Historia naturalis bulgarica, 23: 109-118, 2016

Endemics and relicts in the high-mountain fauna of Bulgaria

Petar Beron

Abstract: The orophyte zone in Bulgarian mountains is about 1.37% of Bulgarian territory in eight mountains higher than 2000 m). Rila and Pirin are the only mountains higher than 2400 m and most of the relicts and endemics are centered in these mountains.

Key words: Endemics, relicts, high-mountain fauna, Bulgaria

The orophyte zone in the Bulgarian mountains starts usually at 1900 – 2200 m a.s.l. This is the upper limit of the closed high forest (the mountain fur excluded). This high mountain (orophytic) zone of Bulgaria consists of 1.37% of Bulgarian territory (above 2000 m are 1.05% of the total surface of Bulgaria, the land above 2500 m – 0.18%.) in eight mountains (Rila – 2925 m a.s.l., Pirin – 2914 m, Stara planina – 2386 m, Vitosha – 2290 m, Ossogovska planina – 2261 m, Slavyanka – 2212 m, Rhodopes – 2191 m, Belassitsa – 2029 m). Particularly important are the mountains exceeding 2400 m a.s.l. (Rila and Pirin). Here are represented the ''true" high-mountain dwellers, excluding the inhabitants of the ecotone and the carried – away specimens.

If we consider as high-mountain fauna the animals living higher than 1900 m a.s.l., in the eight Bulgarian mountains exceeding 2000 m at least 2300 species of terrestrial Metazoa have been recorded above 1900 m (Beron, 1999, with supplements). The highest mountains (Rila and Pirin) have been glaciated, but at present there are no glaciers. These mountains contain the highest number of glacial relicts, but such relicts are found also on the territory of Vitosha, Central Balkan (Stara planina), Ossogovska planina and Slavyanka Mountains.

The glacial relicts in Bulgaria were firstly summarised first by Buresch & Arndt (1926), than Beron (1969) collated a list of "boreoalpine" species in Bulgaria. Recently several detailed studies of the fauna of Rila, Pirin and Central Balkan (Sakalian V., Ed., 1997; Sakalian M., Ed., 2000a, 2000b) contributed greatly to the knowledge of these animals (several groups). Most animals living on the top of Bulgarian (and other) mountains could be considered as neoendemics.

Development of the high mountain environment in Bulgaria

The development of the fauna is closely related with the development of the plant communities and is indeed determined by it. It is justified to consider here only the changes of the vegetation in the last 15 000 years (the Glacial and Postglacial time, or the end of the Pleistocene and the entire Holocene). According to Palamarev (1982), "The coniferous forests become dominant formation in Rila, Pirin and Rhodopes between 1000 and 2000 m by the end of the Subboreal and the beginning of the Subatlantic phase. In the same time above the timber line there have been developed groups of mountain pines and alpine herbaceous communities". The majority of our knowledge on the history of the high-mountain flora in the Rila and Pirin Mountains we owe to Dr E. Bojilova (Božilova) and her associates. According her (Božilova, 1995), our information about the changes of the upper forest line in the Rila Mountains goes to the end of the last glaciation (10 500 years ago). In the arid climatic conditions during the Glacial periods forest vegetation has not been developed in the mountains of South Europe. The present-day upper forest line (formed by *Pinus sylvestris*, *P. peuce* and *Picea abies*) has taken shape only in the Subatlantic time (less than 7000 years

ago). With the beginning of the Atlantic phase (8000 years BP) domination of *Pinus sylvestris* and *P. peuce* starts. By contrast with Stara planina, in the Rila Mountains the beech (Fagus) has never reached the upper forest limit. About 4000 years ago the upper forest line has been fixed already at the present day level of 2000 m a.s.l.

Endemism. Here as endemics are considered taxa which are found only on the Balkan Peninsula or have a more restricted areal (usually recorded only on one or several of its mountains).

Endemism above 1900 m a.s.l.

Oligochaeta. From the nine species of Oligochaeta known from above 1900 m three are endemics: *Dendrobaena balcanica* (Černosvitov), *D. hrabei* (Černosvitov), and *D. rhodopensis* (Černosvitov).

Gastropoda. From the 31 species, found above 1900 m, endemic for the higher parts of the Pirin Mountains are two species of *Wladislawia*: *W. polinskii* (Wagner) and *W. sztolcmani* (Wagner).

Arachnida. Endemics or relicts that have been recorded above 1900 m a.s.l. are found among Araneae and Acariformes.

Araneae. Endemism is high among the high-altitude spiders. From 192 species living above 1900 m, 12 (6,2 %) are Bulgarian and local endemics:

Fam. Zodariidae:

Zodarion pirini Drenski – Pirin, Rhodope, Rila and Vitosha Mountains.

Fam. Linyphiidae (incl. Erigonidae)

Araeoncus clivifrons Deltshev – Rila and Pirin, not found below the upper border of the forest (Deltshev).

Erigone pirini Deltchev – Pirin, Rila, Stara planina.

Diplocephalus altimontanus Deltshev – Pirin.

Metopobactrus orbelicus Deltshev – Pirin and Rila.

Antrohyphantes rhodopensis (Drenski) – Pirin, Rila.

Drepanotylus pirinicus Deltchev – Pirin.

Centromerus paucidentatus Deltchev – Pirin and Rila.

Mughyphantes lithoclasicolus (Deltchev) – Pirin and Rila.

Tenuiphantes drenskii (Helsdingen) – Rila.

Mansuphantes rectilamellus (Deltshev) – Pirin.

Fam. Lycosidae: *Pardosa drenskii* Buchar – Vitosha, Pirin, Rila, Stara planina Mountains.

Acari

Acariformes.

