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Spiders from the High Altitude Zone of Central Stara Planina Mountain (Bulgaria)

(Araneae)

by

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Synopsis: 103 species (1 Segestriidae, 1 Eresidae, 7 Theridiidae, 41 Linyphiidae, 1 Tetragnathidae, 3 Araneidae, 14 Lycosidae, 1 Agelenidae, 1 Hahniidae, 6 Clubionidae, 1 Zodariidae, 10 Gnaphosidae, 1 Heteropodidae, 4 Philodromidae, 4 Thomisidae, 7 Salticidae) have been established from 24 sites (1700-2376 m) in the high altitude zone of Central Stara planina. The species composition of the high mountain spider community was not well known and this is the first contribution to the problem. Concerning the altitudinal distribution, there are only 8 species occurring mainly in the high altitude zone, though a good number of species is present in the forest belt also and even some in lowlands. Characteristic for the highest sites are *Diplocephalus foraminifer, Erigone pirini, Mecynargus paetulus, Lepthyphantes improbulus, Pardosa drenskii, Cryphoeca pirini, Clubiona alpicola, Gnaphosa leporina.* Species which are not found below the tree-line form the high mountain species complex, which is composed by euro-montane (3, 2.9%), endemic (3, 2.9%), holarctic (arctic-alpine) (1), and palaearctic (1) elements. The character of the high-altitude spider fauna of Central Stara planina mountain is Palaearctic and mainly European.

1. Introduction:

The species composition of the high mountain spider community in Central Stara planina is not well known and this is the first comprehensive contribution. Some single data can be found in papers of Drensky (1911, 1913, 1936, 1938, 1939, 1940, 1942, 1943). This review of the spiders inhabiting the high altitude zone of Central Stara planina mountain is therefore based upon new and recent data.

2. Study area and materials:

Stara planina is the longest mountain system in Bulgaria with 29 peaks above 2000 m a.s.l., ranging for 530 km from the western border (Belogradchishki prohod) to the Black Sea coast (cape Emine). Morphologically, the mountain system is divided into three parts, Northern, Central and Eastern Stara planina. The highest relief is exposed in its Central part with 25 peaks > 2000 m. From these only peak Botev exceeds 2300 m, 5 peaks are between 2200-2300 m, 10 between 2100-2200 m, and 9 between 2000-2100 m. In the pleistocene a small glacier was formed only at peak Botev (2376 m). This is of great importance for the survival of the fauna.

The high altitude zone extends in Central Stara planina from 1700-1900 m and includes only the subalpine belt (grasses, low bushes) and patches of alpine vegetation at peaks Botev and Triglav. In the subalpine belt the vegetation is mainly formed by *Pineta mugi.* In Stara planina nearly all of it has been destroyed in order to enlarge alpine pastures and for production of charcoal. In these places substitute formations now are present, *Junipereta sibiricae, J. pygmaea,* furthermore dwarf scrub associations, *Vaccinieta myrtilli, V. vitis-ideae, Bruckentalieta spiculifoliae,* and grassland, *Nardeta strictae, Agrostideta capillaris, Festuceta validae, Bellardiochloeta*

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violaceae (BONDEV 1991). The survey of spiders inhabiting the high altitude zone of Central Stara planina mountain comprises 24 collecting sites from 1700-2376 m a.s.l., situated in the following parts: Zlatishko-Tetevenska (7), Troyanska (7) and Kaloferska (10). The spider material was collected by hand under stones and screes, on patches of moss and grass between stones, by netting in meadows and by beating small bushes. The localities where the spiders were collected are shown in Table 1.

Table 1: Collection localities in the high altitude zone of Stara planina Mountain: 1-7 Zlatishko-Tetevenska; 8-14 Troyanska; 15-24 Kaloferska region.

1 – Peak Paskal (1800 m), rocky sites, screes, stones, patchy vegetation and low bushes, 7 Aug. 1995.

