

A CRITICAL REVIEW OF THE SPIDER FAMILY GNAPHOSIDAE IN GREECE

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Abstract — In this paper an attempt is made to evaluate the current knowledge of gnaphosids in Greece from a zoogeographical and ecological point of view. Current species catalogs based on literature and on the author's personal data provide a list of 124 species and 23 genera. These numbers are among the highest recorded in European countries and reveal the Mediterranean character of the family and its great diversity, especially in the area of the Eastern Mediterranean. Chorological analysis shows that along the vertical axis of the Greek Peninsula there is a decrease of European and Turano-European elements and an increase of Mediterranean and endemic elements. The representation of species with eastern origin is also more pronounced in the southern and eastern part of the country. This chorological variation along the main axis of Greece creates two main zoogeographical zones, a "north-continental" zone, which is mostly affected by the European arachnofauna, and a "south-continental/insular" zone, which is mainly characterized by its affinity to the East and its geographical isolation. The poor knowledge of the araneofauna throughout the whole area of the Eastern Mediterranean leads to an overestimation of local endemisms. Gnaphosidae of Greece are mostly xerophilic species occurring in all kinds of habitats of the country from sea level up to its high mountains, where they form the main bulge of ground spiders. Phenological patterns of the dominant species suggest shared exploitation of time during the favorable period, i.e., from May to September, in order to avoid interspecific competition.

Key words: Spiders, Gnaphosidae, morphology, zoogeography, Greece

INTRODUCTION

The araneofauna of Greece has been poorly studied. Recently Bosmans and Chatzaki (2005) reviewed a total of 213 papers dealing with spiders of the Greek peninsula and came up with a list of 856 species, a number that certainly underestimates the actual diversity of this very rich group of arthropods in an area that undoubtedly is a hotspot of diversity and endemism (Deltshev, 1999). A number of publications have sporadically been published in the past with emphasis on certain families, regions,

or habitat types such as caves or islands (see extended references in Bosmans and Chatzaki, 2005).

The best studied family is Salticidae, due to the important work of Heiko Metzner (1999), which covered salticids of the whole country and included drawings, identification keys, and maps of distribution. Other families studied to a moderate level are Dysderidae, Amaurobiidae, Linyphiidae, Theridiidae, Ctenizidae, and Zodariidae owing to the contributions of several researchers, but none of them can be considered as fully studied throughout all of Greece. An overview of the literature on the Greek arachnofauna reveals areas that have attracted strong interest of researchers and others that are almost completely neglected. Among the former, Crete, Attica, Ionian islands, and the Dodecanese islands prevail, while continental parts of northern and central Greece and north-northeast Aegean islands are among the most neglected areas in terms of arachnological knowledge.

Gnaphosidae is one of the largest families of spiders in regard to numbers of species and genera. Up to now (2008), it includes 2013 species and 114 genera worldwide (Platnick, 2008), numbers that put it in seventh place after Linyphiidae, Salticidae, Araneidae, Lycosidae, Theridiidae, and Thomisidae. Together with Ammoxenidae, Cithaeronidae, Gallieniellidae, Lamponidae, Prodidomidae, and Trochanteriidae, they comprise the superfamily Gnaphosoidea, which is closely related to the families Corinnidae, Clubionidae, and Liocranidae (Murphy, 2007). Gnaphosidae are of small to largish size (1 mm – 15 mm), two-clawed, usually uniformly colored (from black and dark brown or grey to yellow), and occasionally with dorsal abdominal markings (e.g., *Cesonia*, *Micaria*, *Pterotricha*, *Nomisia*, *Berlandina*, *Callilepis* and others). The character that distinguishes them from other spider families is the elongated tubular anterior lateral spinnerets with pyriform gland spigots emerging from a distensible membranous tip (Platnick, 1978). Other characters which are typical for some - but not all - genera are the oval posterior median eyes and the laterally indented maxillae. Males and females are of similar appearance and size.

Gnaphosidae is also one of the most important families of the arachnofauna of Greece, as is the case with all Mediterranean countries, e.g., Italy (Di Franco, 1986; 1993; 1994; 1996; 1997a and 1997b; 1998), Israel (Levy, 1995; 1998; 1999; 2004), North Africa (Dalmas, 1919; Denis, 1952; Di Franco, 1992a and 1992b; Bosmans and Janssen, 1999; Bosmans and Blick, 2000), and Portugal (Cardoso et al., 2007). Although most recent works prove that this is one of the most diverse and abundant families of ground spiders, the literature that deals with it is very restricted. The reason for this contradiction lies in the fact that the majority of Gnaphosidae are nocturnal hunters that move very fast on the ground; therefore their capture is very difficult if a systematic and continuous (i.e., on a 24-hour basis) method is not used, a method such as pitfall trapping. Previous collectors mostly used hand collecting during sporadic field trips in tourist places of Greece, and accordingly little attention was given to the epigeic arachnofauna of the region.

One of the most detailed works contributed by a Greek arachnologist is that of Hadjissarantos (1940), who studied the spiders of Attica. In this study 72 gnaphosid

species were reported. It was only after about sixty years that a publication dealt exclusively with Gnaphosidae of Greece, and this was the work of the author of this article, who began a taxonomic study of the family focusing on the island of Crete (Chatzaki et al. 2002a and 2003b; 2003) and then published two more papers dealing with the altitudinal variation (Chatzaki et al., 2005b) and seasonal activity of the dominant gnaphosid species on Crete (Chatzaki et al., 2005a). Many taxonomic problems were resolved, providing confirmations/redescriptions of insufficiently known species, new synonymies, new records, and new species. This work raised the current number of Gnaphosidae recorded in Greece to 114, but again this increase mostly concerned the island of Crete and some other islands of the Southern Aegean, while several taxonomic problems remained open and many more gnaphosid species are waiting to be added to the list when more Greek areas are fully studied.

In this paper an attempt is made to evaluate the current knowledge of gnaphosids in Greece from a zoogeographical and ecological point of view. Species catalogs in total and per geographical region are provided. An analysis of the chorological distribution of species and their phenological patterns of activity is given.

SPECIES CATALOGS AND RICHNESS ANALYSIS

In the formation of species catalogs the checklist by Bosmans and Chatzaki (2005) was used as a base. Further geographical records of species already reported and new species records were added, based on personal examination of new material from the collections of the Natural History Museum of the University of Crete and on more recent literature (e.g., Maruzik et al., 2004; Buchholz, 2007; Deltshv et al., 2006). Greece was divided into nine main geographical regions (Fig. 1), following the geographical and administrative map of the country with few exceptions. Due to very limited records of Gnaphosidae in the northern and central Aegean islands, all Greek islands of the Aegean Sea were included in the same group (e.g., "Aigaio"), excluding Crete, which forms a concrete biogeographical unity. The Kithyra and Antikithyra islands found on the southwest margin of the Aegean Sea were also included in the island group of "Aigaio", contrary to Bosmans and Chatzaki (2005) who included them in the Ionian islands. Mainland Greece was divided into six areas: Thrace, Macedonia, Thessaly, Ipeiros, Sterea Ellada, and Peloponnesus.

The overall catalog includes 23 genera and 124 species, of which 108 are positive records beyond any doubt (Table 1). Sixteen species are insufficiently known, in the sense that their identifications were incomplete and their presence was never confirmed after their first description. *Drassodes hypocrita* (Simon, 1878), *Setaphis parvula* (Lucas, 1846), *Trachyzelotes holocericeus* (Simon, 1878), and *Drassyllus pumilus* (C.L. Koch, 1839) are doubtful records for the Greek checklist, although they are well established species with records in the rest of Europe.

