The centipedes of the Maltese Archipelago (Chilopoda)

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The centipedes of the Maltese Archipelago (Chilopoda). - The chilopod fauna of the Maltese Islands (Malta, Gozo, Comino) was studied from a faunistic and zoogeographic point of view. A list of the species found on these islands is given, based on recent faunistic investigations as well as on a critical assessment of the few records available in the literature. Twenty-one species are recorded to occur on the islands: 1 Scutigeromorpha, 7 Lithobiomorpha, 3 Scolopendromorpha, and 10 Geophilomorpha. Twenty species are confirmed to occur on the island of Malta, 11 on Gozo and three on Comino. The Maltese chilopod fauna mostly consists of species that are widespread in the Mediterranean islands, particularly those of the western Mediterranean. As shown in other studies on the chilopod faunas of other Mediterranean micro-insular systems, that of the Maltese Islands is mainly influenced by ecological factors rather than by paleogeographic and paleoclimatic ones. Zoogeographically the Maltese chilopod fauna is mainly Mediterranean in character, with a very limited representation of Holarctic (22%) and European (11%) species.

Key-words: Chilopoda - Maltese Islands - Malta - Gozo - Comino - fauna - biogeography.

INTRODUCTION

Very few papers have been devoted to the Maltese centipedes so far. The first lists of species were published at the end of the nineteenth century by the Maltese naturalist Giovanni Gulia (Gulia, 1890, 1913), who recorded only three species, all probably collected and studied by himself. About eighty years later, Matic et al. (1967) listed another seven species from material collected in 1965 by Marcello La Greca and co-workers, as part of a research programme on the Mediterranean fauna carried out by the Zoological Institute of the University of Catania (Italy). After that, the only published work on this subject known to us is a list of 12 species from the Maltese Islands, in a study on the centipede fauna of the West Mediterranean area by Foddai et al. (1996).

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Recently (mainly in the eighties), research on the Maltese fauna has been taken up by workers from the University of Malta and ample material has been collected from the main islands of the archipelago. This material, together with specimens occasionally collected by Italian universities and natural history museums, is the subject of the present study.

The aim of this paper is to list and discuss this material and all the previously published records of chilopods from the Maltese islands.

STUDY AREA

The Maltese archipelago (Fig. 1), situated in the central Mediterranean, approximately 96 km from Sicily and 290 km from North Africa, consists of three inhabited islands, i.e. Malta (246.5 km²), Gozo (65.8 km²) and Comino (2.9 km²) and of a number of small uninhabited islets (each less than 10 ha). The islands are mainly composed of Oligo-Miocene limestones, the soils are young and very similar to the parent rocks, and there are no mountains, streams or lakes, but only minor springs. The climate is typically Mediterranean and strongly bi-seasonal: the average annual rainfall is c. 530 mm, of which some 85% falls during the period October to March; the mean monthly temperature range is 12-26°C, and the islands are very windy and sunny. The main geomorphological features are karstic limestone plateaux, hillsides covered with clay taluses, gently rolling limestone plains, valleys (widien, see below) that drain runoff during the wet season, steep sea-cliffs on the south-western coasts, and gently sloping rocky shores to the Northeast. The islands have been more or less continuously inhabited since 7000 BP and human impact is significant. Presently some 38% of the land area is cultivated, c. 25% is built up, and the rest is countryside.

The terrestrial habitats of the Maltese Islands are mainly characterized by the vegetation which can be grouped in three categories: (i) communities that are part of the successional sequence (steppe, garigue, maquis) towards a climax (sclerophyll forest); (ii) communities which are either specialised to occupy particular habitats, or occupy habitats that are rare on the islands, or are relics from a previous ecological regime, now surviving in a few refugia; and (iii) vegetational assemblages of disturbed habitats, occupying land subject to periodic disturbance, usually related to anthropic activities.

It is thought that before humans colonised the Maltese Islands, large areas were covered with a Mediterranean sclerophyll forest characterised by Quercus ilex and Pinus halepensis. The early settlers cut the trees for wood and to clear the land for agriculture and buildings, and introduced sheep and goats whose grazing and browsing prevents the trees from regenerating. The native forest on the Maltese Islands is all but extinct and only remnants persist at four localities, none of which has more than a few dozen trees. More extensive tree-covered areas nonetheless exist on the islands; however, all owe their origin to human activities (e.g., gardens, plantations, orchards etc.). Although originally planted, some are now self-maintaining and self-regenerating, and therefore qualify as semi-natural woodlands.

The Maltese maquis is an impoverished scrub community resulting from degeneration of the climax woodland due to cutting, grazing and erosion of the soil.
Map of the Maltese Islands showing the localities from where centipedes recorded in this paper were collected. Key (in alphabetical order): 


semi-natural maquis survives in relatively inaccessible sites, such as the sides of steep valleys, and at the foot of escarpments, while an artificial maquis develops round previously cultivated trees, mainly *Olea europaea* and *Ceratonia siliqua*.
The most widespread natural vegetation type present is the garigue. Some garigue communities are natural, others result from degradation of forest and maquis, particularly where removal of the original vegetation cover has caused such extensive soil erosion that large tracts of the limestone bedrock have become exposed and only patches of stony soil still occur. Garigues are typical of such rocky ground and are especially common on the flat karstic limestone platforms of western Malta and the Gozitan hills. Many subtypes of Maltese garigue exist; the principal ones are those dominated by Coridothymus capitatus, Anthyllis hermanniae, Teucrium fruticans, Erica multiflora, and the endemic Euphorbia melitensis; mixed garigues dominated by two, three or more of these species are also common.

Steppic assemblages dominated by grasses, umbrellifers, thistles and geophytes are widespread and result from degradation of the maquis and garigue, due to grazing and browsing and from soil erosion due to the short but heavy rainstorms which are characteristic of the islands. Some steppic communities are, however, climactic or semi-climactic with Lygeum spartum on clay slopes, or with Hyparrhenia hirta and Andropogon distachyus. Other steppes are characterised by Brachypodium retusum or, rarely, by Phalaris truncata. The more degraded steppes are characterised by Stipa capensis and Aegilops geniculata and a variety of thistles (e.g., Carlina involucrata, Notobasis syriaca, Galactites tomentosa) and geophytes (e.g., Asphodelus aestivus, and Urginea pancreation). Steppic communities also develop on abandoned agricultural land, which is increasing in extent.

