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New records of macrochelid mites and description of a new phoretic species (Acari: Mesostigmata: Macrochelidae) from Greece

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ABSTRACT — Three female specimens of a new macrochelid mite species (*Neopodocinum longisetum* n. sp.) were collected on *Oryctes nasicornis* (Linnaeus, 1758) in the Epirus Mountains in Northern Greece. The new species is closely related to *Neopodocinum caputmedusae* (Berlese, 1908), but these two species differ from each other in the length of setae j1 and j2, the peritreme, the numbers of lyrifissures, the spur-like structures on sternal shield and microspicules on the dorsal shield. Furthermore, seven species belonging to the genus *Geholaspis* Berlese, 1918, *Longicheles* Valle, 1953, *Macrholaspis* Oudemans, 1931, *Macrocheles* Latreille, 1829 and *Nothrholaspis* Berlese, 1918 are recorded for the first time from Greece.

KEYWORDS — Acari; Mesostigmata; phoresy; key; new species; new records; Greece

INTRODUCTION

The family Macrochelidae belongs to the order Mesostigmata, these predatory mites occur in litter, moss, decaying organic matter and other habitats, including insect or bird nests and animal dung (Gwiazdowicz *et al.* 2006). Some are phoretic on beetles, ants, flies, birds and small mammals (Krantz and Mellott 1968, Krantz and Moser 2012, Farish and Axtell 1971, Çicek *et al.* 2008). The family is found throughout the temperate and tropical regions in the world. The number of published data regarding the macrochelid species in the European region is quite different. The family is relatively well-known on the British Isles and Slovakia (Evans and Browning 1956, Mašán 2003), but less explored on the Balkan Peninsula (Serbia, Macedonia and Croatia). The Greek fauna is hardly known, only few papers are published on macrochelid

mites from Greece (Götz and Hirschmann 1957, Ciccolani 1985, Emmanouel and Panou 1991, Ács and Kontschán 2014).

MATERIALS AND METHODS

Numerous soil samples and insects associated with mites were deposited in the Soil Zoology Collections of the Hungarian Natural History Museum, Budapest following collecting trips from different parts of the world. We examined some beetles from Greece in these collections, the macrochelid mites were removed from the ventral surface of the insects and cleared them in lactic acid. The specimens examined stored in 70 % ethanol and deposited in the Soil Zoology Collections of the Hungarian Natural History Museum. In this study, we follow the recent important higher category reappraisal of

Macrochelidae by Emberson (2010). Figures and a table are added to the new species. All measurements are given in micrometres (μm). Drawings were made with the aid of a drawing tube on light microscope. Idiosomal setal nomenclature follows Moraza (2004). Leg chaetotaxy follows Evans (1963). The holotype and one paratype of the new species of *Neopodocinum* are deposited in the Collections of Soil Zoology, Hungarian Natural History Museum, Budapest, Hungary; and the other one paratype is deposited in the Arachnida Collection of the Natural History Museum, Geneva, Switzerland.

RESULTS

Family Macrochelidae Vitzthum, 1930

Genus *Geholaspis* Berlese, 1918

Geholaspis longispinosus (Kramer, 1876)

Material examined — Two females collected from Greece, Larisa county, Ossa Mts, beech forest, 1115 m a.s.l. 39°47.865'N 22°45.298'E, 09 Apr. 2009 Dányi L., Kontschán J., Murányi D. coll.

Published records — Austria (Johnston 1970), Belgium (Skubała *et al.* 2013), British Isles (Evans and Browning 1956), Croatia, Macedonia, Serbia (Ács and Kontschán 2014), Germany (Maraun *et al.* 2001), Hungary (Erőss and Mahunka 1971), Ireland (Arroyo *et al.* 2010), Italy (Sabbatini Peverieri *et al.* 2008), Latvia (Salmane 2001), New Zealand (Emberson 1973), Poland (Gwiazdowicz and Kmita 2004), Romania (Kontschán 2006), Slovakia (Mašán 2003), Slovenia (Ujvári 2009), Sweden (Lundqvist 1974), Turkey (Özbek and Bal 2014).

