 1juv., leg. P. Beron & V. Beshkov, No. 65; Provincia Maputo, Namaacha, 7.VIII.1983, 2 ♀ ♀, leg. P. Beron & V. Beshkov, No. 66.

Uroplectes planimanus (Karsch, 1879)

Zambia, Victoria Falls, 25.VIII.1983, 2M, 7 ♀ ♀, 4 juvs, leg. P. Beron & V. Beshkov, Nos 82 and 156.

Uroplectes vittatus (Thorell, 1876)

Zambia, Victoria Falls, 25.VIII.1983, 1 ♂, leg. P. Beron & V. Beshkov, No. 82.

Fam. Chaerilidae Pocock, 1893

Chaerilus truncatus Karsch, 1879

Nepal, Kathmandu, 1900 m, 26.VII.1981, 1 ♀, leg. P. B.

Chaerilus variegatus Simon, 1877

Indonesia, Java, Puncak Pass, 34 km from Bogor, 1500 - 1600 m, 7.VII.1994, 1 im, leg. P. Beron & V. Beshkov, No. 178.

Chaerilus tryznai Kovařik, 2000

China (Tibet), Bomi env., ca 3000 m, 9.VII.1997, leg. M. Tryzna et O. Šafránek. **Paratype No 10**

Fam. Diplocentridae Pocock, 1893

Diplocentrus cf. *steeleae* Stockwell, 1988

Mexico, Chiapas, Palenque, 18.I.1982, 1 im., leg. P. B., No. 18.

Fam. Euscorpiidae Laurie, 1896

Euscorpiops problematicus (Kovařík, 2000)

Thailand, Doi Inthanon, National Park, 1200-1300 m, 12.XI.1984, 2 im. ♀, leg. P. Beron & St. Andreev, Nos 105 and 107.

Euscorpius popovi Tropea, Fet, Parmakelis, Kotsakiozi et Stathi, 2015

Bulgaria. Holotype ♂ and paratypes: Blagoevgrad District, Melnik, 29.IV.1983, 2♂1im. ♀, No. 88, leg. P. Beron, S. Andreev & V. Pomakov; Other paratypes – not yet returned; Other material: Blagoevgrad District, Ilinden, locality Pazlaka, 6.V.1981, 2♂2 ♀1juv., No. 7, leg. P. Beron, S. Andreev & V. Pomakov; Blagoevgrad District, Goleshovo, near the karstic source, 10.V.1984, 3 ♀, leg. P. Beron & S. Andreev; ; Blagoevgrad District, Musomishta, locality Grebenaro, litter, 2♂, No. 31, leg. P. Beron & S. Andreev.

Euscorpius (*Euscorpius*) *beroni* Fet, 2000

Albania, Shkoder District, Boga, Maya Tchardakut, 1400-1800 m, 1.VI.1993, 1 ♀ (**holotype**), No. 137, leg. P. B.; Shkoder District, Boga, upper Camp, 1800-1900 m, 20 -25.VI.1993, 1 ♀, 3 juvs. (paratypes), No. 142, leg. P. Beron & B. Petrov; Shkoder District, Mt. Radohimës, 2200-2400 m, 29.V.1993, 3 ♀ (**paratypes**), No. 134, leg. P. B.

Euscorpius (*Euscorpius*) *tergestinus* (C. L. Koch, 1837)

France, Corsica, Zama, 19.IX.1967, 1 ♀, leg. P. B., No. 59.

Croatia. Island of Hvar, vill. Humac, cave Grabcina Spilja, 16.08.2006, B.

Petrov et St. Lazarov leg.; Isl. of Mljet, vill. Blato, cave Velika Spilja,, alt.

90 m, 13.08.2006, B. Petrov et St. Lazarov leg.

Euscorpius (*Euscorpius*) *deltshevi* Fet, Graham, Webber et Blagoev, 2014

Bulgaria. ♂, **Holotype**: Sofia Prov.: Tserovo, 739 m, 4.05.2005, leg. V. Fet & A. Popov. **Paratypes**: same label, 3 ♂♂, 8 ♀; 1 ♂, 1 ♀; 1 ♂, 2 ♀, Tserovo, leg. P. Beron (36); 1 ♀, between Tserovo and Iskrets, 1000 m, 25.09.1960, leg. V. Beshkov (235); 1 ♀, Lakatnik Railway St., 23.03.1930, leg. P. Drenski (313); ídem, 2 ♂♂ subad., 6.05.1934, leg. J. Zonkov (305); 1 ♀, ídem, 20.08.1934, G. Stoyanov (300); 1 ♂ subad., 2 ♀ ♀ subad., ídem, 10.07.1948, leg. I.A. Ivanov & P. Tranteev (274); 2 ♀, 1 ♀ juv., ídem, nr. Razhishkata Cave, 7.08.1948, leg. G.Rupev (281); 2 ♀, ídem, 15.05.1997, leg. B. Petrov (220); 1 ♂, 2 ♀ ♀, Opletnya nr. Lakatnik, 21.05.1994, leg. P. Stoev (214); 1 ♀, Svoge, 8.07.1934, leg. N. Miladinov (303); 1 ♂, Thompson Station, 29.06.1952, leg. A. Popov (532); 4 ♀, Zanoge, 1100 – 1300 m, 2.05.1985 (114). Other material studied by Fet, Graham, Webber & Blagoev, 2014: 3 ♂, 1 ♀, Asklepion near Zlatna Panega Village, 4.08.1948 (340); 3 ♂, 1 ♀ (341); 1 m, Karlukovo, 9.09.1923, leg. I. Buresch (297); 1 ♂, Karlukovo, nr. Temnata dupka Cave, 24.11.1935, leg. K. Popov (316); 1 ♂, Lukovit Distr., Bezhanovo, Georgikovata Cave, 11.10.1973, leg. A. Petkova (157); 1 ♂, ídem, nr. Entrance of Parnitsite Cave, 15. 03.1998, leg. B. Petrov (203); 1 ♀, 1 ♀ subad., Troyan, 6. 1919, leg. P. Drenski (307); 1 ♂, 2 ♀ ♀, Chiprovtsi Distr., Beli Mel, 13.06.1973, leg. P. B. (49); 1 ♂, 1 ♀ juv., Debelidelska Murtvina area, 1100 – 1300 m, 28.06.1998, leg. P. B. (207); 2 ♀ juv., Diva Slatina, 21.06.1998, leg. B. Petrov (205); 1 ♀, Ravna, 1.06.1972, leg. P. B. (348); 1 ♀, Gorna Bela Rechka, Vartop Cave, 7.05.1909 (503); 1 ♂, 2 ♀, Radomir Distr., Golo Bardo Mts., 1000 m, 25.03.1937, leg. P. Drenski (510); 1 ♂, Deventsi, Haydushkata Peshtera Cave, 24.08.1927, leg. H. Matrov (283); 1 ♀, Dolni Dabnik District, Sadovets nr. Pleven, 29.05.1926, leg. H. Matrov (524); 1 ♀, Pleven, 06.1912, leg. Klein (312); 1 ♂, 1 ♀, Svalenik, Byalata Stena, "Rusenski Lom" Nature Park, 3.10.1999, leg. B. Petrov (226); 1 ♂, Pepelina, 4.10.1999, leg. P. Petrov (225); Shumen Prov.: 1 ♀ with juvs., Veliki Preslav, Patleyna, 13.10.1933, leg. I. Grozev (293); 3 ♂, 3 ♀ ♀ (523); 1 ♀, 1 ♀ juv., Sliven Prov.: Sliven, ca. 500 m, 06.1985, leg. G. Ribarov (343); 1 ♂ subad., Byala, 13.06.1927, I. Julius & P. Drenski (311); 2 ♀ ♀, Davidov Dol, 10.07.1934, leg. G. Kozarov (285); 1 ♂, Katunishte, 10.1993, leg. T. Lerov (239); 2 ♀ juv., Kotel, 600 m, G. Ribarov (240); 1 ♀ juv., "Ponor", nr. Kotel, 30.04.1924, leg. N. Radev (509); 1 ♀, Sinite Kamani Natural Park, 29.03.1983, leg. T. Petrov (241); 1 ♂, idem, between Karandila and Buchvata, 800-900 m, 25.05.2001, leg. B. Petrov & V. Beshkov (259); Sofia prov.: 1 ♀, Beledie Han, 5.10.1958, leg. A. Popov (549); 1 ♂, Praveshka Lakavitsa, Aliova dupka Cave, 5.02.1994, leg. B. Petrov (206); 1 n, Bov Village, Mt. Izdremets, 1400 m, 14.09.1999, leg. B. Petrov, V. Beshkov & Yu. Gorelov (224); 1 ♀ subad., Chepan Hill, above Dragoman, 28.05.1932, leg. J. Zonkov (284); 1 ♂ juv., 2 ♀ ♀, Goten Mt. Above Buhovo Village, leg. G. Stoyanov (513); 2 ♀ ♀, Kremikovski Mon., 23.04.1900, leg. I. Buresch (273); 1 ♂ juv., Novi Iskar, Kurilo, 6.05.1952, leg. A. Popov & I. Buresch (517); 1 ♂, 1 ♀, Kurilo, 30.05.1952, leg. G. Stoyanov (540); 4 ♂, 2 ♀ ♀, 1 ♂ juv., between Milanovo and Gorna Bela Rechka, 05.1911, leg. P. Drenski (270); 5 ♀ ♀, Ogoya, 12.06.1938, leg. G. Stoyanov (327); 1 ♂, 2 ♀ ♀, Batuliya, Rebrovo Station, 23.05.1954, Ieg. I. Urumov & I. Buresch (542); 1 ♂, Rebrovo Railway Station, 10.06.1949, leg. G. Zagorov (233); 1 ♀, Rebrovo, 9.10.1980, leg. P. B. (109); 1 ♂ juv., Sedemte Prestola Mon., 10.04.1988, leg. P. B. (232); 1 ♂, Sofia

(brought with firewood ¿), 1.06.1957, leg. A. Popov (516); Targovishte Prov.: 1 ♀, Valley nr. Targovishte, 207 m, 1.05.1962, leg. I. Buresch (539); Veliko Tarnovo Prov.: 1 ♀, Arbanasi, Lyaskovskata peshtera Cave, 6.08.1968, leg. P. Beron (39); 1 ♀, Preobrazhenski Mon. Nr. Veliko Tarnovo, 25.07.1928, leg. Kr. Tuleshkov (538); Vidin Prov.: 1 ♂, Belogradchik, Neprivetlivata Pothole, 6.06.1973, leg. P. B. (333); 1 ♀, Oreshets Railway St., 17.10.1971, leg. P. B. (339); Vratsa prov.: 1 ♀ subad., Vratsa Town, 1.07. 1924, leg. I. Buresch (291); 1 ♂ subad., env. of Vratsa, 2.06.1926, leg. H. Matrov (278); 1 ♀, southern Vrachanska Mts, 880 m, 1.01.2005, leg. T. Ljubomirov; 1 ♂, Chelopek, Malata Yama Pothole, 30 m deep, 1.07.1929, leg. N. Radev (304); 1 ♂, Cherepishki Mon., 1.05.1959, leg. A. Popov (528); Chiren Village, small cave near entrance of Ponora Cave, 22.04, 1995, leg. T. Ivanova (234); 2 ♀♀, Kunino, 1.05.1993, leg. T. Ivanova (186); 1 ♂, near Dyavolska Vodenitsa Cave, nr. Kunino, 5.04.1924, leg. I. Buresch (529); 1 ♂, Near Ledenika Cave, 5.06.1933, leg. D. Papazov & N. Atanassov (289); 1 ♂ (294); 1 ♀, Lyutadjik, 450 m, 1.04.2000, leg. B. Petrov & V. Beshkov (237); 1 ♀, Matnishki Mon., Cherniya Izvor Cave, 3.04.1999, leg. B. Petrov (209); 1 ♀, Vrachanska Mts., Parshevitsa Hut, 1000 m, 2.05.1994, leg. P. Stoev (216); 1 m, Yambol Prov. Yambol, 10.08.1934, leg. I. Tarpanov (302).

Euscorpius (*Euscorpius*) *scaber* Birula, 1900

Greece. Pangeo Mt., under stones nr. Pangeo Ski Center, 1700 – 1760 m, 1.09.2007, B. Petrov leg.

Euscorpius (*Euscorpius*) *solegladi* Fet, Graham, Webber et Blagoev, 2014

Bulgaria. Holotype: ♂, Blagoevgrad Prov., Sandanska Bistritsa River,

26.05. 2005, leg. V.& E. Fet; **Paratypes**: 2 ♀♀, same data; 2 ♂, 4 ♀♀, Kresna District, Gorna Breznitsa, 27.05.2005, leg. V. Fet & D. Dobrev; 1 ♂, 2 ♀♀ Kresna, 30.04.1983, leg. P. B. & K. Marincheva (87); 2 ♂, 1 ♀, waterfall near Kresna Station, 14.05.1981, leg. P.B. & S. Andreev (3); 1 ♂, Blagoevgrad, 14.04.1955, G. Radev (534); 1 ♂, 2 ♀♀, Gotze Delchev Distr., Breznitsa, 25.06.1937, leg. J. Zonkov (543); 1 ♀, Kresna Gorge, 9.04.1922, leg. I. Buresch (526); 2 ♀♀, idem, 8.06.1966, leg. A. Popov (547); 1 ♂ juv., idem, 21.03.1994, leg. B. Petrov (194); 2 ♀♀, Krupnik, 300 m, 27.04.1996, leg. P. Mitov; Kresna Gorge, nr. Sheitandere, 2-3.07.1997, leg. B. Petrov (198); 1 ♀, Maleshevska Mts, Ilyina Cheshma, 14.06.1992, T. Ljubomirov (342); 1 ♂, 1 ♀, Maleshevska Mts, W from Gorna Breznitsa, 14.08 – 2.10.2003, leg. B. Gueorguiev; 1 ♂, 1 ♀, Melnik, 30.06.1935, leg. K. Tuleshkov (317); 1 ♀, Melnik, 1.08.1983 (112); 1 ♂ juv., Ograzhden Mts, Markovi Kladentsi Peak, 1500 m, 26.05.1996, leg. B. Petrov (197); 1 ♂, 1 ♀, Parangalitsa, 1400 m, 12.07.1931, leg. N. Fenenko (271); 2 ♀, Petrich, 29.07.1983, leg. K. Marincheva (111); 1 ♂, Strumyani District, Pirin Mts. Above Ilindentsi, nr. entrance of Sharaliiskata Cave, 1600 m, 3.05.1999, leg. B. Perov (208); 1 ♀, Sandanski Distr., Ploski, Zandana Cave, under stones in guano, 31.05.2000, leg. B. Petrov & L. Nissen (244); 1 ♂, 2 ♀♀, Ribnitsa, 31.07.1983, leg. K. Marincheva (110); 2 ♂, 3 ♀♀, Samuilovo, leg. P. B. (6); 1 ♀, Slavyanka (Alibotush) Mts, Summer Post 10, 28.06.1937, leg. J. Zonkov (501), 1 ♀ (506); Other material studied by Fet, Graham, Webber & Blagoev, 2014: 1 ♂, 1 ♂ juv., 2 ♀♀, Nr. Kyustendil, 27.05.1937, leg. Bandarski (514); 1 ♀, Ossogovska Mts., Stradalovo, 10.08.1994, leg. P. Stoev (215); 1 m, 7 ♀, 1 ♀ juv., Rila Mts., below Rilski Monastery, Pastra, 500 m, 14-15.04.1928, leg. P. Drenski (518); 1 ♀, Rila Mts., above Rilski Mon., 1450 m, 5.07.1939, leg. N. Atanassov (318); 2 ♂, 1 ♀, Rila Mts., road to Kalin Peak, above Pastra, 1100 m, 24.08.1997, leg. B. Petrov & P. Stoev (201); 1 ♂, 1 ♂ juv., 1 ♀ juv., Tsurvaritsa, Gabra Reserve, 800 – 1000 m, 6.06.2001, leg. B. Petrov & G. Stoyanov (258); Belovo, 90.04.1909, leg. P. Drenski (525); 1 ♂, 2 ♀♀, Gabrovnitsa, stream Dalbochitsa, 6.04.1986, 450 m, leg. P. B. (117); (244); 1 ♀, 2 ♀ juv., Devin, 06.1924, leg. P. Drenski (288); 2 ♂, 1 ♀, Ihtimanska Sredna Gora Mts., Muhovo, 16.08.1997, leg. D. Milcheva; Sofia, brought with firewood, 1.101931, leg. I. Buresch (314).

Greece. 1 ♂, 1 ♀, Thessaloniki, Hortiatis Mt., 2.07.1939, leg. D. Papazov; 1 m, 1 ♀, Thes., Rentina100 m, under Platanus bark, 19.09.2000, leg. B. Petrov, P. Stoev & St. Beshkov (250).

Euscorpius drenskii Tropea, Fet, Parmakelis, Kotsakiozi et Stathi, 2015

Bulgaria. Holotype: West Rhodope Mts., Smolyan Prov., Shiroka Laka, leg. P. Drenski (NMNHS 275); **Paratypes**: Smolyan Prov., Devin Distr., Trigrad, 25.06.1924, leg. P. Drenski (301); Smolyan Prov., Shiroka Laka, 26.06.1924, leg. P. Drenski (310); other material (leg. P. Beron, Prince Ferdinand I, D. Raichev, B. Petrov, V. Beshkov): Yagodina (517), Rozhen Pass, 1500 m (221), Trigrad (200), betw. Mihalkovo and Devin (198)

Euscorpius birulai Fet, Soleglad, Parmakelis, Kotsakiozi et Stathi, 2014

Greece. **Holotype** ♂, Euboea Island, Karistos, Agia Triada Cave, 200 m, 2.01.2003, leg. P. B. (266); **Paratypes**: same label, 1 ♂, 2 ♂ subad., 1 ♂ immat., 3 ♀♀ immat. (266).

Euscorpius (*Tetratrichobothrius*) *flavicaudis* (De Geer, 1778)

France, Valence (Drôme), 35 Boulevard d´Alsace, 28.V.1967, 1 ♀, leg. P. Réveillet, No. 51. **Italy**, Sardinia, Prov. Sassari, Bonorva, 500 m, 16.X.1980, 1 ♀, leg. P. B., No. 9; Sardinia, Prov. Sassari, 18.X.1980, 1♂, 1 ♀, leg. P. B., No. 37.

Euscorpius italicus (Herbst, 1800)

Italy, Abruzzo, Silvi Marina, 1-10.VI.2000 (F. Kovařik leg. et det.)

Euscorpius carpathicus (L., 1767)

Romania. Baile Herculane, August 2014, P. B. leg.

Euscorpius spp., indicated as "Complex *Euscorpius* (*Euscorpius*) *carpathicus* (Linné, 1767)"

(Note by P.B.: as *E. carpathicus* has been restricted only to the area North of Danube, the material from Albania, Bulgaria and Greece belongs to other species)

Albania. Shkoder District, Theth, 800-900 m, 28.V.1993, 1♂5 ♀, Nos. 141 and 144, leg. P. B.; Shkoder District, Boga, 1000-1100 m, 5.-9.VI.1993, 5♂8 ♀, Nos. 133, 136, 140, 143, 145 and 147, leg. P. Beron & B. Petrov; Shkoder District, Boga, Maya Tchardakut, 1200-1400 m, 1.VI.1993, 2 ♀, No. 148, leg. P. B.; Shkoder District, Boga, Maya Tchardakut, 1400-1600 m, 1.VI.1993, 2♂, No. 146, 2.VI.1993, 2♂, No. 139, leg. P. B.; Shkoder District, Mt. Radohimës, 1000-1100 m, 5.-9.VI.1993, 3♂1 ♀, No. 138, leg. P. Beron & B. Petrov; Rrëshen District, Merkurth, under stones, 11.VI.1993, 1 ♀, No. 132, leg. P. Beron & B. Petrov.

Bulgaria. East Rhodope Mts, Kurdzhali District, Devesili, 4.VI.1982, 3♂2 ♀1 juv.f, No. 4, leg. P. B.; Pleven District, Bezhanovo, Georgicovata Cave, 11.X.1973, 1♂, No. 4, leg. A. Petkova; Burgas District, Sc. Vlas, Emine, 22.VIII.1983, 3♂7 ♀, Nos. 108 and 113, leg. K. Marincheva; Blagoevgrad District, Paril, near Rupata Cave, 8.-9.V.1981, 2♂3 ♀, Nos. 2 and 11, leg. P. Beron & S. Andreev; Blagoevgrad District, Samuilovo, litter under *Castanea*, 11.V.1981, 1♂2 ♀, No. 6, leg. P. Beron, S. Andreev & V. Pomakov; Blagoevgrad District, waterfall near Kreshna station, 14.V.1981, 1♂2 ♀, No. 3, leg. P. Beron & S. Andreev; Blagoevgrad District, Kresna, 30.IV.1983, 1♂2 ♀, No. 87, leg. P. Beron & K. Marincheva;; Blagoevgrad District, Melnik, 1.VIII.1983, 1 ♀, No. 112, leg. K. Marincheva; Blagoevgrad District, Petrich, 29.VII.1983, 1 ♀1juv., No. 111, leg. K. Marincheva; Blagoevgrad District, Rybnitsa, 31.VII.1983, 1♂2 ♀, No. 110, leg. K. Marincheva; Mikhailovgrad (now Montana) District, Beli Mel, 13.VI.1973, 1♂2 ♀, No. 49, leg. P. B.; Sofia District, Rebrovo, 9.X.1980, 1 ♀, No. 109, leg. P. B.; Sofia District, Tserovo station, 24.V.1964, 1 ♀, No. 36, leg. P. B.; Sofia District, Zanoge, 1100-1300 m, 2.V.1985, 1♂ 4 ♀, No. 114, leg. P. B.; Plovdiv District, Bachkovsky Monastery, 18.VI.1960, 1♂1 ♀, No. 45, leg. P. B.; Veliko Turnovo District, Arbanasi, Lyaskovskata Cave, 6.VIII.1968, 1 ♀, No. 39, leg. P. B.; West Rhodope Mts., Smolian District, Trigrad area, Yagodina, 20.V.1983, 1 ♀, No. 517, leg. P. B.; Pazardzhik District, Gabrovnica, left bank of Maritsa, stream Dalbochitsa, 6.IV.1986, 4 ♀1juv. ♀, No. 117, leg. P. B.

