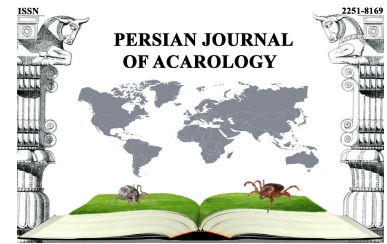




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Article

New records of the microdispid mites (Acari: Heterostigmata: Microdispidae) associated with ants with a review of the family in Iran

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ABSTRACT

Two genera and four species of myrmecophilous microdispid mites (Acari: Heterostigmata: Microdispidae), associated with various ants (Hymenoptera: Formicidae), are recorded from northwestern Iran: *Unguidispus japonicus* Kurosa, 1979 phoretic on *Lasius obscuratus* Stitz, 1930, *Caesarodispus samsinaki* (Mahunka, 1967) on *Formica* sp., *C. modestus* (Berlese, 1903) on *Messor* sp. and *C. minutus* Sevastianov, 1981 on *Tetramorium* sp. The species *C. samsinaki* and *U. japonicus* are recorded for mite fauna of Iran for the first time. A new ant host record is also documented for *U. japonicus*. The world distributions of the recorded mites are presented. Moreover, all Iranian microdispid records, along with their host/habitat are reviewed and a key to their genera and species is provided.

KEY WORDS: *Formica*; Formicidae; *Lasius*; *Messor*; phoretic mites; *Tetramorium*.

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INTRODUCTION

The family Microdispidae Cross, 1965 (Acari: Heterostigmata: Pygmephoroidae) includes 25 described genera and more than 120 species (Khaustov 2017; Azhari *et al.* 2018) that are mostly fungivorous, inhabiting soil, litter, mosses, decaying plant material and some associated with various arthropods (Rack 1979; Kaliszewski *et al.* 1995; Walter *et al.* 2009; Hajiqanbar *et al.* 2012a). At least three microdispid genera (*Myrmecodispus*, *Unguidispus*, *Caesarodispus*) are exclusively associated with various ants (Hymenoptera: Formicidae). However, there are some other generic records like *Microdispus* Paoli, 1911 that include some ant-associate members (see Table 2 in Hajiqanbar and Hosseininaveh 2014). Thus far, six genera including *Premicrodispus* Cross, 1965, *Caesarodispus* Mahunka, 1970, *Unguidispus* Mahunka, 1970, *Paramicrodispus* Khaustov, 2009, *Neomicrodispus* Hajiqanbar and Hosseininaveh, 2014 and *Punicodoxa* Mahunka, 1978 have been recorded from Iran (Rahiminejad *et al.* 2010; Abbasi-Moghadam *et al.* 2014; Hosseininaveh *et al.* 2015; Hajiqanbar & Hosseininaveh 2014; Hajiqanbar *et al.* 2012a; Loghmani *et al.* 2014b; Azhari *et al.* 2018). During a survey on insect-associate heterostigmatic mite fauna in northwestern Iran, we found four species of two myrmecophilous microdispid genera, *Caesarodispus* (with three species) and *Unguidispus* (with one species). The aims of this article are to report these microdispid mites and to provide a review on host/habitat of Iranian microdispids and world distribution of all collected mites. In addition, a key to all Iranian microdispid genera and species is provided.

MATERIAL AND METHODS

All four species of mites presented here were collected from various ants (Hymenoptera: Formicidae). The ant specimens were collected directly from their nests and were preserved in vials with 96% ethanol. Thereafter, ants and alcohol sediments were inspected for phoretic mites under a stereomicroscope (Olympus SZX9, Tokyo, Japan). The mite specimens were cleared in lacto-Nessbitt's solution (50:50, v/v) and mounted in Hoyer's medium. The morphology of mites was studied using a phase contrast compound microscope (Olympus BX51, Tokyo, Japan). The geographical coordinates of sampling places were recorded using a GPS mobile device. The terminology follows that of Lindquist (1986). Ants were identified with the help of Drs. Bernhard Seifert (Department of Entomology, Senckenberg Museum für Naturkunde, Berlin, Germany) and Alexander Radchenko (I.I. Schmalhausen Institute of Zoology, Kiev, Ukraine). All collected material including ants and mites are deposited in the Acarological Collection, Department of Entomology, Faculty of Agriculture, Tarbiat Modares University, Tehran, Iran.

