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New records of soil dwelling mites of the superfamily Pygmephoroidae (Acari: Heterostigmata) from northern Iran

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ABSTRACT. Following a short-term faunistic study on soil inhabiting heterostigmatic mites (Acari: Prostigmata: Heterostigmata), during spring-winter 2019, in Gorgan, Golestan Province, northern Iran, a total of six species from five genera of two families were identified. Among them *Promicrodispus pumilis* (Sevastianov, 1975) and *Promicrodispus montanus* Khaustov, 2006 are new records for mite fauna of Iran. The genus *Promicrodispus* Khaustov, 2017 is recorded for the first time for the mite fauna of Iran. Moreover, *Pre. akermanae* (Sevastianov & Al Douri, 1988), *Paramicrodispus scarabidophilus* Hajiqanbar & Rahiminejad, 2012, *Pygmodispus (Allodispus) latisternus* Paoli, 1911 and *Scutacarus sphaeroideus* Karafiati, 1959 were collected from soil in the sampling sites. The world distribution of the mites is reviewed.

Key words: Soil arthropods, Forest, Berlese funnel, Gorgan, Iran

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Introduction

Among animals, arthropods, specially mites and collembolans, are the most species-rich group that have long been a major and ubiquitous component of the soil biodiversity. Mites are poorly studied, but enormously significant for nutrient release in the soil (Bengtson et al., 1974; Dunlop et al., 2013). Cohort Heterostigmata (Acari: Prostigmata) comprises more than 2000 described species in eight superfamilies (Zhang et al., 2011). Various modes of life, such as fungivory, herbivory, kleptoparasitism, parasitism, parasitoidism, predatory and host-symbiont associations, such as phoresy, that probably derived from free-living fungivory in their ancestors, are found in heterostigmatic mites (Kaliszewski et al., 1995; Walter et al., 2009). Although, many of these mites take various advantages of their association with arthropods, mostly prefer to be free-living in their soil microhabitats during some periods of their life (Kaliszewski et al., 1995). Soil, litter, humus, compost, manure, nests of birds and small mammals, decaying vegetation, rotting woods, moss beds are among the most dominant habitats of many of them (Kaliszewski et al., 1995; Walter et al. 2009). According to Khaustov

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(2004, 2008), four families Pygmephoridae, Neopygmephoridae, Scutacaridae and Microdispidae collectively include the superfamily Pygmephoridea - the most diverse group of the cohort. Alternatively, Walter et al. (2009) classified these four families in two separate superfamilies, Scutacaridea (including Scutacaridae and Microdispidae) and Pygmephoridea (including Siteroptidae and Pygmephoridae). The least diverse family of pygmephoroid mites, Microdispidae Cross, 1965, includes 28 described genera and more than 120 species (Khaustov & Minor, 2020). On the other hands, Scutacaridae Oudemans, 1917, is a cosmopolitan taxon with 25 genera and more than 800 described species, accounting for the largest family in Pygmephoridea (Khaustov, 2008; Baumann, 2018; Baumann & Ferragut, 2018). Almost all of them are occupants of soil habitats and tend to show phoretic associations with various host taxa (Khaustov, 2008; Rahiminejad et al., 2010; Navabi et al., 2018b). Following a short-term study of soil-dwelling mite fauna in Gorgan, northern Iran in 2019, four species of microdispid mites, including *Promicrodispus pumilis* (Sevastianov, 1975), *Promicrodispus montanus* Khaustov, 2006, *Pre. akermanae* (Sevastianov & Al Douri, 1988), *Paramicrodispus scarabidophilus* Hajiqanbar & Rahiminejad, 2012 and two species of scutacarid mites, including *Pygmodispus* (*Allodispus*) *latisternus* Paoli, 1911 and *Scutacarus sphaeroideus* Karafiat, 1959 were extracted by Berlese funnel from the soil samples.

Material and methods

Mites were extracted from soil samples collected in the forest areas around Gorgan (Northern Iran), including NaharKhoran, AlangDareh and Ziarat using Berlese funnels. The mite specimens separated from soil particles under a stereomicroscope (Olympus SZ, Tokyo, Japan) and then cleared in a mixture of lactophenol and Nesbitt's fluids and subsequently mounted in Hoyer's medium. The morphology of the specimens was studied with a phase contrast microscope (Olympus BX51, Tokyo, Japan). All obtained specimens were adult female and collected by the first and second author. The taxonomic system of Pygmephoridea follows Khaustov (2004, 2008). Details of geographical position have been recorded using a global positioning system (GPS smart phone device). All the materials are deposited in the Arthropods Collection, Acari section, Department of Plant Protection, Faculty of Plant Production, Gorgan University of Agricultural Science and Natural Resources, Golestan, Iran.