Greece. Peloponnesos, Laconia, Mystras, 18.IX.1983, 2 ♀, No. 68, leg. P. Beron & V. Beshkov; Thessaly, Mt. Olympus, 1700 m, 17.IX.1974, 1♂, No. 55, leg. P. Beron & V. Beshkov; Macedonia, Drama District, Xiropotamos, 10.IV.1993, 2 ♀, No. 153, leg. P. B.; Thrace, Evros District, Avas, 17.V.1987, 1♂2 ♀, No. 168, leg. P. B.; Thrace, Evros District, Essimi, 18.V.1987, 1 ♀, No. 162, leg. P. B.; Kythira, Miteta, 28.IV.1984, 1♂1 ♀, No. 164, leg. P. B.; Kythira, Mylopotamos, 27.IV.1987, 1♂2 ♀, No. 169, 9.V.1987, 2 ♀, No. 161, leg. P. B.; Paros, Marathi, cave – marble quarry, 23.XII.1982, 1♂1 ♀, No. 58, leg. P. Beron & S. Andreev; Iraklia, small cave, 15.IX.1981, 1♂, No. 61, leg. P. Beron & A. Bartsiokas; Amorgos, Katapola, 13.IX.1981, 1♂, No. 1, leg. P. Beron & A. Bartsiokas; Kasos, Stylokamara Cave, 6.V.1984, 1juv. ♂, No. 69, leg. P. B.; Karpathos, Archangel Michail, 1000 -1215 m, 4.V.1984, 1♂, No. 98, leg. P. B.; Crete, Lefka Ori, 1500 m, 25.IX.1974, 1♂1 ♀, No. 40, leg. P. B.; Crete, Lefka Ori, 2200 m, 25.IX.1974, 1juv. ♂, No. 41, leg. P. B.; Crete, Psiloritis, 1600-2000 m, 11.V.1984, 1♂1 ♀1juv. ♀, No. 115, leg. P. B.; Crete, Rethymnon District, Melidoni, 14.I.1968, 2juvs. ♀, No. 56, leg. P. B. **Turkey**, Distr. Beysehir, Dedegől Mts. Düdeni Yayla, v. Dumanli, 2000 - 2200 m, 8.VII.1993, 5♂4 ♀1juv., leg. P. B., No. 149.

Fam. Hormuridae (= Liochelidae Fet et Bechly, 2001 = Hemiscorpiidae)

Hadogenes troglodytes (Peters, 1862)

Zimbabwe, Great Zimbabwe ruins, 20.VIII.1983, 1♂, 1 ♀, 5 juvs, leg. P. Beron & V. Beshkov, No. 83.

Hadogenes cf. *troglodytes* (Peters, 1862)

?, 2 ♀ ♀ no location.

Iomachus politus Pocock, 1896

Mozambique, Provincia Maputo, Catuane, 24.VI.1983, 1 juv., leg. P. Beron & V. Beshkov, No. 65; Provincia Cabo Delgado, Mazeze, near Pemba, 1.VII.1983, 1 ♀ (im), leg. P. Beron & V. Beshkov, No. 72; Provincia Cabo Delgado, Stream, 40 km from Pemba, 3.VII.1983, 1 ♀, leg. P. Beron, No. 67; Provincia Cabo Delgado, 100 km from Pemba, 16.VI.1983, 1 ♀, leg. P. Beron, No. 79; Provincia Cabo Delgado, 10 km N from Mecufi, 24.VII.1983, 3 ♀, 2 juvs, leg.

P. Beron & V. Beshkov, Nos 74, 80 and 81; Provincia Cabo Delgado, 94 km from Pemba, 28.VII.1983, 1 ♀, 3 juvs, leg. P. Beron, Nos 70 and 76.

Liocheles australasiae (Fabricius, 1775)

Indonesia, Sumatra, Sibolga, 14.V.1994, 1S, 5 juvs, leg. P. Beron & V. Beshkov, No. 183; Nias I. (N. Sumatra), Teluk Dalam, sea level, 19.V.1994, 3 ♀, 1 im. ♀, leg. P. Beron & V. Beshkov; Flores, Borong, 21.VI.1994, sub cort., 1 ♀, leg. P. Beron & V. Beshkov; Sumba, 11 km SW Waingapu, 26.VI.1994, 1 ♀, 1 juv., leg. P. Beron & V. Beshkov, No. 174; West Sumatra Lemban Anai Nat. Reserve, near Bukittinggi, 300 - 400 m, 14.VIII.1995, 1S, leg. P. Beron & T. Ivanova; Mentawai islands, Siberut Island, Muarasiberut, 0 - 150 m, 15.-20.VIII.1995, 3S, leg. P. Beron & T. Ivanova, No. 181; Sulawesi Selatan Tana Toraja, v. Balik, 700 - 800 m, 6.IX.1995, 6S, 4 juvs, leg. P. Beron & T. Ivanova, Nos 172 and 179; Sulawesi, Tengah, v. Selugan, 20 km from Toli-Toli, 150 - 200 m, 13.IX.1995, 9S, leg. P. Beron & T. Ivanova, No. 175; Timur Nunukan 1, rain forest, 15 -17.IX.1995, 2S, leg. P. Beron & T. Ivanova, No. 177. **Malaysia**, Sabah, Kota Kinabalu, a hill near the town, 23.IX.1995, 1S, leg. P. B., No. 184. **Papua New Guinea**, New Ireland, v. Kolonboboi, 21.XI.1975, 1 ♀,1 im., leg. P. B., No. 347; New Ireland, v. Kolonboboi, 23.XI.1975, 1 ♀, 1 im., leg. P. B., No. 332; New Ireland, Sillom Village, litter, 28.XI.1975, 2 ♀ ♀, leg. P. B., No. 349; New Ireland, Lamerica Plantion, 28.XI.1975, 3 ♀ ♀, leg. P. B., No. 330; New Ireland, Lelet Plateau, v. Lenkamin, 820 m, 2.XII.1975, 1 ♀, leg. P. B., No. 335; New Ireland, between Kaluan I and Kaluan II, 200-800 m, 4.XII.1975, 1 ♀, leg. P. B., No. 331. **Thailand**, Phang Nga, 19.XI.1984, 1, leg. P. Beron & St. Andreev, No. 100. **Vietnam**, Prov. Quang Ninh Camo at Vinh Ha Long (Halong hotel), 28.II.1989, 2 ♀, 1 im., leg. P. Beron & D. Kojucharov, No. 150.

Liocheles nigripes (Pocock, 1897)

Thailand, Phuket town, 16.XI.1984, 1 ♀ im., leg. P. Beron & St. Andreev, No. 101; Phuket town, Tonesai Waterfall, 17.XI.1984, 1 ♀, leg. P. Beron & St. Andreev, No. 104.

Liocheles waigiensis (Gervais, 1843)

Papua New Guinea, New Ireland, v. Kolonboboi, 21.XI.1975, 1 ♀, leg. P. Beron, No. 346; New Ireland, v. Karu, under stones, 26.XI.1975, 1 ♀, leg. P. Beron, No. 328; New Ireland, v. Limbin, ca 500 m, 30.XI.1975, 4 ♀ ♀, leg. P. B., No. 336.

Opisthacanthus (*Nepabellus*) cf. *asper* (Peters, 1862)

Mozambique, Provincia Maputo, Namaacha, 7.VIII.1983, 1♂, 9 ♀ ♀,16 juvs, leg. P. Beron & V. Beshkov, Nos 66, 85, and 155. **?**, 1 ♀, 2juvs.

Hemiscorpius lepturus Peters, 1862

Iran, 10 km S of Firuz Abad, 20-21.4.2000, alt.1412 m, J. Sobotnik leg.

Fam. Iuridae Thorell, 1876

Hadruroides lunatus (L. Koch, 1867)

Peru, Cordillera Blanca, Huaraz, 1979, 1♂, 1 ♀, 3 juvs, leg. P. B.

Iurus asiaticus Birula, 1903

Turkey, Distr. Beysehir, Dedegől Mts. Düdeni Yayla, v. Dumanli, 1600 - 1800 m, 4-9.VII.1993, 2♂♂, leg. P. B., No. 131; Distr. Beyşehir, v. Çamlik, 11.VII.1993, 1 im., leg. P. B., No. 171.

Iurus dufoureius (Brullé, 1832)

Greece, Peloponnesos, Laconia, Mystras, 18.IX.1983, 1♂, 1 ♀, No. 68, leg. P. Beron & V. Beschkov; Kasos, Stylokamara Cave, 6.V.1984, 1 ♂, No. 96, leg. P. B.; Rhodes, Archangelos, 2.V.1987, 1 ♀, No, 158, leg. P. B.

Fam. Caraboctonidae

Caraboctonus keyserlingi Pocock, 1893

Chile, Santiago Prov., X. 1995, El Colpo, A. Ugarte leg., F. Kovařik det.

Fam. Scorpionidae Peters, 1862

Heterometrus (*Javanimetrus*) *cyaneus* (C. L. Koch, 1836)

Indonesia, Java, Bogor, The Botanical Garden, ca 300 m, 26.VIII.1995, 3 ♀, 5 im., 4 juvs, leg. P. Beron et T. Ivanova.

Heterometrus (*Heterometrus*) *liophysa* (Thorell, 1888)

Indonesia, Mentawai islands, Siberut Island, Muarasiberut, 0 - 150 m, 15-20.VIII.1995, 2 juvs, leg. P. Beron & T. Ivanova, Nos 180 and 182;

Heterometrus (*Heterometrus*) *longimanus* (Herbst, 1800)

Indonesia, Timur Nunukan 1 ♀, rain forest, 15 -17.IX.1995, 1 ♀, 2 juvs, leg. P. Beron & T. Ivanova, No. 177.

Heterometrus (*Heterometrus*) *spinifer* (Ehrenberg, 1828)

Thailand, Phang Nga, 18.XI.1984, 1 juv. after 3rd ecdysis, leg. P. Beron & St. Andreev, No. 102; Phang Nga, 19.XI.1984, 2 juvs after 2nd ecdysis, leg. P. Beron & St. Andreev, No. 100.

Scorpio maurus Linné, 1758

Algeria, Sahara, Ruslan, 1 ♀, leg. Zahariev.

Tunisia, St. No2. 5.3.2008, NW Tunisia, Bizerta Distr., Sejenane (10 km of Nefza), slope, N. Akkari, P. Stoev leg. (V. Fet det.)

Fam. Vaejovidae Thorell, 1876

Vaejovis cf. *intermedius* Borelli, 1915

Mexico, v. Tlachichuca (near Pico de Orizaba), 12.I.1982, 1 ♀, leg. P. Beron, No. 29.

List of the specimens mounted in glass cylinders

1. *Scorpio maurus* – Tunisia
2. Scorpion from South Italy, 01.08.1929, gift from Berlin Museum
3. *Androctonus australis* – Qued Cherchara, 1905, Tunisia
4. *Euscorpius* sp. – Bulgaria, Rhodopes, Assenova krepost, 25.07.1931, I. Buresch and Y. Tsonkov leg.
5. "*Buthus* sp." Ispahan, Iran, 01.08.1929, B. Kurzius leg.
6. *Scorpio maurus* - Qued Cherchara, 1905, Tunisia
7. "*Buthus* sp." - Tehran, Iran, 15.09.1929, B. Kurzius leg.
8. "*Buthus* sp." – Egypt, Luxor, 30.03.1927, Iv. Buresch leg.
9. *Buthus gibbosus* (Buresch det.) – 3 km S of Veles, Macedonia, 5.05.1943, I. Buresch and B. Biacheva leg.
10. idem
11. *Centruroides infamatus* – 29.05.1929, Tucson, Arizona, Prof. J.C. Uphov
12. idem
13. Scorpion indet., Iran, Tehran, 20.08.1932, I. Buresch leg.
14. Scorpion indet., Transvaal, South Africa, Vall de Molapo, E. Holub leg.
15. "*Buthus europaeus*"1.8.1929, South Italy (donated by Berlin Museum)
16. *Buthus gibbosus* (Buresch det.) – 3 km S of Veles, Macedonia, 5.05.1943, I. Buresch and B. Biacheva leg.
17. *Euscorpius* sp. – v. Bukovets, nr. Byala Slatina, 21.05.1938, I. Buresch leg.
18. *Euscorpius* sp. ("*carpathicus*"), v. Brestnitsa nr Sveti Vrach [Sandanski], 24.07. 1930, Y. Tsonkov leg.
19. Scorpion indet., ("*Buthus*"), 30.03.1927, Egypt, Luxor, I. Buresch leg.
20. *Buthus gibbosus* (Buresch det.) – 3 km S of Veles, Macedonia, 5.05.1943, I. Buresch and B. Biacheva leg.
21. *Euscorpius* sp., Alibotush Planina [Slavyanka], 1400 m, 7.06.1935, P. Drenski leg.
22. "*Scorpio* sp." 15.09.1932, Iran, Tehran, B. Kurzius leg.

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Скорпионите (Arachnida: Scorpiones) в колекциите на Националния природонаучен музей в София, България

Франтишек Коваржик, Петър Берон

(Резюме)

В Националния природонаучен музей в София се пазят представители на 61 вида скорпиони от 34 рода и 10 семейства (Bothriuridae, Buthidae, Chaerilidae, Diplocentridae, Euscorpiidae, Hormuridae (= Ischnuridae, Liochelidae, Hemiscorpiidae), Iuridae, Caraboctonidae, Scorpionidae, Vaejovidae). Те са събирани главно от П. Берон, а също и от Вл. Бешков, Т. Иванова, Б. Петров, П. Стоев, Ст. Бешков, Ив. Буреш, Й. Цонков, Д. Папазов, П. Дренски, Кр. Тулешков, P. Reveillet, H. Coiffait, К. Маринчева и др. от 35 страни: България, Македония, Албания, Ромъния, Гърция, Черна гора, Турция, Италия (вкл. Сардиния), Франция (вкл. Корсика), САЩ, Мексико, Куба, Доминиканската република, Перу, Чили, Боливия, Еквадор, Алжир, Мароко, Тунис, Египет, Нигерия, Мозамбик, Танзания, Замбия, Зимбабве, Южна Африка, Индонезия, Иран, Китай, Малайзия, Непал, Тайланд, Афганистан и Папуа Нова Гвинея. В колекцията на НПМ (София) са депозирани холотипове или паратипове на видовете *Euscorpius beroni* Fet (hol. et par.), *E. deltshevi* Fet et al. (hol. et par.), *E. solegladi* Fet et al. (hol. et par.), *E. birulai* Fet et al. (hol. et par.), *E. drenskii* Tropea et al. (hol. et par.), *E. popovi* Tropea et al. (hol. et par.), *Chaerilus tyznai* Kovařik (par.). Материалът е определен от F. Kovařik, V. Fet and M. Soleglad, а колекцията е комплектована от П. Берон.

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Invertebrate Animals (Metazoa: Invertebrata) of the Atanasovsko Lake, Bulgaria

Zdravko Hubenov, Lyubomir Kenderov, Ivan Pandourski

Abstract: The role of the Atanasovsko Lake for storage and protection of the specific faunistic diversity, characteristic of the hyper-saline lakes of the Bulgarian seaside is presented. The fauna of the lake and surrounding waters is reviewed, the taxonomic diversity and some zoogeographical and ecological features of the invertebrates are analyzed. The lake system includes from freshwater to hyper-saline basins with fast changing environment. A total of 6 types, 10 classes, 35 orders, 82 families and 157 species are known from the Atanasovsko Lake and the surrounding basins. They include 56 species (35.7%) marine and marine-brackish forms and 101 species (64.3%) brackish-freshwater, freshwater and terrestrial forms, connected with water. For the first time, 23 species in this study are established (12 marine, 1 brackish and 10 freshwater). The marine and marine- brackish species have 4 types of ranges – Cosmopolitan, Atlantic-Indian, Atlantic-Pacific and Atlantic. The Atlantic (66.1%) and Cosmopolitan (23.2%) ranges that include 80% of the species, predominate. Most of the fauna (over 60%) has an Atlantic-Mediterranean origin and represents an impoverished Atlantic-Mediterranean fauna. The freshwater-brackish, freshwater and terrestrial forms, connected with water, that have been established from the Atanasovsko Lake, have 2 main types of ranges – species, distributed in the Palaearctic and beyond it and species, distributed only in the Palaearctic. The representatives of the first type (52.4%) predominate. They are related to the typical marine coastal habitats, optimal for the development of certain species. The second type combines Palaearctic (20.0%), Eurosiberian (9.5%) and Mediterranean (15.2%) taxa. Caspian relicts lack in the Atanasovsko Lake. That is probably related to the specific hydrological regime, technological processes of the salt producing and the highly variable hyper-saline nature of the lake. Of the Pontic species *Chironomus valkanovi* is established. Of the benthic forms *Cerastoderma glaucum* (to 134376 ind/m^2), *Ecrobia ventrosa* (to 19800 ind/m^2), *Abra segmentum* and *Cyprideis torosa* (to 77440 ind/m^2) dominate. *Corophium volutator* is a mass species in all seasons and is one of the most adapted inhabitants of the saltpans. The Cosmopolitan *Acartia clausi* reaches high numbers (to 130000 ind/m^3) as well. Typical for the Atanasovsko Lake are the halobionts *Artemia parthenogenetica* and *Artemia salina* that reach densities up to 3400 ind/l water. The presence of 6 types of foreign immigrants (*Ficopomatus enigmaticus*, *Amphibalanus eburneus*, *Rapana venosa*, *Physella acuta*, *Anadara kagoshimensis* and *Mya arenaria*) is established. Of the invertebrate animals of the Atanasovsko Lake 3 species are included in the Black Sea Red Data Book and 8 species – in the European and IUCN Red Lists.

Key words: Atanasovsko Lake, invertebrates, species composition, zoogeography, invasive alien species

Introduction

The Atanasovsko Lake has an essential role in the preservation and protection of the specific faunistic diversity, distinctive of the hyper-saline lakes of the Bulgarian seaside. The communities of invertebrates in these basins are undergoing major changes related to environmental factors. The fauna of the lake and surrounding basins, taxonomic diversity and some zoogeographical and ecological features of the invertebrate animals are analyzed. Attention is paid to the species that define the functioning of the ecosystems in the protected area. The invasive species and those of conservation interest, established in the lake and its surroundings, are considered. The investigations are focused on the marine, marine-brackish, brackish-freshwater, freshwater and terrestrial forms, connected with water. Representatives of the terrestrial fauna that inhabit the surrounding areas, fall in the area of wetland accidentally and are not related to the typical for the lake system natural habitats, are not scrutinized.

The technological processes of salt producing make an impact on the hydrological regime of the lake and its faunistic diversity. The lake system includes basins with varying salinity (from freshwater to hyper-saline) and fast changing environment. In the spring the salinity is about 5-25 ‰ and during the summer months reaches 150-340 ‰ in some basins. The annual evaporation is about 10 lake volumes (Ivanov et al., 1964). The lake is filled with fresh water from the rivers Azmaka, Vetrenska and some dried up gullies. In some years the salinity of the lake is strongly influenced by the rainfalls and can be significantly reduced. Its lagoon nature, the imported organics and the technological processes of salt producing put the communities to environmental stress.

Literature data

The Bulgarian Black Sea invertebrates had been studied for more than 100 years (Chichkoff, 1907, 1908, 1912). During the last 60 years, the coast is under a drastic anthropogenic impact and large landscape changes. Changes in the cenoses are caused by some invasive species (Cvetkov & Marinov, 1986; Konsulov, 1998; Gomoiu et al., 2002). The published catalogues of the Bulgarian Black Sea fauna have not a systematic character (Valkanov, 1957; Valkanov, Marinov, 1964; Marinov, Golemansky, 1989; Marinov, 1990; Konsulov & Konsulova, 1993). The published generalized studies by Konsulov (1998) and Konsulov & Konsulova (1998) are similar to the works of Marinov (1990) and Konsulov & Konsulova (1993). A part of the names used is out-of-date and needs to be updated. There is a contemporary systematic view for some taxonomic groups, included in the monograph series Fauna of Bulgaria (Polychaeta – Marinov, 1977; Harpacticoida – Apostolov, Marinov, 1988), in survey papers (Mollusca – Wilke, 1996; Hubenov, 2005, 2007a, 2007b) or in dissertations (Nematoda – Stoykov, 1980; Malacostraca – Uzunova, 2006). There is a lack of areographical characteristic of the fauna except some taxa of Polychaeta, Harpacticoida, Malacostraca and Mollusca.

The first data on the invertebrates of the Atanasovsko Lake and the surrounding basins are published by Chichkoff (1909) and Valkanov (1934, 1935, 1936). Later halophilic species of the family Chironomidae are recorded by Cvetkov (1955, 1958) and a research on the meiobenthos was done. In the generalization of the known data until then Vodenicharov (1964) indicated 15 species of invertebrate animals. Naidenow (1967) reported 3 species of Cladocera and Copepoda each, found in the canal around the lake. Some invertebrate animal species have been established by Iankov (1993). In the study related to the first management plan of the protected area, 69 invertebrate species have been established by Andreev (1997, 2003) and Kovachev (1993). In connection with the elaboration of a monitoring plan of the Atanasovsko Lake, Varadinova (2013) reported 46 taxa for the benthos fauna, of which 27 are determined to species.

Weaknesses in the literature data which limit the obtaining of an equivalent information include: different levels of study of the individual taxa; insufficient research of many groups in the corresponding areas; a lack of exact localities for the part of the recorded species; existence of rich synonymy; outdated data; a lack of generalized investigations for most of the groups; significant differences in the number of taxa in the separate areas; unexplored territories; prolonged periods of data accumulation for most regions; predominance in recent years of the ecological studies versus those of the fauna; independent review of the benthos and plankton forms. These weaknesses lead to 5 problems.

- Continuous supplementation of an existing historical list of the fauna. As a result, species diversity in a given area is higher than in reality.
- Incomparability of data in terms of time periods. Data comparisons between two areas very often cover different periods as it is not possible to study all taxonomic groups and territories simultaneously.
- Incomparability of benthos – plankton data. Many studies are look at either benthos only or plankton only, despite the fact that most taxa have both a benthic and planktonic stages.
- Incomplete reporting of anthropogenic influences, successional and landscape changes on the composition of the communities. A number of well-studied brackish basins in the past no longer exist or have changed.
- Prioritization of research in areas under monitoring or environmental protection legislation.

The references present the first record of the taxon and its inclusion in the catalogues and some new or important literature data. Under updating of the names and specifying of the species distribution, some electronic issues are used: Antarctic Invertebrates, CLEMAM (Check List of European Marine Mollusca), DAISIE (Delivering Alien Invasive Species Inventories for Europe), EOL (Encyclopedia of Life), ERMS (European Register of Marine Species), EUNIS biodiversity database,

Fauna Europaea, Global Invasive Species Database, Global Names Index, ITIS (Integrated Taxonomic Information System), Marine Planktonic Copepods, Marine Species Identification Portal, MarLIN (The Marine Life Information Network), NARMS (North Atlantic Register for Marine Species), NeMys, NEOBANIS (European Network on Invasive Alien Species), PESI (A Pan-European Species directories Infrastructure), PlanktonNet Image, OBIS (Ocean Biogeographic Information System), The World of Copepods, World Polychaeta Database, WoRMS (World Register of Marine Species).

Approach, material and methods

The aim of this work is to present the invertebrate fauna of the Atanasovsko Lake as well as to analyze the taxonomic diversity and some zoogeographical and ecological features of the invertebrates of the lake.

