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FAUNA AND ZOOGEOGRAPHY OF SPIDERS (ARANEAE) IN BULGARIA

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ABSTRACT. Bulgaria is home to 975 species of spiders in 41 families. This number was established after a critical review of the existing literature and taxonomic review of the available collections. The spiders are distributed in all districts of Bulgaria, occurring in lowlands, forests, mountains, caves and urban territories. According to their current distribution the established 975 species can be split into 27 zoogeographical categories, grouped into five major chorotypes (Cosmopolitan, Holarctic, European, Mediterranean, Endemics). The largest number of species belongs to the widely distributed species in the Holarctic, but the most characteristic are the endemics. Their established number (76 species) is high and reflects the local character of the fauna. This phenomenon can be attributed to the relative isolation of the mountains compared with the lowlands in the context of paleo-enviromental changes since the Pliocene.

Keywords: Europe, diversity, distribution, chorotypes

The first information on the spiders fauna of Bulgaria came from the end of 19th century (Pavesi 1876). Systematic investigation started in the beginning of 20th century by P. Drensky (1913, 1921, 1929, 1931, 1936a, b, 1937, 1938, 1939, 1940, 1942, 1943). Drensky (1936a) published the only catalogue of the spiders on the Balkan Peninsula in which 624 species from Bulgaria were reported. More recent publications are a result of intensive faunistic research after 1967 (Deltshev 1967, 1972a, b, 1973, 1974, 1977a, b, 1978, 1980, 1983a, b, c, 1984, 1985, 1987a, b, 1988, 1990, 1992, 1993, 1996, 1997a, b, 1998, 2003; Deltshev & Blagoev 1995, 1997, 2001; Helsdingen et al. 1977 2001]; Blagoev & Deltshev 1989; Blagoev et al. 2002; Dimitrov 1993, 1994, 1996, 1997, 1999, 2003; Dimitrov & Lazarov 1999, 2002; Thaler et al. 1994; Lazarov 1998, 2003, 2004; Lazarov et al. 2001; Tzonev & Lazarov 2001). The accumulation of new data makes possible a critical taxonomic and faunistic review, together with a zoogeographic analysis.

METHODS

The material treated herein can be divided into two major parts: the first comprises a critical incorporation of all available literature records concerning the distribution of spiders in Bulgaria; the second concerns the original collections obtained from 1965–2002 during a field survey covering most of the districts in Bulgaria, kept in the collections of Institute of Zoology, Bulgarian Academy of Sciences.

RESULTS AND DISCUSSION

The spider fauna is represented in Bulgaria by 975 species, included in 41 families and 285 genera. The number of species is high compared with the number of spiders recorded from other European countries with similar territories (Tables 1, 2). The number of families is also high compared with the data for the world: 110 (Platnick 2005; Austria 40, Germany 39, Switzerland 39 (Blick et al. 2002). Best represented are the families Linyphiidae (226 species or 23.2%), Gnaphosidae (98 species or 10%), Salticidae (91 species or 9.3%), Lycosidae (80 species or 8.2%) and Theridiidae (74 species or 7.5%). The genera with the highest number of species are: *Centromerus* (16 species or 7.3%), *Walckenaeria* (14 species or 6.4%), *Tenuiphantes* (11 species or 5%) and *Diplocephalus* (9 species or 4.1%) (Table 2). This richness, however, depends not only on the size of the regions, but also on the degree of exploration by araneologists.

According to their current distribution Bulgarian spiders can be divided into 27 zoogeographical chorotypes, grouped into 5 zoogeographical complexes (I = Cosmopolitan, II = Holarctic, III = European, IV—Mediterranean, V = Endemic) (Fig. 1). The data concerning general distribution of spiders are tak-

Table 1.—Comparison of area and spider species richness of some European countries.

