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Scutacarid mites (Acari: Heterostigmata: Scutacaroidea) of Mazandaran province, northern Iran

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Among more than 55 thousand of described mite species, Heterostigmata (Acari: Prostigmata) with over than 2300 described species, classified in eight superfamilies, have a wide continuum of life forms, such as fungivory, herbivory, predation, parasitism, parasitoidism and kleptoparasitism (Lindquist 1986; Kaliszewski *et al*. 1995; Walter *et al*. 2009; Rahiminejad *et al*. 2023). The Scutacaridae is the largest family in the cohort, is ubiquitous, and dwell on soil, forest litter, humus, manure, compost, the nests of birds and small animals (Khaustov 2008; Baumann 2018). In addition, these small-sized mites have phoretic association with insects (especially various ants, beetles, flies, bees and termites), and rarely with spiders and hooded tick-spiders (Baumann 2018; Rahiminejad *et al*. 2022a).

Despite the passage of more than half a century since the first report of scutacarid mites from Iran, only 63 species belonging to seven genera have been recorded from various habitats across the country (Rahiminejad *et al*. 2023). The number is relatively small compared to the more than 800 species known worldwide, belonging to 26 genera (Baumann 2018; Rahiminejad *et al*. 2022a, 2023). Despite Iran's diverse climate, which is a result of its location between the Caspian Sea to the north and the Persian Gulf and Oman Sea to the south and also its topography, the number of recorded species is still low. However, the country's rich flora and fauna are evident throughout the various habitats (Gholizadeh *et al*. 2020; Rahiminejad *et al*. 2020a, 2023).

Mazandaran is a province situated along the southern shoreline of the Caspian Sea and north of the Alborz Mountains. The region boasts a moderate and humid climate, as well as fertile soils. The southern belt of the province is covered by the Caspian Hyrcanian mixed forest, which provides an excellent environment for a diverse range of organisms. Over 3200 vascular plants, including the oriental beech, Chestnut-leaved oak, Caucasian zelkova, and European hornbeam, thrive in this region. Additionally, numerous arthropods, including mites have been documented in the area

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(Alavi *et al*. 2020; Rahiminejad *et al*. 2023).

During a study on heterostigmatic mites in Hyrcanian forest, Mazandaran province, northern Iran in summer 2021, some mites belong to *Pygmodispus* (*Allodispus*) *latisternus* Paoli, 1911, *Scutacarus echidna* (Berlese, 1905), *S*. (*S*.) *longitarsus* (Berlese, 1905), *S*. (*S*.) *sphaeroideus* (Karafiati, 1959) and *Imparipes dilatatus* Mahunka & Zaki, 1982 were extracted from soil samples and forest litter under old trees, and treated by a Berlese funnel. Mites were preserved in 75% ethanol and cleared in Nesbitt's fluid and mounted using Hoyer's medium (Walter and Krantz 2009). Measurements (given in micrometers) were made using BX51 Olympus compound microscope equipped with phase contrast illumination and a drawing tube and magnification changer. The terminology and abbreviations follow that of Grandjean (1940), with modifications used in Lindquist (1986) for Heterostigmata. All materials were collected by M. Davari and E. Yahyapour. 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 Resource, Golestan, Iran.

RESULTS

The mites are arranged alphabetically. In addition, all the scutacarid mites recorded from Mazandaran province are summarized in Table 1.

World distribution – Country(ies), host(s) [as given in source publication], source publication(s).
Material examined – All available data about species, host(s), sampling method(s) and location(s).
Remarks – Any relevant information [new record for fauna of Iran and/or new host record(s)].

Superfamily Pygmephoroidea
Family Scutacaridae
Genus *Imparipes* Berlese, 1903

Type species: *Imparipes histricinus* Berlese, 1903

Imparipes dilatatus Mahunka & Zaki, 1982

World distribution – This species was described from Hungary and reported from Ukraine (Khaustov 2008).
Material examined – Two females were found in soil sample of Galogah-Damghan forestry road, 36.38° N, 53.49° E, and altitude 1000 m a.s.l., June 12, 2021, coll. M. Davari.
Remarks – This species is new for mite fauna of Iran.

Genus *Scutacarus* Gros, 1845

Type species: *Scutacarus femoris* Gros, 1845

Scutacarus (*Scutacarus*) *echidna* (Berlese, 1905)

World distribution – Previously, this species was recorded from Italy, Germany, Greece, Hungary, France, Russia, Korea and Ukraine (Khaustov 2008).
Material examined – Four females were extracted from soil samples and forest litter under old trees of Galogah-Damghan forestry road, 36.08° N, 53.48° E, and altitude 1000 m a.s.l., June 12, 2021, coll. M. Davari.
Remarks – This species is new for mite fauna of Iran.