The investigations of the Atanasovsko Lake territory for the last 2 centuries are generalized in this work. The works of Caspers (1951), Valkanov (1957), Valkanov, Marinov (1964), Marinov, Golemansky (1989), Marinov (1990), Konsulov & Konsulova (1993, 1998), Konsulov (1998) and Uzunov et al. (1998) have been analysed. Data from new publications, from the previous management plan of the lake (Andreev, 1997, 2003; Kovachev, 1997) and the last monitoring data (Gecheva et al., 2013) are included. All free living water (marine, brackish and freshwater) and the terrestrial invertebrate animals, connected with water, are scrutinized (Table 1). The endoparasitic forms of Plathelminthes, Nematoda and Acanthocephala have not been included. Many authors traditionally regard Protozoa as a part of Animalia. In the catalogues of Valkanov (1957) and Marinov, Golemansky (1989) 7 Protozoa species from the Atanasovsko Lake have been recorded (*Dunaliella salina*, *Monadodendron latypes*, *Rebecca salina*, *Hymenomonas coccolithophora*, *Salpingoeca aggregata*, *Aubignyna perlucida* and *Raphidiophrysopsis sessilis*). Now the protists are accepted as a separate kingdom (Protozoa), equivalent to the animal kingdom (Animalia) and are not considered in this review. Attention is paid to the invasive species and taxa of great conservation significance. The investigations on the plankton and benthos, carried out by I. Pandourski and L. Kenderov, are also included. Additional data were obtained from the exploration of the protected area in September 2014.

The numbers of the stations (Figure 1, Table 1) is the same as in the previous management plan (Minchev, 2003) and the investigations under the monitoring (1-4 in brackets – Gecheva et al., 2013). The habitats in the study territory are under Natura 2000. Two types of natural habitats of the Natura 2000 site Atanasovsko Lake (BG0000270) are not included because they are not represented in the protected area of the managed reserve Atanasovsko Lake.

The areographical categorization of the species is done on the basis of data of their distribution, taken from the literature and the newest electronic issues. The presented ecological data are taken from the Bulgarian literature. Only if there are no data from Bulgaria, foreign data are included for the corresponding species. The conservation value of taxa is determined regarding to their populations inhabiting Bulgaria. For local endemics, 100 % of their populations are localized in Bulgaria, therefore they are given the highest conservation category (world importance). This category also includes regional endemics because of their restricted distribution and species from the IUCN Red List. Taxa of European importance include Black Sea endemics as well as the species from the Bern Convention and Habitats Directive. The relicts and rare taxa (if not listed under other category) form the group of national importance. The species, included in Black Sea Red Data Book (Dumont et al., 1999), European and IUCN Red List are marked.

Abbreviations used

Stations (localities) [numeration according to the previous plan (Figure 1) and the project LIFE11/NAT/BG/000362 in brackets]: **1** – freshwater slowly flowing tributary and pollution; **2** – very slowly flowing freshwater tributary (roundabout canal); **3** – eutrophic marsh, collecting waters from 1 and 2; **4** – canal in the eastern part of the lake, freshwater or saltwater periodically (connection of the salt-producing basins with the sea); **5-11** – salt-producing (most often hyper-saline) basins; **13** – canal in the western part (mainly freshwater); **12**, **12a**, **14**, **15** and **16** – salt-producing basins with a varying degrees of salinity; **17** and **18** – points per canal 4; **(1)** and **(2)** – basin Tolbuhin (about 1000 m distance between the two points); **(3)** - South salt-pan, against the hiding of the Regional Inspectorate of Environment and Water; **(4)** – South salt-pan, to the floodgate of Azmashka River to Rudnik Village

Habitats, classified according to Natura 2000: **I** – Coastal lagoons (1150); **II** – *Salicornia* and other annuals colonizing mud and sand (1310); **III** – Mediterranean salt meadows (1410); **IV** – Pannonic

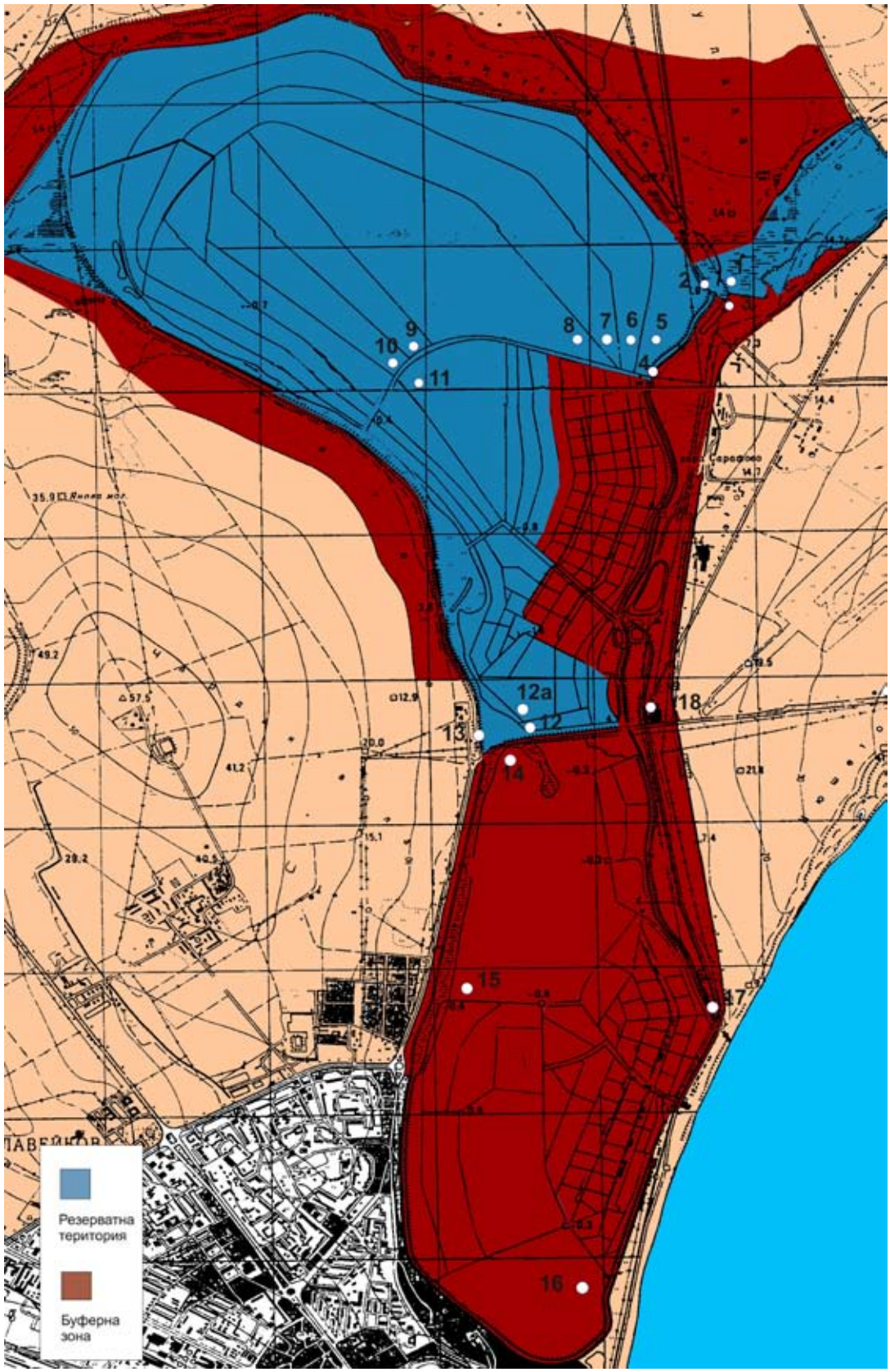

Fig. 1. Stations (localities) from which samples for exploration are taken, as in the previous management plan (Minchev, 2003): **1** – freshwater slowly flowing tributary and pollution; **2** – very slowly flowing freshwater tributary (roundabout canal); **3** – eutrophic marsh, collecting waters from 1 and 2; **4** – canal in the eastern part of the lake, freshwater or saltwater periodically (connection of the salt-producing basins with the sea); **5-11** – salt-producing basins; **13** – canal in the western part (mainly freshwater); **12**, **12a**, **14**, **15** and **16** – salt-producing basins with a varying degrees of salinity; **17** and **18** – points per canal 4

salt steppes and salt marshes (1530); **V** – Embryonic shifting dunes (2110).

Zoogeographical categories (the abbreviations in brackets refer to the freshwater and terrestrial species): **aamip** – Arctic-Atlantic-Mediterranean-Indo-Pacific, **ace** – Arctic-Circumeuropean, **aminp** – Atlantic-Mediterranean-Indo-North Pacific, **aminz** – Atlantic-Mediterranean-Indo-New Zealand, **amip** – Atlantic-Mediterranean-Indo-Pacific, **amiwp** – Atlantic-Mediterranean-Indo-West Pacific, **amnp** – Atlantic-Mediterranean-North Pacific, **amnz** – Atlantic-Mediterranean-New Zealand, **amswp** – Atlantic-Mediterranean-Southwest Pacific, **anam** – Arctic-North Atlantic-Mediterranean, **anamnep** – Arctic-North Atlantic-Mediterranean-Northeast Pacific, **anamnp** – Arctic-North Atlantic-Mediterranean-North Pacific, (**atm**) – Afrotropical-Mediterranean, **bam** – Boreal Atlantic-Mediterranean, **cbm** – Circumboreal-Mediterranean, **ce** – Circumeuropean, **clm** – Celtic-Lusitanian-Mediterranean, **clmm** – Celtic-Lusitanian-Mediterranean-Mauritanian, **cpc** – Celtic-Pontian-Caspian, (**cseeit**) – Central and Southeast European-Iran-Turanian, (**dp**) – Disjunct Palaearctic, (**e**) – European, **eam** – East Atlantic-Mediterranean, **eamp** – **eamrs** – East Atlantic-Mediterranean-Red Sea, (**ean**) – European-Anatolian, (**eca**) – European-Central Asian, **em** (**em**) – East Mediterranean, (**Ep**) – Pontian endemic, **ep** – Aegean-Pontian, (**ewca**) – European-West Central Asian, (**h**) – Holarctic, **ham** – Holatlantic-Mediterranean, (**hn**) – Holarctic-Neotropical, (**hna**) – Holarctic-Neotropical-Australian, (**hno**) – Holarctic-Neotropical-Oriental, (**ho**) – Holarctic-Oriental, (**hoa**) – Holarctic-Oriental-Australian, (**hoes**) – Holoeurosiberian, **hom** (**hom**) – Holomediterranean, (**hop**) – Holopalaearctic, **i** – introduced species (immigrants), **j** – Japanese, **K (k)** – Cosmopolitan, **lm** – Lusitanian-Mediterranean, **m** – Mediterranean, (**mca**) – Mediterranean-Central Asian, **miwp** – Mediterranean-Indo-West Pacific, **mrs** – Mediterranean-Red Sea, (**mwca**) – Mediterranean-West Central Asian, (**na**) – North American, **nam** – North Atlantic-Mediterranean, **namj** – North Atlantic-Mediterranean-Japonic, **namnz** – North Atlantic-Mediterranean-New Zealand, **namswp** – North Atlantic-Mediterranean-Southwest Pacific, **neamj** – Northeast Atlantic-Mediterranean-Japonic, (**nem**) – Northeast Mediterranean, (**nemit**) – Northeast Mediterranean-Iran-Turanian, **nm** (**nm**) – North Mediterranean, (**omca**) – Oriental-Mediterranean-Central Asian, (**omcaa**) – Oriental-Mediterranean-Central Asian-Australian, (**pat**) – Palearctic-Afrotropical, (**pm**) – Pontomediterranean (**po**) – Palearctic-Oriental, (**poa**) – Palearctic-Oriental-Australian, (**ptm**) – Paleotropical-Mediterranean, (**ptmca**) – Paleotropical-Mediterranean-Central Asian, (**ptsp**) – Paleotropical-South Palearctic, **SK (sk)** – Subcosmopolitan, (**sp**) – South Palaearctic, (**tp**) – Transpalaearctic, (**tpo**) – Transpalaearctic-Oriental, (**wces**) – West and Central Eurosiberian, (**wcp**) – West and Central Palaearctic, (**wcpo**) – West and Central Palaearctic-Oriental, (**wes**) – West Eurosiberian, (**wesa**) – West Eurosiberian-Anatolian, (**wp**) – West Palearctic, (**wpo**) – West Palaearctic-Oriental, (**wppt**) – West Palearctic-Paleotropical, **?** – probable category.

Ecological data: **α** – α-mesosaprobic, **α-β** – α-β-mesosaprobic, **β** – β-mesosaprobic, **B** – brackish, **bt** – benthos, **cr** – crenobiont, **DD** – data deficient, **eb** – eurybathic, **eh** – euryhaline, **EN** – endangered, **ep** – epibathic, **epp** – epipelagic, **et** – eurythermal, **eu** – eurybiont, **gw** – ground-water, **ha** – halophilous or halobiont, **is** – invasive species, **L** – freshwater, **l** – littoral zone, **LC** – least concern, **lt** – rocks or lithophilous, **M** – marine, **mb** – mesobathic, **mc** – *Mytilus* cenosis, **p** – plankton, **pe** – pelophilous, **ph** – algae overgrowth or phytophilous, **po** – potamophilous, **pp** – pelagic, **ps** – sand or psammophilous, **r** – rare, **ro** – rocky, **s** – silt, **sep** – stenoepibathic, **sg** – shells and sand with shells, **sl** – sublittoral zone (infra- and circalittoral, subtidal), **slc** – *Cystoseira* sublittoral, **sp** – supralittoral zone (supratidal), **sw** – stagnant water, **T** – terrestrial, **TL** – terrestrial forms connected with water, **tx** - trogloxene, **VU** – vulnerable, **zc** – *Zostera* cenosis, **‰** – limiting freshwater level for marine and salinity level for the freshwater forms, ▪ – Black Sea Red Data Book, ♦ – European and IUCN Red List, **+++** – species established for the first time, **‰** – limiting freshwater level for marine and salinity level for the freshwater forms.

Results and Discussion

A total of 6 types, 10 classes, 35 orders, 82 families and 157 species have been known from the Atanasovsko Lake and the surrounding basins (Table 1). These taxa include 56 species (35.7%) marine and marine-brackish forms and 101 species (64.3%) brackish-freshwater, freshwater and terrestrial forms, connected with water. A small number of supercosmopolitan forms (6-7 species), inhabitants of the freshwater, saline and brackish waters and wet terrestrial habitats are scrutinized to both two categories. For the first time 23 species (12 marine, 1 brackish and 10 freshwater) are established in this study. The types Rotifera, Annelida and Arthropoda

and the classes Eurotatoria, Crustacea and Insecta have a high species composition (over 20 species). These groups comprise the main part of the known taxa. It is supposed that about half of the known species of the protected area are established. There are significant gaps in knowledge of the terrestrial and parasitic groups. In the south part of the Atanasovsko Lake the species and quantitative composition of the communities are poor. Typical for the coastal lakes fauna is the presence of brackish elements. The marine brackish species endure water down to 1 ‰ salinity and the freshwater forms withstand water salinization from 1.5 ‰ to 8 ‰. Many euryhaline sea species also take part in the formation of the coastal basins's fauna, which could vary from marine to freshwater, depending on the water salinity (Valkanov, 1935, 1936; Drensky, 1947; Petrbok, 1947; Kaneva-Abadjieva, 1957, 1976; Zaschev & Angelov, 1959; Mihailova-Neikova, 1961; Kaneva-Abadjieva & Marinov, 1967; Stoykov, 1979, 1980; Маринов, 1990).

Formation of the coastal lakes fauna is connected with the origin of the Black Sea basin itself.[1] Before the last glaciation, a connection with the Caspian basin arose and Caspian interglacial immigrants invaded the Black Sea (Mordukhay-Boltovskoy, 1960; Nevesskaya, 1965; Starobogatov, 1970; Shopov, 1996). Most authors accept these species as Caspian relicts. They are concentrated mainly in the coastal lakes-firths and the mouths of the Black Sea rivers, inhabit the freshwater and brackish basins and usually have Pontian-Caspian or Pontian ranges. According to Mordukhay-Boltovskoy (1960) the evolution of the Caspian fauna gave rise to the origin of eurybiontic oligohaline and freshwater forms, which began to acquire new habitats with their pervasion in Black Sea. Recent data for the distribution of many relict taxa contradict their relict nature – especially their widespread distribution outside the Pontian-Caspian region. The lack of relict forms (leastways those which strongly considered relicts) in the Atanasovsko Lake is probably related to the specific hydrological regime, the technological processes of salt producing and its highly variable hyper lagoon character.

Of Pontian species (Black Sea endemics), *Chironomus valkanovi* is established – halophilous Black Sea species and Bulgarian subendemic, known from the Pomorie Lake and some hyper-saline lakes in Ukraine.

The marine and marine-brackish species have 4 types of ranges (Table 2) – Cosmopolitan, Atlantic-Indian, Atlantic-Pacific and Atlantic. The Atlantic (66.1%) [East- and Northeast Atlantic (23.2%), Holatlantic and North Atlantic (14.3%) and Tropical and Subtropical Atlantic (16.1%)] and Cosmopolitan (23.2%) [предимно Atlantic-Indian-Pacific (16.1%)] areas that comprise 80% of the species, prevail. The main portion of the fauna (over 60 %) has an Atlantic–Mediterranean origin and represents the impoverished Atlantic-Mediterranean fauna. As this fauna was becoming impoverished, many stenobiotic Lusitanian-Mediterranean species were eliminated, so this category is defined by the eurybiontic forms, often distributed along the European coast up to Scotland, North Sea and Scandinavia. Thus an impression is created of the atlantization of this fauna, manifested differently in the various taxonomic groups, benthic and planktonic forms. Usually the atlantization is poorly presented in the planktonic forms. The fauna is composed mainly of widely distributed eurybiontic taxa, some of them with cosmopolitan areas, inhabitants of saline, brackish and fresh waters.

The freshwater-brackish, freshwater and terrestrial forms, connected with water, recorded from the Atanasovsko Lake, are divided into 2 main groups (Table 3) – species, distributed in Palaearctic and beyond it and species distributed in Palaearctic only. The representatives of the first type (52.4%), which are determinant for the zoogeographical categorization of the coastal fauna due to the great

[1] The Upper Miocene Sarmatian Sea (18-30‰, a descendant of Tethys) gave rise to the Pontian Sea-Lake, from which two separate basins were formed later, the Black Sea and the Caspian Sea. Initially, the Black Sea basin had been inhabited by fauna similar to the Caspian one [Chaudian Sea (12-14‰) and Paleoeuxinian Sea (6-8‰)]. Then, it had been connected with the Mediterranean Sea and became saline, so the Mediterranean fauna penetrated into it, whereas the Caspian fauna retreated to the brackish coastal parts [time of Uzunlar Sea (16‰) and Karangat Sea (22-30‰)]. Later, the connection with the Mediterranean Sea had been severed, and the brackish basin [the New Euxinian Sea (7‰)] originated, where the Mediterranean fauna disappeared. Recently, 7000-8000 years ago, this basin had been again connected with the Mediterranean Sea and its level increased. The marine fauna invaded it and the current Black Sea had been formed (Mischev & Popov, 1978; Shopov, 1993; Dimitrov et al., 1998; Evlogiev, 2009; Studencka & Jasionowski, 2011). There is no unanimity about the zoogeographical status of the Black Sea, which is either considered as independent subregion or is unified with the Mediterranean Sea (and Lusitanean Atlantic subregion): Guryanova (1964), De Lattin (1967), Golikov & Starobogatov (1968, 1972), Starobogatov (1970), Mordukhay-Boltovskogo (1972), Golikov (1982), Nesis (1982), Riedl (1983), Bănărescu (1990), Abbott & Dance (1991), Elder & Pernetta (1991), Bruyne (2003), Hook (2008), Earle & Glover (2009).

Table 1. Faunistic diversity of the invertebrate animals (Metazoa: Invertebrata) of the Atanasovsko Lake and the surrounding basins

Taxa	Localities (stations)	Habitats	Distribution	Ecological data	References
CNIDARIA					
Anthozoa: Hexacoralia					
Actiniaria					
Sagartiidae					
Actinothoe clavata (Ilmoni, 1830)	7, 17	I, II	clm	M, bt, ep, mc, sg, s	+++
PLATHELMINTHES					
Turbellaria					
Macrostomida					
Macrostomidae					
Macrostomum appendiculatum (O. Fabricius, 1826)	14, 15	I, II	clm	? B-L, 50‰, bt, eh	154, 156
ROTIFERA					
Eurotatoria					
Ploima					
Asplanchnidae					
Asplanchna priodonta Gosse, 1850	2, 3, 4, 7	I, II	? ace, (k)	L, 17.3‰, p, eu, sw	5, 85, 86, 91, 95, 129
Asplanchnopus hyalinus Harring, 1913	12	I, II	(ho)	L, p	+++
Brachionidae					
Brachionus angularis Gosse, 1851	1, 4, 6, 8, 9, 10	I, II	ham, (k)	L-B, 5‰, p, sw	5, 86, 91, 95, 124, 129, 154, 156
Brachionus calyciflorus Pallas, 1776	2, 3, 4, 9, 10	I, II	? ham, (k)	L, 5‰, p, sw	5, 72, 83, 86, 91, 95, 122, 129, 154, 156
Brachionus plicatilis Müller, 1786		I, II	ham, (k)	M-B, 6-20‰, eh, p	46, 47, 83, 94, 154, 156
Brachionus quadridentatus Hermann, 1783	2	I, II	ham, (k)	L, 3-16‰, l, p	5, 91, 95, 122, 124, 154, 156
Brachionus urceolaris Müller, 1773	2, 3, 4, 6, 9, 10	I, II	bam, (k)	L, 4.3-15‰, eh, p	5, 83, 91, 95, 129, 154, 156
Keratella cochlearis (Gosse, 1851)	2, 3, 4, 8, 9, 10	I, II	anamnp, (sk)	L-B, 10-16‰, eh, p, sw	5, 86, 91, 95, 122, 124, 129, 135, 136, 156
Keratella quadrata (Müller, 1786)	2	I, II	ace, (k)	L, 0.5-6‰, p, sw	5, 83, 91, 106, 122, 124, 154, 156
Keratella valga (Ehrenberg, 1834)	4, 11	I, II	lm, (k)	L-B, p, sw	5, 86, 91, 95, 122
Notholca acuminata (Ehrenberg, 1832)	2	I, II	neamj, (pat)	L-B, 0.1-18‰, p, sw	5, 91, 95, 109, 124, 154
Notholca labis Gosse, 1887	9	I, II	neamj, (dp)	L, 25-54‰, p, eh	5, 91, 109
Euchlanidae					
Euchlanis pyriformis Gosse, 1851	2		(e, ? sk)	L, p, sw	5, 91, 109
Synchaetidae					
Synchaeta oblonga Ehrenberg, 1831	2	I, II	bam, (k)	L, 1.8‰, p	5, 91, 109