Results

Cohort Heterostigmata

Superfamily **Pygmephoridea** Cross, 1965

Family **Microdispidae** Cross, 1965

Genus *Promicrodispus* Khaustov, 2017

Type species: *Brennandania pumilis* Sevastianov, 1975

Distribution and habitat: Species of the genus *Promicrodispus* inhabit soil, forest litter and nests of small mammals and ants. *Pro. fageus* is known from Germany (Rack, 1965); *Pro. pumilis* is known from Crimea and Western Ukraine (Sosnina & Sevastianov, 1975), Western Siberia (Khaustov, 2017) and northern Iran (Present study) and finally, *Pro. bisetus* has recently been found in New Zealand (Khaustov & Minor, 2020).

Promicrodispus pumilis (Sevastianov, 1975)

Material examined. Three females were obtained from a soil sample under Oak trees (*Quercus* sp.) in Alang-Dareh forest, Gorgan (36.79° N, 54.45° E, and altitude 341m a.s.l.), 25.X.2019 and five females in rotten log of *Quercus* sp. from Naharkhoran Forest Park, Gorgan (36.77° N, 54.45° E, and altitude 456m a.s.l.), 1.X.2019, both collected by V. Rahiminejad.

Remarks. The genus *Promicrodispus* is recorded from Iran for the first time.

Genus *Premicrodispus* Cross, 1965

Type species: *Microdispus* (*Premicrodispus*) *chandleri* Cross, 1965, by original designation

Three subgenera, *Premicrodispus* Cross, 1965, *Premicrodispulus* Khaustov & Chydyrov, 2010, *Premicrodispoides* Khaustov & Maslov, 2013, and about 31 species constitute the cosmopolitan genus, *Premicrodispus* (Khaustov & Minor, 2020).