Prostigmata. Currently some terrestrial Prostigmata are considered endemic:

Fam. Scutacaridae: *Scutacarus pirinicus* Dobrev – Pirin, Stara planina Mountains

Fam. Trombiculidae: *Neotrombicula monticola* Kolebinova – Pirin

Fam. Erythraeidae: *Erythraeus rilensis* Beron, *E. bulgaromontanus* Beron – Rila

Oribatida

Fam. Carabodidae: *Carabodes pirinensis* Kunst – Pirin

Fam. Eremaeidae: *Eremaeus valkanovi* Kunst

Pauropoda

Fam. Pauropodidae: *Allopauropus doryphorus* Remy – Rila

Chilopoda

Lithobiomorpha

Fam. Lithobiidae: *Lithobius* (L.) *borisi* Verhoeff – Pirin

L. (*L.*) *electron* Verhoeff – W. Rhodopes

L.(*L.*) *glaciei* Verhoeff – Ossogovo

Fam. Geophilomorpha

Fam. Geophilidae

Geophilus rhodopensis Kaczmarek – W. Rhodopes, Vitosha

Diplopoda

Iulida

Fam. Iulidae:

Leptoiulus borisi Verhoeff – Rila, Vitosha, Pirin

Megaphyllum glossulifer (Schubart) – Rila

M. rhodopinus (Verhoeff) – Rhodopes, Slavyanka, Pirin

Chordeumatida

Fam. Anthroleucosomatidae: *Bulgarosoma superficiei* Strasser – Vitosha

Insecta s.l.

Collembola. In the pot holes of the higher parts of Pirin we have collected some species, described as new and so far considered endemic (Pomorski, 2006).

Fam. Onychiuridae

Onychiuroides bojani Pomorski, *O. peteri* Pomorski, *O. pirinicus* Pomorski – Pirin Mountains

Orthoptera. The endemism in the mountain species of Orthoptera from Bulgaria has been outlined by Peschev (1987). Most of the species, enumerated as "paleoendemics" or "neoendemics", are not distributed above 1900 m. All the "paleoendemic" species and the high-mountain "neoendemics" are *Poecilimon* spp. from Pirin. According to Popov (1997b), the species of Orthoptera from the Pirin National Park could be considered as endemics (neoendemics). However, only five of them are recorded above 1900 m a.s.l.: *Poecilimon harzi* Peshev (1500-2400 m, endemic for Pirin), *P. m. mistshenkoi*

Peshev (1250-2000 m, endemic for Pirin), *P. orbelicus* Panč. (900-2400 m, Balkan endemic), *Metrioptera arnoldi* Ramme (1200-2200 m, Balkan endemic), and *Pholidoptera aptera karnyi* (Ebner) (950-2400 m, Balkan endemic).

In the Rila National Park six species are considered as Balkan endemics by Popov (in Hubenov et al., 2000a) as Balkan endemics, four of them living above 1900 m. Three of them coincide with the endemics recorded in the higher parts of Pirin Mountains: *Poecilimon orbelicus* Panč., *Metrioptera arnoldi* Ramme and *Pholidoptera aptera karnyi* (Ebner). The fourth is *Psorodonotus fieberi* Friv. (recorded from the Rila, Rhodope, Belassitsa, and Stara planina Mountains). In Central Balkan National Park five Balkan endemics were recorded so far (Popov, in Hubenov et al., 2000b), including four living above 1900 m. Again three species are found also in the high parts of Rila: *Metrioptera arnoldi* Ramme, *Pholidoptera aptera karnyi* (Ebner) and *Psorodonotus fieberi* Friv. The fourth species is *Isophya obtusa* Br.-W. As local endemics is described the subspecies *Isophia pravdini bazyluki* Peshev.

Altogether, from 44 species of Orthoptera, found in Bulgaria higher than 1900 m, the following eight (18,2 %) could be considered endemics (all of them members of Tettigoniidae): *Isophia obtusa* Br.-W., *I. rhodopensis* Ramme, *I. pravdini bazyluki* Peshev, *Poecilimon harzi* Peshev, *P. m. mistshenkoi* Peshev, *P. orbelicus* Panc. (Balkan endemic), *Pholidoptera aptera karnyi* (Ebner)(Balkan endemic), *Metrioptera arnoldi* Ramme.

Plecoptera. From the 101 species of this order in Bulgaria 16 live above 1900 m, including ten endemic species (ca. 10%):

Fam. Taeniopterygidae:

Brachyptera bulgarica Raušer (Pirin)

Fam. Nemouridae:

Nemoura bulgarica Raušer (Stara planina, Rila, Pirin, Rhodope)

N. pirinensis Raušer (Stara planina, Rila, Pirin, Rhodope)

Protonemoura tarda Braasch (Rila and Pirin)

P. mattheyi (Aubert)(Balkan endemic)

Fam. Leuctridae:

Leuctra joosti Braasch (Vitoscha, Pirin)

L. kumanskii Braasch et Joost (Pirin)

Fam. Perlodidae:

Isoperla buresi Raušer (Rila, Pirin, Rhodope)

Chloroperla russevi Braasch (Balkan endemic)

Ch. kozarovi Braasch (Balkan endemic)

Coleoptera

Fam. Carabidae. Endemic ground beetles (Carabidae) in Bulgaria has been studied by Guéorguiev in Sakalian & Guéorguiev (1997). According to these authors among the 756 species and subspecies of Carabidae in Bulgaria 125 species and subspecies, belonging to 34 genera, are Balkan endemics (some of them Bulgarian or local endemics). "The lowest level of endemism diversity has been observed in the orophyte zone: 32 (34.04%). Although as few as eight endemic carabid taxa occur in Bulgaria only within this zone, as many as seven of them, or 19,44% of the total local endemics, are confined to the orophyte belt, this share being the highest among Bulgaria's local epigean endemics – (p.33-34).

Our analysis has shown that above 1900 m in Bulgaria 30 species and 17 subspecies of endemic ground beetles have been found. They belong to 15 genera, as follows:

