

The faunistic diversity of cave-dwelling spiders (Arachnida, Araneae) of Greece

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Abstract: Until today, from Greek caves a total of 109 species of spiders belonging to 25 families are known. One species, the linyphiid *Porrhomma convexum* (Westring, 1861) was recorded here for the first time in Greece. The 109 species are distributed in caves of different geographic territories as follows: Thrace – 8 species, Macedonia – 18, Epirus – 1, Thessaly – 6, Central Greece – 3, Attiki-Saronic Islands – 24, Peloponnese – 15, Evoia-Vories Sporades – 1, Eastern Aegean Islands – 5, Cyclades – 3, Dodecanese – 6, Ionian Islands – 23, Crete – 47. The largest fraction of troglobite species were encountered mainly in the territories of Crete – 15 species (5 of which are anophthalmic), the Ionian Islands – 4, Thrace – 2 (both anophthalmic), the Attiki-Saronic Islands – 2 (both anophthalmic), the Peloponnese – 2 (one anophthalmic), and Macedonia, Thessaly, and the Cyclades – each with 2 species. The richness of the troglobitic spiders in these regions strengthens the assumption that they were major centres of speciation and evolution for the species of this group. According to their current distribution, the established 109 species can be classified into 12 zoogeographical categories, grouped into 4 complexes (widely distributed, European, Mediterranean, endemics). The largest number of species belong to the endemic complex (53.2 %) and are also the most characteristic and reflect the local character of the cave-dwelling spiders.

Key words: cave-spiders fauna, endemics, troglobites, zoogeography

The earliest data on Greek cave-dwelling spiders were presented by SIMON (1885), KULCZYŃSKI (1903), ROEWER (1928, 1959), DRENSKY (1936); KRATOCHVÍL (1937, 1938), HADJISSARANTOS (1940), and FAGE (1945). More recent publications derive from the investigations of BRIGNOLI (1968, 1971a, 1971b, 1972, 1974a, 1974b, 1974c, 1976, 1977, 1978, 1979, 1984), DEELEMEN-REINHOLD (1971, 1977, 1983, 1985, 1989, 1993), DEELEMEN-REINHOLD & DEELEMEN (1988), SENGLER (1971, 2001), DELTSHEV (1979, 1985, 1999, 2000, 2008), BERON (1985, 1986), BERON & STOEV (2004), THALER & KNOFLACH (1995), WUNDERLICH (1995), BOSSELAERS (1998), BOSSELAERS & HENDERICKX (2002), GASPARO (2003, 2004a, 2004b, 2005a, 2005b, 2006, 2007, 2008, 2009), CHATZAKI et al 2002, BOSMANS & CHATZAKI (2005), CHATZAKI & ARNEDO (2006), and PLATNICK (2009). The critical incorporation of all available literature records and the accumulation of new data are now sufficient to allow a critical analysis of the distribution of spiders established in the caves of Greece.

Study area and material

Greece is a country in south-eastern Europe, situated

on the southern end of the Balkan Peninsula. The country has borders with Albania, the Republic of Macedonia and Bulgaria to the north, and Turkey to the east. The Aegean Sea lies to the east and south of mainland Greece, while the Ionian Sea lies to the west. Both parts of the Eastern Mediterranean basin feature a vast number of islands, islets and rock islands (Fig.1). Two-thirds of the territory of Greece is dominated by limestone, many of which are karstified (CLENDENON 2009).

The territory of Greece can be divided into 13 geographical regions (BOSMANS & CHATZAKI 2005; Fig. 1). There are 7 geographical regions on the mainland: Thrace, Macedonia, Epirus, Thessaly, Central Greece, Attica and the Peloponnese. The Ionian Islands are situated on the western border of Greece in the Ionian Sea. There are several island groups in the Aegean Sea on the eastern side of Greece: Evoia and the Sporades, the Saronic Islands (grouped with Attica), the Cyclades, the Eastern Aegean Islands, the Dodecanese and Crete (Fig. 1).

Results

Species composition

The spiders established in the caves of Greece (Mainland and Insular part) are represented by 109 species, included in 52 genera and 25 families: Ctenizidae – 1, Filistatidae – 1, Sicariidae – 1, Scytodidae – 1, Leptonetidae – 9, Pholcidae – 10, Segestriidae – 3, Dysderidae – 12, Oonopidae – 1, Mimetidae – 1, Ere-

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Figure 1: Map of different geographical regions in Greece.