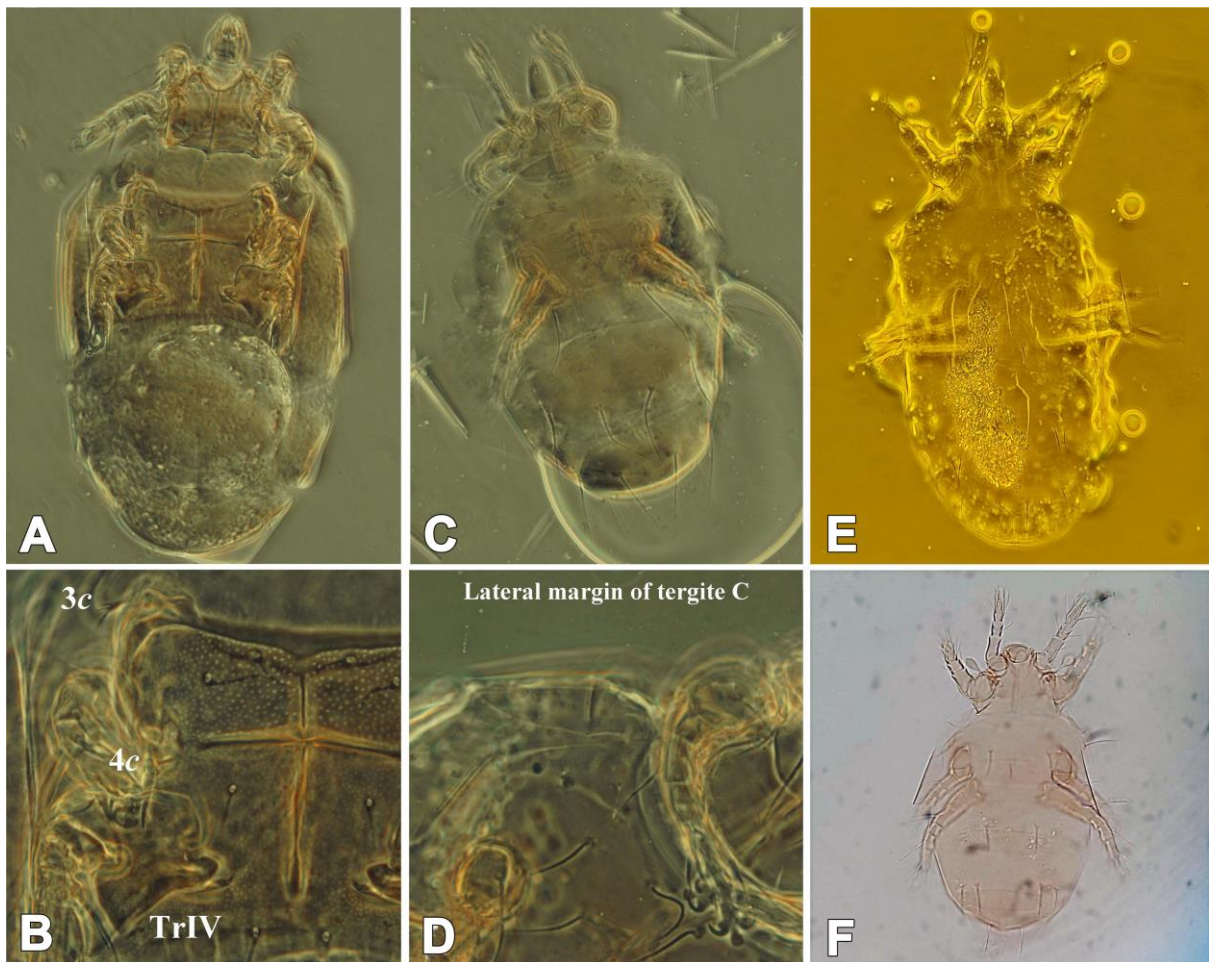


Figure 1. A-B, *Pygmodispus* (*Allodispus*) *latisternus* Paoli, 1911. (A) Body, (B) Modified setae 3c & 4c, Trochanter IV with ventrodiscal process; C-D, *Promicrodispus pumilis* (Sevastianov, 1975). (C) Body, (D) rounded form of lateral margin of tergite C; (E) *Premicrodispus montanus* Khaustov, 2006; (F) *Paramicrodispus scarabidophilus* Hajiqanbar & Rahiminejad, 2012.

Promicrodispus montanus Khaustov, 2006

Distribution and habitat: This species extracted from soil sample, from mountain pastures of Crimea, Ukraine (Khaustov, 2006).

Material examined. Two females were obtained from a soil sample in pine timberland, Hezar-Pich Hill, Gorgan (36.82° N, 54.40° E, and altitude 430m a.s.l.), 20.VI.2019, collected by V. Rahiminejad.

Remarks. This is the first record of *Pre. montanus* for arthropods fauna of Iran.

Promicrodispus akermanae (Sevastianov & Al Douri, 1988)

Distribution and habitat: This species recorded from Ukraine and Russia in soil samples (Khaustov, 2006), and also from Iran in association with *Oryctes nasicornis* L. (Col.: Scarabaeidae) (Hosseininaveh et al., 2013) and soil (Present study).

Material examined. Three females were obtained from a soil sample in Naharkhoran Forest Park, Gorgan (36.77° N, 54.45° E, and altitude 450m a.s.l.), 24.V.2019, Collected by V. Rahiminejad.

Remarks. The soil-dwelling's record of this species, is new for Iran.

Genus *Paramicrodispus* Khaustov, 2009

Type species: *Brennandania crenulata* Savulkina, 1978

Paramicrodispus scarabidophilus Hajiqanbar & Rahiminejad, 2012

Distribution and habitat: This genus comprises three species. *Para. scarabidophilus*, recorded in Iran in association with *Oryctes nasicornis* L., *Gnorimus subcostatus* (Menetries) (Col.: Scarabaeidae) and *Dorcus parallelus* (Say) (Col.: Lucanidae) (Hajiqanbar et al., 2012; Badoodam et al., 2015; Katlav et al., 2015). Another species is *Para. crenulatus* (Savulkina, 1978), recorded from Bulgaria in the nest of a small mammal (Savulkina, 1978), from Ukraine (Crimea) beneath elytra of a carabid beetle *Pterostichus niger* (Schaller, 1783), in a rotten log of *Fagus orientalis* (Khaustov, 2009) and from Iran in association with *Lucanus ibericus* Motschulsky (Col.: Lucanidae) and under elytra of *Parandra caspia* Ménétériès, 1832 (Col.: Cerambycidae) (Hajiqanbar et al., 2012; Hajiqanbar & Arjomandi, 2019). The last one is *Para. scolopendrae* (Rack, 1979) collected from Côte d'Ivoire on red-headed centipedes, *Scolopendra morstans* (Chilopoda: Scolopendridae) (Rack, 1979).

Material examined. Six females were obtained from a soil sample under Hornbeam trees (*Carpinus* sp.) in Ziarat forest, Gorgan (36.71° N, 54.47° E, and altitude 1500m a.s.l.), 01.VIII.2019 and three females from a soil sample from Naharkhoran Forest Park, Gorgan (36.77° N, 54.45° E, and altitude 450m a.s.l.), 26.VII.2019, both collected by V. Rahiminejad.

