A revised checklist of the Solifugae (Arachnida) of Greece

Revised control list of camel spiders (Arachnida: Solifugae) of Greece

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ABSTRACT: An overview of Greek solifuges is presented as an annotated checklist of the bibliography, covering the literature related directly to the solifuges of Greece with all known localities. Two species are added to the known camel spider fauna for the country, Galeodes araneoides (Pallas, 1772) and G. barbarus Lucas, 1849, which were omitted from the last checklist. Currently, a total of 14 species and one subspecies belonging to four families and eight genera are reported from Greece. Four species, Gluviella rhodicensis Caporiacco, 1948, Galeodes helenicus Roewer, 1934, G. rhodicola Roewer, 1941 and Barrussus furcichelis Roewer, 1928 and one genus, Gluviella, are presently known to be endemic. Potential erroneous data and dubious distributional records that may exist in the literature are also identified.

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Резюме: Обзор сольпуг Греции представлен в виде аннотированного контрольного списка с литературными данными по всем известным местонахождениям. По сравнению с предыдущим контрольным списком, в состав фауны региона добавлены два вида, Galeodes araneoides (Pallas, 1772) и G. barbarus Lucas, 1849. Таким образом, в Греции отмечено 14 видов и один подвид сольпуг из 8 родов и 4 семейств. Четыре вида, Gluviella rhodicensis Caporiacco, 1948, Galeodes helenicus Roewer, 1934, G. rhodicola Roewer, 1941 и Barrussus furcichelis Roewer, 1928, и один род, Gluviella, можно рассматривать как эндемичные для региона. Проанализированы возможные ошибочные данные и сомнительные находки.

Introduction

The first publications on solifuge fauna of Greece published in eighteenth-century when Lichtenstein & Herbst [1797] catalogued three species. Most studies of the Solifugae of Greece are mostly based on sporadic and limited collections by various authors. Sonnini [1801], Brullé [1832], Koch [1836, 1842, 1847], Gervais [1844], Dafour [1861], Butler [1873], Pavesi [1876, 1877, 1878], Simon [1879a, b, 1885, 1890] and Kraepelin [1899] reported Solifugae from Greece.

In the early twentieth century, there was a significant increase in the publishing of taxonomic investigations on solifuges. However, these publications were limited in their scope and focus, particularly when it came to Greece [Kraepelin, 1901; Fage, 1921; Roewer, 1928; Caporiacco, 1929, 1936, 1948; Kästner, 1932; Roewer, 1933, 1934, 1941; Werner, 1935; Moriggi, 1941; Zilch, 1946; Turk, 1948; Millot, Vachon, 1949]; nevertheless, three new endemic species have been described [Roewer, 1934, 1941; Caporiacco, 1948].

In the second half of the twentieth century, several authors contributed to the overall understanding of the distribution of Solifugae in Greece [Lawrence, 1953; Roewer, 1959; Junqua, 1966; Schenker, 1980; El-Hennawy, 1998].

The twenty-first century began with some higher-level systematics and taxonomic works. In 2003, Harvey prepared a Catalogue of the Smaller Arachnid Orders of the World, which still serves — updated taxonomically — as one of the main sources of our knowledge of the Solifugae. A checklist of solifuges of Greece provided by Alexiou [2014] including 12 species. On the other hand, World Solifugae Catalog has ten species and one subspecies from Greece as of June 29, 2023 [Harms et al., 2022].

The aim of this work is to present an updated checklist of the Solifugae of Greece. For this purpose, older lists were reviewed and annotated according to the recent literature and current taxonomic status of the species. We hope that this article will provide fundamental and overall knowledge on the biodiversity of solifuges of Greece and will stimulate local biologists who are interested in order Solifugae.

Methods

Study area

Greece is located centrally in the Eastern Mediterranean Sea. Greece’s climatic conditions are categorized into four...
zones. These are the Mediterranean, Alpine, Temperate, and Dry Summer Subtropical zones. The Mediterranean zone dominates the majority of the country with mild winters and hot summers. The Alpine zone is present in the country’s mountainous regions and is characterized by severe winters and mild summers. The Temperate zone appears in the northern, central, and western regions and features mild winters and moderate summers. Lastly, the Dry Summer Subtropical zone is only seen on the island of Crete and has hot, dry summers and mild winters [Technical Guide, TOTEE 20701-3, 2012].