Distribution — Europe, Balkans and New Zealand.

Remarks — This species is an edaphic detriticole with wide ecological tolerance. Common in European soils (Mašán 2003). This is the first record from Greece.

Genus *Longicheles* Valle, 1953

Longicheles longisetosus (Balogh, 1958)

Material examined — One female was collected from Greece, Crete, 5 km from Knossos, Agia Irini, beside a streamside, *Platanus occidentalis* forest litter 03 Mar. 2003 Szűts T. coll. Three females were collected from Greece, Crete, 2 km from Knossos, moss from hillside 02 Mar. 2003 Szűts T. coll. One female was collected from Greece, Arkadia county, Vitina, stream and its gallery, woody pasture SW of the city, 960 m a.s.l. 37°39.031'N 22°10.156'E, 06 Apr. 2009 Dányi L., Kontschán J., Murányi D. coll.

Published records — Hungary (Kontschán 2007), Romania (Manu *et al.* 2013), Slovakia (Mašán 2003), Turkey (Özbek and Bal 2012).

Distribution — Middle and South East Europe.

Remarks — Edaphic detriticole; these are the first records of *L. longisetosus* from Greece.

Genus *Macrholaspis* Oudemans, 1931

Macrholaspis recki (Bregetova and Koroleva 1960)

Material examined — Two females were collected from Greece, "Holhiditri" Palaikastro 22 May 1995 Orosz A. coll.

Published records — Hungary (Erőss and Mahunka 1971); former USSR (Bregetova and Koroleva 1960); Iran (Faraji *et al.* 2008); La Gomera (Canary Islands, Spain) (Moraza and Peña 2005); Slovakia, Poland, Transcarpathian Ukraine, Bulgaria, Crimea, Armenia, Georgia (Mašán 2003).

Distribution — Palaearctic.

Remarks — Xerothermophilous species, often found in dry and warm microhabitats (Mašán 2003). First record from Greece.

Genus *Macrocheles* Latreille, 1829

Macrocheles nataliae Bregetova and Koroleva, 1960

Material examined — Three females were collected on *Scarabaeus sacer* Linnaeus, 1758, Greece, Thrace, Rhodope peripheral unit, Sapka Mts, Nea Sanda, river and rocky forest, E of the village, 225 m a.s.l., 41°06.928'N 25°49.686'E, 26 May 2012., Kontschán,

J., Murányi, D. and Szederjesi, T. coll. Another three phoretic females were found on *Oryctes nasicornis* (Linnaeus, 1758), Greece, Epirus, Preveza peripheral unit, Ano Kotsanopoulo, garden of a cafe bar along the road towards Louros, W of the village, 130 m a.s.l., 39°13.026'N 20°42.823'E, 05 May 2011. Kontschán, J., Murányi, D., Szederjesi, T. and Ujvári, Zs. coll.

Published records — Asia, Belgium, British Isles, Germany, Hungary, Lithuania, Poland, Russia, Slovakia (Mašán 2003); China (Lin and Zhang 2010); Latvia (Salmane 2001); Iran (Kazemi and Rajaei 2013).

Distribution — Palaearctic.

Remarks — *M. nataliae* is necrophilous detriticole that lives in decaying substrates and also is phoretic on various beetles, comprise the necrophilous (Gorb 2007; Mašán 2003). The collected specimens were phoretic on *Scarabaeus sacer* and *Oryctes nasicornis* beetles in Greece. This is the first record from Greece.

Macrocheles penicilliger (Berlese, 1904)

Material examined — Two females were collected from Greece, Ioannina county, Kalpaki, Vellas Monasteri, karstic spring, 419 m a.s.l., bird nest 39°51'57.0"N 20°37'26.1"E, 12 May 2006 Dányi L., Kontschán J., Murányi D. coll.