Country	Area (km²)	Spider species	Sources
Austria	83,858	961	Blick et al. (2002)
Bulgaria	110,993	975	Blagoev et al. (2002)
Czech Republic	77,280	830	Buchar & Růžička (2002)
Greece	128,900	810	Bosmans (pers. comm.)
Hungary	92,340	725	Samu & Szinetar (1999)
Macedonia	25,713	558	Blagoev (2002)
Portugal	91,500	660	Cardoso (1999)
Serbia	102,000	618	Deltshev et al. (2003)
Slovenia	20,120	529	Kuntner & Šereg (2002)

en from Michailov (1997), Marusik et al. (2000), Platnick (2004) and Vigna Taglianti et al. (1999) (Fig. 1).

Cosmopolitan species complex (COS + SCO, 20, 2%): Includes especially widespread species associated with lowlands, woodlands and high elevation zones of mountains.

Complex of species widely distributed in the Holarctic Region (HOL + OLW + PAT + PAL + WPA + ECA + EEC + SEC + EEE + WPA): Is best represented and comprises 561 (57.5%) species widespread in Bulgaria (Fig. 1). Palearctic species (sensu lato) are dominant (36.1%), followed by Holarctic (10.5%), European Central Asiatic (7%) and West Palearctic (3%). The remaining chorotypes (EEC, SEC & EEE) are represented by single species. The complex includes especially widespread species associated with lowlands, woodlands and high elevation zones of mountains. Most of the species are well represented in the mountains. Characteristic mountain species are represented by the linyphiids *Bolyphantes alticeps* (Sundevall 1833), *B. luteolus* (Blackwall 1833), *Frontinellina frutetorum* (C. L. Koch 1834), *Gonatium rubens* (Blackwall 1833), *Pityohyphantes phrygianus* (C. L. Koch 1836), *Tenuiphantes alacris* (Blackwall 1853), *T. tenebricola* (Wider 1834). High mountain species are the lin-

Table 2.—The spider fauna of Bulgaria listed by families, depicting numbers of genera and species.

Families	Genera	Species	Families	Genera	Species
Atypidae	1	2	Oxyopidae	1	3
Nemesiidae	2	4	Zoropsidae	1	2
Filistatidae	2	2	Zoridae	1	6
Scytodidae	1	1	Agelenidae	6	32
Leptonetidae	1	2	Cybaeidae	2	3
Pholcidae	4	7	Hahnidae	4	9
Segestridae	1	3	Dictynidae	8	15
Dysderidae	4	29	Amaurobiidae	5	22
Oonopidae	4	4	Titanoecidae	2	7
Mimetidae	2	4	Miturgidae	1	12
Eresidae	1	2	Anyphenidae	1	2
Oecobiidae	1	1	Liocranidae	7	13
Uloboridae	2	4	Clubionidae	1	26
Nesticidae	1	3	Corinnidae	3	5
Theridiidae	17	74	Zodariidae	1	11
Theridiosomatidae	1	1	Gnaphosidae	19	96
Linyphiidae	94	226	Sparassidae	2	3
Tetragnathidae	4	17	Philodromidae	4	32
Araneidae	16	56	Thomisidae	13	60
Lycosidae	11	80	Salticidae	31	91
Pisauridae	2	3			
			Total	285	975