The following species are left out of the current list of Gnaphosidae of Greece due to the synonymies proposed in a recent revision of the genus *Drassodes* (Chatzopoulou and Chatzaki, *in press*): *D. alexandrinus* (O.P. - Cambridge, 1874) = *D.*



Fig. 1. Map of Greece and the nine geographical regions into which the country was divided for chorological analysis: Thrace, Macedonia, Ipeiros, Thessaly, Sterea Ellada, Peloponnesus, Crete, Ionian islands (Ionia), Aegean islands (Aigaio). The islands of Karpathos, Astypalaia, Kos, and Kalymnos included in the analysis are indicated on the map for facilitation of the reader.

lutescens (C.L. Koch, 1839), *D. omalosis* Rower, 1928 = *D. unicolor* (O.P.- Cambridge, 1872), *D. oreinos* (Chatzaki, 2002) = *D. albicans* (Simon, 1878), and *D. serratichelis* (Roewer, 1928) = *D. luteomicans* (Simon, 1878). *Zelotes* cf. *ilotarum* (Simon, 1884) as recorded by Chatzaki et al. (2003) can now be included as a new species in the list, since a careful study of more specimens of the true *Z. ilotarum* from other parts of Greece confirmed the previous assumption that the species from Crete is different in many taxonomical characters and can thus be assumed to be a new species, endemic to the island of Crete.

In order to give a comparative measure of the recorded richness of species/genera, data from electronic databases or published checklists from other Mediterranean or European countries are given in Table 2. The following citations were used for the corresponding countries: Central European countries (Blick *et al.*, 2004); Sweden

Table 1. Species list of Gnaphosidae in Greece, their presence in the geographical divisions of the country, and their chorological identity. Species found as a reference (first column), verified by the author (second column), and doubtful species (third column) are separately indicated by (X). Abbreviations: a - cited in literature; b - confirmed by author; c - doubtful species or Greek record needs confirmation; d - chorology; e - Thrace; f - Macedonia; g - Thessaly; h - Ipeiros; i - Ionio; j - Sterea Ellada; k - Peloponnesus; l - Aigaiο; m - Crete.

| Species name | a | b | c | d | e | f | g | h | i | j | k | l | m |
|--|---|---|---|--------|---|---|---|---|---|---|---|---|---|
| <i>Aphantaulax cincta</i> (L. Koch, 1866) | X | | | Ci-Me | X | | | | X | | | | |
| <i>Aphantaulax trifasciata</i> (O. P.-Cambridge, 1872) | X | | | Ci-Me | X | | | | | X | | X | |
| <i>Aphantaulax trifasciata trimaculata</i> Simon, 1878 | X | | X | Seu | | | | | | X | | | |
| <i>Arboricaria koeni</i> Bosmans, 2000 | X | | | Gr | | | | | | | X | | X |
| <i>Berinda aegilia</i> Chatzaki, 2002 | X | X | | Gr | | | | | | | X | X | |
| <i>Berinda amabilis</i> Roewer, 1928 | X | X | | Tur | | | | | | | | | X |
| <i>Berinda ensigera</i> (O. P.-Cambridge, 1874) | X | X | | Gr | | | | | X | X | X | X | |
| <i>Berlandina corcyraea</i> (O. P.-Cambridge, 1874) | X | | | Gr | | | | | X | X | | | |
| <i>Berlandina plumalis</i> (O. P.-Cambridge, 1872) | X | X | | Wi | | X | | | | | | X | X |
| <i>Callilepis concolor</i> Simon, 1914 | X | | | Seu | | | | | | | | X | X |
| <i>Callilepis cretica</i> (Roewer, 1928) | X | X | | Tur | | X | | | | X | X | X | X |
| <i>Callilepis nocturna</i> (Linnaeus, 1758) | X | X | | Wi | | X | | | | | X | | |
| <i>Callilepis schuszteri</i> (Herman, 1879) | X | | | Wi | | X | | | | | | | |
| <i>Camillina metellus</i> (Roewer, 1928) | X | X | | SAe | | | | | | | | X | X |
| <i>Cesonia aspida</i> Chatzaki, 2002 | X | X | | Tur | | | | | | | | X | X |
| <i>Cryptodrassus creticus</i> Chatzaki, 2002 | X | X | | SAe | | | | | | | | X | X |
| <i>Drassodes albicans</i> (Simon, 1878) | X | X | | Seu | | | | | | X | | X | X |
| <i>Drassodes hypocrita</i> (Simon, 1878) | X | | X | Tur-Me | | | | | | | | X | |
| <i>Drassodes lacertosus</i> (O. P.-Cambridge, 1872) | | | X | Tur-Me | | | | | | | | X | |
| <i>Drassodes lapidosus</i> (Walckenaer, 1802) | X | X | | Wi | X | X | X | X | X | X | X | X | X |
| <i>Drassodes luteomicans</i> (Simon, 1878) | X | X | | Ci-Me | | | | | | | | X | X |
| <i>Drassodes lutescens</i> (C. L. Koch, 1839) | X | X | | Tur-Me | X | | X | X | X | X | X | X | X |
| <i>Drassodes lutetianus</i> (L. Koch, 1866) | X | | | Tur-Eu | X | | | | | | | | |
| <i>Drassodes pubescens</i> (Thorell, 1856) | X | | | Wi | X | | | | | | | X | X |
| <i>Drassodes unicolor</i> (O. P.-Cambridge, 1872) | X | | | EaMe | | | | | | | | | X |
| <i>Drassyllus jubatopalpis</i> Levy, 1998 | | | X | EaMe | | | | | | | | X | |
| <i>Drassyllus praeficus</i> (L. Koch, 1866) | X | X | | Tur-Eu | X | | X | | X | X | | | X |
| <i>Drassyllus pumiloides</i> Chatzaki, 2003 | X | X | | Crt | | | | | | | | | X |
| <i>Drassyllus pumilus</i> (C. L. Koch, 1839) | X | | X | Tur-Eu | | | | | | | | X | |
| <i>Drassyllus pusillus</i> (C. L. Koch, 1833) | X | X | | Wi | X | X | | | | X | | | |
| <i>Gnaphosa bicolor</i> (Hahn, 1833) | X | | | Tur-Eu | X | | | | | | | | |
| <i>Gnaphosa bithynica</i> Kulczyński, 1903 | X | X | | EaMe | | | | | | | X | | X |
| <i>Gnaphosa dolosa</i> Herman, 1879 | X | X | | Tur-Eu | | | | | | | | | X |
| <i>Gnaphosa lucifuga</i> (Walckenaer, 1802) | X | | | Wi | X | X | | X | X | X | X | X | |
| <i>Gnaphosa lugubris</i> (C. L. Koch, 1839) | X | | | Tur-Eu | X | | X | | | | X | | |
| <i>Gnaphosa oceanica</i> Simon, 1878 | X | | X | Seu | X | | | | | | | | |
| <i>Gnaphosa orchymonti</i> Giltay, 1932 | X | | X | Gr | | | | | | | X | | |
| <i>Gnaphosa stussineri</i> Simon, 1885 | X | | X | Gr | | | X | | | | | | |