SYSTEMATICS

Family Microdispidae Cross, 1965

Genus *Caesarodispus* Mahunka, 1977

Type species: *Caesarodispus gaius* Mahunka, 1977, by original designation.

Caesarodispus modestus (Berlese, 1903)

Pediculoides modestus: Berlese, 1903: 25.

Pyemotes modestus: Krczal, 1959: 458.

Material examined – The species was obtained during sampling directly from nest of ants in Koli Olia village, near Meshguin shahr, Ardabil Province, northwestern Iran, 38° 24' 36.0" N 47° 33' 00.0" E, three females phoretic on *Messor* sp., 25 May 2016, leg. M. Sobhi.

Distribution – Italy, from the ants *Messor barbarus* (Linnaeus, 1767); Crimea, on *M. rufitarsus* (Fabricius, 1804) (Khaustov 2009); Iran from unidentified ants (Badoodam 2014), and from nest of ants of *Messor* sp. (current study).

Caesarodispus samsinaki (Mahunka, 1967)

Pygmephorus samsinaki Mahunka, 1967, p. 241, Fig. 1.

Brennandania samsinaki: Mahunka 1972: 82.

Petalomium samsinaki: Sevastianov 1978: 37.

Material examined – The species was obtained during sampling directly from nest of ants in fruit orchards of Kangarlo village, vicinity of Gara Sou river, near Meshguin shahr, Ardabil province, northwestern Iran, 38° 21' 00.0" N 47° 28' 12.0" E. One female were removed from a vial containing more than 25 ants of *Formica* sp., 15 July 2015, leg. M. Sobhi.

Distribution – Czech Republic, Ukraine, Belarus, Russia, all associated with *Formica rufa* Linnaeus, 1761, *F. pratensis* Retzius, 1783, and *F. polyctena* Forster, 1850 (Mahunka 1967; Sevastianov 1978; Khaustov 2014; Khaustov and Tolstikov 2016); Iran, associated with *Formica* sp. (current study).

Remarks – This species was originally described by Mahunka (1967) from Czech Republic. Mahunka (1967) described this species in the genus *Pygmephorus* Kramer (Pygmephoridae). Subsequently, he placed it in the genus *Brennandania* Sasa, 1961 (Microdispidae) (Mahunka 1972).

Later on, Sevastianov (1978) transferred this species in the genus *Petalomium* Cross, 1965 (Neopygmephoridae), whereas, finally, Khaustov (2014) accommodated it in the genus *Caesarodispus*. This is a new record for the mite fauna of Iran.

***Caesarodispus minutus* (Sevastianov, 1981)**

Microdispus minutus Sevastianov, 1981, p. 29, Fig. 5.

Caesarodispus minutus: Khaustov 2008: 390.

Material examined – This species was collected directly from nest of ants in Gooshe Olia village, vicinity of Meshguin shahr, Ardabil province, northwestern Iran, 38° 26' 24.0" N 47° 33' 36.0" E. Four females were removed from a vial containing more than 20 ants of *Tetramorium* sp., 12 May 2016, leg. M. Sobhi.

Distribution – Ukraine, described originally by Sevastianov (1981) associated with ant *Tetramorium caespitum* (Linnaeus, 1758); Russia (Siberia), from *Lasius flavus* (Fabricius, 1782) (Khaustov and Tolstikov 2016); Iran, from *Temnothorax* sp. (Loghmani *et al.* 2014b) and associated with *Tetramorium* sp. (current study).