sidæ – 1, Uloboridae – 1, Nesticidae – 4, Theridiidae – 4, Anapidae – 1, Linyphiidae – 16, Tetragnathidae – 4, Araneidae – 1, Lycosidae – 1, Agelenidae – 21, Amaurobiidae – 4, Gnaphosidae – 6, Philodromidae – 1, Thomisidae – 2, Salticidae – 2 (Table 1). One species is new for the Greek spider fauna: *Porrhomma convexum* (Westring, 1861) (marked in the list with *), a spider with a Holarctic distribution and widespread in European caves. It is also well represented in the caves of the Balkan Peninsula – and not only established in the caves of Croatia, Romania and Turkey (DELTSHEV 2008). The number of species is high and represents about 13 % of the Greek spiders. This is also evident from a comparison with the number of cave-dwelling spiders recorded from the other countries of the Balkan Peninsula: Bulgaria – 99, Croatia – 63, Serbia – 59, Bosnia and Herzegovina – 52, Macedonia – 44, Montenegro – 44, Slovenia – 43, Albania – 10, Turkey – 8, and Romania – 4 (DELTSHEV 2008). The established number of species, however, depends not only on the size of the regions, but also on the degree of exploration. The most characteristic are the families: Leptonetidae (8.2 %), Pholcidae (9.2 %), Dysderidae (11 %), Linyphiidae (14.6 %), and Agelenidae (19.2 %). The families with largest number of anophthalmic species are Leptonetidae

(6), Dysderidae (3), Nesticidae (2), and Linyphiidae (1). The genera with the largest number of species are *Tegenaria* (8), *Lepthyphantes* (6), *Harpactea* (5), and *Histopona* (5).

The species are distributed in caves belonging to the geographic territories of Greece as follows: Thrace – 8 species, Macedonia – 18, Epirus – 1, Thessaly – 6, Central Greece – 3, Attiki-Saronic Islands – 24, the Peloponnese – 15, Evoia-Voroies Sporades – 1, the Eastern Aegean Islands – 5, the Cyclades – 7, the Dodecanese – 6, the Ionian Islands – 23, Crete – 47 (Table 1). We also have to emphasise that the degree of exploration in these territories is not equal: the territories of Evoia-Sporades, the Cyclades, the Dodecanese and Central Greece are less explored.

Cave-dwelling spiders can be categorised into four ecological groups (SKET 2008):

- troglobites: species limited to a life cycle in caves. Often they show a suite of characters, associated with their adaptation to subterranean life: loss of pigment, loss of eyes and elongation of appendages.
- eutroglophiles: species which can live their entire life in caves, but also occur in other environments.
- subtroglophiles: species which utilise caves, but must leave the caves to complete their life cycle.
- trogloxenes: species which occur underground sporadically.

The largest fraction of troglobite species was encountered mainly in the caves of the territories of Crete – 15 (5 anophthalmic), the Ionian Islands – 4, Thrace – 2 (2 anophthalmic), the Attiki-Saronic Islands 2 (2 anophthalmic), the Peloponnese – 2 (1 anophthalmic), and Macedonia, Thessaly and the Cyclades each by 2 species (Table 1). All troglobites are endemics for the territory of Greece or the Balkan Peninsula.

Very important is the presence of eutroglophiles (35 species), because together with troglobites (29 species), they can be considered as dependent faunistic elements of caves. The largest number of species is established in the caves of Crete (14 species), the Ionian Islands (11 species), the Attiki-Saronic Islands (9 species), Macedonia (8 species), and the Peloponnese (8 species). Here, the endemics are represented by 14 species (35 %). A present day example of active subterranean colonisation and cave penetration are the species *Lepthyphantes centromeroides* and *Palliduphantes spelaeorum*, widespread in the Balkan Peninsula (DEELEMANN-REINHOLD 1978). Here, the species *Palliduphantes istrianus* should also be included.

Table 1: Species composition of cave dwelling spiders in Greece

Category (CAT): **tb** – troglobite; **tba** – troglobite anophthalmic; **etph** – eutroglophile; **stph** – subtroglophile; **tx** - troglonexene

Zoogeography (Z_G): **COS** – Cosmopolitan; **H** – Holarctic; **P** – Palearctic; **WP** - West Palearctic; **ECA** - European-Central Asian; **E** - European; **MSEE** - Middle Southeast European; **MCA** – Mediterranean-Central Asian; **M** - Mediterranean; **NM** - North Mediterranean; **NEM** - Northeast Mediterranean; **E** – Endemics; **ETHR** - Endemic for Thrace; **EMTH** - Endemic for Macedonia and Thrace; **EEP** - Endemic for Epirus; **EETI** - Endemic for Epirus, Thessaly and Ionian Islands; **ECGR** - Endemic for Central Greece; **EAS** - Endemic for Attiki-Saronic Islands; **ECOG** – Endemic for continental Greece; **EPE** - Endemic for Peloponnese; **EAP** - Endemic for Attiki-Saronic Islands and Peloponnese; **EPI** – Endemic for Peloponnissus and Ionian Islands; **EEAI** - Endemic for Eastern Aegean Islands; **ECY** - Endemic for Cyclades; **EKA** - Endemic for Karpathos; **EIO** - Endemic for Ionian Islands; **ECR** – Endemic for Crete; **EGR** - Endemic for continental and island Greece; **EBP** - Endemic for Balkan Peninsula.