| Species name | a | b | c | d | e | f | g | h | i | j | k | l | m |
|---|---|---|---|--------|---|---|---|---|---|---|---|---|---|
| <i>Haplodrassus acrotirius</i> (Roewer, 1928) | X | | X | Crt | | | | | | | | | X |
| <i>Haplodrassus creticus</i> (Roewer, 1928) | X | X | | Gr | | | | | | X | X | | X |
| <i>Haplodrassus dalmatensis</i> (L. Koch, 1866) | X | X | | Wi | | X | | X | | X | X | X | X |
| <i>Haplodrassus invalidus</i> (O. P.-Cambridge, 1872) | | X | | Ci-Me | | | | | | | | X | |
| <i>Haplodrassus kulczynskii</i> Lohmander, 1942 | X | | | Wi | | X | | | | | | X | X |
| <i>Haplodrassus macellinus</i> (Thorell, 1871) | X | | | Ci-Me | | | | | | | | X | |
| <i>Haplodrassus minor</i> (O. P.-Cambridge, 1879) | X | X | | Tur-Eu | | X | | | | | | | X |
| <i>Haplodrassus morosus</i> (O. P.-Cambridge, 1872) | | X | | Tur-Eu | | | | | | | | X | X |
| <i>Haplodrassus pugnans</i> (Simon, 1880) | | X | | Wi | | | | | | | | X | |
| <i>Haplodrassus severus</i> (C. L. Koch, 1839) | X | | | Ci-Me | | | | | | X | X | X | |
| <i>Haplodrassus signifer</i> (C. L. Koch, 1839) | X | X | | Wi | | X | X | | X | X | X | X | X |
| <i>Haplodrassus silvestris</i> (Blackwall, 1833) | X | | | Wi | | | | | X | | | | |
| <i>Haplodrassus umbratilis</i> (L. Koch, 1866) | X | | | Tur-Eu | | X | | | | | | | |
| <i>Leptodrassus albidus</i> Simon, 1914 | X | X | | Seu | | | | | | | | X | X |
| <i>Leptodrassus femineus</i> (Simon, 1878) | X | X | | Ci-Me | | | | | | | | X | X |
| <i>Leptodrassus hadjissaranti</i> Chatzaki, 2002 | X | X | | SAe | | | | | | | | X | X |
| <i>Leptodrassus manolisi</i> Chatzaki, 2002 | X | X | | Crt | | | | | | | | | X |
| <i>Leptodrassus pupa</i> Dalmas, 1919 | X | X | | EaMe | | | | | | | | | X |
| <i>Micaria albovittata</i> (Lucas, 1846) | X | X | | Ci-Me | | X | | | | | X | X | X |
| <i>Micaria coarctata</i> (Lucas, 1846) | X | X | | Tur-Me | | | | | | X | X | X | X |
| <i>Micaria dives</i> (Lucas, 1846) | X | X | | Wi | | | | | | X | X | | X |
| <i>Micaria guttulata</i> (C. L. Koch, 1839) | X | | | Eu | | X | | | | | | | |
| <i>Micaria fulgens</i> (Walckenaer, 1802) | X | | | Tur-Eu | | X | | | | | | | |
| <i>Micaria ignea</i> (O. P.-Cambridge, 1872) | X | X | | Tur-Eu | | | | | | | | | X |
| <i>Micaria pallipes</i> (Lucas, 1846) | X | | | Tur-Me | | | | | | | | | X |
| <i>Micaria pulicaria</i> (Sundevall, 1831) | X | | | Wi | | X | | | | | | | X |
| <i>Micaria silesiaca</i> L. Koch, 1875 | X | | | Tur-Eu | | X | | | | | | | |
| <i>Nomisia aussereri</i> (L. Koch, 1872) | X | X | | Tur-Me | | X | X | X | | X | | X | |
| <i>Nomisia castanea</i> Dalmas, 1921 | | X | | Ci-Me | | | | | | | X | | |
| <i>Nomisia excerpta</i> (O. P.-Cambridge, 1872) | X | X | | Ci-Me | | | | X | | | | X | X |
| <i>Nomisia exornata</i> (C. L. Koch, 1839) | X | X | | Tur-Eu | | X | | X | X | X | X | X | X |
| <i>Nomisia orientalis</i> Dalmas, 1921 | X | | | EaMe | | | | | | X | | | |
| <i>Nomisia palaestina</i> (O. P.-Cambridge, 1872) | X | X | | EaMe | | | | | | | X | X | |
| <i>Nomisia recepta</i> (Pavesi, 1880) | | X | | Ci-Me | | | | | | | X | | X |
| <i>Nomisia ripariensis</i> (O. P.-Cambridge, 1872) | X | X | | Tur | | X | X | | | X | X | X | X |
| <i>Poecilochroa senilis</i> (O. P.-Cambridge, 1872) | X | X | | Tur-Me | | | | | | | | X | X |
| <i>Poecilochroa variana</i> (C. L. Koch, 1839) | X | | | Tur-Eu | | X | | | | | | | |
| <i>Pterotricha lentiginosa</i> (C. L. Koch, 1837) | X | X | | Tur | | | X | | X | X | X | X | X |
| <i>Scotophaeus blackwalli</i> (Thorell, 1871) | X | | | Wi | | | | | | | X | X | |
| <i>Scotophaeus peninsularis</i> Roewer, 1928 | X | X | | EaMe | | | | | | | X | X | X |
| <i>Scotophaeus scutulatus</i> (L. Koch, 1866) | X | X | | Tur-Eu | | X | X | | X | | X | X | X |
| <i>Scotophaeus validus</i> (Lucas, 1846) | X | | | Ci-Me | | | | | | | | X | |
| <i>Setaphis carmeli</i> (O. P.-Cambridge, 1872) | X | X | | Ci-Me | | | | | | X | | X | X |
| <i>Setaphis parvula</i> (Lucas, 1846) | X | | X | Gr | | | | | | X | | | |