Published records — Africa (van Driel *et al.* 1977), Australia (Manning and Halliday 1994), Austria (Johnston 1970), Balkan (Willmann 1941), British Isles (Evans and Browning 1956), Croatia (Leitner 1946), France (Niogret *et al.* 2006), Hungary (Kandil 1983), India (Roy 1991), Italy (Berlese 1904), Japan (Takaku 2000), Slovakia (Mašán 2003), Switzerland (Airoldi *et al.* 1989), U.S.A. (Krantz and Whitaker 1988).

Distribution — Widely distributed in the world.

Remarks — Necrophilous detriticole and abundant in nest of birds and rotting organic matter. This is the first record from Greece.

Genus *Nothrholaspis* Berlese, 1918

Nothrholaspis carinatus (C.L. Koch, 1939)

Material examined — Six females were collected from Greece, Arkadia county, Korfes, gorge with mixed forest (*Platanus* and conifers), S of the village, 885 m a.s.l. 38°05.099'N 22°02.036'E, 07 Apr. 2009 Dányi L., Kontschán J., Murányi D. coll. One female was collected from Greece, Arkadia county, Panahaiko Mts, Sella, ruderal vegetation in the village, 430 m a.s.l. 38°17.040'N 21°52.748'E, 08 Apr. 2009 Dányi L., Kontschán J., Murányi D. coll. One female was collected from Greece, Lakonia county, Potamia, *Platanus* gallery E of the village, 220 m a.s.l. 36°55.332'N 22°29.877'E, 03 Apr. 2009 Dányi L., Kontschán J., Murányi D. coll.

Published records — Austria (Johnston 1970), Balkans (Szalay 1931, Willmann 1938, 1941), Belgium (Skubała *et al.* 2013), British Isles (Evans and Browning 1956), Bulgaria (Balogh 1958), Hungary (Eróss and Mahunka 1971), Iran (Babaeian *et al.* 2014), Latvia (Salmane 2001), Macedonia (Ács and Kontschán 2014), Poland (Gwiazdowicz and Kmita 2004), Romania (Manu 2010), Slovakia (Mašán 2003).

Distribution — Europe and Balkans.

Remarks — Edaphic detriticole and strongly hygrophilous (Mašán 2003). Recorded from several countries in Europe, but this is the first record from Greece.

Nothrholaspis montanus Willmann, 1951

Material examined — Two females were collected from Greece, Lakonia county, Taigetos Mts, Mistras, *Platanus* gallery in the village, 310 m a.s.l. 37°04.192'N 22°22.305'E, 04 Apr. 2009 Dányi L., Kontschán J., Murányi D. coll.

Published records — Austria (Johnston 1970), Belgium (Skubała *et al.* 2013), British Isles (Evans and Browning 1956), Croatia, Serbia (Ács and Kontschán 2014), Hungary (Ambros 1987), Iran (Babaeian *et al.* 2014), Latvia (Salmane 2001), Poland (Gwiazdowicz and Kmita 2004), Romania (Manu 2010), Slovakia (Mašán 2003), Spain (Moraza 2007), Sweden (Lundqvist 1974).