Habitats that are not part of the successional sequence include coastal marsh-lands, sand dunes, maritime vegetation, freshwater, and rupestral communities.

Maltese coastal marshes are characterized by a muddy substratum on which a pool of brackish water collects in the wet season. During the dry season this water becomes progressively more brackish until it finally disappears completely, leaving the marsh dry until the following wet season.

Many local sandy beaches were backed by dune systems, but at present only very few persist and even these have been much degraded mainly due to human activities in connection with beach development for touristic purposes and recreational use. Sand dune ecosystems are thus amongst the rarest and most threatened of local ecosystems. Local dunes are dominated by the dune grasses Elytrigia juncea and Sporobolus pungens, and, until recently, also by Ammophila littoralis which has now been totally extirpated.

On gently sloping rocky shores halophytic vegetation grows in isolated patches on the shallow saline soil that accumulates in pockets of the rock. The species present form part of the Mediterranean vegetational community called the Crithmo-Limonietum.

Rupestral assemblages dominated by shrubs occur on sheer rock faces and cliff/scree environments, mainly at the south, southwest and west coasts of the islands. Because of their relative inaccessibility these habitats provide important refuges for many species of Maltese flora and fauna, including many endemics, amongst which are two plant taxa (Palaeocyanus crassifolius and Creminophyton lanfrancoi) belonging to monotypic genera.

The main freshwater habitats are those associated with valleys (in Maltese: widien), which are geomorphologically dry valleys, that is, valleys formed during a
previous climatic regime (the Pleistocene pluvial periods), which are now dry for some months of the year and in which water only flows during the wet season. However, some local widien drain springs originating from perched aquifers and retain some surface water even during the dry season. Other freshwater habitats are temporary rainwater pools, formed by rainwater that collects in natural depressions and hollows in rock during the wet season, and a few permanent ponds.

In spite of being made up almost exclusively of limestone, the Maltese Islands have surprisingly few known deep caves. Those caves that have been explored biologically have revealed an impoverished but interesting biota with a number of endemic invertebrates.

Because of the islands' high human population and considerable land use, anthropogenic habitats have a large coverage. Such habitats are dominated by a variety of plant species consisting mainly of ruderals and aliens. Different types occur in association with agriculture, afforestation, abandoned fields, along roadsides, in disturbed seaside habitats and in urban areas.

The above synthesis is based on Alexander (1988), Axiak et al. (2002), Bowen Jones et al. (1961), Chetcuti et al. (1992), Haslam et al. (1977), Lanfranco (1995), Pedley et al. (1976), Schembri (1993, 1997), Schembri et al. (1999), Schembri & Lanfranco (1993), and Vossmerbäumer (1972); these works should be consulted for more detail and for an extensive bibliography.

MATERIAL AND METHODS

The present paper is based on literature records that have been critically revised, and on unpublished material. For each species the following is reported: the scientific name; the complete name of the author and year of publication; the bibliographic references concerning the study area listed chronologically, with the name of the species and author as originally quoted; the general geographic distribution, mainly as a list of the countries or geopolitical units from where the species is known, critically revised from the literature; the chorotype according to Vigna Taglianti et al. (1992, 1999); the list of collecting sites for the species in the Maltese Islands, arranged according to island (Malta, Comino, Gozo), with the collecting sites for each island listed alphabetically; a synthesis of available data on habitat preferences in the study area; and taxonomic remarks where relevant.

The following acronyms are used for the collectors of the material examined and for the collections where this material is now deposited. Collectors: AD = A. Deidun; AV = A. Valle; CA = Causin; DC = D. Caruso; DJ = D.M. Johnson; EG = E.H. Giglioli; EL = E. Lanfranco; GT = G.B. Toscanelli; JS = J.L. Schembri; LM = L. Main; MG = M. Gauci; MP = M. Pace; PS = P.J. Schembri; SA = S. Azzopardi; SS = S. Schembri; ST = S. Saliba. Collections: AM = A. Minelli; BG = Museo Civico di Scienze naturali “E. Caffi”, Bergamo, Italy; CT = Dipartimento di Zoologia, Università di Catania, Italy; DBUM = Department of Biology, University of Malta; FI = Museo di Storia naturale di Firenze, sezione Zoologica “La Specola”; MHNG = Muséum d’histoire naturelle, Genève; MZ = M. Zapparoli.
LIST OF THE SPECIES

SCUTIGEROMORPHA Gervais, 1837
SCUTIGERIDAE Gervais, 1837

Scutigera Lamarck, 1801

1. Scutigera coleoptrata (Linne, 1758)

Cermatia variegata Risso: Giulia, 1890: 41.
Cermatia variegata: Giulia, 1913: 554.
Scutigera coleoptrata: Schembri, 1996: 120.

Material examined. Malta: 1, Balluta' l-Imgiebah, 8.4.1984, PS (MZ, MZ det.); 1, Chadwick Lakes, 7.3.1975, DC (CT, AM det.); 1, G'Mangia, 1987, MG (MZ, MZ det.); 1, Malta, 5.1973, AV (BG, AM det.); 1, Manoel Island, 16.3.1985, PS (MZ, MZ det.); 1, S. Antonino [= San Anton Gardens], 12.3.1975, leg. ? (CT, AM det.); Siggiewi, 6.1982, MP (MZ, MZ det.).

General distribution. Portugal, Spain (incl. Balearic Is.), France (incl. Corsica), Italy (incl. Sardinia and Sicily), Switzerland, S. Germany, Austria, Czech Republic, Slovakia, S. Hungary, Slovenia, Croatia, Montenegro, FYR Macedonia, Albania, mainland and insular Greece (incl. Crete), Bulgaria, Romania, Ukraine (incl. Crimea), Caucasus, Near and Middle East, N. Africa (Egypt, Libya, Tunisia, Algeria, Morocco); also recorded from Madeira and the Canary Is. (introduced ?); introduced in Central and N. Europe, Asia, N. America, S. Africa, St. Helena, Argentina (Attems, 1907; Würmli, 1973, 1977).