Duvalius (*Paraduvalius*) *klimai* Janák et Moravec – Bulgarian endemic

D. (*Paraduvalius*) *kuboni* Janák et Moravec – Bulgarian endemic

Carabus violaceus azurescens Dejean – Balkan endemic

C. cavernosus cavernosus Friv. – Balkan endemic

Cychrus semigranosus balcanicus Hopffg. – Balkan endemic

Nebria eugeniae Daniel – Endemic to Rila

N. hybrida hybrida Rottenberg – Rila

N. hybrida pirinensis Horv. – Endemic to Pirin

N. hybrida rhodopensis Horv. – Rhodope

N. rhilensis Friv. – Endemic to Rila and Pirin

Trechus bohemorum Pawlowski – Endemic to Rila and Pirin

T. cardioderus balcanicus Jeannel – Balkan endemic

T. demircapicus Moravec – Endemic to Pirin

T. gulickai Löbl – Endemic to Pirin

T. matrismeae Pawlowski – Rhodope

T. merkli Pawl. – Western Stara planina (endemic to Stara planina)

T. orphaeus Pawlovski – Endemic to Rila

T. pirinicus Pawlowski – Endemic to Pirin

T. priapus Daniel – Balkan endemic

T. rambouseki Breit – Endemic to Rila

T. rhilensis Kaufmann – Endemic to Vitosha and Rila

T. rhodopeius Jeannel – Endemic to Bulgaria

T. szujeckii Pawlowski – Rhodope

Asaphidion caraboides balcanicus Netolitzky – Balkan endemic

Bembidion rhodopense Apf. – Balkan endemic

Xenion ignitum (Kraatz) – Balkan endemic

Pterostichus rh. rhilensis Rottb. – Rila, Rhodope, Stara planina

P. rhilensis kourili Mařan – Endemic subspecies in Pirin

P. rhilensis vitosensis Mařan – Vitosha, Central Balkan

P. macedonicus Apfelbeck – Belasitsa, Stara planina (Balkan endemic)

Tapinopterus balcanicus balcanicus Ganglbauer – Bulgaria

T. balcanicus belasicensis Mařan – Belassitsa

T. kaufmanni kalofirensis Mařan – Bulgarian endemic

T. kaufmanni winkleri Mandl – Stara planina, East Serbia (Balkan endemic)

T. kaufmanni kulti Mařan – Rila, Rhodope

Molops alpestris centralis Mlynař – endemic for Bulgaria

M. alpestris kalofericus Mlynař – endemic for Bulgaria

M. alpestris rhilensis Apfelbeck – Endemic for Bulgaria

M. dilatatus dilatatus Chaudoir – Balkan endemic

M. dilatatus angulicollis G. Müller – endemic for Bulgaria

M. piceus bulgaricus Mařan – Macedonia, Bulgaria (Balkan endemic)

M. rhodopensis rhodopensis Apfelbeck – Endemic for Bulgaria

Calathus ellipticus Reitter – Balkan endemic

C. metallicus aeneus Putzeys – Balkan endemic

Laemostenus plasoni (Reitter) – Endemic for Bulgaria

Amara messae Baliani – Balkan endemic

Zabrus rhodopensis Apfelbeck – Balkan endemic

Fam. Dytiscidae. From 27 species living above 1900 m only *Agabus balcanicus* Hlisnikovsky (Pirin, Vitosha, Rila, Stara planina, Slavyanka Mountains), the subspecies *Agabus solieri falcozi* Guignot (Pirin) and *Illybius fuliginosus pirinicus* Guéorguiev (Pirin) could be considered endemic.

Fam. Staphylinidae. From the 124 species of row beetles known from Bulgaria above 1900 m there are 20 Bulgarian and local endemics (16.6%): *Omalium bulgaricum* Zerche, *Deliphrosoma pirinense* Zerche (endemics for Pirin), *Geodromicus schuberti* Scheerpeltz, *Gabrius beroni* Raitschev (Ossogovska planina), *Atheta scintillans* Scheerpeltz, *Leptusa rhilensis* Pace, *Ocalea bulgarica* Scheerpeltz, *Ocyusa ferdinandicoburgi* Rambousek, *O. regisborisi* Scheerpeltz, *Ophthalmoniphetodes longicornis* Zerche (Pirin), *O. maljovicensis* Zerche (Rila), *O. piger* Zerche (Rila), *O. gracilis* Zerche (Pirin), *O. rhilensis* Zerche (Rila), *O. macrocephalus* Zerche (Pirin), *O. musalensis* Zerche (Rila), *O. ilievi* Zerche (Vitosha), *O. behnei* Zerche (Vitosha, Rila), *O. doeblerae* Zerche (Rila), *O. heidemariae* Zerche (Pirin). Particularly interesting is the genus *Ophthalmoniphetodes*, studied by L. Zerche.

Fam. Curculionidae. Among the 63 weevil species found above 1900 m the following eight (12,7%) are endemic: *Otiorrrhynchus biformatus* Mazur (Pirin), *O. rhilensis* Stierlin (Rila, Rhodope, Central Balkan, Pirin, Vitosha, 1700 – 2600 m), *O. joakimoffi* Apfelbeck (Pirin, Rila), *O. serdicanus* Apfelbeck (Pirin, Rila, Vitosha), *Plinthus sturmi bulgaricus* Meregalli, *Omias taygetanus* Purkyne (Balkan endemic), *Tachyphloeus bosnicus* Apfelbeck (Balkan endemic), *Alophus rhodopensis* Reitter (Vitosha, Rila, Pirin, Rhodope).

Fam. Elateridae. From the nine species of click beetles living above 1900 m endemic for Bulgaria is *Ctenicera schneebergi* Roubal.

Fam. Chrysomelidae. Among the 43 leaf beetles that are found above 1900 m Balkan endemic is *Oreina speciossisima drenskii* (Gruev). *Luperus rhilensis* Weise is endemic for Rila Mountains. Among the 289 species of leaf beetles in Pirin (Gruev, 2006) there are six Balkan endemics and one (*Longitarsus behnei* Gruev et Arnold) is local endemic.

Fam. Leiodidae. *Catops pirinensis* Zerche is endemic for the Pirin Mountains (Vihren, 2100 -1500 m).

Heteroptera. *Dimorphocoris fuscus* Joakimoff is endemic for Rila, Pirin and Vitosha.

Trichoptera. Among the 57 species of caddis flies known to occur in Pirin National Park (73 in the whole of Pirin), 13-14 species of the families Rhyacophilidae, Glossosomatidae and Limnephilidae are considered by Kumanski (1997) to be endemic. Some species or subspecies are Bulgarian endemics (*Rhyacophila pseudotristis* Kumanski, *Rh. braaschi* Malicky et Kumanski, *Synagapetus montanus* Kumanski, *Drusus romanicus meridionalis* Botosaneanu et Riedel, *D. discophorus pallidus* Kumanski, *Chaetopteroides bulgaricus* (Kumanski), *Psilopteryx schmidi* Marinković, and *Wormaldia bulgarica* Novak). All endemics reach altitudes above 1900 m.