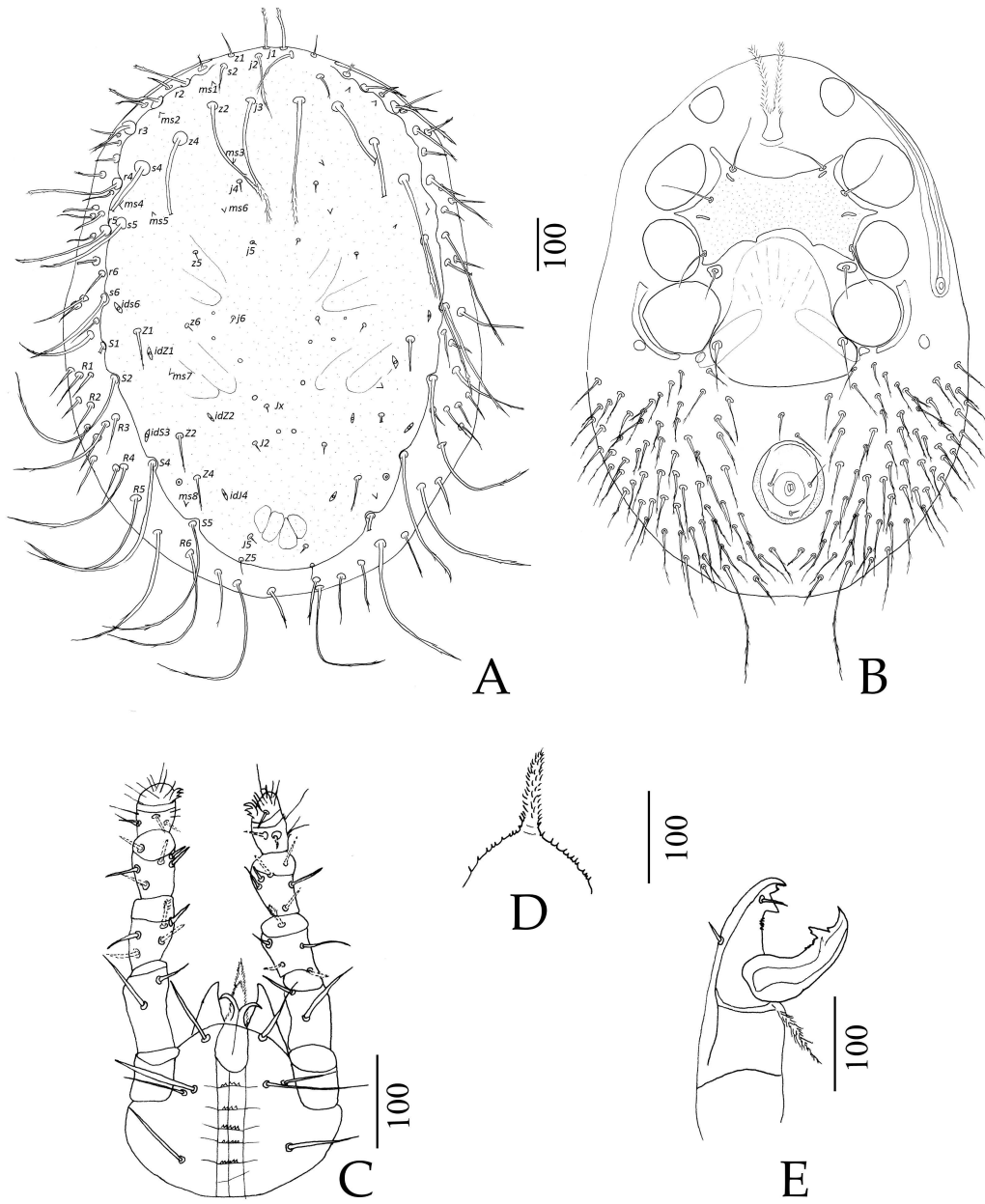


FIGURE 1: *Neopodocinum longisetum* n. sp. holotype, female; A – Body in dorsal view; B – Body in ventral view; C – Ventral view of gnathosoma and palp; D – Epistome; E – Chelicera.

TABLE 1: Most important differences between *Neopodocinum longisetum* n. sp. and *Neopodocinum caputmedusae* (Berlese, 1908)

	<i>Neopodocinum longisetum</i> n. sp.	<i>Neopodocinum caputmedusae</i>
Size of setae j1 and j2	setae j1 and j2 nearly with same length	setae j1 half-length of j2
Marginal dorsal setae	slightly curved	curved totally backwards
Microspicules on dorsal shield	8 pairs	absent
Lyrifissures on dorsal shield	5 pairs	17 pairs
Peritreme	not reaching the base of seta z1	reaching the base of seta z1
Posterior margin of sternal shield	with a pair of spur-like structure	without spur-like structure

Distribution — Palaearctic.