Greece boasts numerous East Mediterranean climate ecosystems that are typical of the region, which is mostly concentrated in the central and southern areas and islands. These ecosystems vary widely in their flora and fauna, from lush forests and wetlands to dry scrublands and rocky coasts. Some of the most iconic ecosystems include the maquis, a type of Mediterranean scrubland dominated by shrubs and small trees, and the phrygana, which is characterized by low, drought-tolerant shrubs and herbs [Dimopoulos et al., 2012].

The Checklist
This checklist is based on a thorough review of the literature on the solifuges which their presence has been confirmed in Greece. The list includes data from all publications containing records of solifugae of Greece, from 1797 to 2023. Generic and species names are listed alphabetically. Authors are chronologically arranged, and literature records are given within brackets after locality information. The classification and nomenclature follow the “Catalogue of the Smaller Arachnid Orders of the World” published by Harvey [2003]. The occurrence in Greece of two species is considered as doubtful; these are written after the species names “Nomen dubium” in the list, but these species are still conditionally included in the fauna of Greece and are counted in the total number of species.

Results
This annotated checklist is based on the published literature up-to-date. It comprises 14 species and one subspecies of Solifugae found in Greece.

Family DAESIIDAE Kraepelin, 1899

Biton (Biton) ehrenbergi Karsch, 1880

TYPE LOCALITY. Al Tor, Janûb Sinâî, Egypt; Syria; Egypt; Dunqulah, Ash Shamaliyah, Sudan.


DISTRIBUTION OUTSIDE GREECE. Cyprus, Egypt, Ethiopia, Israel, Italy (mainland), Saudi Arabia, Somalia, Sudan and Tunisia [Harms et al., 2022].

Gluviella rhodensis Caporiacco, 1948

TYPE LOCALITY. Rhodes, Dodekanisos, Greece

DISTRIBUTION IN GREECE. Lardos [Caporiacco, 1948: 33]; Rhodes, Dodekanisos, Greece [Harvey, 2003: 234]; Rodos Island [Alexiou, 2014: 9].

REMARKS. Known only from the type locality and endemic to Greece. This species is not currently assigned to a subfamily, which has the monotypic genus Gluviella and a single species. Description based on male (as female [sic.]).

Gluviopsis discolor Kraepelin, 1899

TYPE LOCALITY. Izmir, Turkiye; Algeria.


DISTRIBUTION OUTSIDE GREECE. Algeria, Iran, Somalia, Syria and Turkiye [Harms et al., 2022].

REMARKS. Moriggi [1941] reported the occurrence of Gluviopsis discolor in Greece. Later, Caporiacco [1948] included G. discolor in the list of solifugae of Rhodes Island without collecting any specimens during a sampling survey in the island of Rhodes. However, Harvey [2003] stated that the specimen recorded by Moriggi [1941] was misidentified.

Gluviopsis rufescens (Pocock, 1897)


DISTRIBUTION OUTSIDE GREECE. Djibouti, Iraq, Somalia and Yemen [Harms et al., 2022].

REMARKS. Caporiacco [1948] added it to the list of species in Rhodes Island; the species is preceded by an asterisk because it was not collected from Rhodes Island.

Gluviopsis rufescens rufescens (Pocock, 1897)


DISTRIBUTION IN GREECE. Greece, Rhodes [Harvey, 2003: 230; Harms et al., 2022].

DISTRIBUTION OUTSIDE GREECE. Djibouti, Iraq, Somalia and Yemen [Harms et al., 2022].

REMARKS. Recorded from Rhodes, Greece, without any collecting details or comments, by Harvey [2003] and Harms et al. [2022].

Family GALEODIDAE Sundevall, 1833

Galeodes araneoides (Pallas, 1772)

TYPE LOCALITY. Unknown.


DISTRIBUTION OUTSIDE GREECE. Afghanistan, Armenia, Azerbaijan, Egypt, Iran, Iraq, Israel, Kazakhstan, Russia (North Ossetia), Syria, Turkiye, Turkmenistan and Ukraine [Harms et al., 2022].