2 – Peak Buluvanya (2000 m), low bushes, grassy patches between stones and subalpine meadows, 16 June 1995.

3 – Peak Vezhen (1700-2000), grassy patches between stones, screes and small stream, 16 June 1995, 1 Aug. 1995.

4 – Peak Vezhen (2198 m), grassy patches between stones and subalpine meadows 17 June 1995, 1 Aug. 1995.

5 – Peak Kamenitsa (1800-2000 m), screes, stones, grassy patches between stones and low bushes, 21 July 1995.

6 – Ribarishki prohod (1800 m), subalpine meadows and low bushes, 21 July 1995.

7 – Peak Jumruka (1800 m), stones, grassy patches between stones and subalpine meadows, 20 July 1995.

8 – Peak Ushite (1700 m), screes, stones, grassy patches between stones and low bushes, 19 July 1995.

9 – Peak Kozyata stena (1670 m), rocky sites, screes, grassy patches between stones and low bushes, 18 July 1995.

10 – Peak Dermenka, screes, stones and grassy patches between stones, 16 July 1995.

11 – Peak Levski (1700-1900 m), rocky sites, and subalpine meadows, 20 July 1966.

12 – Peak Levski (2166 m), screes, grassy patches between stones and subalpine meadows, 20 July 1996.

13 – Peak Malak Kupen (1700-2000 m), rocky and scree sites, subalpine meadows and small stream, 11 June 1996, 19 July 1996.

14 – Golyam Kupen (2000 m), rocky, scree sites and grassy patches between stones, 19 July 1996.

15 – Bashmandra (1700-1800 m), scree sites, grassy patches between stones and subalpine meadows, 15 Aug. 1996.

16 – South Dzhendem (1700-1800 m), rocky sites, wet grassy patches between stones and small streams, 15 Aug. 1996.

17 – Peak Zultec (1800-2000 m), scree sites and subalpine meadows, 12 June 1996, 18 July 1996.

18 – Peak Botev (1900-2100 m), rocky and scree sites and grassy patches between stones, 18 July 1996, 12 Aug. 1996.

19 – Peak Botev (2376 m), rocky and scree sites and grassy patches between stones, 15 July 1996, 12 Aug. 1996.

20 – Peak Rusalka (1990 m), rocky and scree sites, grassy patches between stones, 27 July 1996.

21 – Smesitel (1700-1800 m), grassy patches betwen stones and subalpine meadows, 26 July 1996.

22 – Peak Rosovatec (1900 m), scree sites and alpine meadows, 25 July 1996.

23 – Peeshti skali (1800 m), rocky and scree sites and grassy patches between stones, 25 July 1996.

24 – Cottage Mazalat (1700 m), scree sites and subalpine meadows, 24 July 1996.

3. 3. Results and discussion:

3.1. Species composition:

This contribution is based upon collections at 24 localities situated in three regions of Central Stara planina mountain above 1700 m a.s.l.: Zlatishko-Tetevenska, Troyanska and Kaloferska. Included are 103 species from 16 families: Segestriidae 1, Eresidae 1, Theridiidae 7, Linyphiidae 41, Tetragnathidae 1, Araneidae 3, Lycosidae 14, Agelenidae 1, Hahniidae 1, Clubionidae 6, Zodariidae 1, Gnaphosidae 10, Heteropodidae 1, Philodromidae 4, Thomisidae 4, Salticidae 7 (table 2). 84 species are new for the spider fauna of Stara planina and 7 are new to the Bulgarian fauna. Most characteristic are the families Linyphiidae s.l. (40 %), Lycosidae (13.5 %), Gnaphosidae (9.7 %) and Theridiidae (6.6 %). Genera with most species are *Pardosa* (11), *Lepthyphantes* (8) and *Clubiona* (6 species). The data are close to these for the high altitude zone of Rila and Pirin mountains (DELTSHEV 1990, 1995). Not all species listed can be considered as typical high-altitude elements. There are three groups (DELTSHEV 1980, 1990, 1995): Group A includes species inhabiting both lowlands and mountain habitats above the forest-line. Species of group B are rare or absent in lowlands, but abundant in mountains exceeding the forest line; species of group C inhabit only the high-altitude zone.