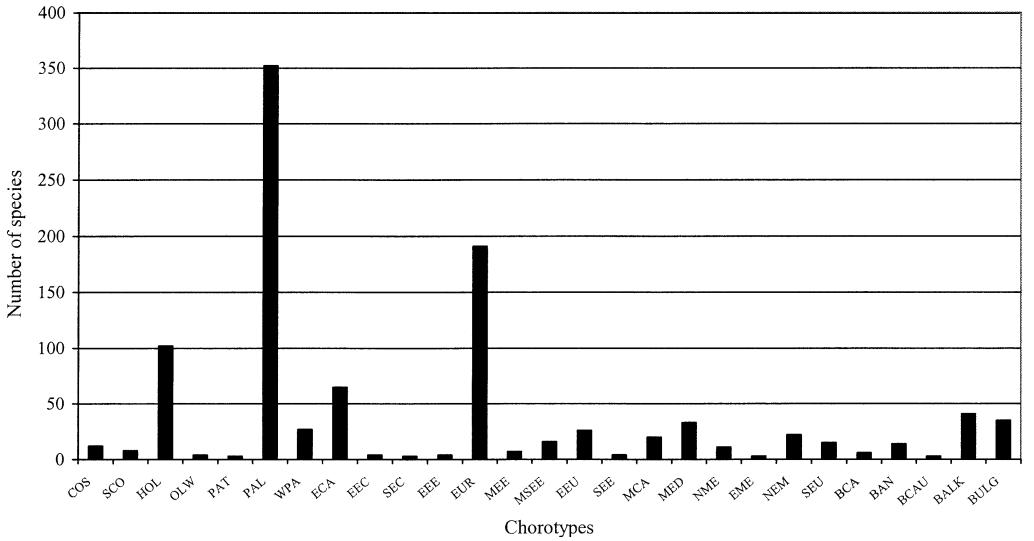

Figure 1.—Zoogeographical types in the spider fauna of Bulgaria, showing the number of species represented in each. Abbreviations: COS = cosmopolitan; SCO = subcosmopolitan; HOL = Holarctic; OLW = Old World; PAT = Palearctic-Paleotropic; PAL = Palearctic; WPA = west-Palearctic; ECA = European-central Asian; EEC = east European-central Asian; SEC = south European-central Asian; EEE = east European-east Mediterranean; MCA = Mediterranean-central Asian; BCA = Balkan-central Asian; EUR = European; MEE = middle-east European; MSEE = middle-southeast European; SEU = south European; EEU = east European; SEE = southeast European; BCAU = Balkan-Caucasian; BAN = Balkan Anatolian; MED = Mediterranean; EME = east Mediteranean; NME = north Mediterranean; NEM = northeast Mediterranean; BALK = Balkan endemics; BULG = Bulgarian endemics.

yphiids *Entelecara media* (Kulczyński 1887) and *Mecynargus paetulus* (O.P.-Cambridge 1875), which are not established in the forest belt. Some xenotopic species (Thaler 1988) are widely distributed in the mountains and reach the highest summits as aeronauts. To this group belong the linyphiids *Dicymbium nigrum* (Blackwall 1834), *Diplostyla concolor* (Wider 1834), *Meioneta rurestris* (C.L. Koch 1836), *Oedothorax agrestis* (Blackwall 1853), *O. apicatus* (Blackwall 1850), *O. fuscus* (Blackwall 1834) which inhabit the mountain zone in dense populations (Deltshev 1990, 1995).

European species complex (EUR + MEE + MSEE + EEU+ SEE): Comprises 191 (20%) species, widespread in Europe and Bulgaria (Fig. 1). European species (sensu lato) are dominant (14%), followed by East European species (3%), and Middle Southeast European species (1.5%). The remaining chorotypes (MEE & SEE) are represented by single species. The complex comprises widespread species which inhabit both lowland and mountains. Interesting is the group of European mountain species, best represented in the forest, subalpine and alpine belts. Characteristic mountain species are the linyphiids, *Araeoncus anguineus* Deltshev 1987, *Bolyphantes kolosvaryi* (Caporiacco 1936), *Cinetata gradata* (Simon 1881), *Diplocephalus foraminifer* (O.P.-Cambridge 1875), *Improphantes improbulus* (Simon 1929), *Maso gallicus* Simon 1894, *Mughiphantes pulcher* (Kulczyński 1881), *Oreonetides glacialis* (C.L. Koch 1872), *Tiso vagans* (Blackwall 1834). Other linyphiid species such as *Palliduphantes istrianus* (Kulczyński 1914), *Centromerus* capucinus (Simon 1884), *C. cavernarum* (L. Koch 1872), *Porrhomma lativelum* Tretzel 1956 and *P. microps* (Roewer 1931), are characteristic of caves.