REMARKS. Gervais [1844] claimed that it is an assertion and the presence of this species in southern Europe requires verification. Lastly, Pavesi [1876] has listed this species from Greece (Cret and Morea). After 140 years, it is added to the list of Greek solifugae.
Galeodes barbarus Lucas, 1849
TYPE LOCALITY. Algeria.
DISTRIBUTION IN GREECE. Grèce [Dufour, 1861: 376].
DISTRIBUTION OUTSIDE GREECE. Algeria, Egypt, Ethiopia, Libya, Morocco, Sudan and Tunisia [Harms et al., 2022].
Later, Harvey [2003] synonymised Galeodes (Solpuga) intrepidus [Dufour, 1861: 384–385] to Galeodes barbarus Lucas. Regarding Galeodes barbarus, distributional information given by Harvey [2003], he excluded the species from Greece, without any comment or information. Galeodes barbarus should be included on the list until clarification.

Galeodes gracae C.L. Koch, 1842
TYPE LOCALITY. Peloponnisos (as Morée), Greece.
DISTRIBUTION OUTSIDE GREECE. Armenia, Bulgaria, Cyprus, Egypt, Syria and Turkey [Harms et al., 2022].
REMARKS. G. gracae is a common species in Greece.

Galeodes hellenicus Roewer, 1934
TYPE LOCALITY. Tripolis (as Tripolitsa), Arkadia, Peloponnisos.
DISTRIBUTION IN GREECE. Morea, Tripolitsa [Roewer, 1934: 516, 523, 531; Zilch, 1946: 144]; Tripolitsa (as Tripolitsa), Arkadia, Peloponnisos (as Morée) [Greece [Harvey, 2003: 264]; Alexiou, 2014: 10].
REMARKS. Known only from the type locality and endemic to Greece.

Galeodes rhodocola Roewer, 1941
TYPE LOCALITY. Rhodos, Dodekanisos, Voreio Aigaio, Greece.
COMMENT. It was described from Rhodes Island in Greece by Roewer [1941]. Later, the species was listed from Greece, although with an asterisk, by Caporiacco [1948] who did not collect this species from Rhodes Island.
REMARKS. G. rhodocola is known only from the type locality and endemic to Greece.

Galeodes ruptor Roewer, 1934
TYPE LOCALITY. Northern Diyarbakır, Diyarbakır, Turkey.
DISTRIBUTION OUTSIDE GREECE. Turkey [Harms et al., 2022].

Family KARSCHIIDAE Kraepelin, 1899
Barrussus furcichelis Roewer, 1928
TYPE LOCALITY. Vitina, Arkadia, Peloponnisos, Greece.
REMARKS. B. furcichelis is known only from the male holotype and endemic to Greece.

Eusimonia nigrescens Kraepelin, 1899
TYPE LOCALITY. Syria.
DISTRIBUTION IN GREECE. Wula bei Athen [Werner, 1935: 294]; Greece [Harvey, 2003: 284; Alexiou, 2014: 10].
DISTRIBUTION OUTSIDE GREECE. Syria, Turkey [Harms et al., 2022].

Family SOLPUGIDAE Leach, 1815
Solpuga scenicus Lichtenstein, 1797 Nomen dubium
TYPE LOCALITY. Sardinien, Italy; Puglia, Italy.
DISTRIBUTION OUTSIDE GREECE. Italy (mainland) and Turkey [Harms et al., 2022].
REMARKS. Actually, two old literature records by Lichtenstein & Herbst [1797] and Butler [1873] refer to the sites or areas located in the Mediterranean Region, i.e., Crete, Sardinia and Greece, Naples? respectively. Hence, the species is conditionally included in Greek fauna, although its existence on the island of Crete (Greece), Sardinia (Italy) and Naples (Italy) has not been confirmed for more than the last 100 years.

Solpuga tarda Lichtenstein, 1797 Nomen dubium
TYPE LOCALITY. Sardinien, Italy; Puglia, Italy.
DISTRIBUTION IN GREECE. Grèce [Gervais, 1844: 90]; Grèce, Naples [Dufour, 1861: 376] (as Galeodes

**DISTRIBUTION OUTSIDE GREECE.** Southern Europe [Harms et al., 2022].

**REMARKS.** Solifuge records from Sardinia and Naples [Lichtenstein, Herbst, 1797; Dufour, 1861] date back to 1797 and 1861, respectively. While there have been general records of their presence in Greece, no specific locations have been confirmed since then.