Table 1. Continued

Taxa	Localities (stations)	Habitats	Distribution	Ecological data	References
Synchaeta pectinata Ehrenberg, 1832	1, 2, 4, 5, 6, 7, 9	I, II	amnz, (sk)	M-B-L, eh, p	5, 91, 95, 124, 136
Synchaeta vorax Rousselet, 1902	1, 2, 4, 5, 6, 7, 8, 9, 10, 11	I, II	clm, (h)	M-B, 12‰, p	5, 154, 91, 105, 46, 83, 84, 128, 135, 160
Polyarthra dolichoptera Idelson, 1925	1, 2, 4, 6, 8, 9, 10	I, II	clm, (k)	L-B, 0.8‰, p, β	5, 154, 91, 95, 124, 129
Ploesoma hudsoni (Imhof, 1891)	8, 10	I, II	clm, (e)	B-L, 24-58‰, p, eh	5, 91, 109
Trichotriidae					
Trichotria pocillum (O. F. Müller 1776)	3	I, II	(h)	L, p	+++
Flosculariida					
Trichosphaeridae					
Filinia longiseta (Ehrenberg, 1834)	10	I, II	clm, (k)	L-B, 0.8-15‰, p, sw	5, 91, 106, 86, 122, 124
Hexarthridae					
Hexarthra mira (Hudson, 1841)	1, 2, 6, 7, 9, 10	I, II	namnz, (k)	M-B-L, p, eh	5, 91, 95, 124
Testudinellidae					
Testudinella patina (Hermann, 1783)	2, 3, 4, 10	I, II	amnz, (k)	M-L, 0.8‰, p-bt, l, s	5, 91, 124
ANNELIDA					
Polychaeta					
Phyllodocida					
Nereididae					
Hediste diversicolor (O. F. Müller, 1776)	(3), 5, 7, 8, 11, 12, 14, 15	I	anam	M, bt, eh-0.5-36‰, eb, s, pe-ps, eu	5, 28, 31, 38, 91, 102, 104, 154, 156, 158
Alitta succinea (Frey & Leuckart, 1847)	4, 5, 6, 7, 8, 9, 10, 11, 12, 14, 15	I	amip	M, bt, eh, ep, mc-s-ps	5, 31, 91, 102, 104, 154
Spioniida					
Spionidae					
Polydora limicola Annenkova, 1934	(1, 2)	I			158
Sabellida					
Serpulidae					
Ficopomatus enigmaticus (Fauvel, 1923)	5, 7, 9, 10, 12, 14, 15	I, II	amip, i	M, bt, 0-55‰, ep, is	5, 91, 102, 104, 105, 156
Oligochaeta					
Opistophora					
Criodrilidae					
Criodrilus lacuum Hoffmeister, 1845		I	(eca, ? h)	L, bt	148
Lumbricidae					
Eiseniella tetraedra (Savigny, 1876)	3	I	(h, ? k)	L-TL, bt, tx	5, 91, 148

Table 1. Continued

Taxa	Localities (stations)	Habitats	Distribution	Ecological data	References
TUBIFICIDA					
Naididae					
Stylaria lacustris (Linnaeus, 1767)	(4)	I	nam, (hno)	M, bt, 7‰, ps, gw	14, 31, 35, 105, 148, 158
Dero digitata (O. F. Müller, 1773)	(4)	I	(k)	L, bt	148, 158
Aulophorus furcatus (Oken, 1815)	(4)	I			
Nais barbata O. F. Müller, 1773		I	(hoa)	L, bt,	148
Nais elinguis O. F. Müller, 1774		I	aminz, (k)	M-B-L, bt, 18‰, eh, eu, sw-po	31, 34, 35, 105, 148, 154, 156
Nais pseudobtusa Piguet, 1906	(4)	I			158
Tubificidae					
Tubifex tubifex (O. F. Müller, 1774)	1, 3, 4, (4)	I	(k)	M-B-L, bt, eu	5, 91, 148, 158
Limnodrilus hoffmeisteri Claparède, 1862	(4)	I	SK, (k)	M-L, bt, sw, po, α, s	31, 105, 148, 156, 158
Potamothrix hammoniensis (Michaelsen, 1901)	(4)	I	clm, (ho)	M-L, bt, sw, po, pe	92, 148, 158
HIRUDINEA					
RHYNCHOBDELLIDA					
Glossiphoniidae					
Helobdella stagnalis (Linnaeus, 1758)	3	I	(h)	L, bt, ph, 1‰	+++
ARHYNCHOBDELLIDA					
Erpobdellidae					
Erpobdella octoculata (Linnaeus, 1758)	4	I	(po)	L, bt, ph, lt, 5-7‰	5, 91, 109
ARTHROPODA					
CRUSTACEA					
SARSOSTRACA: ANOSTRACA					
Artemiidae					
? *Artemia parthenogenetica* Bowen & Sterling, 1978 [**?** = *Artemia urmiana* Günther, 1899]	6, 7, 8, 9, 10, 11, 12, 12a, 14, 17	I, II	(omcaa, ? mwca)	B, 20-100-340‰, p	55, 147
Artemia salina (Linnaeus, 1758)	6, 7, 8, 9, 10, 11, 12, 12a, 14, 17	I, II	(sp, ? sk)	B, 20-80-340‰, p	3, 5, 33, 38, 43, 55, 150, 156
PHYLLOPODA: CLADOCERA					
Sididae					
Penilia avirostris Dana, 1849	1, 4, 5, 6, 7, 8, 9, 11	I	amiwp	M-B-L, p, eh, epp	5, 87, 89, 91, 136, 156
Bosminidae					

Table 1. Continued

Taxa	Localities (stations)	Habitats	Distribution	Ecological data	References
Bosmina longirostris (O. F. Müller, 1776)	4, 5, 6, 9, 10	I	anam, (k)	M-B-L, 1-2‰, p, epp	5, 156, 91, 122, 123, 124
Chydoridae (Eurycercidae)					
Alona rectangula Sars, 1861	2, 4	I	(sk)	B-L, 0.5-6‰, p	5, 91, 121, 123, 124, 154, 156
Chydorus sphaericus (O. F. Müller 1776)	1, 2	I	amswp, (k)	M-B-L, 3‰, p, epp	+++
Daphniidae					
Daphnia pulex (Leydig, 1860)	2, 4, 5	I	(k)	B-L, p, 5-17‰	5, 91, 109, 123, 154, 156
Simocephalus vetulus (O. F. Müller, 1776)	2, 4, 5, 10	I	(sk)	B-L, p, 0.5-2‰	5, 91, 41, 122, 123, 124
Podonidae					
Pleopis polyphaemoides (Leucart, 1859)	1, 4, 5, 6, 7, 8, 9, 10, 11	I, II	amnp	M-B, p, eh	5, 87, 88, 91, 132, 135
OSTRACODA: PODOCOPIDA					
Cyprididae					
Eucypris inflata (G. O. Sars, 1903)			(mwca)	L-B, bt, eh-150‰	81, 105, 156
Cyprinotus salinus (Brady, 1868)		I	(ean)	M-B-L, bt, 0-20‰	81, 105, 154, 156
Cytherideidae					
Cyprideis torosa (Jones, 1850) [*C. littoralis*]		I	clm, (hat)	M-B-L, bt, ep, 0-30‰, eh, ps, pe, ph	31, 105, 154, 156
Loxoconchidae					
Loxoconcha pontica Klie, 1937		I	clm	M, bt, sep, ph	31, 81, 105, 156
COPEPODA: CALANOIDA					
Paracalanidae					
Paracalanus parvus (Claus, 1863)	5, 6, 7, 8, 11	I	K	M, p, pp, et	5, 38, 88, 91, 132, 156
Temoridae					
Eurytemora velox (Lilljeborg, 1853)	5, 6, 7	I	cpc, (tp)	M-B, p, eh, 0-10‰	5, 154, 156, 91, 124, 130
Centropagidae					
? *Centropages kroyeri* Giesbrecht, 1893	?		amip	M, p	5, 38, 91, 132, 136, 154
Centropages ponticus Karavaev, 1895	1, 5, 6, 7	I	mrs	M, p, ■-EN	50, 79, 87
Diaptomidae					
Arctodiaptomus salinus (Daday, 1885)		I	(po)	L, p, 10‰	37, 38, 123, 156
Pseudodiaptomidae					
Calanipeda aquaedulcis Kritchagin, 1873	1, 4, 5, 6	I	lm, (hom)	B-L, p, eh, et	5, 87, 91, 88, 123, 124, 135, 136, 154, 156
Acartiidae					

Table 1. Continued

Taxa	Localities (stations)	Habitats	Distribution	Ecological data	References
Acartia clausi Giesbrecht, 1889	1, 5, 6, 7, 8, 9, 10, 11	I, II	K, aamip	M, p, 10‰, et	5, 38, 87, 88, 91, 132, 135, 136, 154, 156
Copepoda: Cyclopoida					
Cyclopidae					
Halicyclops rotundipes Kiefer, 1935?		I, II	(nem)	B, p, 0-10‰	123, 154, 156
Macrocyclops albidus (Jurine, 1820)	1	I	(k)	L, p, 0.5-0.8‰	+++
Eucyclops serrulatus (Fischer, 1851)	2, 4	I, II	(sk, ? k)	L, p, 0.5-8‰	5, 91, 106, 121, 122, 124, 154, 156
Acanthocyclops robustus (G. O. Sars, 1863)	2, 3, 4	I, II	(hna, ? sk), i	L, p, is	5, 91, 106, 121, 122, 124
Copepoda: Harpacticoida					
Ameiridae					
Nitokra lacustris (Shmankevich, 1875)		I, II	SK, (pat)	L-B, eh-0-60‰, bt, ps, gw, pe, cr, ph, et	7, 8, 9, 17, 103, 105, 106, 114
Cletodidae					
Cletocamptus retrogressus Schmankevitsch, 1875		I, II	nam, (h)	M-B, 60‰, eu, ps, s	10, , 81, 105, 156
Cirripedia: Thoracica: Balanomorpha					
Balanidae					
Amphibalanus eburneus (Gould, 1841)	5, 6, 7, 9, 10, 17	I	amip, i	M-B, bt-p, 7‰, is, sl	+++
Malacostraca: Amphipoda					
Corophiidae					
Corophium volutator (Pallas, 1766)	4, 7, 8, 9, 10, 11, 12, 14, 15	I	namswp	M, bt, 0.5‰, ep, pe	5, 91, 105, 146, 150, 154
Gammaridae					
Gammarus aequicauda (Martynov, 1931)	5, 6, 7, 8, 9, 11, 12, 14, 15, 17	I	lm	M, eh, bt, ep, ps	27, 95, 150
Gammarus subtypicus Stock, 1966	4, (1), (2,) (3), (4), 5, 6, 7, 8, 9, 10, 11, 12, 14, 15, 17	I, II	m, ep, ? em	M, bt, eh-1-50‰, ep, mc, ro, l-sl	5, 31, 33, 38, 91, 105, 131, 150, 154, 156, 158
Talitridae					
Orchestia bottae Milne Edwards, 1840	2, 3	I	clm, ep	M-B-TL, bt, l-sp, eh	+++
Malacostraca: Isopoda					
Asellidae					
Asellus aquaticus (Linnaeus, 1758)	1, 2, 3, (4), 12	I	(h)	L-B, bt, 5‰	5, 91, 154, 156, 158
Idoteidae					
Idotea balthica (Pallas, 1772)	(3), 6, 7, 8, 9, 10, 11, 12, 14, 15, 17, 18	I, II	ham, ? SK	M, bt, ep, ph, l-sl	5, 31, 38, 91, 105, 150, 154, 156, 158
Sphaeromatidae					

Table 1. Continued

Taxa	Localities (stations)	Habitats	Distribution	Ecological data	References
Sphaeroma serratum (Fabricius, 1787)	5, 6, 7, 8, 9, 10, 11, 12, 14, 17, 17	I, II	amiswp	M, bt, ep, l-sl, ps, slc, mc, ro, ph	5, 38, 39, 91, 105, 150, 154, 156
Malacostraca: Decapoda					
Palaemonidae					
Palaemon elegans Rathke, 1837	6, 8, 9, 17	I	eam	M-B, bt, eh, 4-5‰, ep, ph, mc, eu	30, 105, 150, 151,156
Palaemon serratus (Pennant, 1777)	17	I	eamrs	M, bt, ep, r	13, 38, 97, 105
Crangonidae					
Crangon crangon (Linnaeus, 1758)	4, 6, 8, 9	I	ce, ? namj	M, bt (p), eh, eb, ps, s	5, 12, 30, 91, 105, 151
Grapsidae (Varunidae)					
Brachynotus sexdentatus (Risso, 1827)	17	I	hom, lm, clm	M, bt, mb, ps-pe, s, ph	+++
Insecta					
Ephemeroptera					
Baetidae					
Cloeon dipterum (Linnaeus, 1761)	1, 2, 3, 4, (4)	I	(h)	L-TL, bt, ph	5, 91, 101, 109, 158
Caenidae					
Caenis horaria (Linnaeus, 1758)	1, 2, 3, 4	I	(tp)	L-TL, bt, ph	5, 91, 101, 109
Caenis luctuosa (Burmeister, 1839)	2, 4	I	(wcp, ? hoes)	L-TL, bt, ph	5, 91, 109, 101
Caenis robusta Eaton, 1884	1, 2, 3, (4), 12	I	(tp)	L-TL, bt, ph	101, 109,158
Odonata					
Lestidae					
Lestes barbarus (Fabricius, 1798)		I, II, III, IV	(wpo)	L-TL, 13‰	5, 109, 99, 100, 101
Lestes parvidens (Artobolevski, 1929)		I, III, IV	(nemit)	L-TL	99, 100
Lestes virens (Charpentier, 1825)		I, III, IV	(wp)	L-TL	5, 109, 99, 100
Lestes viridis (Vander Linden, 1825)		I, III, IV	(hom)	L-TL, r, ♦-LC	5 109, 100
Platycnemididae					
Platycnemis pennipes (Pallas, 1771)	1, 2, 3, 4	I, III, IV	(wces)	L-TL	+++
Coenagrionidae					
Coenagrion pulchellum (Vander Linden, 1820)		I, III, IV	(wes)	L-TL	5, 24, 98, 99, 100, 101
Enallagma cyathigerum (Charpentier, 1840)		I, III, IV	(h)	L-TL	5, 99, 100, 101
Ischnura elegans (Vander Linden, 1820)	(4)	I, III, IV	(po)	L-TL	5, 158, 55, 109, 98, 99, 100, 101, 110
Ischnura pumilio (Charpentier, 1825)		I, III, IV	(wcp, wcpo)	L-TL	5, 109, 98, 99, 100, 101
Aeshnidae					

Table 1. Continued

Taxa	Localities (stations)	Habitats	Distribution	Ecological data	References
Anax imperator Leach, 1815		I, III, IV	(wppt)	L-TL, ■-NE-DD-VU, ♦-LC	5, 50, 98, 99, 100, 101, 109
Anax parthenope (Selys, 1839)		I, III, IV	(ptsp)	L-TL, r	5, 99, 100, 101, 109
Hemianax ephippiger (Burmeister, 1839)		I, III, IV	(ptm)	L-TL, r	5, 24, 109, 99, 101
Aeshna isoceles (Müller, 1767)		I, III, IV	(hom, ? wp)	L-TL	5, 55, 99, 110, 109
Aeshna mixta Latreille, 1805		I, III, IV	(tpo)	L-TL	5, 98, 100, 101, 110
Libellulidae					
Libellula fulva Müller, 1764		I, III, IV	(wesa)	L-TL, r	5, 99, 100, 101, 109
Orthetrum albistylum (Sélys, 1848)		I, III, IV	(tp)	L-TL	5, 98, 99, 100, 101
Orthetrum cancellatum (Linnaeus, 1758)		I, II, III, IV	(wp)	L-TL, 13‰	5, 24, 98, 99, 100, 101
Crocothemis erythraea (Brullé, 1832)		I, III, IV	(ptmca)	L-TL	5, 100, 101, 102, 110
Sympetrum fonscolombii (Sélys, 1840)		I, III, IV	(ptm, ptsp)	L-TL	5, 99, 100, 101
Sympetrum meridionale (Sélys, 1841)		I, III, IV	(mca, omca)	L-TL	5, 24, 55, 98, 99, 100, 101, 110
Sympetrum pedemontanum (Allioni, 1766)		I, III, IV	(tp, ? dp)	L-TL	99, 100
Sympetrum sanguineum (Müller, 1764)		I, III, IV	(wp)	L-TL	99, 100
Sympetrum striolatum (Charpentier, 1840)		I, III, IV	(tp)	L-TL, eh	5, 55, 98, 99, 100, 101, 110
Sympetrum vulgatum (Linnaeus, 1758)		I, III, IV	(ewca)	L-TL, ♦-LC	99, 100, 101
Heteroptera					
Corixidae					
Corixa panzeri Fieber 1848	1, 4	I, II, IV	(hom)	L-TL, sp, eu	+++
Hesperocorixa linnaei (Fieber 1848)	1	I, II, IV	(dp)	L-TL, sp, eu	+++
Sigara mayri (Fieber, 1860)	1, 3, 4, 5	I, II, IV	(em)	L-TL, sp, ha-34‰	+++
Sigara striata (Linnaeus, 1758)	1	I, II, IV	(tp, ? hop)	L-TL, sp, hs-3.4‰	+++
Notonectidae					
Notonecta glauca Linnaeus, 1758	1, 3, 4	I, II, IV	(hes, ? hop)	L-TL, sp, eu	5, 91, 93, 109
Naucoridae					
Ilyocoris cimicoides (Linnaeus, 1758)	1, 3, (4)		(tp)	L-TL, sp, eu	101, 158
Miridae					
Phytocoris insignis Reuter, 1876		II, IV	(e)	T, sp, ha	71, 106
Lygus italicus Wagner, 1950		II, IV	(atm)	T, sp, ha	71, 106
Compsidolon pumilum (Jakovlev, 1876)		II, IV	(hom)	T, sp, ha	71, 106
Saldidae					
Chartoscirta longicornis (Jakovlev, 1882)		II, IV	(pm)	T, sp, ha	71, 106

Table 1. Continued

Taxa	Localities (stations)	Habitats	Distribution	Ecological data	References
Lygaeidae					
Peritrechus meridionalis Puton, 1877		II, IV	(hom)	T, sp, ha	71
Coleoptera					
Dytiscidae					
Hygrotus lernaeus (Schaum, 1857)		I	(hom)	L-TL, ha, sw	62, 80, 156
Hydrophilidae					
Enochrus bicolor (Fabricius, 1792)		I	(hop, ? h)	L-TL, sw, eu	32, 80
Hydraenidae					
Ochthebius marinus (Paykull, 1798)		I	(h)	L-TL, ha, sw, eu, sp	32, 63, 80, 156
Trichoptera					
Hydroptilidae					
Agraylea multipunctata Curtis 1834	(4)	I			158
Diptera					
Chironomidae					
Chironomus aprilinus Meigen, 1818	(1), (2,) (3), (4), 5, 7, 8, 9, 10, 11, 12a, 14, 15, 17	I	(wcp)	M-B-TL, 12‰, l-sp	31, 55, 105, 156, 158
Chironomus plumosus (Linnaeus, 1758)	(4)	I	(hno)	L-TL, 0-9‰, sw, sp	31, 41, 55, 105, 145, 154, 156, 158, 159
Chironomus riparius Meigen, 1804	2, 3, 5, 13, 11, 17, 18	I	(hn)	L-TL, 0-16‰, sw, sp	5, 32, 40, 91, 141, 145, 154, 156, 159
Chironomus salinarius Kieffer, 1915	(3), (4), 5, 6, 7, 8, 9, 10, 11, 12, 12a, 14, 15, 16	I	(wcp)	M-TL, 15-60‰, sw, sp	5, 31, 40, 55, 91, 110, 111, 145, 154, 158, 159
Chironomus valkanovi Michailova, 1974		I	(Ep)	M-TL, 60‰, sw	106, 111, 112, 160
Cryptochironomus defectus (Kieffer, 1913)	(4)	I	(pa)	L-TL, 2‰, sw	40, 141, 156, 158
Glyptotendipes cauliginellus (Kieffer, 1913)	(1, 3)	I	(po)	L-TL, 2‰, sw	40, 55, 141, 159
Polypedilum nubifer (Skuse, 1889)	2, 3	I	(poa)	L-TL, 1.5‰, l, ph	5, 41, 91, 105, 156
Ephydridae					
Ephydra attica Becker, 1896	5, 6, 8, 9, 10, 11, 12a	II, III, IV	(dp, ? mca)	TL, 60‰, sl-l-sp	17, 26, 32, 105
Ephydra bivittata Loew, 1860		II, III, IV	(hom)	TL, l-sp, ha, r	18, 26, 105
Ephydra flavipes (Macquart, 1843)		II, III, IV	(ptm, ? atm)	TL, l-sp, ha	26
Ephydra murina Wirth, 1975	5, 6, 8, 9, 10, 11, 12a	II, III, IV	(cseeit)	TL, 60‰, sl-l-sp	26, 32, 156
Ephydra riparia Fallén, 1813	5, 6, 8, 9, 10, 11, 12a	II, III, IV	(h)	TL, 60-80‰, l	17, 26, 106
Schema acrosticale (Becker, 1903)		II, III, IV	(wp)	TL, ha	26
Glenanthe nigripes Czerny, 1909		II, III, IV	(nm)	TL, ha, r	26, 16, 19, 20, 21, 22, 23, 25, 27
MOLLUSCA					

Table 1. Continued

Taxa	Localities (stations)	Habitats	Distribution	Ecological data	References
Gastropoda					
Sorbeoconcha					
Cerithiidae					
Bittium reticulatum (da Costa, 1778)	5, 17	I	clmm	M, bt, eb, ps, ps-s, pe	+++
Hypsogastropoda					
Hydrobiidae					
Ecrobia ventrosa (Montagu, 1803)	1, 5, 6, 7, 8, 9, 10, 11, 12, 12a, 16, 17, (1), (2), (3), (4)	I	clm	B, bt, eh-60‰, ep-mb, sw, ro, ph, pe, zc	5, 31, 56, 76, 91, 105, 133, 154, 156, 158
Rissoidae					
Rissoa splendida Eichwald, 1830	5, 17	I	m, hom	M, bt, sep, zc, ph, ro	+++
Muricidae					
Rapana venosa (Valenciennes, 1846)	(3), ? 14	I	j, aminp, i	M, bt, mb-eb, eu, is	75, 105, 157
Nassariidae					
Cyclope neritea (Linnaeus, 1758)	(3)	I	lm	M, bt, mb, ps-pe	158
Basommatophora					
Acroloxidae					
Acroloxus lacustris (Linnaeus, 1758)	3	I	(wes, ? hoes)	L, bt, ph, sw, ♦-LC	+++
Planorbidae					
Planorbis carinatus O. F. Müller, 1774	1	I	(wes, ? h)	L, bt, sw, ph, pe, r, ♦-LC	5, 91, 108, 109
Planorbis planorbis (Linnaeus, 1758)	1, 2, (4), 12	I	(h)	L, bt, 2‰, sw, ph, pe, ♦-LC	5, 6, 31, 91, 109, 156, 158
Planorbarius corneus (Linnaeus, 1758)	1	I	(wces)	L, 5‰, sw, po, α-β, ♦-LC	5, 6, 91, 133, 156
Physidae					
Physella acuta (Draparnaud, 1805)	1, 2, 3, 4	I, II	(na, sk, i)	L, bt, eu, pe, ph, po, sw, tx, α-β, is, ♦-LC	5, 6, 56, 91, 108, 110
Bivalvia					
Arcoida					
Arcidae					
Anadara kagoshimensis (Tokunaga, 1906)	6, 14	I, II	miwp, i	M, bt, ep, ps, s, sg, is	+++
Mytiloida					
Mytilidae					
Mytilus galloprovincialis Lamarck, 1819	17	I, II	eamp	M, bt, eb, lt, s, s-ps	+++
Mytilaster lineatus (Gmelin, 1791)	5, 6, 17	I, II	lm	M, bt, 5‰, sep, lt-slc	+++
Ostreoida					

Table 1. Continued

Taxa	Localities (stations)	Habitats	Distribution	Ecological data	References
Pectinidae					
Flexopecten glaber (Linnaeus, 1758)	17	I, II	lm	M, bt, sep, ps, ps-s	+++
Ostreidae					
Ostrea edulis Linnaeus, 1758	17	I, II	anamnep, i	M, bt, sep, ro, ■-EN, VU	+++
Veneroida					
Cardiidae					
Cerastoderma glaucum (Poiret, 1789)	(1), (2,) (3), 5, 6, 7, 8, 9, 10, 11, 12, 12a, 16	I, II	clm	M, bt, eh-3.9‰, eb, ps, ps-s, pe	5, 31, 38, 91, 105, 131, 154, 156, 158
Tellinidae					
Tellina tenuis da Costa, 1778		I, II	clm	M, bt, sep, ps, ps-s	31, 38, 105, 156
Semelidae					
Abra segmentum (Récluz, 1843)	(3), 7, 8, 9, 10, 11, 12, 12a, 15, 16	I, II	lm	M, bt, eh-6-60‰, ep, et, pe, ps-s	5, 31, 58, 91, 105, 154, 156, 158
Myoida					
Myidae					
Mya arenaria Linnaeus, 1758	5, 17	I, II	cbm, i	M, bt, ep, ps, ps-s, is	+++

species diversity, prevail. They are connected with the typical for the sea coasts natural habitats, optimum for the development of their representatives and are poorly presented in the interior. The Cosmopolitan (18.1%), Subcosmopolitan (8.6%) and Holarctic (7.6%) species are the most numerous. The second type (44.8%) combine Palaearctic (20.0%), Eurosiberian (9.5%) and Mediterranean (15.2%) taxa. The Transpalaearctic (6.7%) and Holomediterranean (7.6%) forms are the most numerous. The Mediterranean group is better presented in terrestrial forms and poorly presented in freshwater species. Endemic species have not been found. The specific conditions along the coast do not favor the formation of endemic taxa which often are newly described forms or rare species with unclear distribution.