Mediterranean species complex (MCA—MED + EME + NME + NEM + SEU+ BCA + BAN + BCAU): Includes 127 species (13%) that occur in the Mediterranean area or a part of it. The complex forms only 13% of the total spider fauna of Bulgaria, but the real percentage is probably higher, because a large part of the endemics have a Mediterranean or-

igin. Most of the species in the complex are widely distributed in the Mediterranean region. Very interesting are the mountain-Mediterranean species [*Aculepeira talishia* (Zavadsky 1902), *Pardosa incerta* 1905], which may be regarded as ancient elements in the high mountains.

Endemic species complex (BALK + BULG): Includes 76 species (10%) established in Bulgaria (35 species) and other territories of the Balkan Peninsula (41 species). The established number is high and reflects the local character of the fauna. The question about the status and distribution of endemic spiders found in Bulgaria is complicated. Some of them are found only in restricted areas, while others show wider distributions, sometimes even over the whole peninsula.

According to their origin, the endemics form two groups. Some of the species can be regarded as probable remnants of ancient Mediterranean mountain fauna (paleoendemics), and others came from the northern parts of Europe during the glacials and evolved under isolation on mountains during the interglacials (neoendemics). The curious is the distribution of the genus *Antrohyphantes* Dumitrescu 1971 (Linyphiidae), found only in the high elevation zone and in caves. It is related to the genus *Fageiella* Kratochvíl 1934 (Linyphiidae), an endemic from the caves of the western part of the Balkan Peninsula (Bosnia, Montenegro). Their allopatric distribution indicates that they had already separated before the establishment of the Vardar tectonic zones (Deltshev 1996). This suggests that these two genera are paleoendemics.

Concerning the formation of cave fauna, Deeleman-Reinhold (1976) wrote that ''many European cave spiders are probably relics of populations of moist Tertiary forests''. Due to the lack of knowledge, it is difficult to determine with certainty which of the cave spider endemics of Bulgaria are Tertiary and which are Quaternary elements. Nevertheless, the blind species in the family linyphiid, *Centromerus bulgarianus* (Drensky 1931), *Troglohyphantes drenskii* Deltshev 1973 and *Troglohyphates bureschianus* Deltshev 1975, all species with primitive three branched paracymbia, also can be regarded as probable paleoendemics (Deltshev 1996).

The linyphiid spiders *Araeoncus clivifrons* Deltshev 1987, *Diplocephalus altimontanus* Deltshev 1984, *Drepanotylus pirinicus* Deltshev 1992, *Erigone l. pirini* Deltshev 1983, *Incestophantes annulatus* (Kulczyński 1882), *Mughiphantes lithoclasicolus* Deltshev 1983, *Metopobactrus orbelicus* Deltshev 1985, known only from the high alpine parts of the Pirin and Rila Mountains are high alpine elements?. Here, also can be placed *Thenuiphantes drenskyi* Helsdingen 1977, occurring in the high elevation belts of Pirin, Rila, Central Stara Planina and Vitosha mountains. These species are regarded as derivative of their respective North or Middle European species (*Diplocephalus picinus* (Blackwall 1841), *Drepanotylus borealis* Holm 1945, *Erigone longipalpis* (Sundevall 1830), *Metopobactrus prominulus* (O.P.-Cambridge 1872), due to the disjunction of ranges during the glacial and interglacial (Deltshev 1996; Deltshev & Blagoev 1997). The largest fraction of endemics was encountered mainly in caves, coastal sites, woodlands and high altitude zones.

The presence of the 975 spider species shows that Bulgaria is a territory of considerable species richness. This conclusion is supported also by the existence of 76 endemic species. In a zoogeographical respect, the widely distributed spiders in the Holarctic region are dominant. However, the most characteristic faunal elements are the endemics. Their number is high, and their faunistic composition reflects the local character of the fauna. According to their origin the endemics belong to two principal faunistic complexes: Mediterranean and European. This phenomenon can be explained by the relative isolation of the mountains compared with the lowlands, in the context of palaeo-environmental changes that have occurred since the Pliocene.

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