Genus *Unguidispus* Mahunka, 1970

Type species: *Unguidispus stammeri* Mahunka, 1970, by original designation.

***Unguidispus japonicus* Kurosa, 1979**

Unguidispus japonicus Kurosa, 1979, p. 64, Figs 1–2.

Material examined – The species was obtained during sampling directly from nest of ants in summering of Sabalan Mountain, near Meshguin shahr, Ardabil Province, northwestern Iran, 38° 12' 36.0" N 47 °32' 24.0" E. One female was removed from a vial containing many ants of the species *Lasius obscuratus* Stitz, 1930, 25 May 2016, leg. M. Sobhi.

Distribution – Japan, Russia, associated with *Lasius niger* (Linnaeus, 1758) (Kurosa 1979; Khaustov 2014); Iran, associated with *L. obscuratus* (current study).

Remarks – The species *Unguidispus japonicus* is recorded from Iran for the first time. Moreover, the association between this mite and ants of the species *Lasius obscuratus* is new.

DISCUSSION

Taking the two aforementioned new records of micodispids into account, hitherto, 23 microdispid species have been recorded from Iran (see Table 1). These species are distributed in six genera: *Premicrodispus* (10 species), *Caesarodispus* (seven species), *Unguidispus* (two species), *Paramicrodispus* (two species), *Neomicrodispus* (one species), and *Punicodoxa* (one species). The genera *Caesarodispus* and *Unguidispus* are myrmecophilous, and *Punicodoxa* is phoretic on termites. Except for two species of the *Premicrodispus* recorded from soil, all representatives of other three genera are associated with the three beetle families Scarabaeidae, Lucanidae, and Tenebrionidae.

Table 1. Iranian microdispid records with their host/habitat.