Of the benthic forms, *Cerastoderma glaucum* [density of 3234 ind/m^2 (maximum – 134376 ind/m^2) and biomass of 338.7 g/m^2 (Cvetkov, 1958)], *Ecrobia ventrosa* [from 6924-10000 ind/m^2 (Gecheva et al., 2013) to 19800 ind/m^2 (Cvetkov, 1958)], *Abra segmentum* and *Cyprideis torosa* [77440 ind/m^2 and biomass 13.9 g/m^2 (Cvetkov, 1958)] are permanent dominants. Along the coast of most basins the shells of *Cerastoderma glaucum* (Celtic-Lusitanian-Mediterranean species) form large aggregations (Fig. 2, 3). There is a lack of the Mediterranean species *Gammarus subtypicus* [698-1863 ind/m^2 (Gecheva et al, 2013)] and *G. aequicauda* [1600 ind/m^2 (Andreev, 1997, 2003; Kovachev, 1993)] in the basins with salinity over 90‰. The species *Corophium volutator* (Atlantic-Pacific) is a mass species in all seasons (lacking in the basins with high salinity) and is one of the most adapted inhabitants of the saltpans. The marine isopods *Idotea balthica* (Atlantic-Mediterranean) and *Sphaeroma serratum* (Atlantic-Indian-Pacific) are persistent species but with limited amounts. High numbers reaches the cosmopolitan *Acartia clausi* [130000 ind/m^3 (Vassilev, 1994)].

The shrimps found in the Atanasovsko Lake – *Crangon crangon* (established in station 4), *Palaemon elegans* and the rare species *Palaemon serratus* (collected in station 17) are not accepted as permanent inhabitants. They are related to the coastal marine communities, rich in macrophytes and probably have entered the lake with the invading marine waters. Shells of several marine molluscs species (*Bittium reticulatum*, *Rissoa splendida*, *Mytilaster lineatus*, *Mytilus galloprovincialis*, *Flexopecten glaber*, *Ostrea edulis* and *Mya arenaria*) are often found in the canal (station 17) through which the water enters from the

Table 2. Zoogeographical characteristic of the marine and marine-brackish fauna of the Atanasovsko Lake

Zoogeographical scheme of the used categories and main taxa	Total	Benthos	Plankton	Marine	Brackish
COSMOPOLITAN TYPE	**13 (23.2)**	**8 (19.5)**	**4 (17.4)**	**11 (22.4)**	**3 (15.8)**
Arctic-Antarctic-Atlantic-Indian-Pacific	**4 (7.1)**	**2 (4.9)**	**2 (8.7)**	**4 (8.2)**	**1 (5.3)**
Cosmopolitan	3	2	1	3	1
Arctic-Atlantic-Mediterranean-Indo-Pacific	1		1	1	
Atlantic-Indian-Pacific	**9 (16.1)**	**7 (17.1)**	**2 (8.7)**	**8 (16.3)**	**2 (10.5)**
Hol- and East Atlantic-Indian-Pacific	**8 (14.3)**	**6 (14.6)**	**2 (8.7)**	**8 (16.3)**	**2 (10.5)**
Atlantic-Mediterranean-Indo-Pacific	4	3	1	4	
Atlantic-Mediterranean-Indo-West Pacific	1		1	1	1
Atlantic-Mediterranean-Indo-Southwest Pacific	1	1		1	
Atlantic-Mediterranean-Indo-New Zealand	1	1		1	1
Atlantic-Mediterranean-Indo-North Pacific	1	1		1	
Tropical and Subtropical Atlantic-Indian-Pacific	**1 (1.8)**	**1 (2.4)**			
Mediterranean-Indo-West Pacific	1	1		1	
ATLANTIC-INDIAN TYPE	**2 (3.6)**	**1 (2.4)**	**1 (4.3)**	**2 (4.1)**	
Atlantic-Indian	**2 (3.6)**	**1 (2.4)**	**1 (4.3)**	**2 (4.1)**	
Tropical and Subtropical Atlantic-Indian	**1 (1.8)**		**1 (4.3)**	**1 (2.0)**	
Mediterranean-Red Sea	1		1	1	
East and Northeast Atlantic-Indian	**1 (1.8)**	**1 (2.4)**		**1 (2.0)**	
East Atlantic-Mediterranean-Red Sea	1	1		1	
ATLANTIC-PACIFIC TYPE	**11 (19.6)**	**5 (12.2)**	**7 (30.4)**	**8 (16.3)**	**6 (31.6)**
Arctic-Antarctic-Atlantic-Pacific	**2 (3.6)**	**1 (2.4)**	**1 (4.3)**	**1 (2.0)**	**1 (5.3)**
Arctic-North Atlantic-Mediterranean-North Pacific	1		1		1
Arctic-North Atlantic-Mediterranean-Northeast Pacific	1	1		1	
Atlantic-Pacific	**9 (16.1)**	**4 (9.7)**	**6 (26.1)**	**7 (12.3)**	**5 (26.3)**
Hol- and North Atlantic-Pacific	**1 (1.8)**		**1 (4.3)**		**1 (5.3)**
Atlantic-Mediterranean-North Pacific	1		1		1
North Atlantic-Pacific	**2 (3.6)**	**1 (2.4)**	**1 (4.3)**	**1 (2.0)**	**1 (5.3)**
Northeast Atlantic-Mediterranean-Japonic	1		1		1
Circumboreal-Mediterranean	1	1		1	
North and South Atlantic-Pacific	**2 (3.6)**	**1 (2.4)**	**1 (4.3)**	**2 (4.1)**	**1 (5.3)**
North Atlantic-Mediterranean-Southwest Pacific	1	1		1	
North Atlantic-Mediterranean-New Zealand	1		1	1	1
Hol- and South Atlantic-Pacific	**3 (5.4)**	**1 (2.4)**	**3 (13.0)**	**3 (6.1)**	**2 (10.5)**
Atlantic-Mediterranean-New Zealand	2	1	2	2	1
Atlantic-Mediterranean-Southwest Pacific	1		1	1	1
East and West Atlantic-Pacific	**1 (1.8)**	**1 (2.4)**		**1 (2.3)**	
East Atlantic-Mediterranean-Pacific	1	1		1	
ATLANTIC TYPE	**37 (66.1)**	**26 (63.4)**	**11 (47.8)**	**27 (55.1)**	**10 (52.6)**
Arctic-Antarctic-Atlantic	**4 (7.1)**	**2 (4.9)**	**2 (8.7)**	**3 (6.1)**	**1 (5.3)**
Arctic-North Atlantic-Mediterranean	2	1	1	2	1
Arctic-Circumeuropean	1		1		
Circumeuropean	1	1		1	
Atlantic	**33 (58.9)**	**24 (58.5)**	**9 (39.1)**	**24 (48.9)**	**9 (47.4)**
Hol- and North Atlantic	**8 (14.3)**	**3 (7.3)**	**5 (21.7)**	**3 (6.1)**	**1 (5.3)**
Holatlantic-Mediterranean	5	1	4	1	
North Atlantic-Mediterranean	2	2		2	1
Boreal Atlantic-Mediterranean	1		1		
Tropical and Subtropical Atlantic	**9 (16.1)**	**7 (17.1)**	**2 (8.7)**	**7 (14.3)**	**3 (15.8)**
Lusitanian-Mediterranean	9	7	2	7	3
East and Northeast Atlantic	**13 (23.2)**	**11 (26.8)**	**2 (8.7)**	**11 (22.4)**	**5 (26.3)**
East Atlantic-Mediterranean	1	1		1	1
Celtic-Lusitanian-Mediterranean-Mauritanian	1	1		1	
Celtic-Lusitanian-Mediterranean	10	9	1	8	3
Celtic-Pontian-Caspian	1		1	1	1
Mediterranean-Pontian-Caspian	**3 (5.4)**	**3 (7.3)**		**3 (6.1)**	
Mediterranean	2	2		2	
Pontian	1	1		1	
Total	**56 (35.7)**	**41 (26.1)**	**23 (15.1)**	**49 (31.2)**	**19 (12.1)**

Table 3. Zoogeographical characteristic of the freshwater-brackish, freshwater and terrestrial fauna

Zoogeographical scheme of the used categories and main taxa	Total	Brackish	Freshwater	Terrestrial
Species distributed in Palaearctic and out of it	**55 (52.4)**	**16 (72.7)**	**49 (53.8)**	**18 (35.3)**
Northern type	**49 (46.7)**	**15 (68.2)**	**45 (49.5)**	**13 (25.5)**
Cosmopolitan	19	8	17	
Subcosmopolitan	9	6	8	
Holarctic-Neotropical-Oriental	1		1	1
Holarctic-Oriental-Australian	1		1	
Holarctic-Neotropical	1		1	1
Holarctic-Oriental	1		1	
Palearctic-Oriental-Australian	1		1	1
Palearctic-Afrotropical	1		1	1
Palearctic-Oriental	4		4	2
West Palearctic-Paleotropical	1		1	1
Transpalaearctic-Oriental	1		1	1
West Palearctic-Oriental	1		1	1
Holarctic	8	1	7	4
South type	**6 (5.7)**	**1 (4.5)**	**4 (4.4)**	**5 (9.8)**
Paleotropical-South Palearctic	1		1	1
Paleotropical-Mediterranean-Central Asian	1		1	1
Paleotropical-Mediterranean	3		2	3
Oriental-Mediterranean-Central Asian-Australian	1	1		
Species with Palaearctic distribution	**47(44.8)**	**5 (22.7)**	**41 (45.1)**	**33 (64.7)**
Palaearctic type	**21 (20.0)**		**19 (20.9)**	**17 (33.3)**
Holopalaearctic	1		1	1
Transpalaearctic	7		7	6
West and Central Palaearctic	4		4	4
West Palaearctic	4		3	4
Disjunct Palaearctic	3		2	1
European-Central Asian	1		1	
European-West Central Asian	1		1	1
Eurosiberian type	**10 (9.5)**	**1 (4.5)**	**11 (12.1)**	**4 (7.8)**
Holoeurosiberian	1		1	1
West and Central Eurosiberian	2		2	
West Eurosiberian-Anatolian	1		1	1
West Eurosiberian	3		3	1
European-Anatolian	1	1	1	
European	3	1	3	1
Mediterranean type	**16 (15.2)**	**4 (18.2)**	**11 (12.1)**	**12 (23.5)**
Mediterranean-Central Asian	1		1	1
Mediterranean-West Central Asian	1	1		
Northeast Mediterranean-Iran-Turanian	1		1	1
Central and Southeast European-Iran-Turanian	1			1
Holomediterranean	8	2	7	6
Atlantomediterranean	1		1	1
North Mediterranean	1			1
East Mediterranean	1		1	
Northeast Mediterranean	1	1		
Pontomediterranean	1		1	1
Pontian endemic	1			
Total	**105 (66.9)**	**22 (14.0)**	**91 (57.9)**	**51 (32.3)**

Fig. 2. Heaps of shells of *Cerastoderma glaucum* along the shores of the basins

Fig. 3. Heaps of shells of *Cerastoderma glaucum* and *Abra segmntum*

sea. The actinia *Actinothoe clavata* is also established in this canal.

Typical for the hyper-saline lakes [such as Atanasovsko Lake – from 30-60‰ to 100-250‰ (Ivanov et al., 1964)] are the halobionts of the genus *Artemia* – *A. parthenogenetica* (South Palaearctic-Oriental) and *Artemia salina* (Subcosmopolitan). In recent years the both species are reported from the Atanasovsko Lake and Pomorie Lake (Triantaphyllidis et al., 1998; Georgiev & Nikolov, 2010). *Artemia* is a problematic genus with an unclear taxonomic status of the part of the species. Some authors impugn the existence of *A. parthenogenetica* (Abatzopoulos et al., 2002; Asem et al., 2010). They accept that these are parthenogenetic populations of different species of the genus *Artemia*. These populations (known as *A. parthenogenetica*) have been established in other continents as well. After DNA analysis Munoz et al. (2010) bring closer the parthenogenetic *Artemia* from the Atanasovsko Lake to *Artemia urmiana* Günther, 1899 (endemic from the Urmia Lake in Iran). Usually *A. salina* develops in the spring and in early summer is displaced from *A. parthenogenetica*. In spring with the increasing of the water's temperature (20-22°C) and salinity (24-26‰), the quantity of *Artemia* increases (to 300-350 ind/l adults and 800-1000 ind/l juveniles) and reaches to 1800 ind/l adults and to 3000 ind/l juvenile forms in summer. It reaches to a high density – 3400 ind/l water (17 g/l) (Andreev, 1997, 2003) which is caused by the abundant phytoplankton blooming. Under the salinity of 250-260‰ *Artemia* maintain life processes (over 170-180‰ they are not propagated) and die under salinity of 340‰ (Caspers, 1952). *Artemia* is important for the salt producing due to the control of the phytoplankton's quantity (obviates the unfavourable effects of the algae *Dunaliella salina* Teodoresco, 1905) and purify the waters in the precrystallizers (Davis, 2000; Georgiev & Nikolov, 2010).

Alien immigrants. Lists of species, introduced in the Black Sea, have been published by several authors (Cvetkov & Marinov, 1986; Gomoiu & Scolka, 1996; Konsulov, 1998; Shadrin, 2000; Zaitsev & Öztürk, 2001; Gomoiu et al., 2002; Moncheva & Kamburska, 2002; Kamburska & Moncheva, 2003; Zaitsev et al., 2004; Konsulova & Stefanova, 2007; Todorova & Moncheva, 2013). Thirty-one invertebrate species are known from the Bulgarian Black Sea coast, occurring at different times. The presence of *Ficopomatus enigmaticus*, *Amphibalanus eburneus*, *Rapana venosa*, *Physella acuta*, *Anadara kagoshimensis* and *Mya arenaria* has been established in the Atanasovsko Lake (Table 4, Figure 4). The invasive species *Rapana venosa*[2], *Anadara kagoshimensis*[3] and *Mya arenaria*[4] have caused significant changes in the Black Sea communities (Cvetkov & Marinov, 1986; Marinov, 1990; Konsulova & Stefanova, 2007; Todorova & Moncheva, 2013). Their populations have a high density in the Burgas Bay in front of the Atanasovsko Lake. According to some experts alive specimens of *Rapana venosa* are not found in the lake. The large number of shells in the northeastern half of the southern part (beside the road) is because of the birds that carry them (to break the shells).

[2] The first specimen of ***Rapana venosa*** in the Bulgarian aquatory was found in 1956 in Varna Bay, near Cape Galata (Kaneva-Abadjieva, 1958). Development of this snail in the rocky sublittoral has a substantial impact on *Mytilus* and *Ostrea*, and in the sand

Table 4. Invasive invertebrate animals, established in the Atanasovsko Lake

Taxa	Finding of the species in Bulgaria	Donor region
Polychaeta		
Ficopomatus enigmaticus (Fauvel, 1923)	1935	Indian Ocean
Crustacea		
Amphibalanus eburneus Gould, 1841	1933	North America
Mollusca		
Rapana venosa (Valenciennes, 1846)	1956	Sea of Japan
Physella acuta (Draparnaud, 1805)	1927	North America
Anadara kagoshimensis (Tokunaga, 1906)	1982	Indian Ocean and Pacific Ocean
Mya arenaria Linnaeus, 1758	1973	Circumboreal

In the same part of the southern lake a relatively high density of *Anadara kagoshimensis*, which has a planktonic larval stage and enters with the inflow of seawater, is observed. This mussel is a eurythermal and euryhaline species that endures very low oxygen concentrations in the water due to the presence of hemoglobin in the haemolimph. Specimens with maximum dimensions are established. The mussel's shells were not found in the reserve but its presence in this part of the lake can be expected. The shells of *Mya arenaria* are established in the reserve (station 5), where the canal ends inside the lake. Probably the planktonic larvae of this mussel also penetrate with the invading seawater.

Conservation significanse. Of the invertebrate species from the Atanasovsko Lake, *Centropages ponticus*, *Anax imperator* and *Ostrea edulis* are included in the Black Sea Red Data Book (Table 5) and belong to the categories endangered (EN) and vulnerable (VU). There are differences in the levels of threat of the species in the separate Black Sea countries (Dumont et al., 1999). *Lestes viridis*, *Anax imperator*, *Sympetrum vulgatum*, *Acroloxus lacustris*, *Planorbis carinatus*, *Planorbis*

sublittoral – on *Chamelea gallina*. The great eurybiontness, high fecundity and lack of competitors allowed this predator to reach mass development in the Black Sea and aroused discussion for eventual measures for a struggle with it. In a single trawling, up to 1500 specimens have been caught, and in some regions between Balchik and Kavarna the entire bottom was covered with Rapa whelks. Very high numbers was observed in Byala, in the region of Cape Cherni Nos (Klissurov, 2008). During the last 20 years, the snail was gathering for food with all possible means. After conquest of the Black Sea the species penetrated the Aegean, Adriatic and Mediterranean Seas, Atlantic coast of France, North Sea, East coast of USA, the mouth of the Rio de la Plata River between Uruguay and Argentina and around New Zealand. The way how the species was transported in the Black Sea is unclear. *R. venosa* is an eurythermal and euryhaline species that develops in the coastal zone on solid substrate and sandy and silty bottom at a depth to 30-40 m. The snail withstands temperature changes (from 0 to 30°C), water pollution and reduced oxygen content. There is a huge fertility (a snail delayed approximately 220000 eggs) which compensates its exploitation by man. It lives about 10 years. There are no precise data on the population of Rapa on the Bulgarian coast (Konsulov & Konsulova, 1993, 1998; Konsulov, 1998).

[3] The first specimens of ***Anadara kagoshimensis*** for the Bulgarian coast were found in 1982 in Varna Bay (Marinov et al., 1983; Kaneva-Abadjieva & Marinov, 1984). Much later, a high density of the species has been found in Burgas Bay (up to 400 specimens/m^2 and biomass 4280 g/m^2). This mussel is a eurythermal and euryhaline species that endures very low oxygen concentrations in the water due to the presence of hemoglobin in the haemolimph. It has a long life cycle and low coefficient of mortality. In a short time, *A. kagoshimensis* became a significant element of psammo- and pelophilous zoocenoses, and started to displace some local species. Thus the „*Chamelea gallina*" group in front of Balchik, Varna and Burgas transforms into „*A. kagoshimensis*" group. The distribution of this species in the Bulgarian part of the Black Sea is restricted from Balchik to the south part of Burgas Bay (Cvetkov & Marinov, 1986; Marinov, 1990; Konsulov, 1998).

[4] ***Mya arenaria*** has been first reported for the Bulgarian coast in the Bay of Burgas in 1973 (Kaneva-Abadjieva, 1974). The mussel inhabits the sandy sublittoral and reaches the wash zone. It has a high ecological plasticity and easy endures variations of the salinity and temperature and oxygen deficiency. It reaches a high density (over 300-400 to 4862 specimens/m^2) in the bays in front of the river mouths. *M. arenaria* is found along the beaches all over the Bulgarian coast but the greatest number of it occurs in front of Durankulak and Albena, in the Varna Bay, Varna Lake, at the influx of the Kamchiya River and Burgas Bay (Stoykov, 1983; Cvetkov & Marinov, 1986; Marinov, 1990). Spawning by eggs thrown straight into the water during the summer months (rarely re-spawning in autumn). From fertilized eggs planktonic larvae develop which 5-6 days after egg hatching convert to mussels. In the 1970s, this mussel is a dominant species in the Romanian coastal zone as 4-5 years after its appearance reaches biomass 16 kg/m^2 and numbers more than 8000 ind/m^2 (Gomoiu & Porumb, 1969). In many areas of the Black Sea shelf *M. arenaria* is a dominant species in new zoocenosis, called her name.

Table 5. Conservation status of the invertebrate animals of the Atanasovsko Lake

Taxa	Black Sea Red Data Book	Ecological data, European and IUCN Red List	Distribution
Centropages ponticus Karavaev, 1895	EN	M, p	Mediterranean-Red Sea
Lestes viridis (Vander Linden, 1825)		L-TL, r, LC	West Palearctic
Anax imperator Leach, 1815	NE, DD, VU	L-TL, LC	West Palearctic-Paleotropical
Sympetrum vulgatum (Linnaeus, 1758)		L-TL, LC	European-West Central Asian
Acroloxus lacustris (Linnaeus, 1758)		L, bt, ph, sw, LC	West Eurosiberian
Planorbis carinatus O. F. Müller, 1774		L, bt, sw, ph, pe, r, LC	West Eurosiberian, ? Holarctic
Planorbis planorbis (Linnaeus, 1758)		L, bt, 2‰, sw, ph, pe, LC	Holarctic
Planorbarius corneus (Linnaeus, 1758)		L, 5‰, sw, po, α-β, LC	West and Central Eurosiberian
Physella acuta (Draparnaud, 1805)		L, bt, pe, tx, α-β, is, LC	Subcosmopolitan, introduced species
Ostrea edulis Linnaeus, 1758	EN, VU	M, bt, sep, ro	North Atlantic-Mediterranean

planorbis, *Planorbarius corneus* and *Physella acuta* belong to the European and IUCN Red Data Lists, from the categories endangered (EN), vulnerable (VU) and least concern (LC). The last category includes the North American invasive species *Physella acuta*, which until recently was considered South European taxon. A total of 8 rare species have been established (*Palaemon serratus*, *Lestes viridis*, *Anax parthenope*, *Hemianax ephippiger*, *Libellula fulva*, *Ephydra bivittata*, *Glenanthe nigripes* and *Planorbis carinatus*). One Black Sea endemic (*Chironomus valkanovi*) has been recorded and relict forms are not known. The two protected areas (maintained reserve and natural monument) are important for the conservation of these species populations along the Bulgarian Black Sea coast.