Group A contains 77 species (74.8 %), which are widespread in Bulgaria, some of them reaching the high-mountain zone as aeronauts. Characteristic species are *Meioneta rurestris, Erigone dentipalpis, Prinerigone vagans, Oedothorax apicatus, O. fuscus, Diplostyla concolor, Pardosa amentata, P. lugubris,* occurring in the high mountains in dense populations. The same species complex is present also in the high-altitude zone of Rila and Pirin mountains (DELTSHEV 1990, 1995).

To group B belong 18 (17.5 %) species, which occur in the forest zone but are also abundant in the low-bushes of the subalpine belt. Characteristic species are *Araeoncus anguineus, Gonatium orientale, G. rubens, Robertus mediterraneus, Pardosa blanda, Tegenaria rilaensis,* and *Zodarion pirini.* Common in the highest points of the mountain are *Pardosa albatula, P. monticola, Haplodrassus signifer, Thanatus formicinus.*

Group C 8 includes eight species (23.2 %) typical for high altitudes. Characteristic elements for Bulgaria are *Erigone pirini, Pardosa drenskii, Cryphoeca pirini,* known only from the high mountain belts of Rila, Pirin and Central Stara planina. *Pardosa drenskii* and *Cryphoeca pirini* are known also from the subalpine belt of Vitosha mountain. *Erigone pirini, Mecynargus paetulus,* and *Lepthyphantes improbulus* are known only from Rila and Pirin mountains. In Central Balkan they are characteristic for the highest peaks with patches of alpine vegetation (p. Botev, p. Triglav).

3.2. Zoogeographic analysis:

The 103 species differ widely concerning their ranges, see table 2 and Fig. 1, 2. The complex of widely distributed species is best represented (h + p, 23, 22.3 %, 41, 39.8 %), occurring mainly in the forest and in the subalpine belt. Only *Mecynargus paetulus,* an arctic-alpine element, and *Gnaphosa leporina* were not found below the tree-line, and belong to the high altitude element. *Meioneta rurestris* reaches the highest points due to aeronautic behaviour. *Haplodrassus signifer* and *Thanatus formicinus* are protocratic species, probably occurring in open sites since late glacial times (THALER 1988).

The group of European species (e + em, 22, 21.4 %, 9, 8.7 %) comprises spiders widespread in Europe and in Bulgaria, which inhabit both lowlands and mountains up to the high mountain zone. Most characteristic is the group of European mountain species (em), many of them not present below the tree-line. All these species are considered as high mountain elements, with some exceptions: *Araeoncus anguineus, Bolyphantes luteolus, Pardosa blanda, Philodromus vagulus.*

Table 2: Spiders established in the high mountain zone (1700-2376 m) of Central Stara planina A, B and C indicate the groups defined insection 2. Geographical distribution: h = holarctic, p = palaearctic, e = european, aa = arctic-alpine, mm = mountain-mediterranean. Degree of endemism: b = Bulgaria, bp = Balkan peninsula, em = European mountains. *) Species new to the Bulgarian fauna.