Kumanski (in Hubenov et al., 2000a) provides a list of 11 Balkan, ten Bulgarian and one local endemics, recorded in the Rila National Park. Among them the Balkan endemics *Rhyacophila loxias* Schmid, *Wormaldia bulgarica* Novak, *Drusus botosaneanui* Kumanski, *Rhadicoleptus alpestris macedonicus* Botosaneanu et Riedel, *Chaetopteryx stankovici* Marinković, *Annitella triloba* Marinković-Gospodnetić, the Bulgarian endemics *Rhyacophila*

pseudotristis Kumanski, *Rh. obtusa* Klapálek, *Synagapetus montanus* Kumanski, *Drusus romanicus meridionalis* Botosaneanu et Riedel, *D. discophorus pallidus* Kumanski, *Chaetopteroides bulgaricus* (Kumanski), *Psilopteryx schmidti* Marinković, and the regional endemic *Chionophylax monteryla* Botosaneanu, all being recorded above 1900 m. Kumanski (in Hubenov et al., 2000b) reports four caddis flies from the Central Balkan National Park above 1900 m: one Balkan endemic and three Bulgarian endemics in Central Balkan National Park (*Rhyacophila loxias* Schmid, *Rh. obtusa* Klapálek, *Rh. kownackiana* Szczesny, and *Drusus botosaneanui* Kumanski).

Altogether, according to Kumanski (in Hubenov et al., 2000), out of 244 species of Trichoptera in Bulgaria, 17 species are endemic for Bulgaria (incl. nine living above 1900 m) and 16 sp. are endemic for the Balkan Peninsula (incl. five living above 1900 m), or the endemic Trichoptera in the Bulgarian high-altitude zone are 14. Represented are the families Rhyacophilidae (four sp.), Glossosomatidae (one species), Philopotamidae (one species), and Limnephilidae (eight species).

Lepidoptera. In the Pirin National Park five species have been found only in the alpine belt and are considered "characteristic endemics" (Abadjiev, 1997): *Erebia rhodopensis* Nicholl (1900-2500 m, Balkan endemic), *E. cassioides macedonica* Buresch (2000-2600 m, endemic for Rila and Pirin), *Euphydryas cynthia leonhardi* (Röber) (2000-2800 m, endemic for Rila and Pirin), *Boloria pales rilaensis* Varga (2600-2800 m, endemic for Rila and Pirin) and *Glacies coracina bureschi* Varga (2600-2900 m, local endemic).

Relicts.

The notion of "relict".

According to Wikipedia, "In biology a relict (or relic) is an organism that at an earlier time was abundant in a large area but now occurs at only one or a few small areas".

This notion has been discussed still by Wangerin (1912). However, some authors contest the very notion of "relict". We may quote Brignoli (1979), discussing the cave spiders:

"pour connaître l'histoire de peuplement d'une région, les troglobies n'ont aucune valeure spéciale. Tous les animaux ont la même importance ..."

"il n'est pas du tout vrai (ou, au moins, ce n'est pas du tout sûr) que les troglobies sont anciens."

"La terme de "relicte" (ou même de "fossile vivant") si souvent employé pour les troglobies, n'a pour moi aucun sense."

For me this opinion is too generalising. Relics and even "living fossils" exist in many groups (classic examples being animals like *Latimeria*, *Sphenodon*, and *Okapia*). For some groups such as the Pseudoscorpions, the relics are indisputable. Such are the *Troglochthonius* from ex-Yugoslavian caves and the species of the family Syarinidae (Chitrellinae). In the caves of Santorin and Iraklia we had the chance to find the first Syarinidae in Balkan Peninsula (*Hadoblothrus aegaeus* Beron). The specialists consider the Chitrellinae on the Europe as relicts. Beier (1969): "Syarinidae: Wohl bei keiner anderen Familie ist der Reliktcharakter so ausgeprägt". Another good example is the cave Opilion *Paralola buresi* (Laniatores, Phalangodidae), living in four caves near Lakatnik (Stara planina). Here also there is another opinion of Martens (1972), disputing the widely accepted relict nature of European *Laniatores*. He says that: "The European *Laniatores* should no longer be regarded as tertiary relics for they are nowadays widely distributed inhabitants of soil litter in areas not covered by ice during the glacious periods".

According to Lopatin (1989): "As relicts are considered species (or genera), which have already left behind their time of maximal development and having areals either restricted or becoming restricted. The present day conditions of the environment do not correspond to their ecological requirements – this is the main factor determining the relict forms. The flourishing of these species is now impossible, what is witnessed by the diminution of their number and the reducing of their areals. Relicts could be very old (*Hateria*) or younger (the so-called glacial relicts, like *Lepus timidus* in Central Europe".

The notion of "relict" is widely used by biogeographers, despite of the warning of some of them to their colleagues to not allow themselves to be carried away too much (Elenevskiy & Radigina, 2002).

This notion was used widely by biospeleologists, influenced by the book of Jeannel (1942) "Les fossils vivant des cavernes". Some researchers oppose strongly this very notion, as does the prominent Italian Arachnologist Brignoli (1979): "Le terme de "relicte" (ou même de "fossile vivant") si souvent employé pour les troglobies, n'a pour moi aucun sense".

Checking in the dictionaries, we can find several interpretations of "relict".

Merriam-Webster Dictionary: "A surviving species of an otherwise extinct group of organisms; also: a remnant of a formerly widespread species that persists in an isolated area".

The Free Dictionary: "An organism or species

of an earlier time surviving in an environment that has undergone considerable change".

The botanists have three concepts to classify relicts: geographic, taxonomic, and lineage relicts.

According Birstein (1947), confirmed by Vandel (1964): "Les rélicts comme des types animaux (ou végétaux) dont l'évolution est arrêtée ou du moins fort ralentie, et qui ont conserve le facies de leurs lointains ancêtres".

Darlington (1957, but translated from the Russian edition in 1966): "Animal or plant which: 1. Keeps existing in given place after its extinction or the extinction of its related forms elsewhere (geographical relict) or 2: Exists after the extinction of most of the group (evolutionary or phylogenetical relict)."

In the recent paper by Grandcolas, Nattier & Trewick (2014) relicts (geographical or phylogenetic) are identified as „a species or a group of species remaining from a large group that is mainly extinct". They speak of "Relict species: a relict concept?".

A special type of relictual distribution is the older notion of Boreo-Alpine distribution (now are used mostly the terms of Arcto-Alpine and Boreomontane distributions). These elements in Bulgarian fauna have been discussed by Beron (1969).

Relicts in the high-mountain fauna of Bulgaria

Glacial relicts are the most typical relicts. The data about them, obtained by the beginning of XX century, have been summarised by Buresch & Arndt (1926), inspired by the work of K. Holdhaus. These authors report 63 species from Bulgaria and Macedonia, considered relicts. Prevail the Lepidoptera, already well known in Bulgarian mountains. Other groups are Carabidae and Dytiscidae (Coleoptera). Many species are known from altitude much lower than 1900 m a.s.l.