Fig. 4. Shells of *Ecrobia ventrosa*, *Anadara kagoshimensis* and *Abra segmntum* in the south part of the lake, near the road to Pomorie

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Безгръбначните животни (Metazoa: Invertebrata) на Атанасовското езеро, България

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(Резюме)

Представена е ролята на Атанасовското езеро за съхраняване и опазване на специфичното фаунистично разнообразие, характерно за хиперхалинните езера от българското черноморие. Разгледана е фауната на езерото и околните водоеми, анализирани са таксономичното разнообразие и някои зоогеографски и екологични особености на безгръбначните животни. Технологичните процеси на солодобива влияят на хидрологичния режим на езерото и на фаунистичното му разнообразие. Езерната система включва от сладководни до хиперхалинни басейни с бърза смяна на средата. От Атанасовското езеро и прилежащите му водоеми са известни 6 типа, 10 класа, 35 разреда, 82 семейства и 157 вида. Тези таксони включват 56 вида (35.7%) морски и морско-бракични форми и 101 вида (64.3%) бракично-сладководни, сладководни и сухоземни форми, свързани с водата. За пръв път при настоящото изследване са установени 23 вида (12 морски, 1 бракичен и 10 сладководни). Морските и морско-бракичните видове имат 4 типа ареали – космополитен, атланто-индийски, атланто-пацифичен и атлантически. Преобладават атлантическите (66.1%) и космополитните (23.2%) ареали, които включват 80% от видовете. По-голямата част от фауната (над 60%) има атланто-медитерански произход и представлява обеднена атланто-медитеранска фауна. Сладководно-бракичните, сладководните и сухоземните видове, свързани с водата, установени в Атанасовското езеро, имат 2 основни типа ареали – видове, разпространени в Палеарктика и извън нея и видове, разпространени само в Палеарктика. Преобладават представителите на първия тип (52.4%). Те са свързани с типичните за морските крайбрежия местообитания, оптимални за развитието на определени видове и са застъпен слабо във вътрешността на страната. Вторият тип обединява палеарктични (20.0%), евросибирски (9.5%) и медитерански (15.2%) таксони. В Атанасовското езеро липсват каспийски реликти, което вероятно е свързано със специфичния хидрологичен режим, технологичните процеси при производството на сол и неговия силно променлив хиперхалинен характер. От понтийските видове е установен *Chironomus valkanovi*. От бентосните форми доминанти са *Cerastoderma glaucum* (до 134376 екз./m^2), *Ecrobia ventrosa* (до 19800 екз./m^2), *Abra segmentum* и *Cyprideis torosa* (до 77440 екз./m^2). Покрай бреговете на басейните черупките на *C. glaucum* образуват струпвания. Видът *Corophium volutator* е масов през всички сезони и е един от най-адаптираните обитатели на солниците. Постоянни видове, но с по-ограничени количества, са морските изоподи *Idotea balthica* и *Sphaeroma serratum*. Висока численост (до 130000 екз./m^3) достига и космополитът *Acartia clausi*. Типични за Атанасовското езеро са халобионтите *Artemia parthenogenetica* и *Artemia salina*, които достигат плътност от 3400 екз./l вода. Те имат значение за солодобива тъй като пречистват водите от фитопланктон в предкристализаторите. Установено е присъствие на 6 вида чуждестранни имигранти (*Ficopomatus enigmaticus*, *Amphibalanus eburneus*, *Rapana venosa*, *Physella acuta*, *Anadara kagoshimensis* и *Mya arenaria*). От безгръбначните животни на Атанасовското езеро 3 вида са включени в Червената книга на Черно море и 8 вида – в европейски и IUCN червени регистри.

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Signs of the bear life activities and their utilization for the monitoring of the brown bear (*Ursus arctos* L.) in Bulgaria

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Abstract: A number of signs of the life activity of the brown bear (*Ursus arctos* L.) (apart from bear footprints: scats, tree markings, overturned stones, messed ant-hills and damaged fruit trees) which give the opportunity to detect the presence of the animal and, in several cases, to identify the different individuals, are analyzed. The identification after the individual habitus is also discussed. These features could add complementary information to the footprint identification during the monitoring of the brown bear in Bulgaria.

Key words: *Ursus arctos*, Bulgaria, bear signs, bear markings

Introduction

The official monitoring of the brown bear (*Ursus arctos* L.) in Bulgaria for evaluation of the status of the species is conducted by several years. This monitoring is currently based mainly on the identification of the bear footprints, a method proposed in the project of the Executive Agency of the Environment (EAE) "Development of National System of Monitoring of the Biodiversity and the Protected Areas in Bulgaria" – PPA03/BG/715 (2004), modified recently by some of us, and accepted by the Ministry of Environment and Wathers (MOEW). Several other signs of bear life activity (Formozov, 1952; Atanassov, 1983; Rukovsky, 1984; Spiridonov & Mileva, 1987; Raychev, 1989; Puchkovskiy, 1990; Sobanskiy & Zavatzkiy, 1993; Spassov et al., 2000; Spassov, 2007; Etienne & Lauzet, 2009) could help the detection of the bear presence in the wild or the evaluation of the age, sex and number of the bears in the studied territory.

Material and methods

A number of signs of the daily activity, other than footprints, collected by the authors over the course of years of field work on the bear status in Bulgaria in the regions of Central Stara Planina, Rila, Pirin, Western Rhodopes and Vitosha Mts, (but also in Eastern Karadeniz Mts., Northern Anatolia, Turkey, 2015), are analyzed: markings on trees, traces of the feeding activity of the bear as scats, overturned stones, messed ant-hills, damaged fruit trees etc. For the age/sex identification of the scats over 70 shaped excrements were measured at the thickest part of their middle portions, using calipers, compasses and tape measure. The sex and age of individuals was identified by footprints. To study the status of the bear in Vitosha mountain 4 camera-traps were used (set to take 15 sec long videos automatically activated by motion and with infrared flash for nocturnal capturing). They were placed for 17 days in the game feeding places of Vitoshko game husbandry, where bears are concentrated in the spring.

Scats and feeding behaviour as an indication of bear presence

Scats. Most often bear traces and scats could be seen in muddy places along the forest trails, close to the foraging places for the game in game husbandries or near fruit- trees. However, despite the fact that the size and shape of the excrements could vary significantly due to obvious reasons, our long term observations show that the width of the well-formed excrements guide the defining of the age and sex of the animal especially in terms of identification of

the mature adult males. Etienne & Lauzet (2009) point out that the width of scats of the European bear varies between 3 and 7 cm. According to our observations the scats of the adult males are usually 5/5.5 – 6 cm wide, sometimes even wider (see also: Spassov et al., 2000), while the scats of the adult females are most often 4-4.5 cm in width. Measured excrements of subadult bears in their third year are usually around 3 to 3.5 cm, and of the cubs – below this size (example: measured scats of mother and two years old cub observed in Stara Reka Reserve in Central Balkan Mountains , which were 4.5 and 2.8 cm in width: Spiridonov & Mileva, 1987).

Considering the significance of the bear scats for individual identification, it is should be noted that the age group and the sex of 52.7% of the bears detected by us were identified by the size of their foot prints, but 33.0% of them – by the size of their excrements. The other signs of bear activity (including direct observations) helped identify the presence of 14.3% of the bear individuals detected by us during the field research related to the project of Natura Consortium for mapping of the habitats in the Natura 2000 zones (2011-2013).

The colour of the scat is related to the food of the bear and its freshness and the consistency of the excrements depends on the food which varies during the different foraging sites and depending on the seasons. We ascertain considerable seasonal, vertical and horizontal movements of individuals. According to our observations (see also: Raychev, 1988) in the spring, when plant food is limited, bears feed mainly on grass which they initially find in the lower free of snow sites and later in the high mountain pastures. After the end of the blueberry season, the grass again becomes the main diet component in the coniferous forests, which are poorer in feeding resources compared to the deciduous ones in the autumn. The scats in which the grass dominates (according to our observations in the Western Rhodopes) are greenish and become darker with the time but the traces of grass remain green inside the excrements for a long time. The scats after blueberries consumption are dark-violet to black and become darker with time (in about a week). Similarly to other carnivores, bear scats after feeding on meat are black. Usually they contain ingested hair (Fig. 1). Besides supplying the meat

Fig.1. Excrements of an adult male with hair from wild boar, and grains of corn Rakitovo state Forestry, the Rhodope mountains (photo: N. Spassov, 2011)

Fig. 2. A fragment of the scat of an affrayed young bear rich in indigested oak acorn shells (Karadeniz Mts., North-East Anatolia, Turkey, photo: A. Ignatov, 2015)

portion in their diet through scavenging, bears can hunt actively as well. We have recorded about four cases of male bears stalking and attacking young wild boars – from the regions of Trigrad, Smolyan, Rakitovo and the state forestry of Seliste (Rhodopes). The fresh scats after feeding on cherry plums or blackberries are watery and not well-shaped; they are pale yellow in colour and rich in fruit stones and very often in skins of the fruits. In late summer and the beginning of the autumn such scats could be seen in great number and should be searched for in close proximity to the territories where cherry plums are abundant, gorges, meadows in the lower mountain regions and close to abandoned agriculture lands. The fresh scats after feeding on corn from the game supplementary feeding stations are yellowish; rich in indigested seeds (they become darker in 1-2 days and frequently are well-shaped). The scats of oak and beech acorns are well-formed, reddish-brown to dark brown, rich in indigested acorn shells (Fig. 2).

Feeding behaviour: Overturned stones, messed ant-hills, and damaged fruit trees

In search for invertebrates the bear often turns over big stones. However, not all capsized large stones observed in the forest are a result of such bear feeding behaviour. Frequently the field researcher could be misled by stones turned over by tourists and foresters or – in the periphery of the road – by cars. Stones could be capsized by wild boars in search for food as well (Fig. 3.); when stones are overturned by bears there are usually several capsized stones, rather than a single one.

Assessment of the impact of bears on the ant-hills of four forest ant species has been provided by Atanassov (1983). The ant-hills could be destroyed by wild boars or other animals as well, while when they are accidentally trampled by wild horse or cow this usually leaves a deep footprint in the ant-hills. The bear frequently throws away considerable part of the ant-hill aside (Fig. 4) and could destroy it almost completely to its base. In a region where the ant-hills have been dug up by bears, these are usually not single cases.

When the fruits ripen the fruit trees (especially cherry plums and plums) they are frequented by number of bears. The trees that are regularly visited and picked up by bears often have twisted or broken branches and traces of claws on the trunks. Branches twisted and broken by the snow could be mistaken for traces left by the bears on the fruit trees.

Marking behaviour

Leaving marks on trees represents typical bear behaviour with multifunctional meaning which is not completely clarified yet. It seems that the females and the cubs can also leave marks: however, such marks are the most typical for the mature territorial males especially during the breeding season (Rukovskiy, 1984; Puchkovskiy, 1990; Pajetnov, 1990; Seryodkin, Pachkovskiy, 2006). We have established marked trees during the period 1997-1998 in the Central Balkan Mountains – the Rositsa and in Karlovo State Forestries, as well in the Dzhendema reserve (in the basin of Tuzha river). Such were also discovered in Bistrishko Branishte reserve (Vitosha Mountain). Considerable number of marks were discovered during the present assessment period from July 2011 through October 2012 as well as in 2014 in the Mazalat hunting husbandry, and the hunting husbandries of Rositsa, Tvurditsa Balkan, Teteven Balkan (Central Balkan), Rila National Park, Rila Monastery Forest (Rila Mountain), Slavyanka Mountain, the hunting husbandry of Adzhilarska Reka near the village of Kozhari (Western Rhodopes) (Figs. 5-7). The height of the claw marks found by us (19 in total) varied from 178 cm (Bistrishko Branishte) to 240-245 cm in the hunting husbandry of Mazalat on a spruce near a game feeding site. The mark is often pealed bark but sometimes only deep claw traces are left on it. In six of the cases, the fresh traces coincide for sure with the mating period (Tvurditsa Mountain and Adzhalarska river– May; Rila monastery forest – June; Alibotush reserve in Slavyanka Mountain – in the beginning of July). In one of these cases a marking left by a male bear by stamping down the ground with paws was recorded (leaving large footprints of paws: for examples of

Fig. 3. Sign of the feeding behaviour of the bear: upturned large stone, The Rilamountains, above Semkovo (photo: N. Spassov, 2012).

such type of marking see Puchkovskii, 1990), while in two of the cases the presence of female bear was registered in direct proximity to the markings. In Central Stara Planina and the Alibotush reserve, we have established marking by teeth (such behaviour is known from different parts of the vast bear area, for example from Altai: Sobanskiy & Zavatzkiy, 1993). In such cases the distance between the marks left by the canine teeth or the height of the marking could give an idea for the size of the male bear. In one of the cases along the Tuzha River tooth marks were left on a fallen tree in close proximity to an inhabited den. Marking by teeth from four-legged position – at a height of about 100 cm (distance between the marks left by the upper canines approx. ~ 5 cm) was observed on a tree trunk at the site of Babski rut in Tuzha (Spassov et al., 2000; Spassov, 2007). In Rositsa hunting husbandry marking by teeth from upright position at a height of 170 cm was registered, while that in Alibotush reserve has been at a height of 175 cm. The marks were most often near trails used by both bears and humans. The cases observed by us were mainly marks on coniferous trees (which coincides with the data from other authors as well: Puchkovskiy, 1990), and also on impregnated wooden poles or pillars (for similar cases see also Pajetnov (1990). Probably the stronger smell of the resin of the coniferous trees is an additional stimulus for the marking male bear. The same could be valid for the strong odour of the impregnated wooden poles (for a similar opinion regarding the attracting role of the strong smells in the marking see also Etienne &Lauzet, 2009). A scratching point was found also at the base of beech on a forest road in Slavyanka Mountain. When the bears use the same tree a number of times they leave traces by rubbing with their back and head. On a century old spruce tree used numerous times for scratching, a dense dark patch was left at a height of about 2 m made by head rubbing and witnessing the presence of a territorial male. In similar cases hairs from the animal stuck on the tree remain.

Other tracks on trees: the case of peeled off Macedonian pines

Widely distributed specific behaviour of the bear in our mountains is peeling off the cover of coniferous trees. In the great majority of the cases this has been observed on the trunks of Macedonian pine (*Pinus peuce*) in Rila and Pirin. In June 1985 in Bayuvi dupki – Dzhindzhiritsa Reserve (Pirin Mountain) at the edge of the forest, a line of approximately 20 Macedonian pines with a diameter of 20-25 cm, were found marked by fresh traces – the bark scratched by claws and peeled off at a height till 1.30 – 1.70 m. In the abovementioned mountains a number of Macedonian pines peeled off by bear were observed by us in 2009-2013: in Rila – above

Fig. 4. Sign of the feeding behaviour of the bear: destroyed ant-hill, The Rilamountains, above Sitniakovo (photo: V. Ivanov, 2012)

Kamenitsa Hut; above Tchakar Voyvoda Hut; above Parangalitsa reserve; in Rila Monastery Forest; in the region of Belmeken Peak (here approximately 15 Macedonian pines were found in August 2012, peeled off probably several months previously); in Pirin – below Bezbog Peak; along the road Pirin hut – Semkovo; in Bayuvi Dupki – Dzhindzhiritsa reserve; between Aramibunar and Vapata (in this case: 13 peeled off Macedonian pines with marks of different age – between 2-3 to ~ 10 year old). Unlike the cases of Rila and Pirin Mountains among the investigated Macedonian pines in Vitosha Nature Park (below Goli vrah) and during the intensive field research in Tsaritchina reserve (Central Balkan Mountains), peeled off Macedonian pines were not observed. It seems that the bear peels off other coniferous species in the places where Macedonian pine doesn't occur. In Rila and Pirin we have observed only two cases of other coniferous species peeled off – Scots pine (*P. sylvestris*) in the area between Arami Bunar and the village of Kremen and a fir tree (*Abies alba*) above Sitnyakovo in Rila Mountain (Fig. 8). The spruce (*Picea excelsa*) ranks second in terms of peeled off trees, but found outside the region of Rila and Pirin. In July 2011 dozens of peeled off spruces were

Fig. 5. Marking with nails: 240-245 cm height, Mazalat Forestry, The Central Balkan mountains (photo: N. Spassov, 2012)

Fig. 6. Marking behaviour with canines from upright position, Mazalat Forestry, The Central Balkan mountains (photo: N. Spassov, 2012)

discovered in Beglika area, Western Rhodopes, on an area of approximately 100 ha. Five freshly peeled off Scots pines were found in Izvora site above the village of Borino (W. Rhodopes).

Very often the trunk is peeled off lower – at the base of the tree. Attached hairs from the paws and the head of the animal can be seen. Relatively young trees (diameter 30-50 cm) are peeled off more frequently but the cover of very old (century old) ones could also be peeled off. The same animal can visit the same region with marked trees for years (see above). At places, the height of such peeled off zone reaches from the base of the tree up to 1, even 1.9 m. Sometimes its width can cover most of the tree in diameter and even the whole bark at the base of the trunk could be peeled off. In such cases the trees dry up.

On June 16th above Chakur Voivoda Hut (NP Rila) a bear peeled off eight Macedonian pines at a distance of about 1,300 m for one night (Fig.9). In one of them 75% of the bark at the base of the trunk was peeled off. The width of the peeled off part was 94 cm at a height of 60 cm. The freshly (several hours ago) peeled off Macedonian pine has an absolutely white trunk at the place of the peeled off bark. The resin has just started to ooze. The pieces of the peeled off cover are still wet. In a week the peeled off part of the tree is abundantly covered by flows of resin. The resin is still white. The dried up resin on a peeled off trunk a year ago is dark yellow at the peeled off area. In very old traces of peeling off the resin eventually disappears with time. The cover is peeled off by claws. Their traces are visible on the trunk and in the parts of the peeled off cover poked by the claws. On the freshly peeled off trunk traces of the incisors (probably due to licking the resin) could be seen.

It is not clear if this behaviour has marking meaning (it is most intensive in the late astronomic spring which practically coincides with the breeding season). The highest intensity of the peeling off (maybe 90% of the cases) is highest in the spring up to the end of June. In any case, such behaviour looks like a feeding one in the widest meaning of the term and we believe it has curative meaning. It seems that similar behaviour is also recorded

Fig. 7. A bear marking tree (diameter 50 cm) in Adjilarska reka hunting Forestry, Western Rhodopes. The bark of the base of the tree is erased from regular scrubbing of the bear body made from position of four legs (photo: N. Spassov)

Fig. 8. Peeled bark of a pine spruce (*Abies alba*), Rilamountains, above Borovets (photo: N. Spassov, 2012)

Fig. 9. Peeled bark of Macedonian pine (*Pinuspeuce*), 10 hours ago, and about 10 days ago, the Kaiser path, Rila mountains (photo: N. Spassov, 2012)

Fig.10. The bear habitus:
a. An adult male
(a photo from a camera-trap.Vitoskohunting Forestry. Photo V. Ivanov);
b. male (to the left, 5 years old) and female (4 years old) bears from Bulgaria. Lovech Zoo. (Photo: H. Mihailov)

in coniferous forest regions in the Carpathian Mountains, Sweden, Finland, France (the Pyrenees) and in Spain (Cantabrian Mountains where the bear attacks, although rarely, chest nuts and willows as well) (Etienne & Lauzet, 2009). According to these authors the tree resin which is rich in amino acids and sugars has high feeding value. At the same time we must point out that local people in Rila and Pirin believe that coniferous resin, especially that of the Macedonian pine, is curative. In Pirin area the resin of Macedonian pine is used for treatment of stomach problems. Studies show that among the local tree species the Macedonian pine has the highest production of resin (Stefanov, 1934). It is possible that the bear peels off the cover and licks the fresh resin looking for some kind of treatment (against intestinal parasites?).

Bear habitus and using of camera-traps for bear identification

The observations of bears in the wild and the analysis of the data obtained through camera-traps give important information about the sex, age and the individual characteristics of the animals. A very specific characteristic of the south European population which includes the Bulgarian bears is the occurrence of a large percentage (even predominance) of bears with contrast colouration – dark paws and withers and lighter (to golden) colour of the body which is lightest on the head and neck (Spassov, 2003). In the north of the European part of Russia bears with golden neck and head are about 4% of the population (Pajetnov, 1990), while in Bulgaria they are very common and typical for the population. There is no sexual dimorphism in

the colouration of the European bears, after some investigations in the more northern territories of the continents, but according to our current observations the lighter (golden, 'blond') colouration occurs more often among the females although this has not been statistically proven yet. (The influence of the colouration on the probable hybridization with individuals from a more northern population that have darker and monotonous colouration as a whole has yet to be investigated by genetic tests). In terms of the analysis of the photo trap videos it should be taken into consideration that the head of the female seems more delicate, with a more pointed muzzle; the head of the adult males (en face) is proportionally bigger and the muzzle has more angular contours and is evidently more massive in its anterior part. The old males standing en face impress by their massive (almost as wide as high) body (Fig 10). The young males (comparison made during the same season) look more long-legged than the adult ones due to the lesser body mass they accumulate. Young bears (till their 3th year of life) are often lighter in colouration, with light end of the hairs (Pajetnov, 1990).

Camera-trap identification combined with foot print identification were used by us for evaluating the bear number in Vitosha mountain. According to the data from the camera-traps in Vitoshko hunting husbandry in May 2013, there were at least eight bears in the area: a territorial male and an oestral female in mating period (Fig. 11), a female with two second year cubs, and a female with two cubs from this year. In this way it was proven that the mature female individuals were three, and the presence of one territorial male was confirmed. If we include in this calculation a young animal from the previous year (which is registered by footprints but not by the photo traps) the number of the bears becomes at least nine. It is very possible that one more animal has inhabited Bistishko Branishte reserve at that time. Thus the maximum bear number for the territory of Vitosha Mountain could be about 10 individuals. It should be taken into account that some of these individuals spread their individual territories in the neighbouring mountains – such as Verila, Plana and even Lozenska Planina, as well.

The data from the camera-traps as a whole confirm the data obtained through the tracking of the footprints and prove that the combined method could produce reliable data, with an accuracy of up to ca. 90%, assuming it is applied to a relatively limited territory. Based on the concrete data obtained through the present study, the claim (Damianov et al., 2008) that the territory is inhabited by eight female and six male bears (cubs not included) based on unclear taxation method seems exaggerated.

