

A FAUNISTIC AND ZOOGEOGRAPHICAL REVIEW OF THE SPIDERS (ARANEAE) OF THE BALKAN PENINSULA

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ABSTRACT. The Balkan Peninsula is home to 1409 species, included in 337 genera and 47 families. This number was established after a critical review of the existing literature and taxonomic revision of some available collections containing spider material from this region. The highest number of species is recorded for the territories of Bulgaria (775), Greece (642), Croatia (615) and Serbia (508). This biodiversity depends not only on the size of the regions, but also on the degree of exploration by researchers. The territories of Albania, Turkey, Montenegro and Bosnia are less well investigated. According to their current distribution, the established 1409 species can be classified into 24 zoogeographical categories, grouped into four complexes (widely distributed, European, Balkan endemics, and Mediterranean). The largest number of species belongs to the widely distributed complex, but the most characteristic are the Balkan endemics. Their established number (379 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-environmental changes since Pliocene. Their high percentage (26.9%) suggests an important process of autochthonous speciation. Thus, the Balkan Peninsula can be considered as a main center of speciation for the European araneofauna.

The spider fauna of the Balkan Peninsula is comparatively well-studied due to the efforts of many araneologists from different countries; but the first large, significant work concerning the spiders of all territories of the region came from Drensky (1936). He reported 1066 species from 35 families which constituted a review of all literature available at that time. Some years later Hadjissarantos (1940) compiled all faunistic data about the spiders of continental Greece. Nikolic & Polenec (1981) combined the data concerning Yugoslavian spiders and reported 1022 species from this country. More recent publications list the fauna of Bulgaria, Greece, Serbia, Macedonia, Montenegro and part of Turkey (Brignoli 1968, 1971, 1972, 1974a, b, 1976, 1977, 1979, 1984, 1986; Deeleman 1976, 1978, 1988, 1993; Deltchev 1979a, b, 1983a, b, 1985, 1988, 1990, 1993, 1996, 1997a, b; Deltchev & Curcic 1997; Deltchev & Paraschi 1990; Thaler 1996; Thaler & Knoflach 1991, 1993, 1995; Wunderlich 1980, 1985, 1994a, b, c). These contributions are a result of intensive faunistic research; and the accumulation of new data makes possible a critical taxonomic and faunistic review, together with a zoogeographical analysis.

STUDY AREA

The Balkan Peninsula is situated in the southeastern part of Europe. The northern border follows the rivers Danube (including its delta), Sava and Soca, and through Gorizia and Monfalcone reaches the line of the Gulf of Trieste. Its western border follows the line of Adriatic and Ionian coast including the islands. The eastern border passes to the east of the Aegean Islands Sirina, Astipalea, Amorgos, Miconos, Tinos, Andros, Skiros, Limnos, and Imros, continues along the Dardanelles, goes across the Marmara Sea and, through the Bosphorus, reaches the Black Sea coast. The southernmost point of the Balkan Peninsula region is Crete and the islands of Gavdos, Aidronisi, and Kufonisi (Fig. 1).

The material treated herein can be divided into two major parts: the first comprises a critical incorporation of all available records from the literature concerning the distribution of spiders on the Balkan Peninsula; the second concerns a revision of all of the existing material from Drensky's collection.

The geographical areas and their abbreviations used in the text, are as follows: AI = Albania, BG = Bulgaria, CT = Crete, CR = Croatia, GR = Greece, BS = Bosnia, MA =