Since then a lot of new data have been obtained by various researchers. The data about most relict from Pirin have been collated in the monograph, edited by Sakalian (1997), but there are no such studies about other Bulgarian mountains. The eight articles on Orthoptera, Plecoptera, Ephemeroptera, Heteroptera, Neuroptera, Coleoptera, Trichoptera, and Lepidoptera contain information about several species of insects, glacial relicts or tertiary relicts. Important information is contained in the volumes on the Biodiversity of the National Parks Rila and Central Balkan (Sakalian M. (Ed.), 1999a, 1999b).

Arachnida.

Araneae. The orophyte zone of several Bulgarian mountains is inhabited by a number of spiders, – preglacial and glacial relicts. The numerous papers of Deltshev and other authors point at the following:

Preglacial relicts

Fam. Linyphiidae

Antrohyphantes balcanicus (Drensky)

Glacial relicts

Fam. Linyphiidae

Diplocephalus foraminifer (O.P. Cambridge) – Rila, Pirin, Stara planina (Botev Summit)(1895 – 2925 m)

Mecynargus paetulus (O.P. Cambridge) – Pirin, Stara planina (Summit Botev)(up to 2914 m)

Improphantes improbulus (Simon) – Pirin, Rila, and Stara planina (up to 2925 m)

Fam. Clubionidae

Clubiona alpicola Kulczynski – Pirin, Rila, Rhodopes, and Vitosha (up to 2914 m)

Chilopoda. Following Stoev (2007), we should take into account that "Several species have been recorded from the subalpine and alpine zones of the Bulgarian mountains, but with almost no exception all were found in the lower, forest belts as well. Only *Lithobius electron*, *L. glaciei*, and *L. borisi* have been described from the altitudes above 2000 m a.s.l. in the Rhodopes, Osogovo, and Pirin Mts. respectively, and were not collected again As a result, no real subalpine or alpine species have been found so far among the Bulgarian myriapods.

Diplopoda. Stoev (in Deltchev et al., 1999a) lists four species of Diplopoda as relicts for the Rila National Park, including two over 1900 m a.s.l.: *Leptoiulus borisi* Verhoeff and *Megaphyllum glossulifer* Schubart.

Orthoptera. Popov (1997a) considers four species of grasshoppers living in the Pirin National Park as relicts – three glacial relicts: *Melanoplus frigidus* (Boh.), *Gomphocerus sibiricus* (L.), *Aeropedellus variegatus* F.-W., and one preglacial relict *Anterastes serbicus* Br.-W. All of them are typical for the highest parts of the Bulgarian mountains. *Anterastes serbicus* is considered (together with *Gomphocerus sibiricus* and *Aeropedellus variegatus*) as glacial relict on Rila (Popov in Hubenov et al., 1999a) and (together with *Gomphocerus sibiricus* and *Melanoplus frigidus*) as glacial relict for the Central Balkan Mountains (Popov in Hubenov et al., 1999b). *Anterastes serbicus* lives also in the mountains Vitosha, Rhodope, Slavyanka, and Belassitsa, *Melanoplus frigidus* – also from Slavyanka Mountain, *Gomphocerus sibiricus* – also from Vitosha, Ossogovska planina, Belassitsa, Slavyanka, and Rhodope Mountains. Detailed analysis of the mountain Orthopterids in Bulgaria is made by Popov (2007). According to this author,

Melanoplus frigidus "is a young (glacial) relict with a typical Arctoalpine type of distribution". A relict *Stenobothrus cotticus* Kruseman et Jeekel surviving in an interglacial refugium in Rila (2300-2650 m) has been announced and analysed by Berger, Chobanov & Mayer (2010).

Coleoptera

Carabidae. From 108 species of ground beetles in Bulgaria known to live above 1900 m a.s.l. the following could be considered relicts (Sakalian in Hubenov et al., 2000a, 2000b):

Amara erratica Duftschmid – G (Rila, Pirin, Vitosha, Rhodope, Stara planina, and Ossogovska planina Mountains)

A. nigricornis Thomson – G (Rila, Stara planina)

A. quenseli (Schönherr) – G (Rila, Pirin, Stara planina, and Slavyanka Mountains)

Bembidion bipunctatum nivale (Schönherr) – G (Rila, Pirin, Vitosha, Stara planina, and Rhodope Mountains)

Nebria rufescens (Ström) (= *gyllenhali* Schönherr) – G (Rila, Pirin, Stara planina)

Dytiscidae. In the Rila National Park six species of this family are considered relicts (Sakalian in Hubenov et al., 1999a), all of them living above 1900 m: *Oreodytes davisi* Curtis, *Hydroporus tartaricus* Le Conte, *H. nivalis* Heer, *H. kraatzi* Schaum, *Potamonectes griseostriatus* (De Geer) and *Coelambus novemlineatus* Steph.

Agabus (*Gaurodytes*) *solieri* Aubé – Rila (2195-2460 m), Pirin (2190-2525 m), Vitosha (above 2000 m). West Palaearctic Boreo-Alpine species. Glacial relict.

The species *Oreodytes davisi*, *Hydroporus tartaricus* and *H. nivalis* have been recorded also from Vitosha and Pirin Mountains, *Agabus solieri* Aubé was found in Vitosha, endemic subspecies of it (*A. s. falcozi*) – in Pirin.

Hydrophilidae. The only endemic species is *Helophorus glacialis* Villa (1400-2600 m, Vitosha, Rila, Stara planina, and Pirin Mountains).

Curculionidae. As relicts is considered the species *Otiorrhynchus dubius* (Ström) (Rila Mts.)

Elateridae. Relict species are *Ctenicera cuprea* F. and *Hypnoidus riparius* (F.)

Chrysomelidae. Among the 289 species of leaf beetles in Pirin (Gruev, 2006) there are also relict.