Distribution: **THR** – Thrace; **MA** – Macedonia; **EP** – Epirus; **THE** – Thessaly; **CGR** – Central Greece; **ASI** - Attiki-Saronic Islands; **PE** – Peloponnese; **ESI** - Evia-Sporades; **EAI** - Eastern Aegean Islands; **CY** - Cyclades; **DO** – Dodecanese; **IO** – Ionian Islands; **CR** – Crete.

TAXA	CAT	Z_G	THR	MA	EP	THE	CGR	ASI	PE	ESI	EAI	CY	DO	IO	CR
Cyrtachaeniidae															
<i>Cyrtocarenum grajum</i> (C.L. Koch 1836)	tx	ECR													x
Filistatidae															
<i>Filistata insidiatrix</i> (Forsskål, 1775)	stph	M		x										x	x
Sicaridae															
<i>Loxosceles rufescens</i> (Dufour, 1820)	stph	COS		x				x	x			x			x
Scytododae															
<i>Scytodes thracica</i> Latreille, 1804	stph	H							x			x	x	x	x
Leptonetidae															
<i>Barusia laconica</i> (Brignoli, 1974)	tb	EPE							x					x	
<i>Cataleptoneta sengleti</i> (Brignoli, 1974)	tba	ECR													x
<i>Leptonetela andreevi</i> Deltshv, 1985	tba	ECY													
<i>Leptonetela kanellisi</i> (Deeleman-Reinhold, 1971)	tba	EAS						x							
<i>Leptonetela strinatii</i> (Brignoli, 1976)	tba	EAS						x							
<i>Leptonetela thracia</i> Gasparo, 2005	tba	ETHR	x												
<i>Sulcia cretica cretica</i> Fage, 1945	tb	ECR													x
<i>Sulcia cretica lindbergi</i> Dresco, 1962	tba	EEP			x										x
<i>Sulcia cretica violacea</i> Brignoli, 1974	tb	EETI			x	x								x	
Pholcidae															
<i>Holocnemus plucei</i> (Scopoli, 1763)	etph	M		x				x					x	x	x
<i>Hoplopholcus figulus</i> Brignoli, 1971	etph	EEAI									x				
<i>Hoplopholcus labyrinthi</i> (Kulczyński, 1903)	tb	ECR													x
<i>Hoplopholcus minotaurinus</i> Senglet, 1971	tb	ECR													x
<i>Hoplopholcus minous</i> Senglet, 1971	stph	EKA											x		
<i>Pholcus creticus</i> Senglet, 1971	etph	ECR													x

TAXA	CAT	Z_G	THR	MA	EP	THE	CGR	ASI	PE	ESI	EAI	CY	DO	IO	CR
<i>Pholcus opilionoides</i> (Schrank, 1781)	etph	H													x
<i>Pholcus phalangioides</i> (Fuesslin, 1775)	etph	COS		x								x			x
<i>Spermophora senoculata</i> (Dugès, 1836)	etph	H											x		
<i>Stygopobolcus photophilus</i> (Senglet, 1971)	etph	EGR		x		x					x			x	x
Segestridae															
<i>Segestria florentina</i> (Rossi, 1790)	tx	WP						x							x
<i>Segestria sbordonii</i> Brignoli, 1984	tx	ECR													x
<i>Segestria senoculata</i> (Linnaeus, 1758)	tx	P												x	
Dysderidae															
<i>Dysdera cephalonica</i> Deeleman-Reinhold, 1988	tx	EIO											x		
<i>Dysdera crocata</i> C.L. Koch, 1838	etph	COS													x
<i>Dysderocrates gasparoi</i> Deeleman-Reinhold, 1988	etph	EIO												x	
<i>Dysderocrates marani</i> (Kratohvil, 1937)	etph	ECR													x
<i>Harpactea catholica</i> (Brignoli, 1984)	etph	ECR													x
<i>Harpactea corinthia</i> Brignoli, 1984	etph	EPE							x						
<i>Harpactea loebli</i> Brignoli, 1974	tx	EIO												x	
<i>Harpactea rubicunda</i> (C.L. Koch, 1838)	stph	E	x	x											
<i>Harpactea strinatii</i> Brignoli, 1979	tba	EPE							x						
<i>Minotauria attemsi</i> Kulczyński, 1903	tb	ECR													x
<i>Minotauria fagei</i> (Kratohvil, 1970)	tba	ECR													x
<i>Rhodera hypogea</i> Deeleman-Reinhold, 1989	tba	ECR													x
Oonopidae															
<i>Oonops mahnerti</i> Brignoli, 1974	tx	EPE							x						
Mimetidae															
<i>Ero flammeola</i> Simon, 1881	tx	M												x	
Eresidae															
<i>Eresus kollari</i> Rossi, 1846	tx	ECA						x	x						
Uloboridae															
<i>Uloborus plumipes</i> Lucas, 1846	tx	COS						x					x		
Nesticidae															
<i>Nesticus beshkovi</i> Deltshv, 1979	tba	ECR													x
<i>Nesticus cellulanus</i> (Clerck, 1757)	etph	H		x											
<i>Nesticus eremita</i> Simon, 1879	tb	NEM				x				x				x	
<i>Nesticus benderickxi</i> Bosselaers, 1998	tba	K													x
Theridiidae															
<i>Crustulina scabripes</i> Simon, 1881	tx	M											x		
<i>Steatoda castanea</i> (Clerck, 1757)	tx	P													x