Segestriidae		
Segestria senoculata (LINNAEUS)	1 (2 f), 2 (1 f)	A, p
Eresidae		
Eresus cinnaberinus (OLIVIER)	15 (1 m)	A, p
Theridiidae		
Enoplognatha latimana HIPPA & OKSALA	20 (1)	A, h
E. thoracica (CLERCK)		A, h
Robertus arundineti (O.P.-CAMBRIDGE)	19 (1 m, 2 f)	A, p
R. mediterraneus ESKOV	2 (1 f)	B, mm
Steatoda albomaculata (DEGEER)	1 (3 f), 9 (1 m), 20 (1 f)	A, h
Theridion impressum L. KOCH	9 (1 f), 3 (1 f), 13 (2 f), 14 (1 f), 15 (1 m, 1 f)	A, h
Th. sisyphium (CLERCK)	10 (3 f), 21 (10 f)	A, p
Linyphiidae (Erigoninae)		
Araeoncus anguineus (L. KOCH)	3 (2 m, 2 f), 5 (1 f)	B, em
Ceratinella brevipes (WESTRING)	22 (1 f)	A, e
Ceratinopsis romana (O.P.-CAMBRIDGE)	3 (1 m)	A, e
Diplocephalus foraminifer (O.P.-CAMBRIDGE)	3 (1 m, 2 f), 17 (1 f), 18 (1 f)	C, em
Dismodicus bifrons (BLACKWALL)	8 (1 f), 9 (1 f)	A, p
Erigone dentipalpis (WIDER)	13 (1 f), 18 (1 f)	A, p
E. pirini DELTSHEV	19 (45 f, 33 f)	C, b
Evansia merens (O.P.-CAMBRIDGE)	23 (1 f)	B, p
Gonatium orientale FAGE	3 (1 m), 21 (1 f)	B, bp
G. rubens (BLACKWALL)	3 (1 f), 5 (2 m, 2 f)	A, h
* *Hilaira excisa* (O.P.-CAMBRIDGE)	19 (1 f)	B, em
Maso gallicus SIMON	3 (1 m)	A, e
M. sundevalli (WESTRING)	12 (1 m)	A, h
Micrargus subaequalis (WESTRING)	10 (1 f)	A, e
Oedothorax agrestis (BLACKWALL)	15 (2 f), 16 (2 m, 1 f) 17 (3 f), 18 (3 m)	A, e
O. apicatus (BLACKWALL)	21 (2 f)	A, p
Mecynargus paetulus (O.P.-CAMBRIDGE)	19 (1 m, 12 f)	C, aa
Prinerigone vagans (AUDOUIN)	9 (2 f), 10 (2 f)	A, p
Silometopus reussi (THORELL)	12 (1 m)	A, p
Thyreosthenius parasiticus (WESTRING)	11 (1 f)	A, h
Tiso vagans (BLACKWALL)	3 (1 f), 10 (1 m)	A, e
Walckenaeria monoceros (WIDER)	12 (1 f), 19 (3 f)	A, e
W. vigilax (BLACKWALL)	11 (1 m)	A, e