Chorotype. Mediterranean (MED).

Ecological notes. Widespread species on the Maltese Islands, occurring in a range of habitats, usually with some degree of humidity, including human habitations and their surroundings (leaf litter, under thick vegetation, under stones on soil, in cellars etc).

LITHOBIOMORPHA Pocock, 1895
LITHOBIIDAE Newport, 1844

Eupolybothrus Verhoeff, 1907

Subgenus Allopolybothrus Verhoeff, 1907

2. Eupolybothrus (Allopolybothrus) nudicornis (Gervais, 1837)
Eupolybothrus elongatus (Newp.): Matic et al., 1967: 197.

Material examined. Malta: 7, Attard, 5.3.1975 (CT, AM det.); 1 ♂, Bahrija Valley, 25.3.1984, PS & SS (DBUM, MZ det.); 1 ♂, Bingemma Gap, 24.3.1984, SS (MHNG, MZ det.); 1, Birkirkara, 10.1969, CA (MZ, MZ det.); 1, Buskett, 12.1.1980, PS (MZ, MZ det.); 1, Chadwick Lakes, 23.4.1983, PS (MZ, MZ det.); 1, Ghadir, 27.12.1979, PS (MZ, MZ det.); 1 juv., Ghajn Hadid, Selmum, 5.12.1983, MG (MHNG, MZ det.); 1, Ghar Lapsi, 6.3.1975, DC (CT, AM det.); 2, Malta, 2.3.1975, leg. ? (CT, AM det.); 4 ♂, 1 ♀, 1 ♀ juv., Manoel Island, 16.3.1985, PS (MZ, MZ det.); 1, Mistra Bay, 3.3.1975, DC (CT, AM det.); 1 ♂, Rabat, St. Agatha's Catacombs, 16.7.1984, MG (MHNG, MZ det.); 2 ♂, San Pawl tat-Targa, garden, pitfall trap, 17.2.1985, DJ (DBUM, MZ det.); 1 ♂, Tal-Kortin, Mistra, 18.3.1984, PS (MZ, MZ det.); 2 ♂, 1 ♀, Tal-Qroqq, UOM, under stones, Acacia stand, 27.3.1984, SA & LM (MZ, MZ det.); 4 ♂, 1 ♀, ibidem, pitfall trap, Acacia stand, 5.4.1984, SA & LM (MHNG, MZ det.); 5 ♂, 2 ♀, ibidem, carob, under stones, 16.4.1984, SA & LM (MZ, MZ det.); exx., Targa Gap, 10.1.1970,
General distribution. SE. France (Basses Alpes, Alpes Maritimes), Corsica, Italy (Apennines), Sardinia, Sicily, Malta, NE. Morocco, N. Tunisia, N. Algeria (Brölemann, 1921, 1930; Foddai et al., 1995; Matic et al., 1967; Zapparoli, 1984). Reported also from Spain by Attems (1927, 1952), but record needs to be confirmed.

Chorotype. W-Mediterranean (WME).

Remarks. The old records of Gulia (1890, 1913) quoted under Lithobius forficatus (Linnaeus, 1758) may refer to this species (see below).

Ecological notes. Common and widespread species on the Maltese Islands, occurring in a range of habitats that include widien, leaf litter under trees such as Acacia and Ceratonia siliqua, under stones in garigue, coastal vegetation, gardens and urbanised areas.

Lithobius Leach, 1814

Subgenus Lithobius Leach, 1814

3. Lithobius (Lithobius) castaneus Newport, 1844

Material examined. Malta: 1 ♀, Ghajn Rihana, 25.3.1984, PS (MHNG, MZ det.); 1, Malta, 2.3.1975, DC (CT, AM det.); 1, Malta, 5.4.1978, leg.? (MZ, MZ det.); 1, Il-Maqluba, 20.1.1980, SS (MZ, MZ det.); 1, ibidem, 14.2.1982, PS (MZ, MZ det.); 1 ♀ juv., San Pawl tat-Targa, garden, pitfall trap, 3.2.1985, DJ (MHNG, MZ det.); 1♂, 1 ♂, Tal-Qroqq, UOM, under stones, Acacia stand, 27.3.1984, SA & LM (DBUM, MZ det.); 3, ibidem, pitfall trap, Acacia stand, 5.4.1984, SA & LM (MZ, MZ det.); 6 ♀, ibidem, carob, under stones, 16.4.1984, SA & LM (MZ, MZ det.); 1 ♀, Wied Babu, 23.5.1985, SS (MHNG, MZ det.); 1 ♀, Wied I-Ghasel, Mosta, garigue, under stones, 26.1.1985, PS (DBUM, MZ det.).

General distribution. Morocco, Tunisia, Algeria, Portugal, Spain, France (incl. Corsica), Italy (including Sardinia and Sicily), Malta, S. Austria, Slovenia, Croatia, Bosnia Herzegovina, Serbia (Brölemann, 1921, 1930, 1932; Eason, 1982; Foddai et al., 1995; Kos, 1992; Machado, 1952; Matic et al., 1967; Stoev, 1997; Zapparoli, 1981); the species has been reported from Bulgaria, but records require confirmation (Stoev, 2002); introduced in Guatemala (Eason, 1973).

Chorotype. S-European (SEU).

Ecological notes. Common and widespread; occurring in a variety of habitats including widien, leaf litter under trees, under stones in garigue, and in gardens.

4. Lithobius (Lithobius) forficatus (Linnaeus, 1758)

Lithobius forficatus Leach [sic]: Gulia, 1890: 41.

Lithobius forficatus: Gulia, 1913: 554.

Material examined. No material from Malta examined (cf. Remarks).