Genus and species	Host/Habitat	Reference
<i>Premicrodispus brevisetus</i> Khaustov, 2006	<i>Oxythyrea cinctella</i> Schaum; <i>Oryctes nasicornis</i> L. (Col.: Scarabaeidae)	Rahiminejad <i>et al.</i> (2010); Katlav <i>et al.</i> (2015)
<i>Premicrodispus lineatus</i> (Mahunka, 1986)	Soil (vineyards)	Hajiqanbar <i>et al.</i> (2012b)
<i>Premicrodispus krczali</i> Khaustov, 2006	<i>Oxythyrea cinctella</i> Schaum (Col.: Scarabaeidae)	Loghmani <i>et al.</i> (2014a)
<i>Premicrodispus akermanae</i> (Sevastianov & Al Douri, 1988)	<i>Oryctes nasicornis</i> L. (Col.: Scarabaeidae)	Hosseininaveh <i>et al.</i> (2013)
<i>Premicrodispus longicaudus</i> Khaustov, 2006	Soil (pomegranate orchards)	Filekesh <i>et al.</i> (2014)
<i>Premicrodispus paramaevi</i> (Hosseininaveh & Hajiqanbar, 2015)	<i>Lucanus ibericus</i> Motschulsky (Col.: Lucanidae)	Hosseininaveh <i>et al.</i> (2015)
<i>Premicrodispus spinosus</i> (Hosseininaveh & Hajiqanbar, 2015)	<i>Corticeus unicolor</i> (Col.: Tenebrionidae)	Hosseininaveh <i>et al.</i> (2015)
<i>Premicrodispus turkmenus</i> (Badooam & Hajiqanbar, 2015)	<i>Lucanus ibericus</i> Motschulsky (Col.: Lucanidae)	Badooam <i>et al.</i> (2015)
<i>Premicrodispus rackae</i> Khaustov, 2006	<i>Oryctes nasicornis</i> L. (Col.: Scarabaeidae)	Badooam <i>et al.</i> (2015)
<i>Premicrodispus acuitisetus</i> Khaustov, 2009	<i>Pleurophorus anatolicus</i> Petrovitz (Col.: Scarabaeidae)	Badooam <i>et al.</i> (2015)
<i>Caesarodispus shandizensis</i> Loghmani & Hajiqanbar, 2014	<i>Temnothorax</i> sp. (Hym.: Formicidae)	Loghmani <i>et al.</i> (2014b)
<i>Caesarodispus minutus</i> (Sevastianov, 1981)	<i>Temnothorax</i> sp.; <i>Tetramorium</i> sp. (Hym.: Formicidae)	Loghmani <i>et al.</i> (2014b); current study
<i>Caesarodispus modestus</i> (Berlese, 1903)	Unidentified ant; <i>Messor</i> sp. (Hym.: Formicidae)	Badooam (2014); current study
<i>Caesarodispus khaustovi</i> Rahiminejad & Hajiqanbar, 2015	<i>Tetramorium</i> sp. (Hym.: Formicidae)	Rahiminejad <i>et al.</i> (2015)
<i>Caesarodispus pheidolei</i> Rahiminejad & Hajiqanbar, 2015	<i>Pheidole</i> sp. (Hym.: Formicidae)	Rahiminejad <i>et al.</i> (2015)
<i>Caesarodispus nodijensis</i> Rahiminejad & Hajiqanbar, 2015	<i>Tetramorium</i> sp. (Hym.: Formicidae)	Rahiminejad <i>et al.</i> (2015)
<i>Caesarodispus samsinaki</i> (Mahunka, 1967)	<i>Formica</i> sp. (Hym.: Formicidae)	Current study
<i>Paramicrodispus scarabidophilus</i> Hajiqanbar & Rahiminejad, 2012	<i>Oryctes nasicornis</i> L.; <i>Gnorimus subcostatus</i> (Menetries) (Col.: Scarabaeidae); <i>Dorcus parallelus</i> (Say) (Col.: Lucanidae)	Hajiqanbar <i>et al.</i> (2012a); Badooam <i>et al.</i> (2015); Katlav <i>et al.</i> (2015)
<i>Paramicrodispus crenulatus</i> (Savulkina, 1978)	<i>Lucanus ibericus</i> Motschulsky (Col.: Lucanidae)	Hajiqanbar <i>et al.</i> (2012a)
<i>Neomicrodispus iranicus</i> Hajiqanbar & Hosseininaveh, 2014	<i>Oryctes nasicornis</i> L. (Col.: Scarabaeidae)	Hajiqanbar & Hosseininaveh (2014)
<i>Unguidispus okumurai</i> Kurosa, 1979	<i>Lasius emarginatus</i> (Hym.: Formicidae)	Abbasi-Moqadam <i>et al.</i> (2014)
<i>Unguidispus japonicus</i> Kurosa, 1979	<i>Lasius obscuratus</i> Stitz (Hym.: Formicidae)	Current study
<i>Punicodoxa termitophila</i> Azhari & Hajiqanbar, 2018	<i>Anacanthotermes</i> sp. (Isoptera: Hodotermitidae)	Azhari <i>et al.</i> (2018)

All the genera and species of Microdispidae recorded thus far from Iran can be identified using the following key.