| Species name | a | b | c | d | e | f | g | h | i | j | k | l | m |
|--|-----|----|----|--------|----|----|---|----|----|----|----|----|----|
| <i>Sosticus loricatus</i> (L. Koch, 1866) | X | | | Wi | | | | | X | | | X | |
| <i>Synaphosus palearticus</i> Ovtsharenko, Levy & Platnick, 1994 | X | X | | Tur | | | | | | | | X | X |
| <i>Synaphosus trichopus</i> (Roewer, 1928) | X | X | | SAe | | | | | | | | X | X |
| <i>Trachyzelotes adriaticus</i> (Caporiacco, 1951) | X | X | | Tur-Me | | X | | | | | | X | X |
| <i>Trachyzelotes barbatus</i> (L. Koch, 1866) | X | X | | Tur-Me | | X | | | | X | X | X | X |
| <i>Trachyzelotes fuscipes</i> (L. Koch, 1866) | X | | | Tur-Me | | | | | | | | X | |
| <i>Trachyzelotes holosericeus</i> (Simon, 1878) | X | | | Ci-Me | | | | | | X | | | |
| <i>Trachyzelotes lyonetti</i> (Audouin, 1826) | X | X | | Tur-Me | | | | | | | | X | X |
| <i>Trachyzelotes malkini</i> Platnick & Murphy, 1984 | X | X | | Tur | | | | | | | | X | X |
| <i>Trachyzelotes pedestris</i> (C. L. Koch, 1837) | X | X | | Tur-Eu | | X | | X | | X | X | X | |
| <i>Zelotes aerosus</i> Charitonov, 1946 | X | X | | Tur | | | | | | | | | X |
| <i>Zelotes apricorum</i> (L. Koch, 1876) | X | | | Tur-Eu | | X | | | | | | | |
| <i>Zelotes argolinensis</i> (C. L. Koch, 1839) | X | | X | Gr | | | | | | | | X | |
| <i>Zelotes balkanicus</i> Deltshv, 2006 | X | | | Blk | | X | X | | | X | X | | |
| <i>Zelotes caucasius</i> (L. Koch, 1866) | X | X | | Tur-Eu | | | | | | X | X | X | X |
| <i>Zelotes cf. ilotarum</i> n.sp. | | | X | Crt | | | | | | | | | X |
| <i>Zelotes cingarus</i> (O. P.-Cambridge, 1874) | X | | X | Tur | | | | | X | | | | |
| <i>Zelotes clivicola</i> (L. Koch, 1870) | X | | | Wi | | X | X | | | X | | | X |
| <i>Zelotes creticus</i> (Kulczynski, 1903) | X | X | | Crt | | | | | | | | | X |
| <i>Zelotes daidalus</i> Chatzaki, 2003 | X | X | | SAe | | | | | | | | X | X |
| <i>Zelotes distinctissimus</i> Caporiacco, 1929 | X | | X | SAe | | | | | | | | X | |
| <i>Zelotes electus</i> (C. L. Koch, 1839) | X | | | Tur-Eu | | X | | | | | | | |
| <i>Zelotes erebeus</i> (Thorell, 1871) | X | X | | Tur-Eu | | X | | | | | | X | |
| <i>Zelotes femellus</i> (L. Koch, 1866) | X | | | Seu | | X | | | | | | | |
| <i>Zelotes flavimanus</i> (C. L. Koch, 1839) | X | | X | Gr | | | | | | | | X | |
| <i>Zelotes graecus</i> (L. Koch, 1867) | X | | X | SAe | | | | | | | | | X |
| <i>Zelotes ilotarum</i> (Simon, 1884) | X | X | | Gr | | | | | | X | X | X | |
| <i>Zelotes insulanus</i> (L. Koch, 1867) | X | | X | SAe | | | | | | | | | X |
| <i>Zelotes longipes</i> (L. Koch, 1866) | X | | | Wi | | X | | X | X | | | | |
| <i>Zelotes minous</i> Chatzaki, 2003 | X | X | | SAe | | | | | | | | X | X |
| <i>Zelotes nilicola</i> (O. P.-Cambridge, 1874) | X | X | | Ci-Me | | | | | | X | | X | X |
| <i>Zelotes oblongus</i> (C. L. Koch, 1833) | X | | | Seu | | X | | | | X | | | X |
| <i>Zelotes olympi</i> (Kulczyński, 1903) | X | | X | Gr | | | X | | | | | | |
| <i>Zelotes parascrutatus</i> Levy, 1998 | | | X | EaMe | | | | | | | | X | |
| <i>Zelotes scrutatus</i> (O. P.-Cambridge, 1872) | X | X | | Tur-Me | | | | | | X | X | | X |
| <i>Zelotes segrex</i> (Simon, 1878) | X | X | | Tur-Me | | | | | | X | X | X | X |
| <i>Zelotes similis</i> (Kulczyński, 1887) | X | | | Eu | | X | | | | | | | |
| <i>Zelotes solstitialis</i> Levy, 1998 | X | X | | EaMe | | | | | | | | X | X |
| <i>Zelotes subterraneus</i> (C. L. Koch, 1833) | X | X | | Wi | | X | | | | | | X | X |
| <i>Zelotes talpinus</i> (L. Koch, 1872) | X | | | Eu | | X | | X | | | | | |
| <i>Zelotes tenuis</i> (L. Koch, 1866) | X | X | | Ci-Me | | | | | | X | X | X | X |
| <i>Zelotes villicoides</i> Giltay, 1932 | X | | X | Gr | | | | | | | | X | |
| TOTAL NUMBER OF SPECIES | 124 | 70 | 16 | | 11 | 41 | 7 | 14 | 12 | 37 | 42 | 66 | 66 |

Table 2. Number of species per genus in Greece and several European or Mediterranean countries. Abbreviations: ISR=Israel, GR=Greece, CRT=Crete, SIC=Sicily, IT=Italy, SP=Spain, PRT=Portugal, BUL=Bulgaria, SL=Slovakia, CZ=Czech Republic, AT=Austria, BE=Belgium, CH=Switzerland, NL=Netherlands, PO=Poland, DE=Denmark, SW=Sweden.

| | ISR | GR | CRT | SIC | IT | SP | PRT | BUL | SL | CZ | AT | BE | CH | NL | PO | DE | SW |
|-----------------------|-----|----|-----|-----|----|----|-----|-----|----|----|----|----|----|----|----|----|----|
| <i>Aphantaulax</i> | 2 | 3 | | 2 | 2 | 2 | 2 | 2 | 2 | 1 | | | | | | | |
| <i>Arboricaria</i> | | 1 | | | | | | | | | | | | | | | |
| <i>Berinda</i> | | 3 | 2 | | | | | | | | | | | | | | |
| <i>Berlandina</i> | 1 | 2 | 1 | | 2 | 1 | 1 | 2 | 1 | 1 | 1 | | 2 | | 1 | 1 | 1 |
| <i>Callilepis</i> | | 4 | 1 | 1 | 2 | 3 | 3 | 4 | 2 | 2 | 2 | 1 | 2 | 1 | 1 | 2 | |
| <i>Camillina</i> | | 1 | 1 | | 2 | | | | | | | | | | | | |
| <i>Cesonia</i> | | 1 | 1 | | | | | | | | | | | | | | |
| <i>Cryptodrassus</i> | | 1 | 1 | | | | | | 1 | 1 | | | 1 | | | | |
| <i>Drassodes</i> | 7 | 9 | 4 | 6 | 15 | 14 | 9 | 5 | 4 | 3 | 5 | 4 | 6 | 2 | 2 | 7 | 5 |
| <i>Drassyllus</i> | 2 | 5 | 3 | 2 | 5 | 3 | 3 | 5 | 6 | 6 | 5 | 5 | 5 | 3 | 4 | 5 | 4 |
| <i>Echemus</i> | | | | 1 | 1 | | 1 | 1 | 1 | 1 | 1 | | 1 | | | 1 | 1 |
| <i>Gnaphosa</i> | 2 | 8 | 1 | 5 | 16 | 13 | 1 | 15 | 9 | 10 | 14 | 5 | 13 | 2 | 8 | 13 | 10 |
| <i>Haplodrassus</i> | 8 | 13 | 4 | 4 | 11 | 8 | 6 | 8 | 9 | 10 | 8 | 6 | 10 | 4 | 9 | 9 | 7 |
| <i>Heser</i> | | 2 | | | | | | | | | | | | | | | |
| <i>Kishidaia</i> | | | | | | 1 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| <i>Leptodrassus</i> | 1 | 5 | 5 | 1 | 2 | 3 | 4 | 1 | | | | | | | | | |
| <i>Megamyрмаekion</i> | | 1 | | | | | | | | | | | | | | | |
| <i>Micaria</i> | 6 | 9 | 6 | | | 14 | 11 | 14 | 11 | 12 | 12 | 8 | 12 | 7 | 6 | 10 | 10 |
| <i>Minosia</i> | | 3 | | | | | | | | | | | | | | | |
| <i>Minosiella</i> | | 2 | | | | | | | | | | | | | | | |
| <i>Nomisia</i> | 5 | 8 | 3 | 3 | 4 | 4 | 5 | 3 | 1 | | | | 1 | | | | |
| <i>Odontodrassus</i> | | 2 | | | | | | | | | | | | | | | |
| <i>Parasyrisca</i> | | | | | 1 | | | | | | | | 1 | | | | |
| <i>Phaeoedus</i> | 1 | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| <i>Poecilochroa</i> | 4 | 2 | 1 | 2 | 3 | 4 | 3 | 1 | 1 | | 1 | 1 | 1 | | 1 | 1 | 1 |
| <i>Pterotricha</i> | 12 | 1 | 1 | | 1 | 1 | 3 | | | | | | | | | | |
| <i>Scotophaeus</i> | 2 | 4 | 2 | 2 | 5 | 3 | 4 | 3 | 3 | 2 | 4 | 2 | 3 | 3 | 3 | 3 | 3 |
| <i>Setaphis</i> | 3 | 2 | 1 | 1 | 1 | 3 | 3 | 1 | | | | | | | | | |
| <i>Sosticus</i> | | 1 | | | 1 | | | 1 | 1 | 1 | 1 | | | | 1 | 1 | |
| <i>Synaphosus</i> | 2 | 2 | 2 | 1 | 1 | 1 | 1 | | | | | | 1 | | | | |
| <i>Talanites</i> | | 1 | | | | | | | | | | | | | | | |
| <i>Trachyzelotes</i> | 6 | 7 | 4 | 6 | 9 | 6 | 6 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 |
| <i>Urozelotes</i> | | | | 1 | 1 | 1 | | 1 | | 1 | 1 | | 1 | | | 1 | |
| <i>Zelominor</i> | | | | | | 2 | 1 | | | | | | | | | | |
| <i>Zelotes</i> | 25 | 32 | 13 | 18 | 51 | 27 | 23 | 27 | 18 | 16 | 24 | 9 | 20 | 5 | 11 | 18 | 8 |