General distribution. Iceland (introduced), Finland, Norway, Sweden, Denmark, United Kingdom, Ireland, Netherlands, France (incl. Corsica, but introduced),
Germany, Poland, Czech Republic, Slovakia, Hungary, Switzerland, Austria, Italy (incl. Sardinia and Sicily (Eolian Is.), but introduced in both), Slovenia, Croatia, Bosnia Herzegovina, Serbia, Montenegro, FYR Macedonia, Romania, Bulgaria, Albania, mainland Greece, N. Turkey, Georgia, Russia (Krasnodar Prov.); also present in N. Africa (introduced?) and in Malta (introduced); from the W-Palearctic it has been introduced to N. America, S. America, St. Helena, Hawaii Is. (established?), Kuriles (Brölemann, 1930; Eason, 1964, 1970, 1982, 1996; Enghoff, 1983; Foddai et al., 1995; Kos, 1992; Országh, 2001; Stoev, 1997; Tajovský, 2001; Wytwer, 1997; Zalesskaja, 1978; Zapparoli, 1999).

Chorotype. European (EUR).

Remarks. According to Zapparoli (1995a) this species has a very limited distribution in the micro- and macro-insular systems of the Mediterranean area, although it is highly anthropophilous. *L. forficatus* has never been recorded from the Balearic Is., Corsica, Sardinia, Sicily, Crete and Cyprus, from where it must be considered absent. In the Tyrrhenian area only a few records from Capri, the Eolian Is. (Lipari, Vulcano) and Lampedusa are known, all probably resulting from anthropic introductions. The only record of this species from the Maltese Islands is that of Gulia (1890, 1913), however, in spite of the in-depth research carried out no new records have been added since the end of the 19th century and we suspect that Gulia’s record from Malta may be based on a misidentification and probably refers to another lithobiid species (possibly *E. nudicornis* ?).

Ecological notes. No data available.

5. *Lithobius* (*Lithobius*) lapidicola Meinert, 1872


*General distribution.* Canary Is., Ireland, United Kingdom, Sweden, Netherlands, Germany, Switzerland, Denmark, Poland, Czech Republic, Slovakia, Ukraine, France (incl. Corsica), Italy (incl. Sardinia and Sicily), Austria, Hungary, Slovenia, Bosnia Herzegovina, Montenegro, Romania, Albania, mainland Greece (incl. Ionian Is.) (Brölemann, 1930; Eason, 1964, 1970, 1982, 1985, 1996; Enghoff, 1983; Foddai et al., 1995, 1996; Kos, 1992; Országh, 2001; Stoev, 1997; Tajovský, 2001; Wytwer, 1997; Zalesskaja, 1978).

Chorotype. European (EUR).

Ecological notes. Records available at present indicate that this is a leaf litter species which occurs in semi-natural wooded areas (Buskett) and in urban gardens (Sliema).

6. *Lithobius* (*Lithobius*) peregrinus Latzel, 1880

*Material examined.* Malta: 1 ♂, Malta, date?, SS (MZ, MZ det.).

*General distribution.* SE. Italy (Gargano), Bosnia Herzegovina, Montenegro, FYR Macedonia, Albania, mainland Greece (incl. Ionian Is.), Bulgaria, Caucasus; introduced in the United Kingdom, France, Spain, NE. Italy, S. Africa, Bermuda Is., Panama (Stoev, 1997, 2001; Zapparoli, 1992).
Chorotype. S-European (SEU).

Remarks. There are no previous records of this species from Malta, were it has probably been introduced.

Ecological notes. No data available.

7. Lithobius (Lithobius) trinacrius Verhoeff, 1925

Material examined. Malta: 1 ♂, Ballut ta’l-Imgiebah, 8.4.1984, PS (MHNG, MZ det.); 1 ♂, Għajn Hadid, 8.5.1983, PS (MZ, MZ det.); 1 ♀, Għajn Hadid, Selmun, 5.12.1983, MG (MHNG, MZ det.); 1 ♀, 2 juv., Selmun, 5.2.1983, PS (MZ, MZ det.); 2 ♂, 2 ♀, Mgiebah, 9.11.1985, leg. ? (MZ, MZ det.). Gozo: 1 ♂, Dwejra, 9.2.1984, MG (MHNG, MZ det.); 1 ♂, 1 ♀, Ramla, 15.2.1986, clay slopes, PS (DBUM, MZ det.); 1 ♂, Xlendi, 26.4.1984, MG (MZ, MZ det.).

General distribution. Sicily (Foddai et al., 1995); also reported from Pantelleria (Zapparoli, 1995a).

Chorotype. W-Mediterranean (WME).

Ecological notes. Available records indicate that this species has a distribution limited to coastal areas where it occurs under trees, shrubs, in grass steppes, on clay slopes and under maritime vegetation.

Subgenus Monotarsosobia Verhoeff, 1905

8. Lithobius (Monotarsosobia) crassipes L. Koch, 1862


General distribution. Scandinavia, United Kingdom, Ireland, Iberia, France, Netherlands, Germany, Switzerland, Poland, Czech Republic, Slovakia, Austria, Italy (incl. Sardinia and Sicily), Slovenia, Croatia, Bosnia Herzegovina, Montenegro, Serbia, Albania, FYR Macedonia, mainland and insular Greece (incl. Crete), Bulgaria, Romania, Russia, Turkey, Syria, Jordan, Central Asia, Algeria, Tunisia, Canary Is., Madeira; probably introduced in N. America (Brölemann, 1921, 1930, 1932; Eason, 1964, 1982, 1985; Foddai et al., 1995; Kos, 1992; Matic et al., 1967; Országh, 2001; Stoev, 1997, 2001; Tajovský, 2001; Wytwr, 1997; Zaleskajka, 1978; Zapparoli, 1991, 1999).

Chorotype. W-Palaearctic (WPA).

Ecological notes. Common and quite widespread; this species occurs in soil and leaf litter beneath trees and shrubs, especially in sheltered situations, such as maquis in the deeper widien.

Scolopendromorpha Pocock, 1895

Scolopendridae Newport, 1844

Scolopendra Linné, 1758
9. **Scolopendra cingulata** Latreille, 1829

*Scolopendra cingulata* Schembri, 1996: 120.

**Material examined.** Malta: 1, Wied Mejxu, under stones, 25.10.1970, EL (MZ det.); 1, Birkirkara, under stones, 5.11.1974, SS (MZ det.). Comino: 2, under stones, 23.03.1975, SS (MZ det.); 1, Santa Marija Bay, 26.9.1982, PS (MZ, MZ det.).