Heteroptera. Among the 101 species of Heteroptera known to exist higher than 1900 m in Bulgaria as much as 43 species could be considered relicts (Josifov in Hubenov et al., 2000a, 2000b; Josifov in Sakalyan (ed.), 1997:

Praeglacial relicts:

Fam. Miridae: Dichrooscytus valesianus Fieber, Dimorphocoris fuscus Joakimov

Fam. Pentatomidae – *Carpocoris melanocerus* (Mulsant et Ray)

Glacial relicts:

Fam. Corixidae: *Arctocorisa carinata* (C. Sahlberg), *A. germari* (Fieber)

Fam. Miridae: *Placochilus* s. *seladonicus* (Fallén), *Lygus wagneri* Remane, *Monalocoris filicis* (L.), *Orthops basalis* (A. Costa), *O. montanus* (Schilling), *Orthotylus virescens* (Douglas et Scott), *Phoenicocoris obscurellus* (Fallén), *Phytocoris pini* Kirschbaum, *Pinalitus rubricatus* (Fallén), *Globiceps dispar* Boh., *G. flavomaculatus* (F.), *Psallus haematodes* (Gmellin), *Atractotomus magnicornis* (Fallén), *Bryocoris pteridis* (Fallén), *Calocoris alpestris* (Meyer – Dür), *C. sexguttatus* (Fabricius)

Fam. Anthocoridae: *Anthocoris nemorum* (L.), *Acompocoris alpinus* Reuter

Fam. Reduviidae: *Rhinocoris annulatus* (L.)

Fam. Nabidae: *Nabis brevis* Scholtz, *N. flavomarginatus* Scholtz, *N. limbatus* Dahlbom, *N. rugosus* (L.)

Fam. Saldidae: *Salda littoralis littoralis* (L.), *Saldula orthochila* (Fieber), *S. c-album* (Fieber), *Macrosaldula scotica* (Curtis)

Fam. Aradidae: *Aradus pallescens frigidus* Kiritschenko

Fam. Lygaeidae: *Nithecus jacobaeae* (Schilling), *Nysius thymi* (Wolff), *Trapezonotus desertus* Seidenstücker, and *Megalonotus dilatatus* (Herrich-Schäffer)

Fam. Stenocephalidae: *Dicranocephalus medius* (Mulsant et Rey)

Fam. Coreidae: *Ulmicola spinipes* Fallén

Fam. Rhopalidae: *Stictopleurus crassicornis* (L.)

Fam. Scutelleridae: *Eurygaster dilaticollis* Dohrn

Fam. Pentatomidae: *Sciocoris microphthalmus* Flor, Aelia klugi Hahn, *A. sibirica* Reuter, *Carpocoris purpureipennis* (De Geer), and *Chlorochroa juniperina* (L.)

Fam. Cydnidae: *Canthophorus impressus* (Horváth)

Neuroptera. According to Popov (1997b), only *Wesmaelius* (*Kimminsia*) *malladai* (Navas) (Hemerobiidae, 1600-2050 m) could be considered as a glacial relict in the Pirin Mts.(rarely found above the timberline). The same species is the only relict Neuroptera in the Central Balkan Mts. (Popov in Hubenov et al., 2000a). For the Rila National Park Popov in Popov et al., 2000, mentions five relict Neuroptera (all Hemerobiidae), but only two of the have been found higher than 1900 m: *Wesmaelius malladai* (Navas) and *Hemerobius schedli* Hölzel.

Diptera.

Trichoptera. According to Kumanski (in Hubenov et al., 2000a, 2000b) two members to the family Limnephilidae are glacial relicts: *Asynarchus lapponicus* (Zetterstedt) from Rila and *Chionophylax mindszentyi bulgaricus* Kumanski from the Central Balkan Mountains (endemic subspecies).

Lepidoptera. Among Lepidoptera of the Pirin National Park 19 species are considered by Abadjiev (1997) as glacial relicts. They belong to the families Hesperiidae, Geometridae and Noctuidae, and are all inhabitants of open herbaceous formations: 11 have been recorded above 1900 m: *Pyrgus cacaliae* (Rambur) (Hesperiidae, 2800 m), *Entephria caesiata* (Denis et Schiff.)(1500-2100 m), *E. flavicinctaria* Duponchel (1600-1950 m), *Venusia cambrica* Curtis (1950 m), *Catascia dilucidaria* (Denis et Schiff.) (2236 m), *Gnophos obfuscatus* (Denis et Schiff.) (1230-2000 m), *Syngrapha interrogationis* (L.)(1800-2000 m), *Discestra melanopa* (Thunberg)(2700 m), *Lycophotia porphirea* (Denis et Schiff.) (2000 m), *Epipsilia grisescens* (F.)(1950 m), and *Xestia ashworthii candelarum* (Staudinger)(1800-1950 m a.s.l.). All endemic Lepidoptera reach the highest areas above 2500 m, but from the 19 relict species only two live in this zone. The others usually remain below 2100 m. From 114 species of Lepidoptera in Bulgaria living above 1900 m 26 are considered relicts (Abadjiev in Hubenov et al., 2000a, 2000b):

Fam. Pyralidae: *Asarta aethiopella* (Duponchel), *Titanio* [*Metaxmeste*] *schrankiana* (Hochenw.)

Fam. Hesperiidae: *Pyrgos cacaliae* (Rambur)

Fam. Pieridae: *Colias caucasica balcanica* Rebel

Fam. Nymphalidae: *Boloria graeca balcanica* (Rebel), *B. pales rilaensis* Varga, *B. selene selene* (Denis et Schiff.), *Euphydryas cynthia leonhardi* (Röber), *Erebia rhodopensis* Nicholl, *E. gorge pirinica* Buresch, *E. melas leonhardi* Frühstorfer, *E. oeme spodia* Staudinger, *E. ottomana balcanica* Rebel, *E. orientalis orientalis* Elwes, *E. pandrose ambicolorata* Varga (= *E. lappona*), *E. pronoe fruhstorferi* Wrn., and *E. cassioides macedonica* Buresch

Fam. Geometridae: *Eupithecia fenestrata* Millière, *Isturgia limbaria rablensis* Zeller, *Gnophos glaucinarius peruni* Varga, *G. obfuscatus* (Denis et Schiff.), *Catascia dilucidaria* (Denis et Schiff.)

Fam. Arctiidae: *Arctia flavia* (Fuessly)

Fam. Noctuidae: *Parasemia plantaginis interrupta* Draudt, *Syngrapha interrogationis* (L.), and *S. divergens rilaecacuminum* Varga et Ronkay

Vertebrata

Amphibia. Two species are considered glacial relicts: *Rana temporaria* L. and *Ichthyosauria* [*Triturus*] *alpestris* (Laurenti) (Beshkov in Beron et al., 2000a, 2000b).

Reptilia. The lizard *Zootoca vivipara* (Lichtenstein) and the viper *Vipera berus* (L.) are the only relict reptiles in the high mountains of Bulgaria (Beshkov in Beron et al., 2000a, 2000b).