The territory inhabited by the species covers the potential habitats of the species of approximately 24,000 ha, with four breeding individuals, while

Fig. 11. A temporary pair in mating season (17.05.2013). Vitoshko Hunting Forestry, Vitosha mountains (a photo from a camera-trap, V. Ivanov)

the bears are rarely seen as in the northern part of the mountain. The relatively low average density of the bears in Vitosha– one individual per ca. 3,000 ha (including cubs and keeping in mind their individual weight compared to the one of the adults) is not evenly distributed since the animals avoid (especially during the day) the areas of the huts and the vicinity of roads in the northern part of the Mountain. Mainly during the spring due to the supplementary feeding of the game, bears concentrate on a smaller territory of approximately 20,000 ha in Vitoshko hunting husbandry (density of about 2,000 ha per individual, if we take the cubs into consideration, and approximately 3,000 ha without them, e.g. – about 2,500 ha per individual). The age structure is normal for a breeding bear population.

Conclusions

A number of signs of the life activity of the bear (a part from the bear footprints) as scats, tree markings, overturned stones, messed ant-hills, and damaged fruit trees, permit detecting the presence of the animal and in several cases (scats and bear trees) identifying the different individuals. Some of the traces of bear life activity (bear trees) could have different "hand" in different regions. Thus these signs of the bear presence in the wild could add complementary information to the footprint identification during the monitoring of the brown bear in Bulgaria.

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Следите от жизнената дейност на мечката (*Ursus arctos* L.) и приложението им при теренния мониторинг на вида в България

Николай Спасов, Жеко Спиридонов, Васил Иванов, Людмил Асенов

(Резюме)

Анализирани са значителен брой следи от жизнената дейност на мечката (отделно от следите от стъпки) като: екскременти, различни маркировки върху дървета, обърнати в търсене на храна камъни, разровени мравуняци и счупени клони на плодни дървета. Те дават възможност за установяване присъствието на вида и в редица случаи за идентифициране на индивидите по пол и възраст. Дискутирани са и белезите по които индивидите могат да бъдат идентифицирани според външния вид. Всички тези белези могат да допълнят значително информацията, получена от анализа на следите от стъпки при монитирането на мечката в България.

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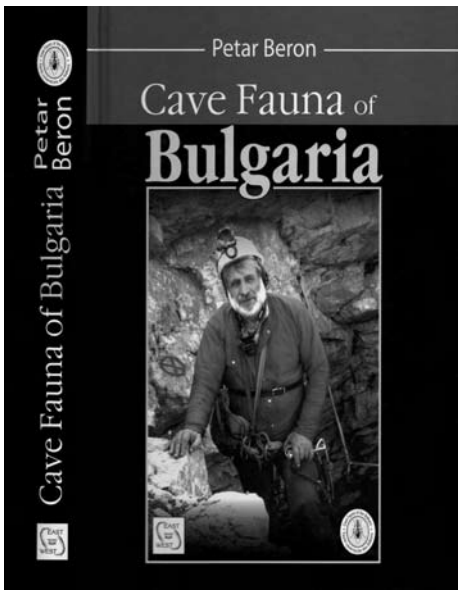

Една нова обобщаваща книга за пещерната фауна на България

Николай Симов

Beron P. 2015. Cave Fauna of Bulgaria. East-West Publishing, Sofia, 434 p.

В ръцете на читателите е една отдавна чакана книга. В рамките на 434 страници са обобщени данните от започналите преди 136 години проучвания на българските пещери. Монографията е логично следствие от серията предхождащи я публикации на автора през втората половина на XX век (Guéorguiev & Beron, 1962 – Ann. de Spéléologie; **17** (2-3): 285-441; Beron & Guéorguiev, 1967 – Изв. Зоол. инст. муз., **24**: 151-210; Beron, 1972 – Int. J. Speleol., **4**: 285-349; Beron, 1994 – Tranteeva, Sofia, **1**: 1-137). По-голямата част от съвременните биоспелеологични изследвания у нас протичат под ръководството или с дейното участие на П. Берон. Монографията съдържа в първата си част пълен списък на срещащите се в българските пещери животни и включва 866 вида и подвида, като 153 вида се съобщават тук за първи път. Ако към този списък прибавим данните за неспоменатите неопределени до вид таксони, броят им би надхвърлил 1050. За 836 проучени в биоспелеологично отношение пещери от общо над 6000 известни в България е представена информация за техните обитатели, като за 189 тя е публикувана за първи път тук. В две последователни глави се разглеждат произходът и зоогеографският характер на българската пещерна фауна и се прави сравнение със съседни територии на Балканския полуостров. Към това можем да прибавим и пълната библиография, съдържаща 584 заглавия за българската пещерна фауна, и удачно подбраните заглавия за пещерната фауна на близките балкански страни. Книгата е илюстрирана с карти, показващи разпространението на троглобионти и стигобионти от различни таксономични групи животни, както и с рисунки или снимки на отделни техни представители. На отделна карта са показани по-важните в биоспелеологично отношение карстови райони у нас и в непосредствена близост до нашите граници. Освен всичко казано дотук монографията на д-р Берон съдържа и кратка история на биоспелеологичните изследвания, както и таблица на броя видове по систематични групи с отделна графа, включваща броя на стигобионтите и троглобионтите за всяка от тях. Общо сухоземните троглобионти, известни от българските пещери, са 130 вида, а стигобионтите – 72, което нарежда страната ни в едно от челните места в списъка на страните в света с най-богата и разнообразна подземна фауна.

Огромната по обем информация, обработена и включена в книгата, е най-вероятната причина за допускането на някои неточности и пропуски. В систематичния списък видовете са представени с валидните си в момента названия, докато във втората част, където всяка пещера се разглежда отделно, същите таксони са с названия, които са синоними (*Delaya* и *Haplotaxis*, *Cyphophthalmus* и *Tranteeva*). Някои видове са посочени в находища, където те не се срещат (*Palliduphantes istrianus* Kulczyński – пещера Духлата), докато за други (*Balkanopetalum graecum* Stoev & Enghoff) в приложените карти не са дадени находища от списъка, а само такива, които са извън съвременните граници на България. Пропуснати са някои важни публикации за подземната и пещерна фауна на отделни карстови райони (Langourov et al., 2014 – Proc. Balkan Speleological Conference "Sofia'2014", pp. 66-76, за Витоша и Боснешкия карстов регион), както и за някои групи, за които има допълнителни данни за срещането на техни представители в пещери – полутвърдокрили насекоми (*Cimex dissimilis* Horv. – Деветашката пещера Lv 37), бръмбари (*Bryaxix rodopensis* Karaman – пещера Лепеница Pz 1), многоножки (*Cylindroiulus horvathi* Verh. – липсва в списъка) и охлюви (*Belgrandiella delevae* Georgiev & Glöer – Леденика Vr 17, *B. petrovi* Georgiev – пещера Чучура Gb 15). Едно от предложените в текста названия на таксон от видовата група практически е nomen nudum – *Neobisium* (*Ommatoblothrus*) sp. [*snezhankae* in prep.]. Някои от пещерите са с номерация вече използвана в предишните каталози (Rs 4 Zorovitsa и Rs 4 Propastta (Beron, 1972); Si 1 Okart и Si 1 Golemata peštera (Guéorguiev & Beron, 1962)). В библиографията за някои работи е посочен само автор без заглавие – Popov Vl. 1976, Popov Vl. 1977, Ruzicka, Karaman I. 20, Onac & Cocean (1996).

Без съмнение книгата на П. Берон е основа за опознаване на тази изключително важна и уязвима част от биоразнообразието. Тя ни представя в синтезиран вид всички достъпни сведения за пещерната фауна в България и ще представлява интерес не само за научната общност у нас и в чужбина, а и за всеки, който проявява интерес към изследването на подземните местообитания. Не на последно място тя ще спомогне за опазването на пещерите и за вземане на важни природозащитни решения за отделни подземни обекти. Българските спелеолози и пещерняци с интерес очакват и следващи подобни монографии за съседни на България територии.

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Из историята на Природонаучния музей в Скопие през 1941-1944 г.

Петър Берон

Абстракт: The article contains so far unknown documents concerning the history of the Natural History Museum in Skopje, when this Museum was a branch of the Natural History Museum in Sofia (1941-1944).

Key words: Natural History Museum, Skopje, History

Когато Скопие е освободен и попада под българско управление (1941 г.), Природонаучният музей става клон на Естественоисторическия музей в София. По думите на акад. Иван Буреш (казани на П.Б.), той предложил на д-р Станко Караман да остане директор, но той отказал, тъй като се съмнявал, че българското присъствие в Скопие ще е много продължително. Тогава д-р Буреш назначил на тази длъжност д-р Кръстю Тулешков, който е ръководил музея до 1944 г. Този четиригодишен период е изцяло прескочен от официалната история на Природонаучния музей в Скопие.

В архивите на Националния природонаучен музей в София намерихме (с помощта на отличната библиотекарка Лили Борисова) папка със старателно подредени документи за този период и смятаме, че не е излишно да се публикуват част от тях. Жалко е само, че не успяхме да разпитаме по-подробно самия д-р Тулешков, който почина през 1976 година, както и д-р Буреш (1885-1980).

Превръщането на основания през 1927 г. от Станко Караман Природонаучен музей в Скопие в клон на софийския Царски музей започва с една заповед на министър председателя и министър на Народното просвещение проф. Богдан Филов. Ето я (Фиг. 1):

За уредник на новия клон на Царските природонаучни институти е назначен асистентът по ентомология д-р Кръстю Тулешков. Преди това д-р Тулешков е бил командирован с цел да се опази музеят. Ето и самите заповеди на д-р Буреш (Фиг. 2, Фиг. 3):

На музея е предоставена нова сграда. На 6 август 1941 г. комисия разглежда и утвърждава искането от 4.8.1941 г. на д-р Тулешков за нова сграда със следния

Протокол

Днес, на 6 август 1941 г., в гр. Скопие, комисията предвидена в чл. 17 от Закона за държавните имоти, в състав...., се занима с искането на Природонаучния музей в гр. Скопие с писмо 4 от 1.VIII. 1941 г. да му бъде отстъпена държавната сграда в гр. Скопие, ул. Княз Кирил 9 - 11 (бивша улица Кнеза Арсена, същия номер), бивша собственост на "Пенсионното сдружение на чиновниците при частните предприятия", което също е престанало да съществува, за да му послужи за нуждите на музея.

Комисията, като взе предвид обстоятелството: 1. Че сега Природонаучния музей, който със заповед 1619 от 24.VIII.1941 г. от Министерството на народната просвета се причислява към Природонаучните институти на Негово Величество Царя – клон в град Скопие, се помещава в едно частно, тясно, полупаянтово и съвсем неудобно за целта здание, за което се плаща месечен наем от около 5500 лв.; 2. Че поради голямата научна и културна роля, която този институт, като клон от Природонаучните инсти-

тути на Н.В. Царя, ще има да изиграе в Скопие и Македония изобщо, като се развие в един истински център за проучването на цялостното природа на Македония; 3. че посоченото и поискано за нуждите на музея здание притежава всички необходими качества и условия за да задоволи нуждите на Природонаучния музей и да гарантира развитието му в бъдеще, понеже е достатъчно широко със застроената си площ от 320 кв.м. и височина 3 етажа и партер, отчасти използуван за магазини, има масивна железобетонна конструкция, централно отопление, удобна за развитието на сбирките система от стаи, лесно пригодими за лаборатории и научни кабинети помещения и пр., реши да одобри отпускането на споменатата сграда за помещение на Природонаучния музей в гр. Скопие и изказва мнение настоящия протокол да бъде одобрен.

Настоящия протокол се направи в три еднообразни екземпляри, които се представят в Министерството на земледелието. Отделение за държавните имоти.

Комисия: Агент по държавните имоти
Пенчо Н. Йосифов
Помощник кмет Жерновски
Представители на данъчните власти и на общинската техническа власт
Представител на Природонаучния музей
д-р Кръстю Тулешков

Протоколът носи още няколко подписа на длъжностни лица и е утвърден от министъра на „земледелието и държавните имоти“ Ив. Георгиев.

Ето протокола за приемането на сградата:

Протокол

Днес, 20.VIII. 1941 г., съгласно заповедта № 308/20.VIII.1941 на Г-на Областния Директор , комисията в състав... се събра и отвори държавната сграда, находяща се на улица Княз Кирил № 9 и 11, бивша собственост на “Пенсионно сдружение на чиновниците при частните предприятия” в бившата Югославия, отстъпена от Министерството на земледелието и държавните имоти на Природонаучния музей в гр. Скопие.

Комисията констатира, че всичките стаи в зданието са празни, с изключение на двата магазина в партера, които са временно наети от частни фирми, и едно малко помещение от 3 малки стаички също в партера, служащи за лекарски кабинет. В никое от помещенията на зданието не са изостанали каквито и да било инвентарни вещи или покъщина.

Настящият протокол се направи в 3 еднообразни екземпляри, по един от които се дава на всяко от представените в комисията учреждения.

Комисия:
Чиновник по държ. имоти Пенчо Йосифов
Пом. Секр. Обл. Дирекция Георги Перелингов
Уредн. на Природонаучния музей Д-р Кр. Тулешков
Скопие, 20.VIII.1941 г.

Както личи от документацията, старото здание на ул. Царица Йоана 80 е било напуснато на 1.IX.1941 г. след ремонта на новопридобитото здание. Запазени са и 29 фотографии, от които личи как са изглеждали зданията и експозицията на музея, както и планове на старото здание на ул. Царица Йоана 80.

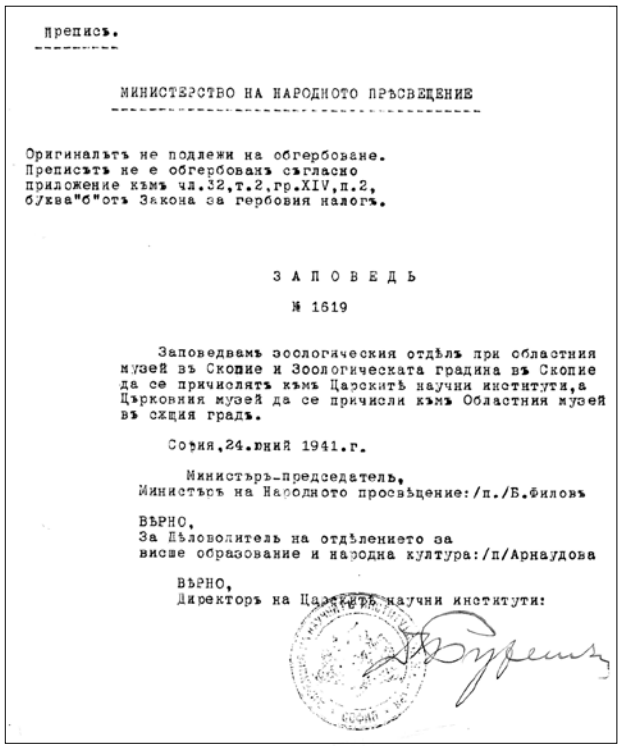
Интересно е да се знае кои хора са работили в Музея по това време. Някои имена могат да бъдат възстановени по акуратно водените „оправдателни“ (финансови) документи. Освен д-р Тулешков, според ведомостта за заплатите от 1942 г., в музея са работили Георги Стоянов (пом. препаратор) и Кирил Богоев (лаборант). Имало е и чистачка.

Д-р Кръстю Тулешков е роден на 24 септември 1901 г. в сегашното село Кайнарджа, Силистренско. Пълната му биография е поместена в книгата на Големански и Божков (1997) „Бележити български зоолози“. Той е изпратен в Скопие първо като мобилизиран, възложено му е било да запази музея от разграбване. По-късно е назначен за уредник на музея, обогатява го с нови колекции и създава отдели по ботаника и геология. Той допринася много и за преместването на музея в новата сграда.

Георги Стоянов Георгиев от Ямбол е назначен на 28 юни 1941 г. до 1 февруари 1942 г. той е бил лаборант към музея в Скопие, а след това (до 15 октомври 1944 г.) – пом. препаратор.

Кирил Димитров Богоев, роден на 10 юни1917 г., и жител на Скопие, е назначен за лаборант в музея в Скопие от 1.2.1942 г. с 2020 лв основна заплата. Преди това е бил на същата служба в музея от 1 юни 1937 г. От 1 август 1943 г. заплатата му се повишава на 3200 лева.

Фотографии (Фиг. 4-8)



Препис.

МИНИСТЕРСТВО НА НАРОДНОТО ПРЪСВЕЩЕНИЕ

Оригиналътъ не подлежи на обгербоване.
Преписътъ не е обгербованъ съгласно приложение къмъ чл.32,т.2,гр.XIV,п.2, буква"б"отъ Закона за гербовия налогъ.

З А П О В Е Д Ь

№ 1619

Заповедвамъ зоологическия отдѣлъ при областния музей въ Скопие и Зоологическата градина въ Скопие да се причислятъ къмъ Царскитѣ научни институти,а Църковния музей да се причисли къмъ Областния музей въ сѫщия градъ.

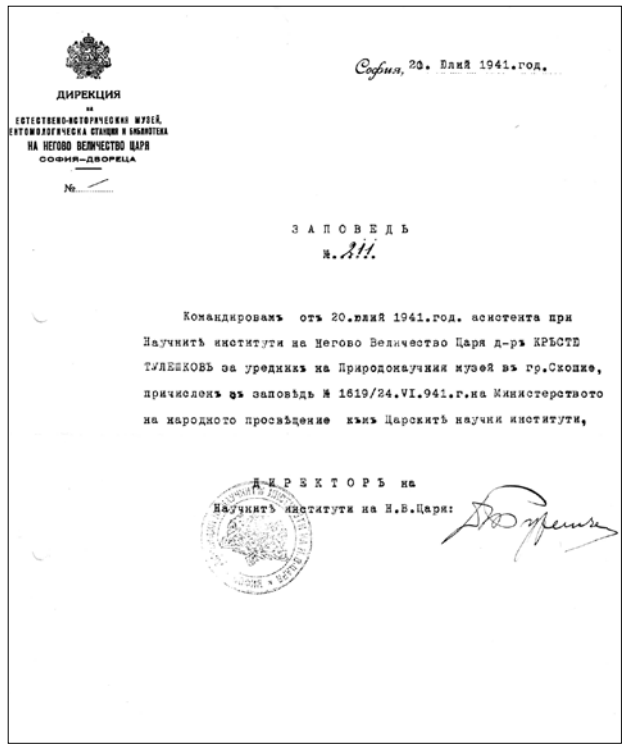
София,24.юний 1941.г.

Министъръ-председатель,
Министъръ на Народното просвѣщение:/п./Б.Филовъ

ВѢРНО,
За Дѣловодитель на отдѣлението за висше образование и народна култура:/п/Арнаудова

ВѢРНО,
Директоръ на Царскитѣ научни институти:

Фиг. 1. Заповед на Б. Филов



ДИРЕКЦИЯ
на
ЕСТЕСТВЕНО-ИСТОРИЧЕСКИЯ МУЗЕЙ,
ЕНТОМОЛОГИЧЕСКА СТАНЦИЯ И БИБЛИОТЕКА
НА НЕГОВО ВЕЛИЧЕСТВО ЦАРЯ
СОФИЯ-ДВОРЕЦА

№ 1

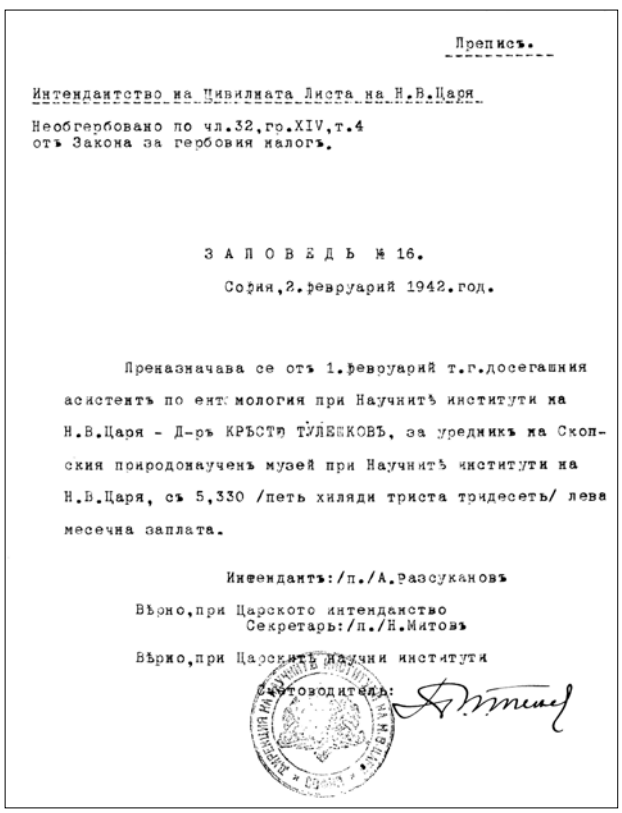
София, 20. Юний 1941.год.

З А П О В Е Д Ь
№ 111.

Командировамъ отъ 20.юний 1941.год. асистента при Научнитѣ институти на Негово Величество Царя д-ръ КРЪСТЕ ТУЛЕШКОВЪ за уредникъ на Природонаучния музей въ гр.Скопие, причисленъ съ заповѣдь № 1619/24.VI.941.г.на Министерството на народното просвѣщение къмъ Царскитѣ научни институти,

Д И Р Е К Т О Р Ъ на
Научнитѣ институти на Н.В.Царя:

Фиг. 2. Заповед на д-р Буреш



Препис.

Интендантство на Цивилната Листа на Н.В.Царя

Необгербовано по чл.32,гр.XIV,т.4
отъ Закона за гербовия налогъ.

З А П О В Е Д № 16.

София,2.февруарий 1942.год.

Преназначава се отъ 1.февруарий т.г.досегашния асистентъ по ентомология при Научнитѣ институти на Н.В.Царя - Д-ръ КРЪСТЮ ТУЛЕШКОВЪ, за уредникъ на Скопския природонаученъ музей при Научнитѣ институти на Н.В.Царя, съ 5,330 /петь хиляди триста тридесетъ/ лева месечна заплата.

Интендантъ:/п./А.Разсукановъ

Вѣрно,при Царското интенданство
Секретарь:/п./Н.Митовъ

Вѣрно,при Царскитѣ научни институти
Дѣловодитель:

Фиг. 3. Заповед на д-р Буреш

Вероятно много от тези експонати са унищожени по време на земетресението на 26 юли 1963 г., което разруши зданието на музея на улица Орце Николов 2.

Фиг. 4. Сградата на музея в Скопие

В документацията са запазени и подробни документи за бюджета на Природонаучния музей в Скопие за този период.

Ето какво направиха за Природонаучния музей в Скопие българите от София през тежките военни години. Все пак, не е лошо колегите от музея в Скопие да включат този период в историята на музея си, а не да го държат като празнина.