**General distribution.** Tunisia, Algeria, Morocco, Portugal, Spain, France, Italy, Slovenia, Croatia, Bosnia Herzegovina, Serbia, Montenegro, FYR Macedonia, Romania, Bulgaria, Albania, mainland and insular Greece, Turkey, Hungary, Ukraine, S. European Russia (Crimea, Caucasus), NW Iran, Syria, Lebanon, Palestine, Israel, Jordan, Egypt (Sai), Cyrenaica; also in Sicily and Cyprus; absent in Balearic Is., Corsica, Sardinia and Crete (Attems, 1930; Brölemann, 1921, 1930, 1932; Foddai et al., 1995; Kos, 1992; Lewis, 1985; Serra, 1983; Stoev, 1997; Zalesskaja & Schileyko, 1992; Zapparoli, 1991, 1999). Two records from Tajikistan (Zalesskaja & Schileyko, 1992).

**Chorotype.** (Turano?)-Mediterranean (MED).

**Remarks.** Recorded from many localities on Malta, as well as from the islands of Comino and Gozo (Matic et al., 1967); many more specimens were seen by one of us (PS) but were not collected.

**Ecological notes.** Widespread species on the Maltese Islands, occurring in a wide range of habitats including coastal garigue and clay slopes, widien, inland garigue and fields.

10. **Scolopendra oraniensis** Lucas, 1846


**Material examined.** Malta: 1, Attard, 5.3.1975, leg. ? (CT, AM det.); 1, Bahrija Valley, 6.4.1985, PS (MZ, MZ det.); 1, Ghadir, 4.3.1975, leg. ? (CT, AM det.); 1, Ghan Tuffieha, clay slopes, 24.2.1985, SS (MZ, MZ det.); 1, Ghar Lapsi, 6.3.1975, DC (CT, AM det.); 1, Gnejna, 10.4.1982, JS (DBUM, MZ det.); 1, Il-Fawwara, Dingli cliffs, 9.4.1983, SP (MZ, MZ det.); 1, Salina, 5.5.1984, SS (MZ, MZ det.); 1, Mgiebah Bay, clay slopes, 8.4.1984, PS (MZ, MZ det.); 1, Mistra, 3.3.1975, DC (CT, AM det.); 1, Wardija, 2.3.1975, leg. ? (CT, AM det.); 1, Wied Bufula, 8.11.1986, leg. ? (MZ, MZ det.); 1, Wied Incita, 25.3.1984, PS & SS (DBUM, MZ det.); 1, Wied I-Ghasel, Mosta, garigue, under stones, 26.1.1985, PS (MZ, MZ det.); 1, Wied Znuber, 15.4.1984, PS (MHNG, MZ det.); 1, Xrob I-Ghagin, 7.5.1984, MG (MHNG, MZ det.); Gozo: 1, Dwejra, 17.5.1984, SS (MHNG, MZ det.); 2, Hondoq ir-Rummien, 5.3.1984, SS (DBUM, MZ det.); 1, Wied il-Mielah, 9.4.1984, MG (MZ, MZ det.).

**General distribution.** Portugal, Spain (incl. Balearic Is.), S. France, Corsica, Central and S. Italy, Sardinia, Sicily, Malta. Records from Morocco and Algeria are also known (Würml, 1980).

**Chorotype.** Western Mediterranean (WME).

**Ecological notes.** Common and widespread especially in coastal areas; it occurs in widien, garigue and on clay slopes.

**CRYPTOPIDAE** Kohlrausch, 1881

**Cryptops** Leach, 1815

11. **Cryptops trisulcatus** Brölemann, 1902

**Cryptops trisulcatus** Bro. [sic]: *Matie et al.*, 1967: 197.
Material examined. Malta: 1, Chadwick Lakes, 7.3.1975, DC (CT, AM det.); 1, Ghadira, 4.3.1975, DC (CT, AM det.). Gozo: 1, Dwejra, 9.11.1984, MG (MZ, MZ det.); 1, ibidem, 17.5.1984, SS (MZ, MZ det.). Comino: 1, central area, 26.9.1982, PS (MZ, MZ det.).


Chorotype. Mediterranean (MED).

Ecological notes. Available records suggest that this species has a rather limited distribution and occurs mostly in coastal areas, but also in widien (Chadwick Lakes).

GEOPHILOMORPHA Leach, 1815
HIMANTARIIDAE Cook, 1895

Himantarium C. Koch, 1847

12. Himantarium gabrielis (Linnaeus, 1767)
Himantarium gabrielis: Schembri, 1996: 120.


General distribution. Tunisia, Algeria, Morocco, S. France (incl. Corsica), Italy (incl. Sardinia and Sicily), Slovenia, Croatia, Bosnia Herzegovina, Montenegro, FYR Macedonia, Albania, mainland and insular Greece (excl. Crete), S. Romania, Bulgaria, W. Turkey; introduced in Madagascar (Attems, 1929; Brölemann, 1921, 1930, 1932; Foddai et al., 1995; Kos, 1992; Minelli et al., 1984; Stoev, 1997, 2001; Zapparoli, 1999). Reported from Portugal by Attems (1929) but not by Machado (1952); also occurring in Central Europe (Brölemann, 1930).

Chorotype. Mediterranean (MED).

Ecological notes. Common and widespread species on the Maltese Islands, occurring in a wide range of habitats that include leaf litter under trees and shrubs, soil in garigue, widien and gardens.

Stigmatogaster Latzel, 1880

13. Stigmatogaster gracilis (Meinert, 1870)

Material examined. Malta: 2, 12.1972/1.1973, AV (BG, AM det.); 2, Malta, 8.1878, EG (FI, AM det.).

General distribution. Tunisia, Algeria, Balearic Is., S. France (incl. Corsica), Italy (incl. Sardinia and Sicily), Croatia, Montenegro, Albania, mainland and insular
Greece (excl. Crete) (Brölemann, 1921, 1930, 1932; Foddai et al., 1995; Kos, 1992; Negrea & Matic, 1973; Stoev, 1997).