Linyphiidae (Linyphiinae)		
* *Agyneta cauta* (O.P.-CAMBRIDGE)	3 (1 f)	B, e
Bolyphantes alticeps (SUNDEVALL)	11 (2)	B, em
B. luteolus (BLACKWALL)	11 (3)	B, em
Diplostyla concolor (WIDER)	3 (1 m)	A, h
Lepthyphantes alacris (BLACKWALL)	19 (2 f)	A, p
L. flavipes (BLACKWALL)	21 (1 m)	A, e
L. improbulus SIMON	5 (1 f)	C, em
L. leprosus (OHLERT)	10 (1 f)	A, p
L. mengei KULCZYNSKI	3 (1 f), 5 (1 f), 8 (1 f)	A, p
L. obscurus (BLACKWALL)	10 (1 f)	A, e
L. tenebricola (WIDER)	3 (1 f), 10 (1 f)	A, p
L tenuis (BLACKWALL)	3(1f),5(1f),9(1m),10(1m),15(2f),18(1m)	A, e
Macrargus rufus (WIDER)	10 (1 f), 11 (1 f)	A, e
Meioneta rurestris (C.L. KOCH)	2 (1 f), 3 (1 m, 1 f), 5 (1 f), 7 (2 f), 10 (1 m, 5 f), 13 (2 f) 15 (2 f), 18 (1 f)	A, p
Microlinyphia pusilla (SUNDEVALL)	3 (1 f), 9 (2 f), 10 (1 m)	A, h
Neriene radiata (WALCKENAER)	11 (1 f)	A, h
Porrhomma convexum (WESTRING)	3 (1 f), 15 (1 f), 18 (1 f), 21 (1 f)	A, e
P. microphthalmum (O.P.-CAMBRIDGE)	3 (1 f)	A, e
Tetragnathidae		
Pachygnatha clercki SUNDEVALL	19 (1 f)	A, h
Araneidae		
Aculepeira ceropegia (WALCKENAER)	3 (1f), 9 (1m), 10 (1m, 1f), 13 (1f), 18 (1f)	A, p
Hypsosinga pygmaea (SUNDEVALL)	3 (1 m, 1 f), 11 (1 m), 15 (1 m, 2 f)	A, h
Neoscona adiantum (WALCKENAER)	24 (1 m)	A, p
Lycosidae		
Alopecosa accentuata (LATREILLE)	7 (1 f), 11 (1 m)	A, p
A. pulverulenta (CLERCK)	11 (1 m), 12 (3 f)	A, p
Pardosa agrestis (THORELL)	19 (5 m, 7 f)	B, p
P. albatula ROEWER	3 (3 m, 8 f), 4 (14 m), 5 (1 m, 12 f), 6 (4 f), 7 (4 f), 8 (6 f), 9 (1 m, 14 f), 10 (5 f), 11 (5 m, 1 f), 12 (2 m), 13 (3 m, 3 f), 14 (3 f), 17 (1 m, 3 f), 18 (7 f), 19 (9 m, 8 f), 20 (5 f), 22 (7 m), 23 (5 f)	B e
Pardosa amentata (CLERCK)	10 (1 m, 2 f)	A, p
P. blanda (C.L. KOCH)	16 (1 m, 2 f)	B, p
P. drenskii BUCHAR	3 (14 m, 4 f), 4 (32 m, 1 f), 5 (1 m), 6 (1 m), 7 (2 f), 10 (1 f), 12 (98 m, 50 f), 14 (2 f), 17 (2 f), 18 (2 f), 19 (3 m, 37 f), 22 (1 f)	C, b

P. lugubris (WALCKENAER)	3 (2 m, 3 f), 10 (1 f), 21 (78 f)	A, p
P. monticola (CLERCK)	2 (1 f), 3 (1 m), 4 (9 m), 10 (5 m, 6 f), 12 (1 m, 1f), 13 (1 m), 17 (2 f), 19 (13 m, 7 f), 21 (1 f)	A, p
P. morosa (L. KOCH)	21 (1 f)	A, e
P. palustris (LINNAEUS)	3 (1 f), 4 (20 m, 1 f), 5 (1 f), 10 (1 m), 18 (5 f), 19 (4 m)	A, h
P. riparia (C.L. KOCH)	3 (2 f), 7 (1 m)	A, p
Pirata piraticus (CLERCK)	13 (1 f)	A, h
Xerolycosa nemoralis (WESTRING)	7 (1 m)	A, p
Agelenidae		
Tegenaria rilaensis DELTSHEV	13 (1 m), 17 (1 f)	B, b
Hahniidae		
Cryphoeca pirini (DRENSKY)	4 (1 m), 5 (1 m), 13 (3 f)	C, b
Clubionidae		
Clubiona alpicola KULCZYNSKI	5 (1 f)	C, em
* *C. diversa* O.P.-CAMBRIDGE	3 (1 m)	A, e
C. genevensis L. KOCH	1 (1 f)	A, p
C. neglecta O.P.-CAMBRIDGE	3 (1 f), 18 (1 f)	A, h
C. similis L. KOCH	18 (1 f)	A, e
C. trivialis C.L. KOCH	21 (1 m)	A, e
Zodariidae		
Zodarion pirini DRENSKY	1 (2 f), 3 (2 f), 10 (2 f), 13 (2 f), 14 (3 f), 18 (3 f), 20 (4 f), 23 (2 f)	B, b
Gnaphosidae		
Drassodes lapidosus (WALCKENAER)	1 (3 f), 7 (1 f), 10 (2 f), 14 (1 f)	A, p
D. pubescens (THORELL)	1 (1 f), 9 (1 f), 18 (2 f), 22 (1 m)	A, p
* *Gnaphosa leporina* (L. KOCH)	2 (1 m, 1 f), 12 (25 m, 4 f), 19 (21, 4 f)	C, p
Haplodrassus signifer (C.L. KOCH)	2 (4 f), 3 (1 f), 4 (1 m, 3 f), 5 (1 f), 6 (1 f), 7 (1 m, 2 f), 9 (2 f), 12 (9 m, 36 f), 13 (1 f), 14 (1 m, 1 f), 18 (1 f), 19 (3 f), 20 (7 f)	A, h
Micaria aenea THORELL	7 (5 m, 5 f), 12 (4 m)	B, h
Micaria pulicaria (SUNDEVALL)	5 (1 f), 12 (1 m)	B, h
* *M. rossica* THORELL	10 (1 f), 15 (2 f)	B, h
Zelotes petrensis (C.L. KOCH)	10 (1 f)	A, e
Z. pusillus (C.L. KOCH)	3 (1 m)	A, e
Z. similis (KULCZYNSKI)	8 (1 f), 14 (1 m), 24 (1 m)	B, em