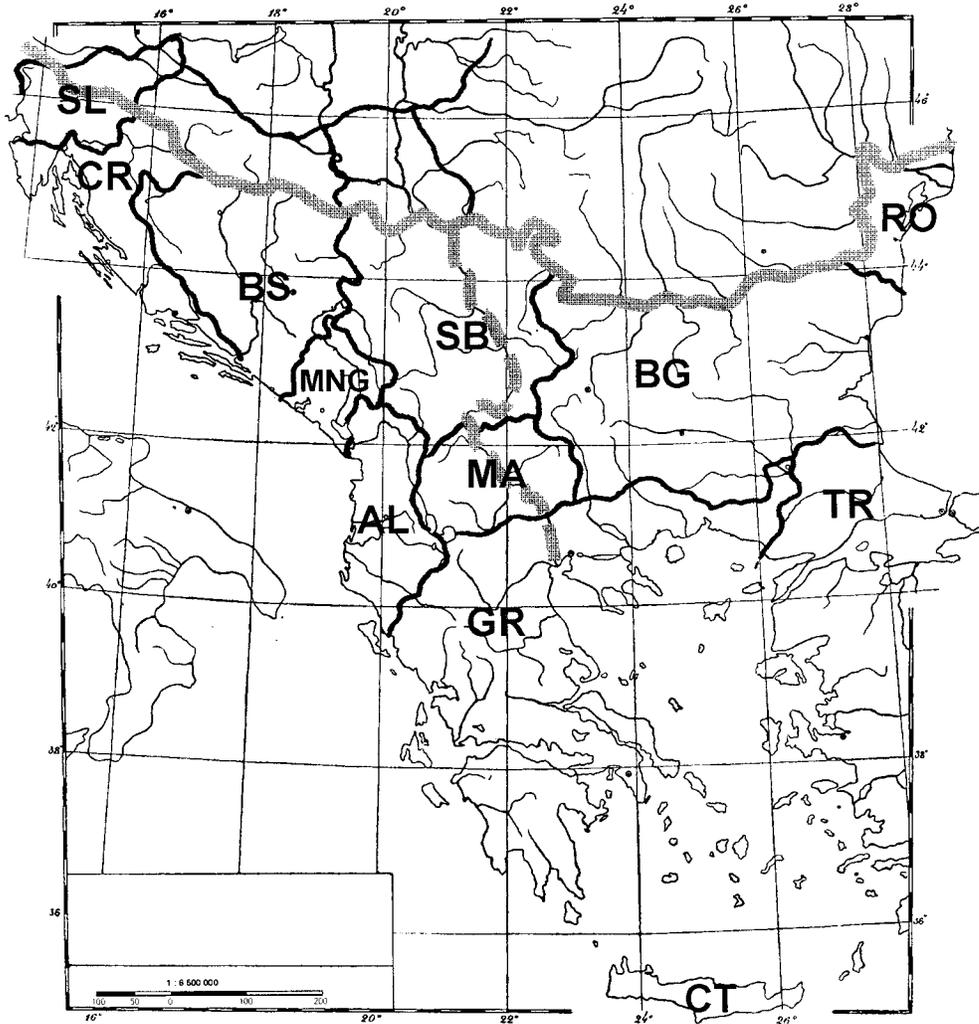


Figure 1.—Map of the Balkan Peninsula. *Abbreviations:* Al = Albania; BG = Bulgaria; CT = Crete; CR = Croatia; GR = Greece; BS = Bosnia; MA = Macedonia; MNG = Montenegro; RO = Romania; SB = Serbia; SL = Slovenia; TR = Turkey.

Macedonia, MNG = Montenegro, RO = Romania, SB = Serbia, SL = Slovenia, and TR = Turkey. The data concerning the general zoogeographical distribution are taken mainly from Platnick (1989, 1993, 1997). The zoogeographical categories used and their abbreviations are as follows: WD = widely distributed, COS = cosmopolitan, PPT = Palearctic-Paleotropical, H = Holarctic, OW = Old World, P = Palearctic, WP = west Palearctic, ECA = European-central Asian, E = European, HE = Holo-European, MEE = middle east-European, MSE = middle south European; MSEE = middle southeast European,

EE = east European; SE = south European, SEE = southeast European, PO = Pontic, BK = Balkans, M = Mediterranean, HM = Holo-Mediterranean, EM = east Mediterranean, NM = north Mediterranean, NEM = north-east Mediterranean, SEM = southeast Mediterranean, BKMA = Balkan-Asia Minor, POM = Pontic-Mediterranean.

RESULTS AND DISCUSSION

Species composition.—The spider fauna of the Balkan Peninsula is represented by 1409 species, included in 337 genera and 47 families (Table 1). This number is established after

Table 1.—The families and number of species and endemic taxa.

Family	Number of species according to Drensky (1936)	Actual number of species	Actual number of endemic species	Actual number of endemic genera
Atypidae	2	2		
Ctenizidae	5	6	5	
Nemesidae	4	7	4	
Filistatidae	4	3		
Sicaridae	1	1		
Scytodidae	1	1		
Leptonetidae		18	18	3
Pholcidae	6	16	9	
Segestridae	4	5	2	
Dysderidae	40	106	81	9
Oonopidae	1	5	2	
Palpimanidae		1		
Mimetidae	4	5		
Eresidae	2	3		
Oecobiidae	1	4		
Uloboridae	5	6		
Nesticidae	6	9	6	2
Theridiidae	80	91	9	
Theridiosomatidae	1	1		
Anapidae	1	2	1	
Mysmenidae		1		
Linyphiidae	172	330	112	3
Tetragnathidae	17	26	1	
Araneidae	60	55		
Lycosidae	80	83	1	
Pisauridae	4	3		
Oxyopidae	3	3		
Zoropsidae		1		
Agelenidae	32	64	36	1
Cybaeidae	2	4	1	
Argyronedidae	1	1		
Desidae		1		
Hahnidae	8	12	5	1
Dictynidae	15	23	1	
Amaurobiidae	24	37	19	
Titanoecidae	6	6		
Anyphoenidae	2	2		
Liocranidae	22	19	4	
Clubionidae	29	36	3	2
Corinnidae	3	3		
Zodariidae	11	23	9	
Prodidomidae		2		
Gnaphosidae	110	131	22	
Zoridae	4	10	2	
Heteropodidae	6	5	2	
Philodromidae	45	37	2	
Thomisidae	55	70	4	
Salticidae	140	130	14	

Table 2.—Distribution of species and endemic taxa in different regions of Balkan Peninsula.