**Chorotype.** Mediterranean (MED).

**Ecological notes.** No data available.

**Bothriogaster** Sseiwanoff, 1879

14. **Bothriogaster signata** (Kessler, 1874)

*Bothriogaster signata* Att. [sic]: Matic et al., 1967: 196.

*Material examined.* Malta: 3, Tal-Qroqq, UOM, Acacia stand, under stones, 27.3.1984, SA & LM (MZ, MZ det.). Gozo: 2, Dwejra, 17.5.1984, SS (DBUM, MZ det.); 1, Qala, 17.5.1985, MG (MHNG, MZ det.).

**General distribution.** FYR Macedonia, Albania, Bulgaria, mainland and insular Greece (incl. Crete), Turkey, Cyprus, Syria, Palestine, Israel, Egypt, Libya (Cyrenaica, Tripolitania), Tunisia, Caucasus, Iran, Iraq, Jordan, Saudi Arabia, Turkistan, Uzbekistan (Stoev, 2000; Zapparoli, 1991).

*Chorotype.** Turano-Mediterranean (TUM).

*Remarks.* Previously recorded from several localities on the island of Malta, as well as from Comino and Gozo (Matic et al., 1967).

**Ecological notes.** Only few records are available but the species seems to prefer soil under vegetation in rather arid situations.

**Dignathodontidae** Cook, 1895

**Dignathodon** Meinert, 1870

15. **Dignathodon microcephalus** (Lucas, 1846)

*Dignathodon microcephalus* [sic] (Luc.): Matic et al., 1967: 197.

*Material examined.* Malta: 2, Targa Gap, 2.10.1982, PS & SS (MZ, MZ det.).

**General distribution.** Morocco, Algeria, Tunisia, Portugal, Spain (incl. Balearic Is.), S. France (incl. Corsica), Italy (incl. Sardinia and Sicily), Austria, Croatia, Bosnia Herzegovina, Serbia, Montenegro, Czech Republic, Slovakia, Romania, Bulgaria, Albania, mainland and insular Greece (incl. Crete), Near and Middle East, Crimea; also recorded from Luxembourg, where it was probably introduced (Attems, 1929; Brölemann, 1921, 1930, 1932; Dobroruka, 1956; Foddai et al., 1995, 1996; Kos, 1992; Machado, 1952; Matic, 1972; Negrea & Matic, 1973; Országh, 2001; Stoev, 1997; Tajovsky, 2001; Zapparoli, 1991, 1995b, 1999).

*Chorotype.** Mediterranean (MED).

*Remarks.* This species has been previously recorded from Gozo (Matic et al., 1967).

**Ecological notes.** No data available.

**Henia** C.L. Koch, 1847

Subgenus *Meinertia* Bollmann, 1893

16. **Henia (Meinertia) bicarinata** (Meinert, 1870)
Material examined. Malta: 1, Bahrija Valley, 25.3.1984, PS & SS (MHNG, MZ det.); 1, Buskett, soil, leaf litter, Berlesse extractor, 30.4.1984, PS (MZ, MZ det.); 1, Chadwick Lakes, 7.3.1975, DC (AM, AM det.); 1, Formm ir-Rih (cobble beach), October 2001, MG (AM, AM det.); 1, Formm ir-Rih (cobble beach, on wrack), October 2001, MG (AM, AM det.); 1, Wied 1-Ghasel, near Mosta Fort, 16.3.1985, PS (MHNG, MZ det.); 1, Manoel Island, 3.4.1984, MG (MZ, MZ det.); 2, Mgiebah, 17.3.1985, leg.? (DBUM, MZ det.). Gozo: 1, Dwejra, 17.5.1984, SS (MZ, MZ det.); 1, Fort Chambray slopes, 3.2.1985, PS & MG (MHNG, MZ det.); 1, Ta' Cenc, 2.2.1985, PS & MG (DBUM, MZ det.); 1, Ta' Cenc, 11.3.1975, DC (AM, AM det.).

General distribution. Macaronesia, Maghreb, Iberia, France (incl. Corsica), Italy (peninsular regions, Sardinia and Sicily), Croatia, Bosnia Herzegovina, Slovakia, Hungary, Bulgaria, mainland and insular Greece (incl. Crete), Turkey, Caucasus (Minelli, 1982; Országh, 2001).

Chorotype. Mediterranean (MED).

Ecological notes. A more or less widespread species that occurs in coastal areas in stranded Posidonia debris on beaches, on coastal clay slopes and amongst coastal vegetation, but also inland in widien, in soil and leaf litter under trees and shrubs, and under stones in garigue.

Subgenus Chaetechelyne Meinert, 1870

17. Henia (Chaetechelyne) vesuviana (Newport, 1845)


General distribution. Tunisia (?), Spain (?), S. France, Corsica (?), Switzerland, Italy (incl. Sardinia and Sicily), Croatia, Slovenia, SW. Romania (Minelli, 1982; Kos, 1992; Stoev, 1997).

Chorotype. Western Mediterranean (WME).

Ecological notes. The only locality where this species has been collected on the Maltese Islands has mainly a garigue and low maquis vegetation.

Schendylidae Verhoeff, 1908

Schendyla Bergsoe & Meinert, 1866

18. Schendyla sp. n.

Material examined. Malta: 7, Ballut ta’l-Imgiebah, soil leaf litter, 8.4.1984, PS (MZ, MZ det.); 1, Nadur, near Bingemma Gap, 30.12.1984, PS (MZ, MZ det.); 1 ♂, Mtaheb, 6.3.1975, DC (AM, AM det.).

Remarks. This new taxon will be described in the context of a revision of the Mediterranean Schendyla species.

Ecological notes. The specimens were found in soil and leaf litter under trees (Quercus ilex at Ballut ta’l-Imgiebah) and in low maquis (Ceratonia siliqua at Bingemma Gap).