TAXA	CAT	Z_G	THR	MA	EP	THE	CGR	ASI	PE	ESI	EAI	CY	DO	IO	CR
<i>Steatoda grossa</i> (C.L. Koch, 1838)	stph	COS												x	x
<i>Steatoda triangulosa</i> (Walckenaer, 1802)	stph	COS							x						
Anapidae															
<i>Zantherella apuliae</i> (Caporiacco, 1949)	tb	NM												x	
Linyphiidae															
<i>Centromerus milleri</i> Deltshv, 1974	tba	EMTH	x												
<i>Diplocephalus turcicus</i> Brignoli, 1972	tx	NEM						x							
<i>Icariella hauseri</i> Brignoli, 1979	tx	EGR									x				
<i>Lepthyphantes beroni</i> Deltshv, 1979	tb	ECR										x			x
<i>Lepthyphantes beshkovi</i> Deltshv, 1979	tb	ECR													x
<i>Lepthyphantes brignolianus</i> Deltshv, 1979	tb	ECR													x
<i>Lepthyphantes kratochvili</i> Fage, 1945	tb	ECR													x
<i>Lepthyphantes magnesiae</i> Brignoli, 1979	etph	ECOG							x						
<i>Palliduphantes byzantinus</i> (Fage, 1931)	etph	EBP							x						
<i>Palliduphantes epaminonda</i> (Brignoli, 1979)	tb	ECGR					x								
<i>Palliduphantes istrianus</i> (Kulczyński, 1914)	tb	EBP		x										x	
<i>Palliduphantes spelaeorum</i> (Kulczyński, 1914)	tb	EBP		x											
<i>Porrhomma convexum</i> (Westring, 1851)	tb	P		x											
<i>Savignia naniplopi</i> Bosselaers & Henderickx, 2002	tx	ECR													x
<i>Tenuiphantes tenuis</i> (Blackwall, 1852)	tx	E												x	
Tetragnathidae															
<i>Meta bourneti</i> Simon, 1922	etph	WP	x					x	x						
<i>Meta menardi</i> (Latreille, 1804)	etph	E				x		x	x						
<i>Metellina merianae</i> (Scopoli, 1763)	etph	E		x				x						x	x
<i>Tetragnatha montana</i> Simon, 1874	tx	P		x											
Araneidae															
<i>Larinioides suspicax</i> (O.P.-Cambridge, 1876)	tx	E													x
Lycosidae															
<i>Alopecosa albofasciata</i> (Brüllé, 1832)	tx	M		x				x							x
Agelenidae															
<i>Allagelena gracilens</i> (C.L. Koch, 1841)	tx	WP						x							
<i>Histopona hauseri</i> Brignoli, 1972	etph	EIO												x	
<i>Histopona isolata</i> Deeleman-Reinhold, 1983	tb	ECR													x
<i>Histopona myops</i> (Simon, 1885)	etph	ECOG				x			x						
<i>Histopona strinatii</i> (Brignoli, 1976)	etph	EP							x						
<i>Histopona thaleri</i> Gasparo, 2005	etph	ECGR					x								
<i>Maimuna cretica</i> (Kulczyński, 1903)	stph	EK													x