(Kronestedt, 2001); Portugal (Cardoso, 2008); Spain (Morano and Cardoso, 2008); Italy (Di Franco, 1993; 1997a and 1997b; 1998); Bulgaria (Blagoev and Deltshev, 2002); and Israel (Levy, 1995; 1998; 1999a and 1999b).

In Greece, six of the 23 genera (25%) are monotypic, represented by only one species in the country. Most of the rest of the genera include from two to nine species, whereas higher numbers are recorded for *Haplodrassus* (13) and *Zelotes* (32). The genus *Zelotes* is by far the most diverse in Greece, but it has to be stressed that undoubtedly the catalog is not yet complete. Although *Zelotes* is very diverse in all other countries cited here (especially Mediterranean countries), the species composition of this genus across Europe is very different. Greece forms a geographical link between Anatolian species not recorded in the rest of Europe [for instance *Z. scrutatus* (O.P. Cambridge, 1872), *Z. solstitialis* Levy, 1998, and *Z. parascrutatus* Levy, 1998] found on islands of the Eastern Aegean or on Crete) and others recorded in Europe, but no farther east than Greece [*Z. apricorum* (L. Koch, 1876), *Z. similis* (Kulczyński, 1887), *Z. talpinus* (L. Koch, 1872), etc.]. Many species of this genus are endemics (13 out of 32, i.e., 40.6%), although some are considered as incomplete records due to insufficient knowledge.

Some genera are more diverse in Central and Northern Europe (e.g., *Gnaphosa*, *Micaria*), while others present higher richness in Mediterranean or East Mediterranean regions (*Drassodes*, *Nomisia*, *Trachyzelotes*). There are also characteristic absences of species on the two geographical edges of this area, especially in the north: the genera *Berinda*, *Camillina*, *Leptodrassus*, *Megamyрмаekion*, *Minosia*, *Minosiella*, *Odontodrassus*, *Pterotracha*, *Synaphosus* (except for one record in Switzerland), and *Talanites* are absent from the Central European lists and farther north. The genera *Arboricaria*, *Berinda*, and *Cesonia* are only recorded from Greece among other European countries, and the genera *Megamyрмаekion*, *Minosiella*, *Odontodrassus*, and *Talanites* are not recorded from any European country (here recorded only from Israel).

In Table 3 the total number of genera and species is reported for several countries and islands. Greece has the highest number of genera and second highest number of species after Italy. The ratio of species per genus can be considered a measure of species saturation for a certain region and depends on various factors such as the origin and degree of differentiation of the taxon under consideration, the bioclimatic conditions prevailing in a region, and the total area they cover as well as their topography. For example, islands, areas on the edge of peninsulas (the peninsular effect), or areas at the extremity of a taxon's distribution (Brown, 1984; Brussard, 1984) are expected to show lower numbers of species per genus and thus a clear impoverishment and/or disequilibrium of the fauna (Williamson, 1981). Although Greece is a peninsula and is composed of many islands, such phenomena do not reduce the total richness of the gnaphosid spider fauna compared to other European countries, even when taking into consideration the poor level of knowledge of most Greek regions and the small area they cover. The value of the species/genus ratio is 5.16 ± 0.69 for Mediterranean countries and 4.17 ± 0.78 for Central-North European countries.

Table 3. Total number of genera and species in several countries or islands and their ratios (species / genera).

| | Area (km ²) | Number of genera | Number of species | Species/ Genera |
|----------------|-------------------------|------------------|-------------------|-----------------|
| Crete | 8.34 | 21 | 66 | 3.30 |
| Karpathos | 0.30 | 11 | 17 | 1.54 |
| Kos | 0.29 | 6 | 10 | 1.67 |
| Astypalaia | 0.10 | 11 | 17 | 1.54 |
| Kalymnos | 0.11 | 14 | 25 | 1.78 |
| Sicily | 25.71 | 17 | 57 | 3.35 |
| Israel | 20.77 | 23 | 100 | 4.35 |
| Greece | 130.80 | 23 | 124 | 5.39 |
| Italy | 294.02 | 22 | 137 | 6.23 |
| Spain | 499.54 | 21 | 116 | 5.52 |
| Portugal | 91.50 | 20 | 91 | 4.55 |
| Bulgaria | 110.55 | 20 | 99 | 4.95 |
| Slovakia | 49.04 | 18 | 73 | 4.06 |
| Czech Republic | 78.86 | 15 | 70 | 4.67 |
| Austria | 82.74 | 15 | 81 | 5.40 |
| Belgium | 32.82 | 12 | 44 | 3.67 |
| Switzerland | 39.77 | 19 | 83 | 4.37 |
| Netherlands | 33.88 | 11 | 30 | 2.73 |
| Poland | 304.46 | 14 | 50 | 3.57 |
| Denmark | 42.39 | 16 | 76 | 4.75 |
| Sweden | 449.96 | 12 | 52 | 4.33 |

In Mediterranean countries monotypic genera range from 21.7% (Israel) to 35% (Bulgaria), while in Central and North European countries they range from 41.6% (Sweden) to 60% (Czech Republic). Both these differences reveal the Mediterranean character of the family as a whole, its greater differentiation in this area, and the preference of most species for arid environments.

In Table 3 data from several Southern Aegean islands (Crete, Astypalaia, Kalymnos, Kos, Karpathos) and Sicily are also given separately. The numbers recorded for these islands are used first because they can be considered as well studied (contrary to the rest of Greece, for example) and second because they illustrate the above arguments very well. Although Greece seems not to be strongly affected by the peninsular effect, it is clear that when islands are analyzed separately, the absolute numbers and the species/genera ratio become very low. There is a negative correlation between the species/genera ratio and the conjunction of two main factors: island size and degree of isolation (geographical and historical factors). For example, Kalymnos is three times smaller than Karpathos, but still presents greater richness

(higher numbers of species and genera and value of their ratio) due to its proximity to the mainland (see Fig. 1) and its very recent isolation from it (Van Andel and Shackleton, 1982). On the other hand, Astypalaia / which is found in the center of the Aegean Sea and has size similar to that of Kalymnos / has richness similar to that of Karpathos, revealing its higher isolation. Crete, which is the first island that was isolated during formation of the Aegean Sea, still presents the highest richness due to its much larger size and heterogeneity.