Geophilidae Cook, 1895

Pachymerium C.L. Koch, 1847

19. Pachymerium ferrugineum (C.L. Koch, 1835)

Pachymerium ferrugineum (C. Koch) [sic]: Matic et al., 1967: 197.
Material examined. Malta: 1, Ghadira, near reserve, 21.4.1984, PS (MHNG, MZ det.); 1, Girgenti, 18.10.1986, PS (MZ, MZ det.); 1, Malta, 8.10.1878, EG & GT (FL, AM det.); 1, Salina, 5.5.1984, SS (DBUM, MZ det.); 1, ibidem, 22.1.1985, MG (MZ, MZ det.); 2, San Pawl tat-Targa, garden, pitfall trap, 17.2.1985, DJ (MZ, MZ det.); 4, Tal-Qroqq, UOM, 5.4.1984, SA & LM (MZ, MZ det.); 1, Malta, 8.10.1878, EG & GT (F1, AM det.); 1, Salina, 5.5.1984, SS (DBUM, MZ det.); 1, ibidem, 22.1.1985, MG (MZ, MZ det.); 2, ibidem, 15.2.1985, PS (MZ, MZ det.); 1, Ta’ Cenc, 2.2.1985, PS & MG (MZ, MZ det.); 1, Xatt l-Ahmar, 4.5.2002, AD (AM, AM det.).

General distribution. Macaronesia (Azores, Madeira, Canary Is.), N. Africa (Tunisia; Algeria incl. Mediterranean coasts and Hogggar, Central Sahara; Morocco; Libya: Cyrenaica, Tripolitania), Portugal, Spain (incl. Balearic Is.), France (incl. Corsica), Italy (incl. Sardinia and Sicily), Austria, former Czechoslovakia, Poland, Latvia, Hungary, Slovenia, Croatia, Bosnia Herzegovina, FYR Macedonia, Albania, Bulgaria, Greece, Romania, European Russia, Turkey, Cyprus, Palestine, Iran, Caucasus, Turkestan; recorded from Scandinavia (Finland, Norway), United Kingdom, Netherlands; also present in Alaska and Pribilof Is.; introduced to Japan, Hawaii Is., N. America, Juan Fernández Is., Mexico, Easter I. (Barber, 1985; Eason, 1964; Meidell, 1977; Palmén & Rantala, 1954; Stoev, 2000).

Chorotype. W-Paleartic (WPA).

Ecological notes. Widespread species on the Maltese Islands, occurring in a wide range of habitats including coastal garigue and clay slopes, sandy beaches, widien, inland garigue and gardens.

Clinopodes C.L. Koch, 1847

20. Clinopodes flavidus (C.L. Koch, 1847)

Material examined. Malta: 1, Buskett, 30.12.1978, B/2, JS (MZ, MZ det.).

General distribution. Poland, Czech Republic, Slovakia, Austria, Italy (incl. Sicily, excl. Sardinia), Slovenia, Croatia, Bosnia Herzegovina, Serbia, Montenegro, FYR Macedonia, Albania, Romania, Bulgaria, mainland and insular Greece (incl. Crete), Turkey, Cyprus, Palestine, Syria, European Russia, Crimea, Caucasus, Turkestan (Attems, 1929, 1949; Foddaï et al., 1995; Kos, 1992; Országh, 2001; Stoev, 1997, 2001; Wytwor, 1997; Tajovský, 2001; Zapparoli, 1995b, 1999).

Chorotype. Turano-European (TUE).

Ecological notes. The only locality from where this species was collected in the Maltese Islands is a semi-natural woodland.

Tuoba Chamberlin, 1920

21. Tuoba poseidonis (Verhoeff, 1901)


General distribution. Coasts of S. France (incl. Corsica), Central and S. Italy (incl. Sardinia and Sicily), Slovenia, mainland and insular Greece, Jordan (Dead Sea),
CENTIPEDES OF THE MALTESE ARCHIPELAGO

Egypt (Red Sea), Somalia (Indian Ocean) (Attems, 1929; Brölemann, 1930; Foddai et al., 1995, 1996; Stoev, 1997; Zapparoli, 1990, 1991).

Chorotype. Mediterranean (MED).

Ecological notes. Found under stranded Posidonia debris on sandy beaches.

**FAUNISTIC AND ZOOGEOGRAPHIC REMARKS**

On the basis of the faunistic data available so far, twenty-one species of centipedes are here listed from the Maltese Archipelago, i.e. 1 Scutigeromorpha, 7 Lithobiomorpha, 3 Scolopendromorpha, and 10 Geophilomorpha. Of these, 20 have been confirmed to occur on the island of Malta, 11 species on Gozo and three on Comino (Tab. I).

The faunistic data presented in this study are significant, since they are the result of systematic collecting made in different seasons over a number of years and employing different collecting methods, but it is likely that the real number of species present in the Maltese Islands is slightly higher than reported here.

One possible addition to the list may be Cryptops punicus Silvestri, 1896, a thermostolerophilous species widespread in the W-Mediterranean basin and known from the Tuscany Is. (Montecristo), Sardinia, Ustica, Sicily, Pantelleria, Lampedusa and Tunisia (cf. Zapparoli, 1995a).

Other species that can be expected to occur in the Maltese Archipelago are Hydroschendyla submarina (Grube, 1872) and Nannophilus eximius (Meinert, 1870). *H. submarina* is a halophilous species, with a Mediterranean-Atlantic distribution for which some records are known for the Tyrrhenian (Tuscany Is., NE. Sardinia, Campania, Linosa: Zapparoli, 1995a) and Aegean areas (Zapparoli, 2002). *N. eximius* is a W-Mediterranean element, recorded from Macaronesia (Madeira, Canary Is.), N. Africa (Algeria, Tunisia) and S. Italy (Sicily, Calabria, Basilicata, Puglia); it is also present in the circum-Sicilian micro-insular systems (Egadi Is., Eolian Is., Pelagian Is.).

Another species that may also be present is Geophilus insculptus Attems, 1895, a rather euryoecious geophilomorph widely distributed in Europe and also present in N-Africa. In the Tyrrhenian islands this species is known from many localities on Sardinia and Sicily and it has also been recorded from the Tuscany Is. (Giannutri, Giglio), Campana Is. (Ischia), Egadi Is., Eolian Is., Pantelleria and Lampedusa (Zapparoli, 1995a).