TAXA	CAT	Z_G	THR	MA	EP	THE	CGR	ASI	PE	ESI	EAI	CY	DO	IO	CR
<i>Maimuna vestita</i> (C.L. Koch, 1841)	stph	NEM		x				x							
<i>Malthonica dalmatica</i> (Kulczyński, 1906)	etph	NEM									x			x	x
<i>Malthonica ferruginea</i> (Panzer, 1804)	etph	E	x	x				x							x
<i>Malthonica pagana</i> (C.L. Koch, 1840)	etph	MCA						x				x			x
<i>Tegenaria silvestris</i> (L. Koch, 1872)	etph	E						x							
<i>Tegenaria achaea</i> Brignoli, 1977	etph	EEAI									x				
<i>Tegenaria ariadnae</i> Brignoli, 1984	etph	ECR													x
<i>Tegenaria domestica</i> (Clerck, 1757)	etph	COS		x				x	x					x	
<i>Tegenaria hauseri</i> Brignoli, 1979	etph	EIO												x	
<i>Tegenaria labyrinthi</i> Brignoli, 1984	stph	ECR													x
<i>Tegenaria paragamiani</i> Deltshv, 2008	etph	ETHR													
<i>Tegenaria parietina</i> (Fourcroy, 1785)	etph	WP						x				x		x	x
<i>Tegenaria pieperi</i> Brignoli, 1979	tb	ECR													x
<i>Tegenaria schmalfussi</i> Brignoli, 1976	tb	ECR													x
Amaurobiidae															
<i>Amaurobius cretaensis</i> Wunderlich, 1995	tx	ECR													x
<i>Amaurobius deelemanae</i> Thaler & Knoflach, 1995	tx	ECDC										x			
<i>Amaurobius pelops</i> Thaler & Knoflach, 1991	tx	EAP						x							
<i>Amaurobius strandi</i> Charitonov, 1937	tx	SEE						x							
Gnaphosidae															
<i>Drassodes lapidosus</i> (Walckenaer, 1802)	tx	P						x							x
<i>Nomisia ripariensis</i> (Thorell, 1871)	tx	NEM													x
<i>Pterotricha lentiginosa</i> (C.L. Koch, 1837)	tx	NEM						x							x
<i>Zelotes clivicola</i> (L. Koch, 1870)	tx	P						x							
<i>Zelotes femellus</i> (L. Koch, 1866)	tx	NEM		x											
<i>Zelotes oblongus</i> (C.L. Koch, 1833)	tx	MSEE													x
Sparassidae															
<i>Eusparassus walckenaeri</i> (Audouin, 1826)	tx	NEM													x
Philodromidae															
<i>Philodromus collinus</i> C.L. Koch, 1835	tx	E						x							
Thomisidae															
<i>Synema globosum</i> (Fabricius, 1775)	tx	P						x							
<i>Xysticus kochi</i> Thorell, 1872	tx	WP													x
Salticidae															
<i>Evarcha falcata</i> (Clerck, 1757)	tx	P	x												x
<i>Mendoza canestrinii</i> (Ninni, 1868)	tx	P		x											

Table 2: Zoogeographical composition of cave dwelling spiders in Greece

Complexes	Chorotypes		Species	
	Classification	Code	Number	%
Widely distributed	Cosmopolitan	COS	7	6.4
	Holarctic	HOL	5	4.6
	Palaearctic	PAL	9	8.2
	West Palaearctic	WP	5	4.6
	European-Central Asiatic	ECA	1	0.9
	Total		27	24.7
European	European	E	8	7.3
	Middle-Southeast European	MSEE	1	0.9
	South East European	SEE	1	0.9
	Total		10	9.2
Mediterranean	Mediterranean-Central Asiatic	MCA	1	0.9
	Mediterranean	M	5	4.62
	North East Mediteranean	NEM	8	7.3
	Total		14	12.8
Endemics	Endemic for continental and island Greece	EGR	55	50.4
	Endemic for Balkan Peninsula	EBP	3	2.7
	Total		58	53.2

The group of subtrogliphiles comprises 11 species occurring in dark places such as buildings, crevices, rock crevices and caves. They can be considered as regular inhabitants of the caves. Three species are endemics (*Maimuna cretica*, *Hoplppholcus minous*, and *Tegenaria labyrinthi*).

The troglonexes are represented by 36 species. They are not truly cavernicolous faunistic elements, but their presence in caves should not be ignored. On the other hand some of them will probably be considered subtrogliphiles and even eutrogliphiles once more information on their ecology is gathered. Here, the endemics are represented by 11 species.

Zoogeographical analysis

According to their current distribution, the established 109 species can be classified into 12 zoogeographical categories, grouped into four complexes (widely distributed, European, Mediterranean, endemics) (Tab. 1 & 2, Fig. 2).

Best represented is the complex of endemics with 58 species (53.2 %), which include 29 troglobites, 16 trogliphiles, and 12 troglonexes. The established number is high and reflects the local character of the cave fauna. The endemics are best represented in Crete – 26 species and 2 genera (*Minotauria*, *Rhoderia*), the Ionian Islands – 9 species, the Peloponnese – 8 species, Macedonia and the Eastern Aegean Islands – each with 4 species. The recent cave spider fauna is formed after gradual changes in the fauna of the ancient

humid Tertiary forests (DEELEMAN-REINHOLD 1977). However, due to a lack of data, it is difficult to determine with certainty which cave spider endemics of the Balkans are Tertiary, and which are Quaternary, elements.

The complex of widely distributed species comprises 36 species (29.2 %). Palaearctic species are dominant (47.2 %), followed by Cosmopolitan (19.4 %) Holarctic (13.8 %), West Palaearctic (13.8 %), and European-Central Asiatic (5.5 %). The complex includes mostly widespread species associated with lowlands, buildings, caves, woodlands and high altitude zones of mountains. Here characteristic for caves are *Nesticus cellulanus*, *Porrhomma convexum* and *Tegenaria domestica*. These species are also largely

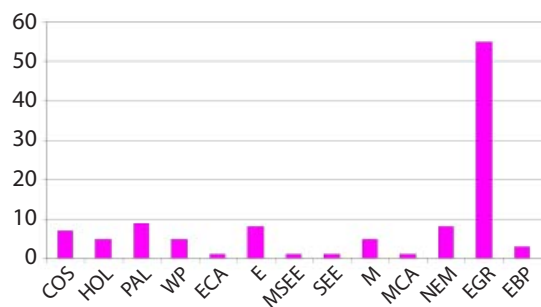


Figure 2: Relative representation of the zoogeographical categories of cave dwelling spiders in Greece (for abbreviations see Table 1).

widespread taxa in European caves where *Porrhomma convexum* occurs in the deep parts.