Compared to Sicily, Crete is spatio-temporally more isolated (Patton, 1996) and is smaller, factors that should result in a more pronounced faunistic impoverishment, which is not evident from the data presented here. Crete shows higher numbers of both genera and species compared to Sicily. It is also interesting that 21 out of the 23 genera recorded in Greece are also present on this island, a number which is higher than for most European countries analyzed here (Italy and Israel are the only exceptions). This is a good indication that the total numbers of genera/species will be much higher when a thorough study of the Greek peninsula is completed. The high richness of Cretan gnaphosids also reveals the clear preference of the family for arid and open environments, as well as a strong faunistic effect from two distinct sources, the Euro-Mediterranean and the Asian (*sensu lato*). The latter explains why Sicily, with similar bioclimatic conditions, larger size, and closer proximity to the Italian mainland has a poorer gnaphosid fauna compared to Crete.

It can therefore be concluded that in Greece, either because of its geographical position or because of its high climatic and habitat heterogeneity, a large number of Gnaphosidae species and genera are concentrated to form a hotspot of diversity for this group, even when compared to other Mediterranean countries.

BIOGEOGRAPHY AND CHOROLOGICAL DISTRIBUTION

Chorological analysis was based on Platnick's web catalog for species distributions (2008), and 12 chorological types were used to characterize distributions of the Greek gnaphosids. These chorological types follow the categorization proposed by Taglianti et al. (1999) because they accurately apply to the distributions of specific taxa known to date and simplify analysis as compared to chorological models that use many more types [e.g., Deltshv (1999) and Di Franco (1997 b)] without adding significant information to the main zoogeographical trends of the specific fauna. The twelve chorological types are roughly divided into four categories defined as follows:

Widespread elements: include all cosmopolitan, palearctic, and holarctic species (Wi), as well as Central/North-European species and Euro-Mediterranean species (Eu).

Mediterranean elements: include circum-Mediterranean (Ci-Me) and South-European (Seu) species.

Eastern elements: include European (Tur-Eu) and Mediterranean (Tur-Me) species whose ranges extend eastward to Central Asia (the Middle East, Iran,

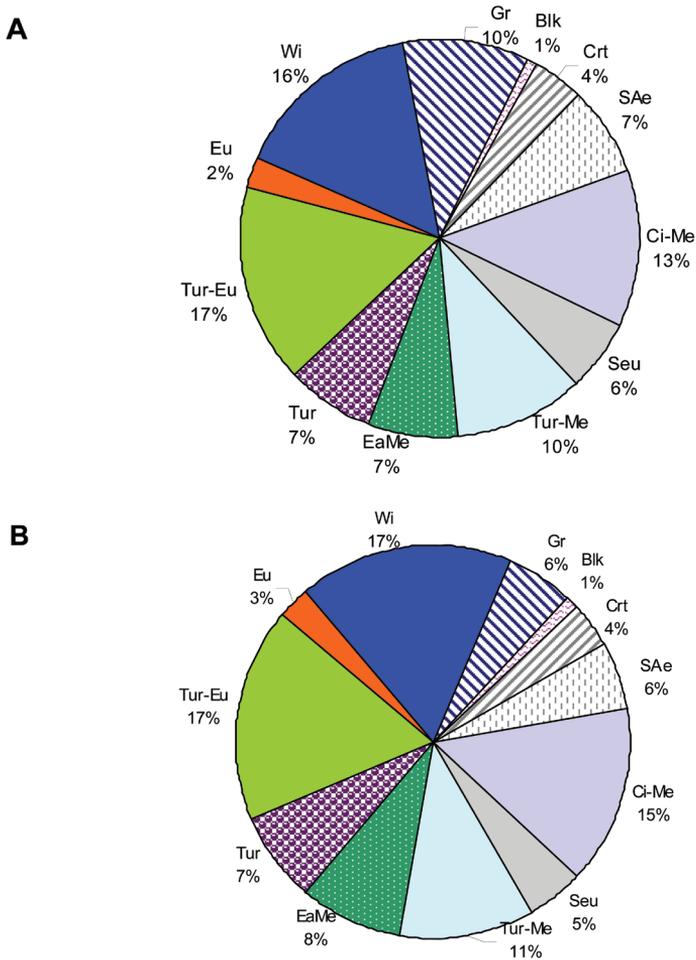


Fig. 2. Chorological distribution of gnaphosid species in Greece using the full list of species (A) and only the certain species (B).

Turkmenistan, and the Caucasus), East-Mediterranean species (EaMe), and Turanian species (Tur), i.e., species with western limits of distribution formed by the Italian and Balkan Peninsulas, respectively and ranging as far as Central Asia.

Endemic elements: include Cretan (Crt), South-Aegean (SAe), Greek (Gr), and Balkan (Blk) endemics. South-Aegean and Greek endemics include several species with more limited distributions (e.g., they are recorded from only one island or only one location on the mainland). Due to insufficient knowledge, it is here assumed that these records will encompass a wider region on the Greek peninsula (continental or insular), and few of them will culminate as real stenoendemics.

Representation of the twelve chorological elements throughout the whole country is shown in Fig. 2A. Turano-European and widespread species dominate in the

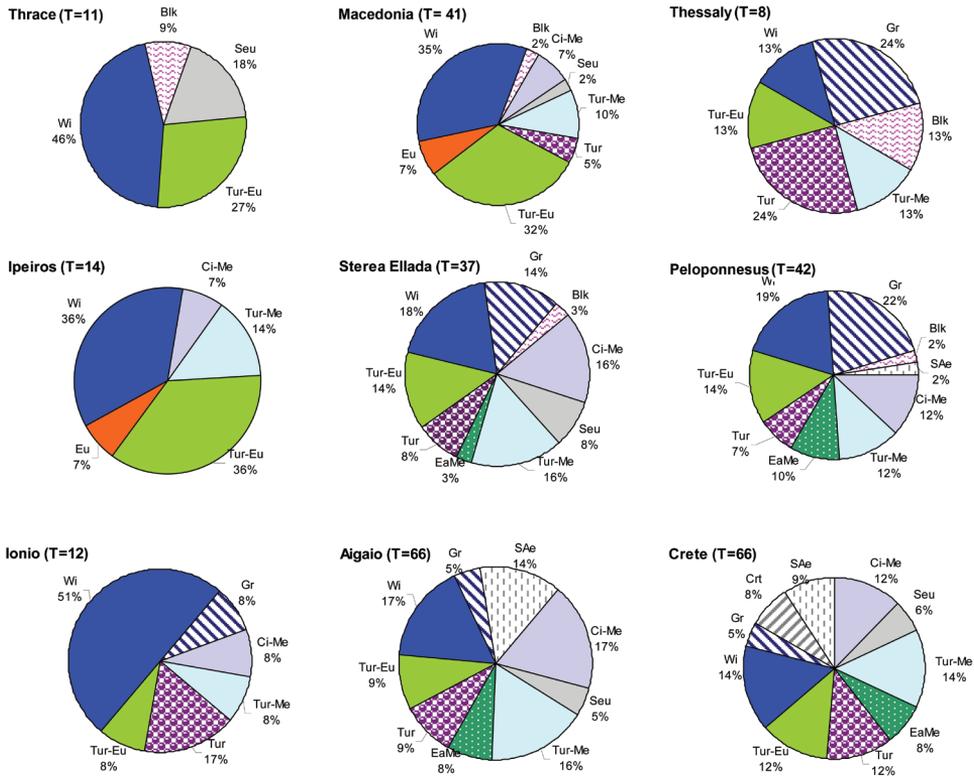


Fig. 3. Chorological representation of Gnaphosidae in the geographical divisions of Greece (T= Total number of species per geographical division).