Aves. Tengmalm's owl (*Aegolius funereus* L.) is considered a glacial relict from Rila, Central and Western Stara Planina, Pirin, and Rhodopes Mountains (Shurulinkov et al., 2003).

Conclusions

In the eight mountains in Bulgaria higher than 2000 m are distributed many species, considered local or Balkanic endemics, some of them relicts, mostly preglacial and glacial. The groups with numerous endemics are Araneae, Orthoptera, Plecoptera, Coleoptera, Trichoptera, and Lepidoptera. Relicts are known among Araneae, Diplopoda, Orthoptera, Heteroptera, Coleoptera, Lepidoptera and even vertebrates like *Rana temporaria*, *Ichthyosauria alpestris* (Amphibia), *Zootoca vivipara*, *Vipera berus* (Reptilia) and *Aegolius funereus* (Aves). Rila and Pirin are the only mountains higher than 2400 m and most of the relicts and endemics are centered in these mountains.

References

Abadjiev S. 1997. Lepidoptera. – In: Sakalian V. (ed.): Endemic and Relict Insects in the Pirin National Park, Bulgaria. Pensoft Publ., Sofia – Moskow, 69 -77.

Beier M. 1969. Reliktformen in der Pseudoscorpioniden-Fauna Europas. – Memorie Societa Entomologica Italiana, **48**: 317-323.

Berger D., Chobanov D., Mayer F. 2010. Interglacial refugia and range shifts of the alpine grasshopper *Stenobothrus cotticus* (Orthoptera: Acrididae: Gomphoceratinae). – Organisms, Diversity & Evolution, **10** (2): 123-133.

Beron P. 1969. Sur les éléments boréo-alpins de la faune bulgare. 'Bulletin de l'Institut de Zoologie et Musée, Sofia, **30**: 115-132.

Beron P. 1985. On the cave fauna of the Greek islands of Santorin and Iraklia, with preliminary description of a new Pseudoscorpion. – Grottes bulgares, Sofia, **3**: 64-71.

Beron P. 1999. Biodiversity of the High Mountain Terrestrial Fauna in Bulgaria. – Historia naturalis bulgarica, **10**: 13-33.

Beron P. 2008. High-mountain Isopoda Oniscidea, Arachnida and Myriapoda in the Old World. – Bureschiana, Sofia, 1: Pensoft & Nat. Mus. Natur. Hist. Sofia, 556 pp.

Beron P., Beshkov V., Popov V., Vassilev M., Pandurska R., Ivanova T. 2000a. Biodiversity of Small Vertebrates (Pisces, Amphibia, Reptilia, Mammalia – Insectivora, Chiroptera, Lagomorpha and Rodentia) in the Rila National Park. – In: Sakalian M. (ed.): Biological Diversity of the Rila National Park, Sofia, 333-360.

Beron P., Beshkov V., Popov V., Vassilev M., Pandurska R., Ivanova T. 2000b. Biodiversity of Small Vertebrates (Pisces, Amphibia, Reptilia, Mammalia – Insectivora, Chiroptera, Lagomorpha and Rodentia) in the Central Balkan National Park. – In: Sakalian M.(ed.): Biological Diversity of the Central Balkan National Park, Sofia, 363-391.

Božilova E. 1995. The upper forest limit in the Rila Mts. in postglacial time – palaeoecological evidence from pollen analysis, macrofossil plant remains and C14 dating. – In: Advances in holocene palaeoecology in Bulgaria, Pensoft Publ., Sofia – Moscow, 1-8.

Brignoli P.M. 1980. La valeur biogéographique des Araignées cavernicoles. – 8. Internat. Arachnologen – Kongr., Wien, **1980**: 427-432.

Buresch I., Arndt W. 1926. Die glazialrelicte stellenden Tierarten Bulgariens und Mazedoniens. – Zeitschrift für Morphologie und Ökologie der Tiere, **5** (3): 381-405.

Darlington P.J. 1957. Zoogeography: The Geographical Distribution of Animals. Wiley, New York.

Deltschev Ch. 1990. The high-altitude spiders (Araneae) in the Pirin Mountains, Bulgaria. – Acta Zoologica Fennica, **190**: 111-115.

Deltschev Ch., Beron P., Blagoev G., Golemansky V., Najdenov V., Peneva V., Stoev P., Todorov M., Hubenov Z. 2000a. Faunistic Diversity of Invertebrates (non Insecta) of the Rila National Park. – In: Sakalian M. (ed.): Biological Diversity of the Rila National Park, Sofia, 249-284.

Deltschev Ch., Beron P., Blagoev G., Golemansky V., Najdenov V., Peneva V., Stoev P., Todorov M., Hubenov Z. 2000b. Faunistic Diversity of Invertebrates (non Insecta) of the Central Balkan National Park. – In: Sakalian M. (ed.): Biological Diversity of the Central Balkan National Park, Sofia, 289-317.

[Elenovskiy A.G., Radigina V.I.] Еленовский А.Ж., Радигина В.И. 2002. О понятии "реликт" и реликтомании в геграфии растений [On the notion of "relict" and the relictomania in the phytogeography]. – Buletin Moskovskogo Obshtestva Ispitateley Prirodi, Otdel Biologii, **107** (3): 39 -48. (In Russian).

Grandcolas Ph., Nattier R., Trewick S. 2014. Relict species: a relict concept? – Trends in Ecology & Evolution, 29(12): 655-663.

Gruev B.A. 2004. The leaf beetles (Insecta: Coleoptera: Chrysomelidae) of the Rila Mountain (Bulgaria). Fauna and Zoogeography. – Travaux scientifiques de l'Université de Plovdiv, Animalia, 40(6): 97-114.

Gruev B. 2006. The leaf beetles (Coleoptera: Chrysomelidae) of the Pirin Mountain (Bulgaria). – Historia naturalis bulgarica, 17: 51-79.

Guéorguiev V. 1988. Coleopters (Coleoptera) in the orophyte zone of the Pirin Mountain. – Fauna of Southwestern Bulgaria, Ed. BAN, Sofia, 2: 74-87 (Bulg., summ. Russ., Engl.).

Georgiev (= Guéorguiev) V. 1990. Coleoptera (Insecta, Coleoptera) from the orophyte zone of Vitoša. – Fauna of Southwestern Bulgaria. Part 3: 134 – 145 (Bulg., summ. Russ., Engl.).