Remarks — Edaphic species, often found in European soils (Mašán 2003). First record from Greece.

Genus *Neopodocinum* Oudemans, 1902

Neopodocinum longisetum n. sp.

(Fig 1)

Diagnosis — Dorsal shield bears long, slightly bent setae marginally and short needle-like setae on median part. Surface of dorsum with 11 pairs of pores and with 8 pairs of microspicules. Posterior margin of sternal shield with a pair of spur-like structure. Anal shield small, egg-shaped with short post-anal seta and a pair of para-anal setae. Tectum typical for the genus, unipartite with small denticles along.

Material examined — Holotype. Female. Collected from *Oryctes nasicornis* (Linnaeus, 1758), Greece, Epirus, Preveza peripheral unit, Ano Kotsanopoulo, garden of a cafe bar along the road towards Louros, W of the village, 130 m a.s.l., 39°13.026'N 20°42.823'E, 05 May 2011. Kontschán, J., Murányi, D., Szederjesi, T. and Ujvári, Zs. coll. Paratypes two females, locality, date and host same as in holotype. The holotype was deposited in the Soil Zoology Collections of the Hungarian Natural History Museum, Budapest.

Description — Female. Dorsum (Figure 1A) — Dorsal shield oblong, with length 994 – 1090 μm and width 628 – 705 μm at level of coxae II (n=3), micropunctuation on surface without ornamentation. Number of setae increased, bearing more than 30 pairs of dorsal setae and one unpaired seta. Setae j4-j6, z5-z6, Jx, J2, J5, Z5 minute, needle-like, other dorsal setae longer to very long; j1 plumose distally, twice the length of adjacent z1; setae j3, z2 and z4 especially long and distally pilose. Marginally bears

neotrichous setae which are very long, slightly bent and pilose in their distal half. Length of dorsal setae: j1 = 83 – 96; j2 = 122 – 128; j3, z2, z4 and s4 = 224 – 288; j4 and z5 = 32 – 38; j5, j6, z6 and Jx = 7 – 13; z1 = 45 – 58; s2 = 77 – 109; s5-s6 = 340 – 372; J2 and Z5 = 26 – 38; J5 = 19 – 26; Z1, Z2 and Z4 = 71 – 83; S1 = 58 – 83; S2, S4 and S5 = 391 – 481. One median unpaired seta present (Jx), posterior to j6. Dorsal shield with 11 pairs of pores (5 pairs of lyrifissures [ids6, idZ1, idZ2, idS3, idJ4] and 6 pairs of gland pores) and 8 pairs of microspicules (ms). Peritreme not reaching the bases of setae z1.

Venter (Figure 1B) — Sternal shield 103 – 109 long and 353 – 365 wide at level of coxae II. Bearing 3 pairs of needle-like setae and two pairs of lyrifissures. Posterior margin of sternal shield with a pair of clearly visible spur-like structure. Measurements of setae: St1 = 109 – 115, St2 = 103 – 115 and St3 = 90 – 96. Cuticle with a slight punctuation. Metasternal setae 58 – 71 long, inserted on small metasternal platelets. Genital shield with straight posterior margin, 308 – 340 long and 244 – 269 wide. Length of setae on epigynal shield 83 – 109. Anal shield egg-shaped, with length 166 – 173 and width 128 – 135. Para-anal setae 38 – 58 long, needle-like, post-anal seta shorter, 32 – 38 long. Cribrum developed with pores on lateral margin of anal shield. Opisthogaster bearing more than 60 pairs of slightly pilose setae.