region, forming up to 33% of the total gnaphosid fauna. Slightly lower is the representation of Mediterranean, circum-Mediterranean, and Turano-Mediterranean elements. Endemic species and species of eastern origin are smaller categories. Even when the uncertain species are excluded (Fig. 2B), the picture does not change significantly, apart from the fact that the representation of Greek endemics is lowered, which is expected since this category contains most of the insufficiently known species of the country. Still, endemism in Greece seems to be very high (23.4% in total or 15.7% when only safe species are taken into account). This is partly due to the high heterogeneity, insular character, and complex history of the area, but is also affected by poor knowledge of the arachnofauna of the whole area of the East Mediterranean. Taking into account the common occurrence of some species recorded here as South-Aegean [for instance, *Zelotes daidalus* Chatzaki, 2003; *Z. minous* Chatzaki, 2003; *Synaphosus trichopus* (Roewer, 1928); and *Leptodrassus hadjissaranti* Chatzaki, 2002), as well as other Greek species like *Berinda ensigera* (O. P.-Cambridge, 1874) and *Zelotes ilotarum*], it is very probable that these species do also occur at least in the coastal area of Turkey and farther southeast. Endemism recorded for other countries is significantly lower (Italy: 3.3-5.2% and 14.7% only in the Tyrrhenian region; the Iberian Peninsula: 9.3%; Central-Northern Europe:

none).

The species recorded for each geographical district as well as their chorological identification are listed in Table 1. It is evident from this list that some areas are characterized by very low numbers of species, so their zoogeographical trends as represented in Fig. 3 cannot be considered reliable. These areas are mainly Thrace, Thessaly, Ipeiros, and Ionio, while the lists from Macedonia, Peloponnesus, Aigaio, and Crete - albeit not complete - may show reliable trends. Between Macedonia and Crete, the two edges of the country, there is a clear zoogeographical difference in the representation of chorological elements: in Macedonia, widespread and Turano-European elements represent 66% of the total species present in the area, while on Crete all elements are more or less equally represented among species recorded on the island. These areas represent the two extreme zoogeographical situations, while in the rest of the country intermediate situations are observed. On the Aegean islands, Mediterranean (Ci-Me and Tur-Me) and widespread (Wi) elements dominate with 17% representation each, followed by South-Aegean elements (14%). Elements of eastern origin (EaMe and Tur) form 16% of the gnaphosids (Fig. 3). On

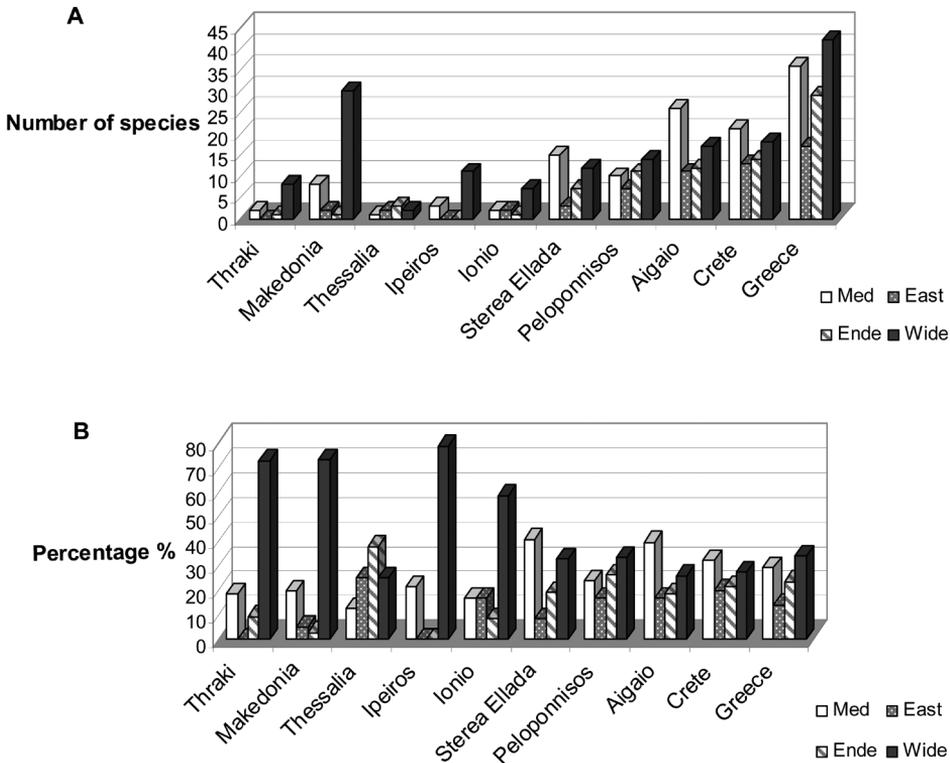


Fig. 4. Rough chorological representation of Gnaphosidae in the geographical divisions of Greece. A. Absolute number of species included in each category. B. Relative representation of each chorological category per geographical division. Chorological categories: Med: Mediterranean; East: Eastern; Wide: Widespread; Ende: Endemics (see text for further details).

the other hand, in Peloponnesus widespread elements are more than one third of the species (33.3% in total), showing a more continental character (compared to insular systems), and Mediterranean and endemic species are also highly represented (24 and 26%, respectively), leaving species of eastern origin to form the smallest group (16.7% in total). As a general observation, Turano-European species decrease from north to south (32% in Macedonia, 14% in Peloponnesus, and 9-12% on the Aegean islands and Crete), while Mediterranean species follow the opposite direction, dominating only from Sterea Ellada and southwards. It is also interesting to note that up to the present time there are no East-Mediterranean species recorded above Sterea Ellada and no European species recorded except for the districts of Macedonia (3) and Ipeiros (1) (instead, Turano-European species occur). This is in great contrast to the chorological analysis of the Italian Peninsula given by Di Franco (1997b), where European species represent 40-71%. As expected, there are significantly more species of eastern origin on the eastern Aegean islands and on Crete. Although this is clearly biased due to our better knowledge of the gnaphosid spiders in these areas, it is doubtful that the given difference will change much in the future.