Guéorguiev V.B., Sakalian V.P., Guéorguiev B.V. 1997. Biogeography of the endemic Balkan Ground – beetles (Coleoptera: Carabidae) in Bulgaria. – Pensoft Series Faun. No 6, Pensoft Publ., Sofia: V+73 p.

Hanák V., Horácek I. 1986. Zur Südgrenze des Areals von Eptesicus nilssoni (Chiroptera: Vespertilionidae). – Annalen Naturhistorischen Museum Wien, 88 – 89: 377 – 388.

Hubenov Z. 2015. Two-winged insects (Insecta: Diptera) of Pirin. – Historia naturalis bulgarica, 21: 215-256.

Hubenov Z., Beshovski V., Josifov M., Popov A., Kumanski K., Sakalian V., Abadjiev S., Vidinova Y., Lyubomirov T. 2000a. Entomofaunistic Diversity of the Rila National Park. – In: Sakalian M. (Ed.) Biological Diversity of the Rila National Park, Sofia: 285-331.

Hubenov Z., Beshovski V., Josifov M., Popov A., Kumanski K., Sakalian V., Abadjiev S., Vidinova Y., Lyubomirov T. 2000b. Entomofaunistic Diversity of the Central Balkan National Park. – In: Sakalian M. (ed.): Biological Diversity of the Central Balkan National Park, Sofia: 319-362.

Josifov M. 1997. Heteroptera. – In: Sakalian V. (Ed.). Endemic and Relict Insects in the Pirin National Park, Bulgaria. Pensoft Publ., Sofia – Moscow, 31-42.

Kumanski K. 1997. Trichoptera. – In: Sakalian V. (Ed.). Endemic and Relict Insects in the Pirin National Park, Bulgaria. Pensoft Publ., Sofia – Moscow, 59-68.

[Lopatin I.K.] Лопатин И.К. 1980. Основы зоогеографии [Fondaments of the Zoogeography]. Minsk, "Visshaya shkola", 199 pp.

Martens J. 1972. Ausobskya athos, der erste Krallenweberknechte aus Griechenland (Opiliones: Phalangodidae). Mit Bemerkungen zum Familien-Gliederung der europäischen Laniatores. – Senckenbergiana biologica, 53(5/6): 431-440.

Palamarev E. 1982. Principal stages in development of the flora and vegetation. Geography of Bulgaria.Physical geography. Publ. House of Bulg. Acad. of Sciences, Sofia., pp. 413-420. (In Bulgarian with English summary).

Peschev G.P. 1987. Endemism among the Orthopterans (Orthoptera) in the Bulgarian mountains. – In: Baccetti B.

(Ed.). Evolutionary biology of orthopteroid insects. Ellis Horwood Limited, Chichester: 414-417.

Pešev G. 1990. Biogeographical significance of the disjunctive distribution on mountaneous Orthoptera in Bulgaria. – Acta zoologica bulgarica, **39**: 16-24.

Pomorski R.J. 2006. Revision of the genus Onychiuroides Bagnall, 1948 (Collembola: Onychiuridae: Onychiurinae). – Insect Systematics and Evolution, **37** (1): 39-69.

Popov A. 1997a. Orthoptera. – In: Sakalian V. (Ed.). Endemic and relict insects in the Pirin National Park, Bulgaria. – Pensoft Publ., Sofia – Moskow, 12-24.

Popov A. 1997b. Neuroptera. – ibidem, 43-44.

Popov A. 2007. Fauna and Zoogeography of the Orthopterid Insects (Embioptera, Dermaptera, Mantodea, Blattodea, Isoptera, and Orthoptera) in Bulgaria. – In: V. Fet & A. Popov (Eds.) Biogeography and Ecology in Bulgaria, Springer, Monographiae Biologicae, **82**: 233-295.

Popov A., Deltshev Ch., Hubenov Z., Beshovski V., Dobrev D., Gueorguiev B. 2000. Invertebrate fauna. – In: Popov A., T. Meshinev, (eds.): High mountain treeless zone of the Central Balkan National Park. Biological diversity and problems of conservation. Sofia, BSBCP, 339-416.

[Popov V., Dimova D., Deltshev Hr.] Попов В., Димова Д., Делчев Хр. 2005. Биоразнообразието на Национален парк Пирин. Българска фондация Биоразнообразие [The Biodiversity of Pirin National Park. Bulgarian Foundation Bioraznoobrazie], Sofia, 95 p. (In Bulgarian).

Sakalian V. 1997. General Results and Discussion. – In: Sakalian V. (ed.): Endemic and Relict Insects in the Pirin National Park, Bulgaria. Pensoft Publ., Sofia–Moscow, 78-91.

Sakalian V., Guéorguiev B. 1997. Coleoptera. – In: Sakalian V. (ed.): Endemic and Relict Insects in the Pirin National Park, Bulgaria. Pesoft Publ., Sofia–Moscow, 45-58.

Shurulinkov P., Stoyanov G., Tzvetkov P., Vultchev K., Kolchagov R., Ilieva M. 2003. Distribution and abundance of Tengmalm's Owl *Aegolius funereus* on Mount Pirin, southwest Bulgaria. – Sandgrouse, **25** (2): 103-117.

Stoev P. 2007. Fauna and Zoogeography of Myriapoda in Bulgaria. – In: V. Fet & A.Popov (Eds.), Biogeography and Ecology of Bulgaria, 379-404.

Varga Z. 1995. Isolates of Arctic-alpine and Alpine Lepidoptera in SE Europe. – Proceedings of the EIS Colloquium, Helsinki, p. 140 -151.

Wangerin W. 1912. Über den Reliktbegriff und die Konstanz der Pflanzenstandorte. – Festschrift des Preußischen Botanischen Vereins, 158-184.

Author's address:

Petar Beron, National Museum of Natural History, 1 Tsar Osvoboditel Blvd, Sofia 1000, Bulgaria. E-mail: beron@mail.bg

Реликти и ендемити във високопланинската фауна на България

Петър Берон

(Резюме)

Разглежданата тук област (над 1900 м) обхваща около 1.37% от българската територия в осем планини, от които Рила и Пирин надхвърлят 2400 м. Там са съсредоточени и повечето ендемични и реликтни видове животни (изброени по-горе). Има както тесни локални ендемити, така и балкански такива. Осоено добре са застъпени групите Araneae, Acari, Orthoptera, Coleoptera, Heteroptera, Lepidoptera.