Region	Number of species according to Drensky (1936)	Actual number of species	Actual number of endemic species	Actual number of endemic genera
Slovenia	108	216	26	3
Croatia	466	615	66	4
Bosnia	42	87	42	2
Serbia	453	508	10	
Montenegro	15	102	29	3
Macedonia	455	394	21	1
Albania	7	73	10	2
Bulgaria	697	775	55	2
Romania	35	47	7	1
Turkey		83	5	
Greece	241	642	156	
Crete		59	42	4

a critical review of all available records from the literature concerning the spiders in the Balkan Peninsula and a revision of all existing materials of Drensky's collection.

The number of species is high compared with the number of spiders recorded from other parts of Europe: France -1400 (Jones et al. 1990); Russian Plain -1001 (Michailov 1997); Alps -1000 (Thaler 1980); Germany -925 (Koponen 1993); Switzerland -875 (Maurer & Hanggi 1990); England & Wales -624 (Roberts 1987). The number of families is also high compared with the data for the world -95 (Platnick 1997); Switzerland -39 (Maurer & Hanggi 1990); Russian Plain -35 (Michailov 1997). Best represented are the families Linyphiidae (327 species or 23.4%), Salticidae (130 species or 9.3%), Gnaphosidae (129 species or 9.2%) and Dysderidae (106 species or 7.6%). The genera with the highest number of species are: *Troglohyphantes* (53), *Lepthyphantes* (49), *Dysdera* (38), *Zelotes* (38), *Xysticus* (37), *Pardosa* (35) and *Tegenaria* (31). The genus *Troglohyphantes* is a remarkable faunistic phenomenon since from all 53 species 52 are the Balkan endemics, distributed mainly in caves. Deeleman-Reinhold (1978) concluded that the present distribution and morphological diversity of *Troglohyphantes* in the Balkan Peninsula represents of a repeated processes of expansion and contraction of its range. The representation of the genera *Dysdera* (28 endemics of 38 species), *Lepthyphantes* (18 endemics of 49 species) and *Tegenaria* (17 endemics of 31 species) is also due to expansion in caves, woodlands and

highlands. Present-day examples of cave penetration are the species *Lepthyphantes centromeroides* and *L. spelaeorum*, comparatively widespread in the Balkan peninsula. They occur in caves but also in the humus and ground detritus, and active subterranean colonization is indicated (Deeleman-Reinhold 1978).

The highest number of species is recorded for the territories of Bulgaria (775), Greece (642), Croatia (614) and Serbia (508). This richness, however, depends not only on the size of the regions, but also on the degree of exploration by araneologists (Table 2). The territories of Albania, Turkey, Montenegro and Bosnia are less well-explored.

Zoogeographical analysis.—According to their current distribution, the established 1409 species can be classified into 24 zoogeographical categories, grouped into 4 complexes (Figs. 2, 3).

Best represented is the complex of widely distributed species (WD) (COS + PPT + H + OW + P + WP + ECA), represented by 533 species (38.1%). Within the WD complex, Palearctic species are dominant (75.4%), followed by Holarctic (19.9%), Cosmopolitan (3.8%) and Palearctic-Paleotropical (0.2%). The complex includes especially widespread species associated with lowlands, buildings, woodlands and high altitude zones of mountains.

The Balkan endemics complex (BK) forms the second largest group and comprises 379 species (26.9%). The established number is high and reflects the local character of the fau-

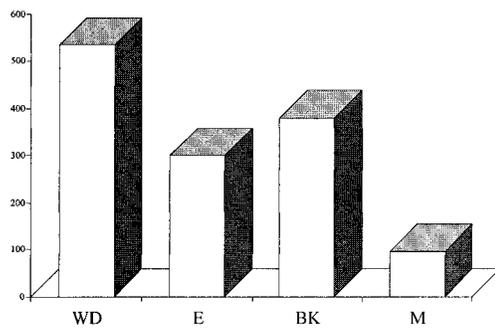


Figure 2.—The main zoogeographic complexes in the spider fauna in Balkan Peninsula, showing the number of species represented in each.

na. The endemics are best represented in Greece (156), Croatia (66), Bulgaria (55), Bosnia (42) and Crete (40). It should be emphasized that of the established 14 endemic genera (*Antrohyphantes*, *Barusia*, *Cryphoecina*, *Fageiella*, *Folkia*, *Icariella*, *Lasconia*, *Macedoniella*, *Minotauria*, *Protoleptoneta*, *Parastalita*, *Rhodera*, *Stalagtia*, *Sulcia*) for the Balkan Peninsula, only three of them (*Antrohyphantes*, *Macedoniella*, *Protoleptoneta*) are distributed in the east of the Balkan Peninsula. Especially interesting is the distribution of the genus *Antrohyphantes*, found only at high altitude zones and caves of the eastern part of the region (Bulgaria). It is related to the genus *Fageiella*, 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 zone (Deltshev 1996). This suggests that these two genera are paleoendemics.