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Received: 04.11.2015

Фиг. 5-8. Експонати от старата експозиция на музея в Скопие

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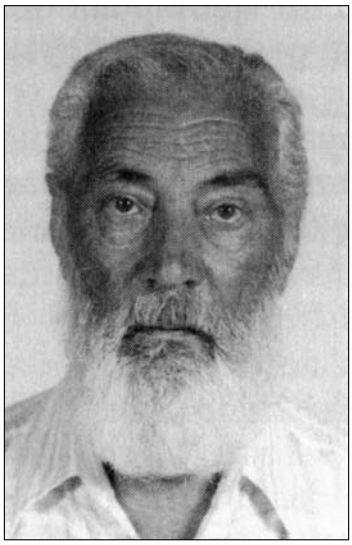
On the history of the Natural History Museum in Skopje in 1941-1944

Petar Beron

(Summary)

The rich and interesting Natural History Museum in Skopje (Rep. Macedonia) was founded in 1927 by Stanko Karaman. Since 1941, after the liberation of Skopje, it became a branch of the Royal Natural History Museum in Sofia. Dr Krastyu Tuleshkov was appointed curator of this branch and, until the end of 1944, contributed to the preservation and enlarging of the museum. He organized the transfer of the museum into a new and better building, introduced botanical and geological sections and, in the difficult war conditions, contributed with new collections to the exhibition and the scientific fund of the Skopje branch. In the actual history of the Natural History Museum of Republic of Macedonia this period is not elucidated, that is why we decided to fill this gap in the history of the institution, using the well preserved documentation housed in the archive of the National Museum of Natural History in Sofia. This documentation contains photos and the original papers for the transfer and organization of the Skopje Museum in 1941 – 1944. We feel that the anti-Bulgarian politics of the official Macedonian authorities should not lead to corrupting history. It is good to know how the short Bulgarian presence in Skopje in the war period contributed to preserving and enhancing a rich and interesting museum, center of studies of Macedonian nature.



In Memoriam

Professor Blagoy Gruev, D. Sc. (1936-2015)

On February 15th 2015, one of the most prominent Bulgarian taxomomists and zoogeographers – Professor Emeritus Blagoy Gruev passed away. Born in Plovdiv on 24.04. 1936, he graduated in the University of Plovdiv, became Assistant in the Zoology of Invertebrates (1966), and later Associated Professor (1979) and Professor (1989), Dean of Biological Faculty of Plovdiv University (1993 – 1999). Becoming gradually one of the best specialists in the large family Chrysomelidae (Coleoptera) in Europe, B. Gruev defended theses as Doctor in Biology (1971) and Doctor in Sciences (1987), the latter on the "Fauna and Zoogeography of the subfamily Alticinae (Chrysomelidae, Coleoptera) of the Balkan Peninsula".

Since his first publication in 1964, B. Gruev published (partly with Prof. P. Angelov and his long term co-author V. Tomov) a series of papers not only on the Chrysomelidae of Bulgaria, but also on the fauna of many other countries.

I remember with gratitude that he published many papers on the Chrysomelidae, collected by me from Nepal, India, Sri Lanka, Vietnam, Burma, Afghanistan and other places. Gruev had acquired excellent reputation with his colleagues as one of the most reliable specialists in Chysomelidae. Gruev and Tomov accumulated a vast collection of Chrysomelidae from the entire Palearctic Region, including many type specimens. Part of it he deposited in the National Museum of Natural History – they will be kept forever in good order and available to specialists.

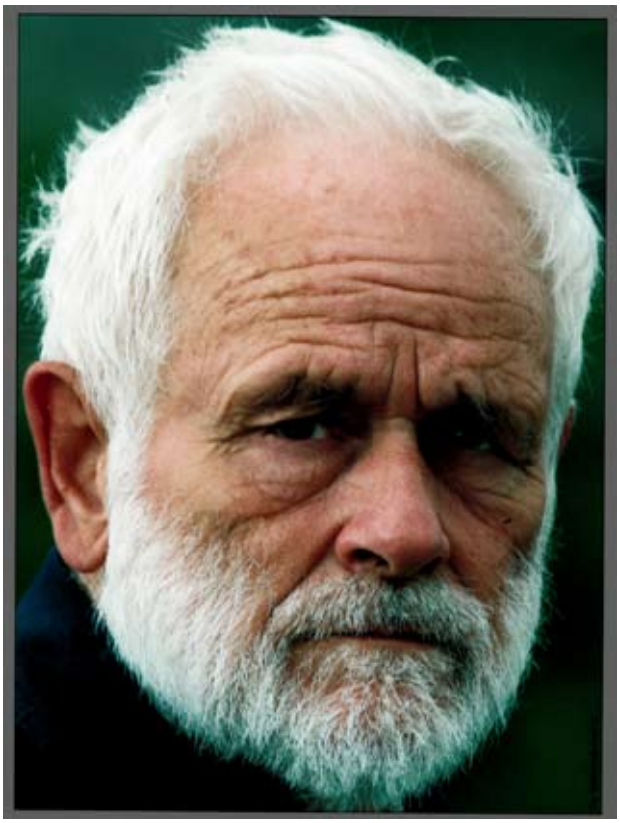
The active work of Gruev and Tomov was crowned by the two volumes of "Fauna Bulgarica" (1984, 1986, altogether 607 pp.) and by a catalogue of Bulgaria's Chrysomelidae. The long experience of B. Gruev reflected also in catalogues of Chrysomelidae of Macedonia (1998), Turkey (1999), Greece (1990), Romania (1993), Cyprus (1995) and the Balkan Peninsula (1992, monograph of 512 pp.).

Gruev lectured for many years in the Plovdiv University, on biogeography, zoology of invertebrates and the special course "Principles of the zoological taxonomy, systematics and classification". His experience in biogeography was materialized in several manuals, still the most used by students and zoologists. His "General Biogeography" had three editions (1988, 1994, 1999), the last two together with B. Kuzmanov. Gruev also authored several articles on the zoogeographic elements of Balkan Peninsula. Together with D. Bechev, Gruev published the very useful Bibliography of the Zoogeography of Bulgaria (2004, First Roll).

Retired in 2004, in 2010 Gruev was honoured with the title Professor Emeritus. We, Bulgarian zoologists, will remember this excellent specialist and Colleague. He will be remembered also by his foreign colleagues worldwide.

Petar Beron

Historia naturalis bulgarica, 22: 91-98, 2015



Dr. Vladimir Beshkov at 80 years of age

Petar Beron

On May 1st 2015 Vladimir and I camped in front of the cave Svinskata Dupka near the Lakatnik railway station. The idea was to celebrate the visit of this cave 60 years earlier – my first cave. Beshkov, who introduced me to caves, had already visited the karst of Lakatnik and Karlukovo, and, more importans, knew Petar Tranteev, who was for many years our guide and teacher in the dark world of caves.

For all these years I was working in permanent colaboration with one of the most learned and remarquable Bulgarian zoologists. There were no computers, internet, xeroxes, even typewriters were a problem. To exchange knowledge and ideas with people like "Beshkata" was important and often one idea has been developed into another – for publications, expeditions and simple humane ties.

Vladimir Anastasov Beshkov was born in Sofia on 10.09.1935, in the family of the prominent Bulgarian geographer Prof. Anastas Beshkov, Member of the Bulgarian Academy of Sciences. His childhood was spent in Svishtov, where his father was professor in geography. Vladimir graduated in the Faculty of Biology, Geology and Geography of the University of Sofia in 1959 and was appointed to the Institute of Zoology of BAS, where he retired in 1995. Besides his main field – Herpetology – Beshkov was very interested in exploring caves and we visited together many of them (and discovered some). Since 1958 we were among the first to make rope laders for descending pot holes, we were exploring new caves with very limited resources while there were no caving clubs or federation.

We started also the first post-war bat ringing and Vladimir remained interested in bats ever since and wrote some papers on them.

The main field of interest of V. Beshkov (Doctor since 1979) remained the reptiles and amphibians. He is now the dean of Bulgarian herpetologists and still helps the younger colleagues in their work. As early as in 1964 we published with him a Catalogue and Bibliography of Bulgarian herpetofauna – the third phase of research on these animals, after Kovatchev and Buresch and Tzonkov. Beshkov's work and personality was highly appreciated by Acad. Dr. Buresch, who published with him an interesting article on *Vipera aspis*. So far Beshkov has written 83 scientific papers, including two books, on the taxonomy, ecology, biology and distribution of Bulgarian amphibians and reptiles and on bats.

Particularly important are his actions for understanding the biology of the snakes in Maleshevska planina (SW Bulgaria), where two thirds of the snake species in Bulgaria live. He greatly contributed with studying the biology of a set of little explored species in this region. Another phenomenon, discovered by V. Beshkov, was the vertical, directional breeding migration of *Rana temporaria* in the lowland near Botevgrad, one of the longest worldwide that could be up to 10 km. This research, carefully carried out for a long time, is of universal importance for the better understanding of the biology of this mountain frog. His efforts are being rewarded with the established protected area the marsh "Muchalnitsa" that is first and the single protected area specially dedicated for amphibian species. Beshkov's research on *Rana graeca* is fundamental for the knowledge of the biology of this little known species. He greatly contributed to herpetospe-

cies faunistics, driving the main framework of their distributional pattern. Beshkov is working for the protection of tortoises and other amphibians and reptiles in Bulgaria and achieved legal results in this field. He started a conservation campaign for the administrative protection of the tortoises' species in the late seventies. Among the main contribution of Beshkov are the amphibians and reptiles texts in the first and the second editions of the national red data book. Another contribution of Beshkov is his activity as consultant of many films about the nature, having received high international awards.

Beshkov was (and remains) interested in traveling to the wonders of the world. Since 1971 it became easier to travel abroad and we started our expeditions first to neighbouring Greece and Turkey, to Iran, Iraq, Syria, Lebanon, and later to far away countries. These travels were difficult, but we were young and everything seemed amazing. Traveling on his motorcycle with side-car, with very little (mostly our own) money, spending the night on the open, we were happy nevertheless. We were (and still are) very interested in monuments, temples, museums, and during the two month tour of the Near East with our friend Tanyu Michev in 1972 we saw a lot – Palmira, Baalbek, Persepolis, Capadokia, mountains like Erjias, Suphan and Elburs, caves and interesting people. Later, with the same motocycle, we visited some Greek islands, Crete and discovered the unusual cave fauna of Santorini. Many new species have been collected and described as a result of these travels.

A memorable travel was the one in East Africa in 1983. After two months in Mozambique, we visited Zimbabwe, Zambia and Tanzania, including Zanzibar, climbed Kilimanjaro and saw many exotic things. Beshkov is fond of mountains and, besides the high summits where we have been together (Erdjias, Suphan, Demavend, Kilimanjaro, Ruwenzori, Kerinci, Rinjani, Greek and Bulgarian mountains), he reached the tops of some others (Ararat, Kazbeg, Elbrus).

In 1994 we traveled in Indonesia and visited Sumatra, Java, Nias, Bali, Nusa Penida, Lombok, Sumba, Sumbawa, Komodo, Flores and Timor. For a herpetologist to see the dragons of Komodo was a life-time experience. Meanwhile Beshkov visited the United States, invited by his partner Prof. Jameson.

We traveled again in East Africa (Kenya and Uganda) in 1993, climbing the summit Ruwenzori and visiting Elgon and some other places in these countries.

Beshkov knows in details Bulgaria, even the smallest villages and hills. With his remarkable memory, inherited from his father, he often helps zoogeographers and makers of atlases of different Bulgarian animals. Vladimir Beshkov remains involved in the protection of nature and made many expert assessments for different projects. With his typical honesty and firmness his assessments are accurate and reflect the real situation in the explored areas.

The activity of Beshkov in protecting the tortoises, the habitats of the Alpine newt, the important breeding pond of *Rana temporaria* near Botevgrad and others contributed to enhancing of public awareness what concerns the amphibians and reptiles.

Beshkov often collects invertebrates in caves and was honoured by specialists who named after him one new genus of cave beetles (*Beskovia*) and 12 species and subspecies of animals (Nematoda, Isopoda, Chilopoda, Diplopoda, Araneae, Acari, Coleoptera, and Amphibia) from Bulgaria, Greece, Indonesia (Sumatra) and Uganda.

For me one of the most important contributions of Vladimir Beshkov to zoology is his son Stoyan, Lepidopterist and fighter for the preserving of Bulgarian nature.

Publications of Dr Vladimir Beshkov (Beškov, Bechkov, Beschkov)

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Taxa honouring Dr Vladimir Beshkov

To Vladimir Beshkov are dedicated one genus (*Beskovia*) and 12 species and subspecies of animals, described by specialists from Bulgaria, France, Germany and Russia. They originate from Bulgaria, Greece, Uganda and Indonesia (Sumatra).

Nematoda
Fam. Filariidae
Litomosa beshkovi Jančev, 1971
Comptes rendus de l'Académie bulgare des Sciences
Bulgaria, parasite
Crustacea
Isopoda Oniscidea
Fam. Trichoniscidae
Trichoniscus beschkovi Andreev, 1986
Biologia Gallo-Hellenica, **11**(2): 158
Greece, cave
Arachnida
Opiliones
Fam. Sironidae
Siro beshkovi Mitov, 1994
Spixiana, **17**(3): 275
(Now *Cyphophthalmus beshkovi*)
Bulgaria, cave
Araneae
Fam. Linyphiidae
Lepthyphantes beshkovi Deltshev, 1979
Acta zoologica bulgarica, **13**: 60
Crete, cave
Fam. Nesticidae
Nesticus beshkovi Deltshev, 1979
Acta zoologica bulgarica, **13**: 54
Crete, cave
Acari
Acariformes
Fam. Ophioptidae
Ophioptes beshkovi Beron, 1974
C.R. de l'Acad. bulg. des Sciences, **27**(5): 691
Bulgaria
Myriapoda
Chilopoda
Lithobius beshkovi Matic et Golemansky, 1967
Bull. Inst. Zool. Mus., Sofia, **24**: 127
(Now *Lithobius* (*L.*) *rushovensis* Matic, 1967)
Bulgaria, cave
Diplopoda
Fam. Trichopolydesmidae
Sphaeroparia beshkovi Mauriès et Heymer, 1996
Bull. Mus. nat. Hist. nat. Paris, **18**, Sect.A (1-2):
Uganda
Fam. Paradoxosomatidae
Tectoporus beshkovi Golovatch, 1996
Arthropoda Selecta, **5**(3- 4): 139
Sumatra
Fam. Schizopetalidae
Balkanopetalum beskovi Strasser, 1973
Ann. Zool., Warszawa, **30**(15): 427
Bulgaria, cave
Insecta
Coleoptera
Fam. Carabidae
Duvalius beshkovi Coiffait, 1970
Ann. de Spéléologie, Toulouse, **25**(3): 721
Bulgaria, cave
Fam. Leiodidae
Beskovia V. Guéorguiev, 1960
C. R. Acad. bulg. Sci., Sofia, **13**(6): 723
Bulgaria, cave
Vertebrata
Amphibia Caudata
Fam. Salamandridae
Salamandra salamandra beshkovi Obst, 1981
Faunist. Abh. Staatl. Mus. Tierkunde in Dresden
Bulgaria

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Доц. д-р Владимир Бешков на 80 години

Петър Берон

(Резюме)

Статията е посветена на 80-годишнината от рождението на видния български зоолог д-р Владимир Бешков, изследовател на пещерите, прилепите, земноводните и влечугите. Д-р Бешков е автор на 83 научни и на множество популярни статии за пещери, животни, защита на природата и паметници на културата. Забележителни негови постижения са подробното изследване на змиите в Малешевската планина, откриването и изследването на уникалната миграция на планинската жаба в Ботевградско, защитата на костенурките и на други земноводни и влечуги и много други.

На името на д-р Владимир Бешков са наречени един род (*Beskovia*) и 12 вида и подвида животни от България, Гърция, Уганда и Индонезия (Суматра) от специалисти от България, Франция, Германия и Русия.

Historia naturalis bulgarica, 22: 99-100, 2015

Otopheidomenidae (Acari: Mesostigmata) – a new mite family for the fauna of Bulgaria and the Balkan Peninsula

Petar Beron

Abstract: A record of *Hemipteroseius adleri* Costa, 1968: the first member of family Otopheidomenidae (Acari) in Bulgaria, on *Pyrrhocoris apterus* (Hemiptera).

Key words: Acari, Otopheidomenidae, Hemiptera, *Pyrrhocoris apterus,* Bulgaria

Mites – ectoparasites on insects of the family Otopheidomenidae live as haemolymph sucking on Lepidoptera (Otopheidomeninae), Hemiptera Heteroptera (Treatiinae), Orthoptera (Katydiseiinae) and Isoptera (the genus *Eickwortius* Zhang, 1995) (Prasad, 2011). Recently the specialist in Heteroptera Dr N. Simov found on the red firebug *Pyrrhocoris apterus* L. (Pyrrocoridae), a very common species in Bulgaria, several mites belonging to Otopheidomenidae. The mites were found under the hemielytrae of the bugs and were identified as the species *Hemipteroseius adleri* Costa, described from Israel on the same bug species and on another one (*Scantius aegyptius* L.) by Costa (1968). Later the species of Costa has been found in Europe (Poland, Lewandowski & Szafranek, 2005), than also from Lithuania (Chmielewski, 2006a, 2006b), Hungary (Kontschan & Gyuris, 2010) and Slovakia (Fend'a, 2011) – mostly in northern and central Europe. Other species of genus Hemipteroseius Evans, 1963 have been found on Pyrrhocoridae and Lygaeidae in Nigeria, India, Congo, Mexico, Jamaica, Cuba, Haiti, Puerto Rico, other Carribean islands, and Panama – all of them in tropical countries (Zhang, 1995).

Hemipteroseius adleri Costa, 1968 – many, Sofia, October 15th, 2013, N. Simov leg., P. Beron det.

The family is new for the fauna of Bulgaria and the Balkan Peninsula.

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Otopheidomenidae (Acari: Mesostigmata) – ново семейство акари за фауната на България и Балканския полуостров

Петър Берон

(Резюме)

Съобщава се за пръв път в България *Hemipteroseius adleri* по *Pyrrhocoris apterus* (Heteroptera: Pyrrhocoridae) – представител на новото за Балканския полуостров семейство акари Otopheidomenidae (Acari: Mesostigmata).

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Observations of Pigmy Owl (*Glaucidium passerinum*) and Three-toed Woodpecker (*Picoides tridactylus*) in Mt. Durmitor, Montenegro

Peter Shurulinkov, Daria Fedchuk

Abstract: Localities of Pigmy Owls (*Glaucidium passerinum*) and Three-toed Woodpeckers (*Picoides tridactylus*) have been recorded in October 2014 in the old-growth coniferous forests of Mt. Durmitor, Montenegro. Both species are very rare glacial relicts found in few occasions in that country.

Key words: Pigmy Owl, Three-toed Woodpecker, Montenegro, Durmitor

Pigmy Owl (*Glaucidium passerinum*) and Three-toed Woodpecker (*Picoides tridactylus*) are rare and endangered species in the Balkan peninsula, having highly fragmented distribution and considered as glacial relicts (Simeonov et al.,1990; Nankinov et al., 1997).Their distribution and numbers are actively studied during the last 20 years in Bulgaria and Serbia (Shurulinkov et al., 2003, Shurulinkov et al., 2012, Spiridonov et al., 2008 Rajkovic et al., 2013) but are not well known in the Western Balkans, especially in Montenegro, Albania, Macedonia and Kosovo.

During a two day field expedition in the forest zone of Mt. Durmitor, Montenegro (1. to 2. 10.2014) we conducted daytime transects using sound imitations of the voice of Pigmy Owl and Three-toed Woodpecker. Imitation was played at points situated at every 500 metres. On 1.10.2014 we passed the route from Ivan Dol through Zmijno Lake, Surdup and up to Crepulj poljana (about 5 km).

Pigmy Owl was found at two localities and Three-toed Woodpecker also at two localities, all of them on 1.10.2014. First record of a Pigmy Owl was made in a 100-150 years old spruce (*Picea abies*) forest with some firs (*Abies alba*) at Zmijno Lake, 1520 m.asl., at 12:00 hrs. The bird was a male which was heard to perform its mating song. After that it was attracted by our playback and was observed at a distance of 10 m and photographed (Fig.1). The second Pigmy Owl was also attracted and observed in 100-years old spruce forest with beech (*Fagus sp.*) and fir at 1600 m asl., at 650 m from the first locality of the same species (13:30 hrs). That bird performed only alarm call.

Three- toed Woodpecker was found also at two places, at a distance of 780 m between them. First locality was at "Surdup" area where one female was observed and photographed (Fig.2).The forest was 100-years old spruce forest with presence of beech and fir, on a very steep slope, at 1590 m asl. The bird was feeding on a dry tree. It was first heard knocking on the bark of the tree and then seen by us without acoustic provocation. The second Three-toed Woodpecker was male and was observed again without sound provocation in a 120-years old spruce-fir forest, at 1568 m asl. At this locality some cut trees were present which was probably made for sanitary cutting. The percent of the dry standing trees in both localities of Three-toed Woodpecker was in frames of 3-5%.

Pigmy Owl was reported as a possible breeding species in Montenegro for the area of Kolašin where one individual was observed from 5 m in Austrian Pine (*Pinus nigra*) forest on 2.05.1978 (Rašajski & Gavrilov, 1983). The total population of the Pigmy Owl in Montenegro was estimated at 3-5 breeding

Fig. 1. Pigmy Owl (*Glaucidium passerinum*), Mt. Durmitor, 1.10.2014, photo: Peter Shurulinkov

Fig. 2. Three-toed Woodpecker (*Picoides tridactylus*), Mt. Durmitor, 1.10.2014. photo: Peter Shurulinkov

pairs and in Serbia at 5-10 pairs (Puzovic et al., 2003). In neighbouring Bosnia and Herzegovina the species is reported to be a regular breeding species with preliminary numbers estimated at 50-100 pairs (Kostrošan & Hatibovic, 2012).

Three-toed Woodpecker has been observed at Mt. Durmitor in 1890 (Reiser & Fuhrer, 1896) and recently between Zabljak and Crno Lake on 28.07.2004 (Steiner, 2004). The species was mapped as a breeding bird in two 50X50 UTM squares of Montenegro (Hagemeijer & Blair, 1997) The total population of Three-toed Woodpecker in Montenegro was estimated at 40-80 breeding pairs (Puzovic et al., 2003).

In Serbia the Three-toed Woodpecker is a very rare species and nests mostly in mountain massifs situated in the southwestern parts of the country – at Prokletije, Kamena gora, Zlatar, Kopaonik and Tara and the numbers were estimated at minimum 5 pairs (Vasic et al., 2009).

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Наблюдения върху малката кукумявка (*Glaucidium passerinum*) и трипръстия кълвач (*Picoides tridactylus*) в планината Дурмитор, Черна Гора

Петър Шурулинков, Даря Федчук

(Резюме)

През октомври 2014 г бяха установени находища на врабчова кукумявка (*Glaucidium passerinum*) и трипръст кълвач (*Picoides tridactylus*) в стари иглолистни гори в планината Дурмитор, Черна гора. И двата вида са много редки глациални реликти регистрирани в единични случаи в тази държава.