Heteropodidae		
Micromìnata virescens (CLERCK)	3 (1 m), 17 (1 m, 1 f)	A, p
Philodromidae		
Philodromus vagulus SIMON	3 (2 f)	B, em
P. fuscomarginatus (DEGEER)	17 (1 m)	A, p
Thanatus formicinus (CLERCK)	17 (1 f)	A, h
Tibellus oblongus (WALCKENAER)	7 (1 f), 10 (2 f), 13 (1 f)	A, h
Thomisidae		
Misumena vatia (CLERCK)	6 (1 f)	A, h
Runcinia grammica (C.L. KOCH)	10 (3 m), 11 (1 m), 13 (1 f), 24 (1 f)	A, p
Thomisus onustus WALCKENAER		A, p
Xysticus audax (SCHRANK)	1 (2 f), 8 (2 f)	A, p
Salticidae		
Evarcha arcuata (CLERCK)	10 (1 m)	A, p
Heliophanus flavipes C.L. KOCH	3 (5 f), 10 (5 f), 17 (1 f)	A, p
H. lineiventris SIMON	15 (1 m)	A, p
H. melinus L. KOCH	17 (1 f)	A, p
Pellenes tripunctatus (WALCKENAER)	9 (1 f)	A, p
Sitticus rupicola (C.L. KOCH)	13 (1 m), 15 (1 m), 17 (2 f)	A, h
S. zimmermanni (SIMON)	1 (2 f), 2 (1 f), 8 (2 f)	A, p

The groups of arctic-alpine (aa) and mountain-mediterranean species (mm) include ancient elements, one species each. *Mecynargus paetulus* (see THALER 1976) and *Robertus mediterraneus* may be considered as true high mountain elements.

In the group of endemic species (b + bp, 5, 4.9 %; 1), high alpine elements are *Erigone pirini, Pardosa drenskii, C. pirini,* characteristic also for the high altitude parts of Rila and Pirin mountains (DELTSHEV 1990, 1995). They can be regarded as derivates of their respective stem species from Middle or Northern Europe, speciation may have resulted from disjunction of ranges during the glacial and interglacial periods (DELTSHEV 1990, 1995). Two remaining species, *Gonatium orientale* and *Zodarion pirini,* are abundant in the mountain and subalpine belt (1200 -2400 m) and may be considered as sister species to *G. rubellum* and *Z. germanicum* from mid Europe.