Remarks. The species extracted from soil for the first time.

Family *Scutacaridae* Oudemans, 1916Genus *Pygmodispus* Paoli, 1911

Type species: *Pygmodispus (Pygmodispus) equestris* Paoli, 1911.

Pygmodispus (Allodispus) latisternus Paoli, 1911

Distribution and habitat: This species inhabits soils and is recorded from Italy, Germany, Hungary, France, Austria, Tunisia, Mangolia, Kazakhstan, Ukraine and Iran (Ebermann et al., 2003; Khaustov, 2008; Present study).

Material examined. Two females were collected from a soil sample from Hezar-Pich Hill, Gorgan (36.82° N, 54.40° E, and altitude 400m a.s.l.), 12VI.2019, collected by V. Rahiminejad.

Remarks. This is the first record of *P. (A.) latisternus* for Golestan Province.

Genus *Scutacarus* Gros, 1845

Type species: *Scutacarus femoris* Gros, 1845

Scutacarus sphaeroideus Karafiati, 1959

Distribution and habitat: This species has world-wide distribution and inhabits soils of shores of rivers and lakes (Khaustov, 2008) and phoretic on ants, beetles (Staphylinidae, Heteroceridae) and small mammals (Cricetidae, Muridae) (Baumann, 2018). This species has been collected several times in Iran associated with hydrophilid beetles (Col.: Hydrophilidae) and *Dryops* sp. (Col.: Dryopidae) (Hajiqanbar, 2008; Tajodin, 2013)

Material examined. About 50 females were collected from soil samples from Hezar-Pich Hill, Alang-Dareh and Ziarat Forests, Gorgan, during summer 2019, collected by V. Rahiminejad.

Discussion

Including the two new records recovered in the present study, *Pro. pumilis* and *Pre. montanus*, the number of microdispid representatives of Iran reached to 28 species belong to seven genera (of 28 genera and more than 120 species worldwide) (Hajiqanbar & Sobhi, 2018; Navabi et al., 2018a; Seyedein et al., 2019; Present study). Heretofore, six species of Microdispidae, are extracted from soil samples (Filekesh et al., 2014; Hajiqanbar & Sobhi, 2018; Present study), one species on termites, 10 species on ants and 11 species on beetles (Hajiqanbar & Sobhi, 2018; Navabi et al., 2018a; Hajiqanbar & Arjomandi, 2019). On the other hand, among 25 genera and more than 800 described species of the family Scutacaridae, only seven genera and 47 species, have been recorded from Iran, that among them, 22 species were collected from soil samples (Kamali et al., 2001; Lotfollahy et al., 2009; Hashemi Khabir et al., 2013; Navabi et al., 2018b, 2018c; Present study). Since, all such phoretic mites are also free-living wanderers in soil, litters or any sort of organic matter, further research on the soil-dwelling mites gives a better understanding of the life history of these mites. This may prompt more taxonomic investigations on such families of mites in Iran.

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Conflict of Interests

The authors declare that there is no conflict of interest regarding the publication of this paper.

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رکوردهای جدید از کنه‌های خاکزی بالاخانواده Pygmephoroidea (Acari: Heterostigmata) از شمال ایران

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چکیده: طی یک پژوهش فونیسیتیک بر روی کنه‌های هترواستیگمای خاکزی (Acari: Prostigmata: Heterostigmata)، در بهار تا زمستان ۱۳۹۸، در شهر گرگان، استان گلستان، شمال ایران، در مجموع شش گونه از پنج جنس متعلق به دو خانواده شناسایی شدند. از بین آنها، گونه‌های *Promicrodispus pumilis* (Sevastianov, 1975) و *Promicrodispus montanus* Khaustov, 2006 گزارش جدیدی برای فون کنه‌های ایران محسوب می‌شوند. همچنین، گونه‌های *Pre. akermanae* (Sevastianov & Al Douri, 1988)، *Paramicrodispus scarabidophilus* Hajiqaanbar & Rahiminejad, 2012 و *Scutacarus sphaeroideus* و *Pygmodispus (Allodispus) latisternus* Paoli, 1911 از Karafiati, 1959 از نمونه‌های خاک در محل‌های نمونه‌برداری بدست آمدند. پراکنش جهانی این کنه‌ها بررسی شده‌است.

واژگان کلیدی: بندپایان خاکزی، جنگل، کیف برلیز، گرگان، ایران