Gnathosoma (Figure 1C) — Gnathosoma well developed. Deutosternal groove with 5 rows of denticles, 3 pairs of hypostomal setae and one pair of palpcoxal seta present, all setae needle-like. Internal posterior hypostomal seta (h2) longer than others. Measurements of hypostomal setae: h1 = 71 – 77, h2 = 103 – 135, h3 = 64 and capitulate seta

= 71 – 96. Tectum (Figure 1D) unipartite with serration, length 115 – 135. Cheliceral measurements: fixed digit: 90, moveable digit 115 – 128. Fixed digit with simple dorsal seta, one median big tooth, distal smaller tooth, pilus dentilis and hooked terminally (Figure 1E). Moveable digit with a bidentate tooth, small teeth and terminal hook. Arthrodistal brush densely pilose. Length of fixed digit 90, moveable digit 115 – 128.

Legs — Tarsus I without ambulacrum, terminates distally in several small setae and one long seta, anterolaterally with a tridentate hook. Tarsi II–IV with well-developed ambulacra and claws. Most of the leg setae simple. Genu IV with 6 simple and 1 pilose setae. Leg chaetotaxy typical for the genus (Krantz 1965). Leg lengths: leg I 724 – 795, leg II 660 – 720, leg III 756 – 788, leg IV 833 – 1147.

Habitat — *N. longisetum* n. sp. was collected as phoretic on *Oryctes nasicornis* (Linnaeus) in Greece. Phoresy on beetles is a common phenomenon in the family Macrochelidae, enabling the mites to disperse easily and thus have the chance to find more suitable substrates. (Costa 1969, Binns 1982)

Etymology — The specific name is taken from the Latin "*longisetum*" and refers to the long marginal and submarginal dorsal setae.

Notes — *N. longisetum* n. sp. is similar to *N. caputmedusae* (Berlese, 1908), differences between them are shown in the Table 1. Differences also were confirmed between *N. longisetum* and the other earlier described species of *Neopodocinum* (Bregotova 1958; Costa 1965; Krantz 1965, Hartini and Takaku 2003; Hartini and Takaku 2004; Iavorschi 1975; Moraza 2004; Takaku and Hartini 2001).

**Key to the European species of *Neopodocinum*
Oudemans, 1902**

- 1. Setae on dorsal shield uniform in length 2
- Setae on marginal portions of dorsal shield longer than central setae 3

- 2. Sternal shield with nearly straight anterior and posterior margins, without punctate pattern on surface *N. mrciaki* Sellnick, 1968

— Sternal shield narrowed medially and punctate.....*N. jaspersi* (Oudemans, 1900)

3. Strong neotrichy present off the dorsal shield on lateral parts 4

— Strong neotrichy absent off the dorsal shield on lateral parts.....*N. meridionalis* Sellnick, 1931

4. Peritremes reaching to setae z1, without microspicules on dorsal shield.....

..... *N. caputmedusae* (Berlese, 1908)

— Peritremes not reaching to setae z1, with microspicules on dorsal shield . . . *N. longisetum* n. sp.

It should be noted that *Neopodocinum jaspersi* (Oudemans, 1900) was described from Holland (Oudemans 1902), but it was excluded from Mašán's (2003) key to European *Neopodocinum* species.

DISCUSSION

Species of the family Macrochelidae inhabit various habitats like upper soil surface, moss, nest of birds and insects and they can be found in association with coprophilous beetles and flies. These mites attach to the host's ventral portion by their chelicerae and are thus carried to new suitable habitats (Krantz 1965). Most macrochelid mites are associated with insects (Mašán 2003), including *Neopodocinum meridionalis* which was mentioned as phoretic on beetles from Greece (Moraza 2004). *Geholaspis longispinosus*, widely distributed in the European and Balkan regions, is a common species with a wide ecological tolerance, so it was expected to occur in Greece. *Macrocheles nataliae* was found for the first time in the Mediterranean region, earlier records are under temperate climatic conditions in Europe, Russia and China. The number of macrochelid species known from Greece prior to this study was 13 (Krantz 1965, Cicolani 1985, Mašán 2003) and it has now increased to 21. Based on its climatic and geological variability and resultant wide range of potential habitats, Greece will probably be found to serve as host to many additional macrochelid species in the future.

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