4. Conclusion:

103 species have been established in the high altitude zone of Central Stara planina mountain. Only eight species not occurring below the tree-line can be considered as high mountain elements. For lack of the alpine belt only a few taxa from the high alpine complex of Rila and Pirin mountains occur on the highest sites of Stara planina: *Erigone pirini, Mecynargus paetulus, Lepthyphantes improbulus, Pardosa drenskii* and *Cryphoeca pirini.* The high mountain species complex characteristic for Central Stara planina is small and composed by local (Bulgarian, 3),

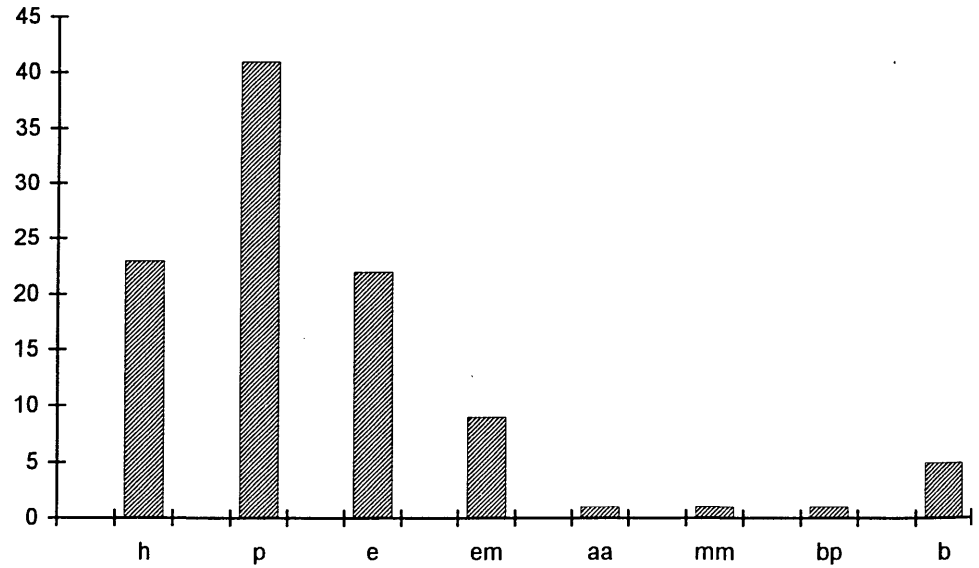

Fig. 1: Distribution types of spiders of the high altitude zone of Central Stara planina mountain. h = holarctic, p = palaearctic, e = european, aa = arctic-alpine, mm = mountain-mediterranean, em = european mountains, bp = Balkan peninsula, b = Bulgaria.