**Discussion**

This paper provides an updated solifuge fauna of Greece, based on all available publications. Regarding the records for Greece presented in this paper, Galeodes araneoides and G. barbarus are included on the present checklist for the first time. Previous records of the two species were overlooked by most recent literature [Harvey, 2003; Alexiou, 2014; Harms et al., 2022]. These species should be included in listings of extant species. With these additions, this study raises the number of known solifuges of Greece to 14 species and one subspecies belonging to four families (four species and one subspecies in Daesiidae, six species in Galeodidae, two species in Karschiidae, and two species in Solpugidae).

Greece has exceptional levels of biodiversity and endemism, making it the most diverse Mediterranean country in terms of its area. This is evident across all levels of biodiversity [Georghiou, Delipetrou, 2010]. Greece’s high biodiversity can be attributed to several factors, including its dramatic geological history and unique climate conditions. The country’s location at the crossroads of Europe, Asia, and Africa has also contributed to the diverse range of plant and animal species found within its borders. Additionally, Greece’s numerous islands and coastal areas provide a variety of habitats for marine and terrestrial species [Higgins, Higgins, 1996]. Greece has several areas that are considered hotspots of biodiversity, with a high concentration of endemic species. These areas, often used for conservation purposes, are typically located in higher mountains. While the criteria for defining these hotspots vary, they are generally characterized by exceptional levels of biodiversity [Legakis et al., 2018]. According to Harms et al [2022], the total number of Solifugae species known in the world is estimated to be around 1209. The present study provides data that there are 14 species and one subspecies of Solifugae in Greece, which is approximately 1.26% of all Solifugae species known globally. This shows that, in comparison to the rest of the world, the Solifugae diversity in Greece is quite low.

Greece is the type locality of seven solifuges species: Gluviella rhodiensis, Galeodes grecus, G. hellenicus, G. rhodicola, Barrussus furcichelis, Solpuga scenica and S. tarda. On the other hand, four species and one genus can be considered endemic according to present knowledge: Gluviella rhodiensis, Galeodes hellenicus, G. rhodicola and Barrussus furcichelis. The endemic Karshiidae species occur in Morea and Vytina, one species being Barrussus furcichelis. Endemic Daesiidae, Gluviella genus, is known presently only from Greece with Gluviella rhodiensis. Galeodidae are represented by six species in Greece, including two endemic species Galeodes hellenicus and G. rhodicola.

Solifuges are difficult to collect due to their rapid movement. Other difficulties may include their nocturnal activity, their unknown life cycle, their unknown distributional pattern, and the use of inappropriate collection methods. Thus, the majority of species were described using only the male or female [Kraepelin, 1899; Roewer, 1928, 1941; Caporiacco, 1948]. Little is known about the diversity of the solifuges of Greece and there are no comprehensive surveys of Greece’s solifuges. The solifuge species recorded in Greece are given in Figures 1 and 2. Based on the described species and records of solifuges appearing in the timeline, it is evident that the most active periods occurred around 1871 and 1901. There was a notable break of almost two decades before another active period between 1921 and 1966. These periods indicate significant research and exploration in the field of solifuges during those times (Fig. 1). As highlighted in Figure 2, it is evident that a significant amount of time, specifically seventy years, has elapsed since Caporiacco’s last work on solifuges. However, it is important to note that no new solifuge species have been reported in the published literature within this period. New sampling surveys should be undertaken, while morphological and molecular studies are required to understand Greek solifuge fauna. This work will serve as a comprehensive reference when assessing the occurrence and conservation status of the solifuges of Greece in future studies. It’s important to note that Greece, as a whole, is still largely unexplored when it comes to research on solifuges. There is a high probability of discovering new species and records in the near future. With more focused...
exploration and research efforts, we can anticipate uncovering new and exciting findings in the field of solifuges in Greece. For example, the family Gylippidae in Greece is yet unknown, and it is expected that more Greek mountainous gylippid species will be discovered.

References
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