With respect to our knowledge of the centipede fauna of individual Maltese islands, data are most complete for Malta, while the number of species that occur on Gozo and Comino is very likely an underestimate. Some widespread Mediterranean elements (e.g.: Scutigera coleoptrata, Eupolybothrus nudicornis, Lithobius crassipes, Scolopendra oraniensis, Pachymerium ferrugineum, Tuoba poseidonis) have not been recorded from Gozo and Comino, probably due to inadequate collecting on these islands.

When compared to the faunas of the Central Mediterranean mainland and insular areas (Sicily, Eolian Is., Ustica, Egadi Is., Pantelleria, Linosa, Lampedusa and Tunisia), the centipede fauna of the Maltese Islands represents about a third of that
known to date for this region as a whole (Tab. II). However, faunistic knowledge of these areas is still incomplete. Best known are the Sicilian (including the small surrounding islands) and Maltese faunas, both of which have been the object of recent and repeated studies. Just under fifty species have been recorded from these localities as a whole (Foddai et al., 1995, 1996). In contrast, knowledge of the centipedes of N. Africa, and particularly Tunisia, is much less complete and in need of updating. Some forty species have been recorded from this region to date, at least five of which are doubtful (Brölemann, 1921, 1932; Zapparoli, unpublished records).

Leaving out L. peregrinus, which is probably introduced, and L. forficatus, the presence of which on Malta is doubtful, almost 70% of the centipedes of the Maltese Islands are represented by species with a high dispersal ability. They are widespread in the Mediterranean area and are present in most of the aforementioned insular and mainland localities in the Central Mediterranean (Tabs II, III).

Apart from Schendyla n. sp., the remaining Maltese centipede species are more or less widely distributed but absent from N. Africa (Lithobius lapidicola, L. trinacrius, Scolopendra oraniensis, Clinopodes flavidus) or from southern Italy (Bothriogaster signata). For Bothriogaster signata, however, the possibility that its presence on Malta is a result of anthropic introduction cannot be excluded.

From a zoogeographic point of view, an analysis of the chorotypes represented in the study area (Tab. III) shows the Maltese centipede fauna to have a strong "Mediterranean" character, with this chorological element approaching 67%. This agrees well with the results of studies on the centipede fauna of other insular systems of the Sicily Channel (Pantelleria, Linosa, Lampedusa) (Zapparoli, 1995a). Species with a wide distribution in the Holarctic Region and in Europe are poorly represented (22% and 11% respectively).

Our studies on the centipede fauna of the Maltese Islands lead us to conclude that the composition of the fauna of these islands is affected mainly by ecological factors (the availability of suitable habitats) and by colonization-extinction events, rather than by paleogeographic and paleoclimatic factors. This is in accordance with the conclusions of previous studies on the centipedes of the W-Mediterranean microinsular systems (Foddai et al., 1996).

ACKNOWLEDGEMENTS

We wish to thank the many people who over the years collected or donated the material on which this paper is based. We are also indebted to Volker Mahnert and Peter Schwendinger, Director and Curator of the Muséum d’histoire naturelle, Genève, for a careful reading of the manuscript. PJS was supported by research grants awarded by the University of Malta Research Committee, for which he is grateful.

REFERENCES


Cross-references

CENTIPEDES OF THE MALTESE ARCHIPELAGO


Tab. I - Distribution of the centipedes recorded from the main islands of the Maltese Archipelago. Symbols: + = present; - = absent; ? = doubtful record; * = introduced or probably introduced species. Only confirmed species are considered in the total.

<table>
<thead>
<tr>
<th>Species</th>
<th>Malta</th>
<th>Gozo</th>
<th>Comino</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scutigera coleoptrata (Linne, 1758)</td>
<td>+</td>
<td>-</td>
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<tr>
<td>Eupolybothrus (Allopolysthus) nudicornis (Gervais, 1837)</td>
<td>+</td>
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<tr>
<td>Lithobius (Lithobius) castaneus Newport, 1844</td>
<td>+</td>
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<tr>
<td>Lithobius (Lithobius) forficatus (Linne, 1758)</td>
<td>?</td>
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<tr>
<td>Lithobius (Lithobius) lapidicola Meinert, 1872</td>
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<tr>
<td>Lithobius (Lithobius) peregrinus Latzel, 1880</td>
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<tr>
<td>Lithobius (Lithobius) tinacrius Verhoeff, 1925</td>
<td>+</td>
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<tr>
<td>Lithobius (Monotarsobius) crassipes L. Koch, 1862</td>
<td>+</td>
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<tr>
<td>Scolopendra cingulata Latreille, 1829</td>
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<tr>
<td>Scolopendra oraniensis Lucas, 1846</td>
<td>+</td>
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<tr>
<td>Cryptops trisulcatus Brölemann, 1902</td>
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<td>Himantarum gabiellis (Linne, 1767)</td>
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<tr>
<td>Stigmotogaster gracilis (Meinert, 1870)</td>
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<tr>
<td>Bothriogaster signata (Kessler, 1874)</td>
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<td>Dignathodon microcephalus (Lucas, 1846)</td>
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<td>Henta (Meinertia) bicarinata (Meinert, 1870)</td>
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<tr>
<td>Henta (Chaetechelyne) vesuviana (Newport, 1845)</td>
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<tr>
<td>Schendyla sp. n.</td>
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<td>Pachymerium ferrugineum (C.L. Koch, 1835)</td>
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<tr>
<td>Tuoba poseidonis (Verhoeff, 1901)</td>
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</table>

Total: 20 11 3
Tab. II. Distribution of the centipedes recorded from Sicily and related micro-insular systems, from the Maltese Islands and from Tunisia. Symbols:
+ = present; - = absent; ? = doubtful record; * = introduced or probably introduced species. SIC = Sicily (main island); EOL = Eolian Is.; UST = Utica; EGA = Egadi Is.; PAN = Pantelleria; MAL = Maltese Is.; LIN = Linosa; LAM = Lampedusa; TUN = Tunisia. Only confirmed species are considered in the total.

<table>
<thead>
<tr>
<th>Species</th>
<th>SIC</th>
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<tr>
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<td>Lithobius crassipes L. Koch, 1862</td>
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