The European complex includes 10 species (9.2 %). European species are dominant (8 %) among this complex. The Middle Southeast European and Southeast European species are represented by single species - troglonemes. The complex comprises widespread spiders in Europe and the Balkan Peninsula which inhabit both lowlands and mountains. The most characteristic are *Meta menardi* and *Metellina merianae*, both widespread in European caves.

The Mediterranean complex includes 14 species (12.8 %). The real representation of this category is probably higher because part of the endemic fauna has a Mediterranean origin. Dominant here are the species widespread in the Mediterranean region or part of it, but the real cavernicolous elements are *Nesticus eremita* and *Zanagherella apuliae* (characteristic mainly for the superficial underground compartment) distributed in the caves of the north-west part of Greece.

Conclusions

- The faunistic diversity of the reported 109 cave-dwelling spiders shows that Greek caves are characterised by a considerable species richness. This is also supported by comparing the number of cave-dwelling spiders recorded from other countries in the Balkan Peninsula: Bulgaria – 99, Croatia – 63, Serbia – 59, Bosnia and Herzegovina – 52, Macedonia – 44, Montenegro – 44, Slovenia – 43, Albania – 10, Turkey – 8, and Romania – 4 (DELTSHEV 2008).
- The uneven species richness in the caves of different regions of Greece is probably due mainly to the different degree of exploration by researchers.
- Isolation and resulting endemism seems to be the driving force for the cave faunal patterns observed.
- Most characteristic, in a faunal and zoogeographical respect, is the presence of 58 endemic species in Greek caves.
- The high percentage of the endemics (53.2 %) suggests a local speciation process with consequent formation of neo-endemics.
- All troglotic spiders are endemic, which leads to the conclusion that the regions where they are currently distributed were major centres of speciation.

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References

- 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. (1986): Results of the studies of the cave fauna of Greece. – *Biologia Gallo-Hellenica* 12: 125-131
- BERON P. (2001): Etude comparative des faunes cavernicoles de la Bulgarie et de la Grèce. – *Historia naturalis bulgarica* 13: 53-68
- BERON P., B. PETROV & P. STOEV (2004): The invertebrate cave fauna of the Eastern Rhodopes (Bulgaria and Greece). In: BERON P. & A. POPOV (eds): Biodiversity of Bulgaria. 2. Biodiversity of Eastern Rhodopes (Bulgaria and Greece). Pensoft & National Museum of Natural History. Sofia. pp. 791-822
- BOSELAERS J. (1998): *Nesticus henderickxi* (Araneae, Nesticidae), a new anophthalmic troglitic spider from Crete. – *Bulletin of British Arachnological Society* 11: 9-14
- BOSELAERS J. & H. HENDERICKX (2002): A new *Savignia* from Cretan caves (Araneae: Linyphiidae). – *Zootaxa* 109: 1-8
- BOSMANS R. & M. CHATZAKI (2005): A catalogue of the spiders of Greece. A critical review of spider species cited from Greece with their localities. – *Newsletter of the Belgian Arachnological Society* 20 (Supplement 2): 1-224
- BRIGNOLI P.M. (1968): Über griechische Leptonetidae (Arachnida: Araneae). – *Senckenbergiana biologica* 49: 259-264
- BRIGNOLI P.M. (1971a): Su alcuni *Leptyphantes* di Creta (Araneae, Linyphiidae). – *Fragmenta entomologica* 7: 231-241
- BRIGNOLI P.M. (1971b): Beitrag zur Kenntnis der mediterranen Pholcidae (Arachnida, Araneae). – *Mitteilungen aus dem Museum für Naturkunde in Berlin* 47: 255-267 – doi: [10.1002/mmzn.19710470203](https://doi.org/10.1002/mmzn.19710470203)
- BRIGNOLI P.M. (1972): Su alcuni ragni cavernicoli di Corfu (Arachnida, Araneae). – *Revue suisse de Zoologie* 79: 861-869
- BRIGNOLI P.M. (1974a): Ragni di Grecia VI. Specie nuove o interessanti delle isole Ionie e della Morea (Araneae). – *Revue suisse de Zoologie* 81: 155-175
- BRIGNOLI P.M. (1974b): Ragni di Grecia VII. Raccolte in grotte dell'Attica del Dr P. Strinati (Araneae). – *Revue suisse de Zoologie* 81: 493-499