The largest fraction of endemics was encountered mainly in caves, coastal sites, woodlands and high altitude zones. According to their ranges, the endemics belong to two principal faunistic complexes: Mediterranean and European. The Mediterranean elements are distributed in caves, forests, coastal sites and high altitudes, while the European elements are distributed mainly in high altitude sites and forests. This phenomenon can be regarded as a result of the relative isolation of the mountains compared with the lowlands, in the context of paleo-environmental changes since the Pliocene (Deltshev 1996).

The European complex (E) (HE + MEE + MSE + MSEE + EE + SEE + PO) includes 300 species (21.3%). Within it, the Holo-European species are dominant (72.7%), widespread mainly in mountains. The middle southeast European (9.0%), southeast European species (9.0%), and east European species (7.4%) are comparatively well represented. The complex comprises widespread spiders in Europe and the Balkan Peninsula which inhabit both lowlands and mountains.

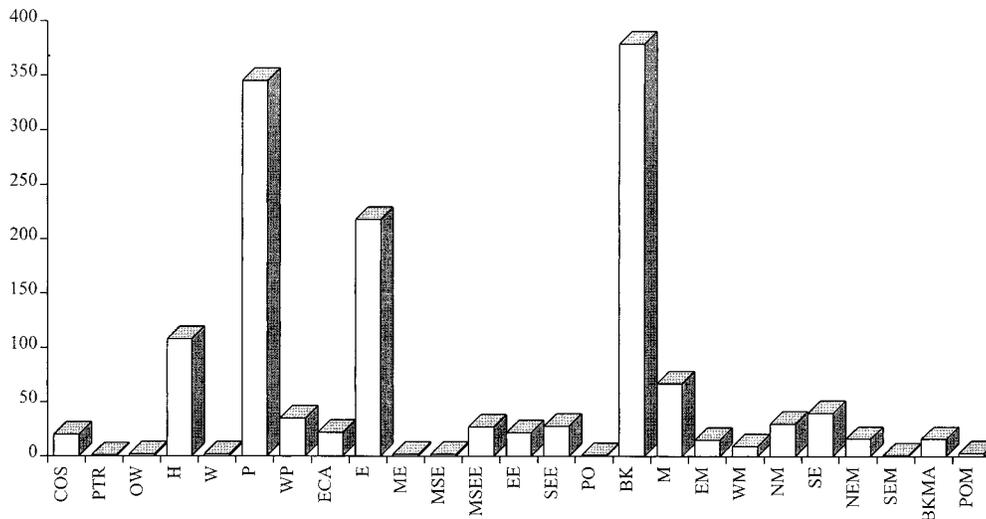


Figure 3.—Zoogeographical types in the spider fauna in Balkan Peninsula, showing the number of species represented in each.

Interesting is the group of European mountain species, best represented in the forest and sub-alpine belts.

The last complex (M) includes 195 species that occur in the Mediterranean area (HM + EM + WM + NM + SE + NEM + SEM + BKMA + POM) or a part of it. This complex forms 13.8% of the total spider fauna of the Balkan Peninsula, but the real percent is probably much higher because a large part of the Balkan endemics have a Mediterranean origin. Most of these species are widely-distributed in the Mediterranean region. Very interesting are the mountain-Mediterranean species (*Aculepeira talishia* and *Pardosa incerta*), which may be regarded as ancient elements in the high mountains.

Conclusions.—The faunistic diversity of the 1409 spider species shows that the Balkan Peninsula is a territory of considerable species richness. This conclusion is supported also by the existence of 379 endemic species. The uneven species richness in different parts of the Balkan Peninsula is due mainly to the degree of exploration by researchers. In a zoogeographical respect, the widely distributed spiders (WD) are dominant. However, the most characteristic faunal element is the Balkan endemics (BK). Their number is high, and their faunistic composition reflects the local character of the fauna. This phenomenon can be explained by the relative isolation of the mountains compared with the lowlands, in the context of paleo-environmental changes that have occurred since the Pliocene. The high percentage of the Balkan endemics (26.9%) suggests an important process of autochthonous speciation. Thus, the existing data suggest that the Balkan Peninsula represents one of the main centers of speciation in Europe.

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