In conclusion, based on Gnaphosidae Greece can be separated into two main zoogeographical zones: one in continental regions, where widespread elements dominate to a certain level, depending on the location across the vertical (north-south) axis of the peninsula; and one in the insular part of the country, where Mediterranean elements prevail, representing the more xerophilic portion of the

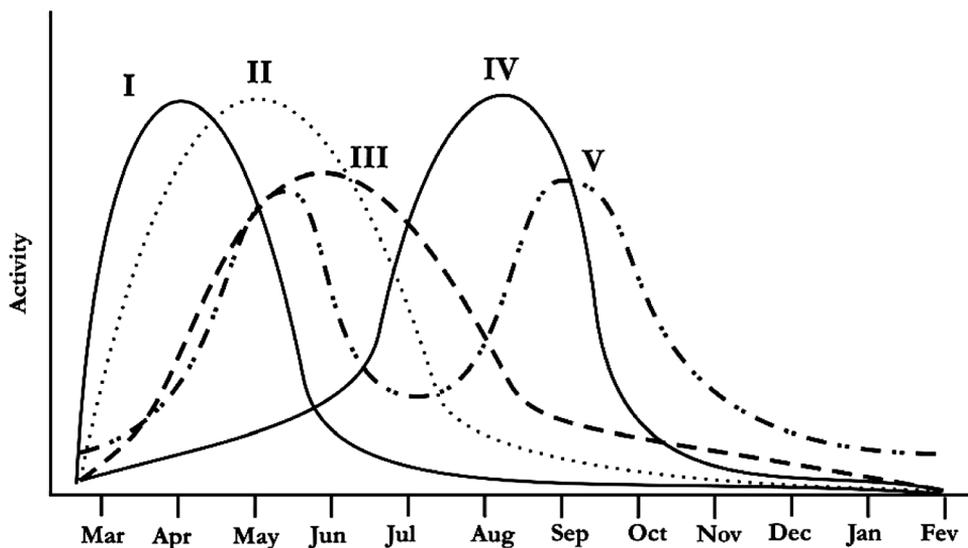


Fig. 5. Model of different patterns of activity of Gnaphosidae on Crete. Categories I and IV correspond to stenochronous species with peak activity in early spring and late summer, respectively; categories II and III correspond to species with prolonged activity period in spring and summer, respectively; category V corresponds to eurychronous species with two peaks of activity in late spring and early autumn (see text for further details).

family (Fig. 4). In both zones, endemic gnaphosids comprise a major part of the fauna, forming hotspots of diversity mainly on mountain tops and islands.

ECOLOGY, PHENOLOGY, AND BIOLOGY

Most Gnaphosidae are nocturnal hunters and spend the daytime in a silken retreat sheltered under stones or in litter. Some forms (such as *Callilepis*, *Micaria*, *Nomisia*, and *Poecilochroa*) are active during the day, feeding mostly on ants. However, the majority of Gnaphosidae are generalized feeders, feeding on Diptera, other spiders, Thysanoura, Homoptera, and Coleoptera (Paraschi, 1988). They prefer open and arid environments and hide under stones. On the Greek Peninsula, there is a clear habitat preference for “phrygana” (i.e., open shrublands with thorny, aromatic plant species) and to a lesser extent for maquis, in which they are the dominant family. In pine forests and other types of woods in Greece, they are less represented as far as both species richness and abundance are concerned (Chatzaki, 2003 and personal observations). Gnaphosidae are diverse from sea level to the high mountains of Greece. In the latter habitats, they form the main part of ground-dwelling spiders, together with some lycosids, thomisids, and philodromids (Chatzaki et al., 2005a).

From mid-spring to mid-autumn, Gnaphosidae is the dominant family of most Greek habitats, as is the case with all Mediterranean regions (Cardoso et al., 2007). In winter, the activity of most gnaphosid species is restricted and the family is outnumbered by other families such as Linyphiidae, Dysderidae, and Clubionidae (Chatzaki et al., 1998). Phenological patterns are species-specific and as far as Greek territory is concerned, they have been analytically studied only in habitats of the island of Crete [by Chatzaki et al., (2005b)]. Within the favorable period (mid-spring to mid-autumn), a continuum in the peaks of species activity can be observed. There are species that are mostly active from mid-spring to early summer, and others that are active at the end of summer or beginning of autumn. Within these rough categories, the following subgroups of patterns are evident (Fig. 5):

I. Stenochronous species, with peak activity at the end of spring and/or beginning of summer (i.e., *Haplodrassus creticus*, *Drassyllus praeficus*, and *Micaria coarctata*).

II. Species with peak activity at the end of spring and/or beginning of summer, but with prolonged activity in the summer months (i.e., *Nomisia excerpta* and *Trachyzelotes* spp.)

III. Species active during the whole favorable period, with peak activity in mid-summer (i.e., *Callilepis cretica*, *Zelotes caucasius*, and most other zelotine species such as *Z. segrex*, *Z. scrutatus*, and *Z. tenuis*).

IV. Stenochronous species with peak activity at the end of summer and/or beginning of autumn (i.e., *Drassodes albicans* and *Zelotes creticus*).

V. Clearly eurychronous species with mature individuals occurring throughout the year and with two peaks of male activity (i.e., *Pterotricha lentiginosa* and to a lesser extent *Zelotes subterraneus*).

Most of the above categories (e.g., groups I, II, III, and IV) encompass species considered to be “high competitors” [sensu Milner (1988)] or ‘conformists’ [sensu Stamou (1998)]. These species are very efficient competitors compared to other predators (even other spiders), confining their energy expenditure to the most advantageous period and avoiding extremes in environmental conditions by long periods of activity pause. Hence, stenochronous activity patterns should be expected for these spiders. However, because of their generalized diet, they unquestionably avoid one of the limiting factors for survival, which is food availability. Therefore, wider spatiotemporal ranges of activity can be expected in these spiders, as is indeed the case with some of the species mentioned above. Few species (e.g., group V) are “stress-tolerant” [sensu Milner (1988)] or “conservatists” [sensu Stamou (1998)], implying longer periods of activity with low and stable energy equilibria and inability to survive only outside extremely critical ranges of environmental parameters. Probably these spiders are catholic feeders, preying on animals that are present all year round or changing their diets with alternating seasons. However, they are unable to out-compete other more vigorous species during the period of optimum conditions and therefore follow a different strategy of life as a compensation for this deficiency.

Most Gnaphosidae have an annual biological cycle, with copulation occurring in spring, egg laying in summer, egg hatching in summer and autumn, and overwintering in the immature stage (Grimm, 1985). Some species of the genus *Zelotes* can have two generations per year, while biennial cycles are rare in Gnaphosidae, except for species from higher latitudes. On Crete it is possible that *D. albicans*, *Z. creticus*, and *G. bithynica* may have biennial cycles, as suggested by the more extended presence of female activity during the year, unaccompanied by increased activity of males (Chatzaki et al., 2005b). These species are linked with the highest altitudes of mountain regions of the island. Thus, prolongation of their biological cycle may be related to the harsher conditions of the environment they occupy.

Activity patterns are not always stable in space, not even within the narrow geographical range of Crete, where there are deviations from the standard, especially along the vertical axis of the island. There are cases in which the activity of species is restricted (i.e., *M. coarctata*, *Z. caucasius*, and *P. lentiginosa*) or is shifted 1-2 months towards summer and early autumn (i.e., *C. cretica*, *H. creticus*, *N. excerpta*, and *T. malkini*). This does not necessarily imply a change in the biological cycle of these species. A more extreme case is that of *P. lentiginosa*, whose phenology is characterized by two generations per year in the lowlands and one generation above 800 m (Chatzaki et al., 2005b). This species is the most abundant throughout the island of Crete, as well as on many other Greek islands (personal observations), which shows that it possesses extreme ecological plasticity, allowing it to overcome great climatic fluctuations.

CONCLUDING REMARKS

Gnaphosidae is a dominant spider family on the Greek Peninsula. After Salticidae, it is the second most diverse family based on present knowledge of the area's arach-

nofauna (Bosmans and Chatzaki, 2005). Gnaphosidae are very common on open grounds of both continental and insular Greece and show high ecological plasticity, which enables many species to dominate in space and time. Species that occur in Greece originate from either Europe or Asia, but there are also a number of endemic species that increase the diversity of the group in the area around the Aegean Sea. It is therefore of great importance to intensify our efforts to gain a deeper insight into the diversity, taxonomy, and evolution of this varied group in the wider geographical range of the East-Mediterranean countries.

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