- BRIGNOLI P.M. (1974c): Araignées de Grèce VIII. Quelques Leptonetidae de la Laconie et de l'île de Crète (Arachnida, Araneae). – *Annales de Spéléologie* 29: 63-70
- BRIGNOLI P.M. (1976): Ragni di Grecia IX. Specie nuove o interessanti delle famiglie Leptonetidae, Dysderidae, Pholcidae ed Agelenidae (Araneae). – *Revue suisse de Zoologie* 83: 539-578
- BRIGNOLI P.M. (1977): Ragni di Grecia X. Nuovi dati sulla Grecia continentale ed insulare (Araneae). – *Revue suisse de Zoologie* 84: 937-954
- BRIGNOLI P.M. (1979): Ragni di Grecia XI. Specie nuove o interessanti, cavernicole ed epigee. – *Revue suisse de Zoologie* 86: 181-202
- BRIGNOLI P.M. (1984): Ragni di Grecia XII. Nuovi dati su varie famiglie (Araneae). – *Revue suisse de Zoologie* 91: 281-321
- CHATZAKI M. & M.A. ARNEDE (2006): Taxonomic revision of the epigean representatives of the spider subfamily Harpactinae (Araneae: Dysderidae) on the island of Crete. – *Zootaxa* 1169: 1-32
- CHATZAKI M., K. THALER & M. MYLONAS (2002): Ground spiders (Gnaphosidae; Araneae) of Crete (Greece). Taxonomy and distribution. I. – *Revue suisse de Zoologie* 109: 559-601
- CLENDENON C. (2009): Karst hydrology in ancient myths from Arcadia and Argolis, Greece. – *Acta karsologica* 38: 145-154
- DEELEMEN-REINHOLD C.L. (1971): A new species of *Sulcia* Kratochvíl (Araneida, Leptonetidae) from Greece, and a discussion of some Japanese cavernicolous Leptonetidae. – *Zoologische Mededelingen* 45: 289-301
- DEELEMEN-REINHOLD C.L. (1977): Distribution patterns in European cave spiders. – *Congrès Internationale de Spéléologie* 7 (Sheffield, 1977): 25-34
- DEELEMEN-REINHOLD C.L. (1983): The genus *Histopona* Thorell (Araneae, Agelenidae) with description of two new cave-dwelling species. – *Mémoires de Biospéologie* 10: 325-337
- DEELEMEN-REINHOLD C.L. (1985): Contribution à la connaissance des *Lepthyphantes* du groupe *pallidus* (Araneae, Linyphiidae) de Yougoslavie, Grèce et Chypre. – *Mémoires de Biospéologie* 12: 37-50
- DEELEMEN-REINHOLD C.L. (1989): *Rhodera* n. gen., *hypogea* n. sp., araignée microphthalme de l'île de Crète. Un fossile vivant? (Araneae: Dysderidae: Dysderinae). – *Mémoires de Biospéologie* 16: 47-51
- DEELEMEN-REINHOLD C.L. (1993): The genus *Rhoda* and the harpacteine genera *Stalagtia*, *Folkia*, *Minotauria*, and *Kaemis* (Araneae, Dysderidae) of Yugoslavia and Crete, with remarks on the genus *Harpactea*. – *Revue arachnologique* 10: 105-135
- DEELEMEN-REINHOLD C.L. & P.R. DEELEMEN (1988): Révision des Dysderinae (Araneae, Dysderidae), les espèces méditerranéennes occidentales exceptées. – *Tijdschrift voor Entomologie* 131: 141-269
- DELTSHEV C. (1979): A contribution to the study of cave spiders (Araneae) in Greece. Four new species (Araneae, Nesticidae, Linyphiidae) from the islands of Crete and Thera. – *Acta zoologica bulgarica* 13: 53-63
- DELTSHEV C. (1985): New data concerning cave spiders (Araneae) in Greece with description of a new *Leptonetela* (Araneae, Leptonetidae). – *Acta zoologica bulgarica* 27: 41-45
- DELTSHEV C. (1999): Faunistic and zoogeographical review of the spiders (Araneae) of the Balkan Peninsula. – *The Journal of Arachnology* 27: 255-261
- DELTSHEV C. (2000): The endemic spiders (Araneae) of the Balkan Peninsula. – *Ekológia, Bratislava* 19, Supplement 3: 59-65
- DELTSHEV C. (2008): Faunistic diversity and zoogeography of cave-dwelling spiders on the Balkan Peninsula. In: MAKAROV S.E. & R.N. DIMITRIJEVIĆ (Eds): *Advances in arachnology and developmental biology. Papers dedicated to Prof. Dr. Božidar Čurčić*. Institute of Zoology, Belgrade; Bulgarian Academy of Sciences, Sofia; Faculty of Life Sciences, Vienna; SASA, Belgrade; UNESCO MAB Committee, Serbia. *Monographs* 12: 327-348
- DRENSKY P. (1936): Katalog der echten Spinnen (Araneae) der Balkanhalbinsel. – *Spisanié na bulgarskata Akademia na naukite* [Reports of the Bulgarian Academy of Science] 32: 1-223
- FAGE L. (1945): A propos de quelques araignées cavernicoles de Crète. – *Bulletin du Muséum national d'Histoire naturelle, Paris* (2) 17: 109-114
- GASPARO F. (2003): Tre campagne biospeleologiche a Creta. – *Progressione, Trieste* 48: 59-62
- GASPARO F. (2004a): Note sul genere *Minotauria* Kulczyński, 1903, con redescrizione del Maschio di *M. fagei* (Kratochvíl, 1970) stat. nov. (Araneae, Dysderidae). – *Atti e Memorie della Commissione Grotte "Eugenio Boegan"* 39: 51-65
- GASPARO F. (2004b): Ricerche biospeleologiche nelle isole Ionie meridionali. – *Progressione, Trieste* 51: 82-84
- GASPARO F. (2005a): Note sulle *Histopona* Thorell, 1869, del gruppo *myops* di Grecia, con descrizione di una nuova specie cavernicola (Araneae, Agelenidae). – *Atti e Memorie della Commissione Grotte "Eugenio Boegan"* 40: 17-35
- GASPARO F. (2005b): Una nuova *Leptonetela* cavernicola di Grecia (Araneae, Leptonetidae). – *Bollettino del Museo Regionale di Scienze Naturali, Torino* 22: 517-524
- GASPARO F. (2006): Indagini faunistiche nelle grotte delle isole di Creta e Lesbos (Grecia). – *Progressione, Trieste* 52: 58-60
- GASPARO F. (2007): Due grotte dell'isola di Chios (Grecia). – *Progressione, Trieste* 53: 51-52