Scutacarus (*Scutacarus*) *longitarsus* (Berlese, 1905)

World distribution – This species has worldwide distribution and has been collected several times from various habitats of Iran (East Azarbaijan, Alborz and Golestan provinces) (Khaustov 2008; Rahiminejad *et al*. 2023).
Material examined – More than 30 specimens extracted from soil samples from agricultural and horticultural areas around Lak-Dasht village, 36.54° N, 53.09° E, and altitude 54 m a.s.l., January 30, 2023, coll. E. Yahyapour.
Remarks – This species is recorded for the first time from Mazandaran province.

Scutacarus (*Scutacarus*) *sphaeroideus* (Karafiati, 1959)

World distribution – This species is found worldwide and can be found in soils shorelines. It has been observed to be phoretic on ants, beetles (Staphylinidae, Heteroceridae), and small mammals (Cricetidae, Muridae). In Iran, this species has been collected multiple times from soil samples and has been found in association with hydrophilid beetles and *Dryops* sp. (Col.: Hydrophilidae and Dryopidae) (Rahimnejad *et al*. 2022b).
Material examined – Three female mite specimens were collected from a soil sample from A'ali-Kola, 36.21° N, 53.65° E, and altitude 112 m a.s.l., February 13, 2023, coll. E. Yahyapour.
Remarks – This species is recorded for the first time from Mazandaran province.

Pygmodispus (*Allodispus*) *latisternus* Paoli, 1911

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

World distribution – This species is soil dwelling and is recorded from Italy, Germany, Hungary, France, Austria, Tunisia, Mangolia, Kazakhstan, Ukraine and Iran (West Azarbaijan, Golestan and Tehran province) (Ebermann *et al*. 2003; Khaustov 2008; Rahiminejad *et al*. 2020b).
Material examined – Five female mite specimens were collected from a soil sample from Zar'rin-Abad forests, Sari (36.52° N, 53.20° E, and altitude 60m a.s.l.), March 12.2023, coll. E. Yahyapour.
Remarks – This species is recorded for the first time from Mazandaran province.

Table 1. Scutacarid mites of Mazandaran province.

Species	Host (habitat)	References
***Archidispus* Karafiat, 1959**		
A. armatus (Karafiat, 1959)	an unidentified staphylinid beetle (Col.: Staphylinidae)	Katlav *et al*. (2015)
A. bembidii (Karafiat, 1959)	*Acuapalpus* sp. and *Pterostichus* sp. (Col.: Carabidae)	Katlav *et al*. (2015); Katlav *et al*. (2014)
A. conspicuous Kurosa, 1978	An unidentified carabid beetle	Katlav *et al*. (2015)
A. irregularis Katlav & Hajiqanbar, 2016	*Bledius* sp. (Col.: Staphylinidae)	Katlav *et al*. (2016)
A. minor (Karafiat, 1959)	*Amara* (*Amara*) sp. and *Harpalus* sp. (Col.: Carabidae)	Hajiqanbar and Arjomandi (2019)
***Imparipes* Berlese, 1903**		
I. (*I.*) *dilatatus* Mahunka & Zaki, 1982	Soil samples	Current study
I. (*I.*) *sevastianovi* Khaustov, 2008	*Lasius flavoniger* Seifert (Hym.: Formicidae)	Hajiqanbar and Arjomandi (2019)
***Pygmodispus* Paoli, 1911**		
P. (*Allodispus*) *latisternus* Paoli, 1911	Soil sample	Current study

Table 1. Continued.

Species	Host (habitat)	References
***Scutacarus* Gros, 1845**		
S. (*Scutacarus*) *acarorum* (Goeze, 1780)	*Bombus argillaceus* (Scopoli) and *Bombus* sp. (Hym.: Apidae)	Hajiqanbar and Arjomandi (2019)
S. (*S.*) *echidna* (Berlese, 1905)	Soil samples	Current study
S. (*S.*) *hystrichocentrus* Sevastianov, 1983	*Parandra caspia* (Col.: Cerambycidae)	Hajiqanbar and Arjomandi (2019)
S. (*S.*) *longitarsus* (Berlese, 1905)	Soil sample	Current study
S. (*S.*) *sphaeroideus* (Karafiati, 1959)	Soil sample	Current study

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