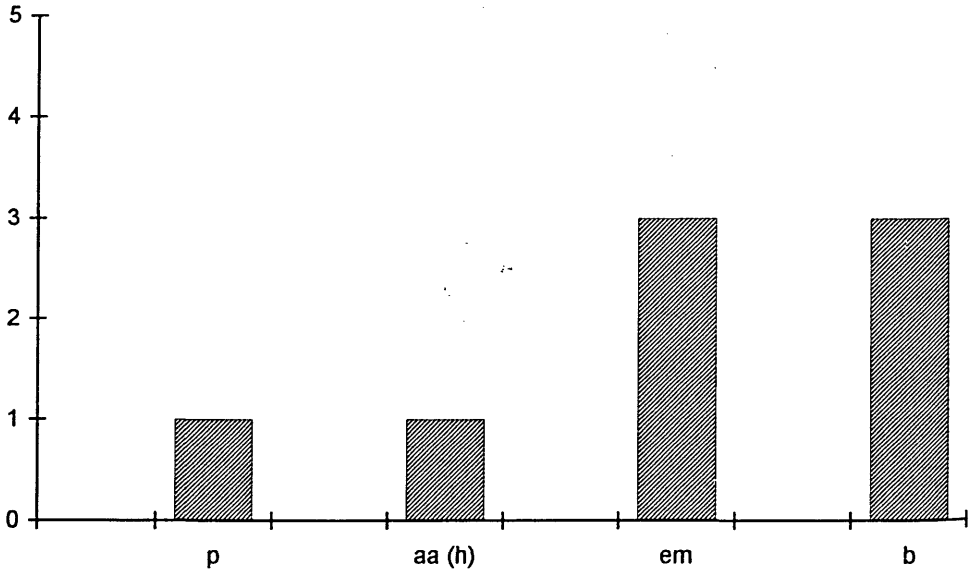

Fig. 2: Zoogeographic characteristics of the high mountain species complex of spiders in Central Stara planina mountain. For symbols see fig. 1.

euro-mountain (3), endemic (3), holarctic (1) and palaearctic (1) species. The character of the high-altitude spider fauna of Central Stara planina mountain is therefore palaearctic and mainly European.

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5. Literature:

BONDEV, I. (1991): [The vegetation of Bulgaria]. – St. Kl. Ochridski University Press, 184 pp.

BUCHAR, J. (1968): Zur Lycosidenfauna Bulgariens (Arachn., Araneae). – Vest. Cs. spol. zool. **32:** 116 - 130.

DELTSHEV, C. (1980): On the high altitude spiders (Araneae) in Bulgaria. – Proc. 8th Int. Congr. Arachn. Vienna: 405 - 409.

– (1990): The high-altitude spiders (Araneae) in the Pirin Mountains, Bulgaria. – Acta Zool. Fenn. **190:** 111 - 115.

– (1995): Spiders (Araneae) from the high altitude zone of Central Stara planina Mountain (Bulgaria). – Ber. nat.-med Verein Innsbruck **82:** 217 - 225.

DRENSKY, P. (1911): Uber die Spinnen-Fauna des Trojan-Balkan und seiner nordlichen Abhange bis zur Stadt Lowetsch. – Entom. Rundschau **6:** 41 - 43.

– (1913): [Über die Spinnen-Fauna Bulgariens]. – Sammlg. Bulgar. Acad. Wiss. **2:** 1 - 144.

– (1936): Katalog der echten Spinnen (Araneae) der Balkanhalbinsel. – Sborn. Bulg. Akad. Nauk. **32:** 1 - 223.

– (1938): [Die Spinnenfauna Bulgariens, II. Unterordnung Arachnomorphae, I Gruppe Tetrastica, Familien: Filistatidae, Dysderidae und Oonopidae]. – Mitt. k. naturwiss. Inst. Sofia **11:** 81 - 106.

– (1939): [Die Spinnenfauna Bulgariens, III. Unterordnung Arachnomorphae, II Gruppe Trionichia, Familien: Urocteidae, Uloboridae, Sicariidae, Pholcidae, Eresidae]. – Mitt. k. naturwiss. Inst. Sofia **12:** 231 - 252.

– (1940): [Die Spinnenfauna Bulgariens, IV. Unterordnung Arachnomorphae, II Gruppe Trionichia, Familien: Zodariidae, Dictynidae, Amaurobiidae]. – Mitt. k. naturwiss. Inst. Sofia **12:** 169 - 194.

– (1942): [Die Spinnenfauna Bulgariens, V. Unterordnung Arachnomorphae, II Gruppe Trionichia, Familie: Agelenidae]. – Mitt. k. naturwiss. Inst. Sofia **15:** 33 - 60.

– (1943): [Die Spinnenfauna Bulgariens, VI. Unterordnung Arachnomorphae, II Gruppe Trionichia, Familie: Eutrioidae]. – Mitt. k. naturwiss. Inst. Sofia **16:** 219 - 254.

THALER, K. (1976): Endemiten and arkoalpine Arten in der Spinnenfauna der Ostalpen (Arachnida: Araneae). – Entomol. Germ. **3:** 135 - 141.

– (1988): Arealformen in der nivalen Spinnenfauna der Ostalpen (Arachnida: Araneai). – Zool. Anz. **220:** 233 - 244.