- GASPARO F. (2008): Le grotte e la fauna cavernicola di Karpathos e Kassos (Dodecaneso, Grecia). – *Progressione*, Trieste 54: 87-89
- GASPARO F. (2009): La grotta di Zoodochos Pigi a Santorini (Cicliadi, Grecia) e la sua fauna. – *Progressione*, Trieste 55: 102-105
- HADJISSARANTOS H. (1940): [Les araignées de l'Attique]. Athens. 132 pp.
- KRATOCHVÍL J. (1933): Evropské druhy celedi Nesticidae Dahl. – *Acta Societatis Scientiarum naturalium Moraviae* 8 (10): 1-69
- KRATOCHVÍL J. (1937): Un *Harpactocrates* nouveau de Crète (Araneae-Dysderidae). – *Festschrift zum 60. Geburtstage von Professor Dr. Embrik Strand* 3: 560-562
- KRATOCHVÍL J. (1938): Étude sur les araignées cavernicoles du genre *Hadites*. – *Acta Societatis Scientiarum naturalium Moraviae* 11 (1): 1-28
- KULCZYŃSKI W. (1903): Araneorum et Opilionum species in insula Creta a comite Dre Carolo Attems collectae. – *Bulletin Academia Cracovie* 1903: 32-58
- PLATNICK N.I. (2009): The world spider catalog, version 10.0. American Museum of Natural History. – Internet: <http://research.amnh.org/iz/spiders/catalog/index.html> (accessed December 2009)
- ROEWER C.F. (1928): Araneae. In: *Zoologische Streifzüge in Attika, Morea, und besonders auf der Insel Kreta*, XI. – *Abhandlungen des naturwissenschaftlichen Vereins zu Bremen* 27: 92-123
- ROEWER C.F. (1959): Die Araneae, Solifuga und Opiliones der Sammlungen des Herrn Dr. K. Lindberg aus Griechenland, Creta, Anatolien, Iran und Indien. – *Göteborgs Kungliga Vetenskaps- och Vitterhets-Samhälles Handlingar* 8 (4): 1-47
- SENGLET A. (1971): Note sur les Pholcidae (Arachn.) de Grèce. – *Mitteilungen der Schweizerischen Entomologischen Gesellschaft* 44: 345-359
- SENGLET A. (2001): Copulatory mechanisms in *Hoplopholcus*, *Stygopholcus* (revalidated), *Pholcus*, *Spermophora* and *Spermophorides* (Araneae, Pholcidae), with additional faunistic and taxonomic data. – *Mitteilungen der Schweizerischen Entomologischen Gesellschaft* 74: 43-67
- SIMON E. (1885): Arachnides recueillis dans la vallée de Tempé et sur le mont Ossa (Thessalie). – *Annales de la Société Entomologique de la France* (6) 5: 209-218
- SKET B. (2008): Can we agree on an ecological classification of subterranean animals? – *Journal of Natural History* 42: 1549-1563 – doi: [10.1080/00222930801995762](https://doi.org/10.1080/00222930801995762)
- THALER K. & B. KNOFLACH (1995): Über Vorkommen und Verbreitung von *Amaurobius*-Arten in Peloponnes und Ägäis (Araneida: Amaurobiidae). – *Revue suisse de Zoologie* 102: 41-60
- WUNDERLICH J. (1995): Beschreibung einer bisher unbekannten Art der Gattung *Amaurobius* C. L. Koch 1837 von Kreta (Arachnida: Araneae: Amaurobiidae). – *Beiträge zur Araneologie* 4: 729-730