Key to genera and species of the family Microdispidae recorded from Iran

1. Tibiotarsus I with claw *Unguidispus* 2

- Tibiotarsus I without claw 3
- 2. Dorsal setae of hysterosoma spatulate with dense barbs *U. japonicus*
- Dorsal setae of hysterosoma simple, smooth or weakly barbed *U. okumurai*
- 3. Posterior margin of posterior sternal plate entire 4
- Posterior margin of posterior sternal plate tripartite 13
- 4. Pseudanal segment with three pairs of setae; tibia IV with three setae
..... *Neomicrodispus* *N. iranicus*
- Pseudanal segment with two pairs of setae; tibia IV with four setae 5
- 5. Tibiotarsus I with three solenidia and 14 setae; pharyngeal pump III much larger than pump I
..... *Paramicrodispus* 6
- Tibiotarsus I with four solenidia and 16 setae; pharyngeal pumps I and III reduced, subequal
..... *Caesarodispus* 7
- 6. Setae c_1 shorter than distance c_1-c_2 ; setae e and f subequal; setae e not reaching to bases of setae
 h_1 *P. scarabidophilous*
- Setae c_1 subequal to distance c_1-c_2 ; setae e longer than f ; setae e reaching to bases of setae h_1
..... *P. crenulatus*
- 7. Hysterosomal tergites not reticulated; femur II with three setae 8
- Hysterosomal tergites distinctly reticulated; femur II with two setae *C. samsinaki*
- 8. Tibia IV seta d heavily barbed, reaching beyond tip of pretarsus IV 9
- Tibia IV seta d smooth or weakly barbed, not reaching beyond tip of pretarsus IV 11
- 9. Seta d of femur IV longer than tc'' of tarsus IV; minute setae ps_2 present *C. modestus*
- Seta d of femur IV shorter than tc'' of tarsus IV; minute setae ps_2 absent 10
- 10. Distance h_1-h_2 and h_1-h_1 usually subequal; posterior part of aggenital plate smooth
..... *C. nodijensis*
- Distance h_1-h_2 about 2.5 times longer than h_1-h_1 ; posterior part of aggenital plate distinctly
reticulated *C. pheidolei*
- 11. Posterior part of aggenital plate distinctly reticulated *C. shandizensis*
- Posterior part of aggenital plate smooth 12
- 12. Distance h_1-h_2 clearly about 2.5 times longer than h_1-h_1 *C. khaustovi*
- Distance h_1-h_2 and h_1-h_1 subequal *C. minutus*
- 13. Seta s of tibiotarsus I present; two pairs of cheliceral setae *Punicodoxa* *P. termitophila*
- Seta s of tibiotarsus I absent; usually one pair of cheliceral setae *Premicrodispus* 14
- 14. Setae $4a$ present 15
- Setae $4a$ absent 16
- 15. Bases of setae f associated with well-developed oblique ridges *P. lineatus*
- No ridges near the bases of setae f *P. paramaevi*
- 16. Setae ps_2 present 17
- Setae ps_2 absent 19
- 17. Setae h_1 and h_2 subequal; tarsi and tibiae II and III with spine-like setae *P. spinosus*
- Setae h_2 distinctly shorter than h_1 ; tarsi and tibiae II and III with no spine-like seta 18
- 18. Tibiotarsus I with four solenidia; seta ps_3 longer than h_1 ; setae e and h_1 subequal *P. turkmenus*
- Tibiotarsus I with three solenidia; seta h_1 distinctly longer than ps_3 and e *P. akermanae*
- 19. Setae sc_2 and d subequal *P. acutisetosus*
- Setae sc_2 distinctly longer than d 20
- 20. Setae ps_3 distinctly longer than ps_1 *P. longicaudus*
- Setae ps_1 and ps_3 subequal 21
- 21. No ridges near the bases of setae e *P. krczali*
- Bases of setae e associated with well developed oblique ridges 22
- 22. Setae sc_2 and c_1 subequal; setae c_2 and c_1 situated almost at the same level *P. rackae*
- Setae sc_2 distinctly longer than c_1 ; setae c_2 situated distinctly anterior to c_1 *P. brevisetus*

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گزارش‌های جدیدی از کنه‌های مایکرودیسپید (Acari: Heterostigmata: Microdispidae) مرتبط با مورچه‌ها همراه با مروری بر خانواده در ایران

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چکیده

دو جنس و چهار گونه از کنه‌های مورچه دوست خانواده (Acari: Heterostigmata) Microdispidae مرتبط با چندین مورچه (Hymenoptera: Formicidae) از شمال غرب ایران به ثبت می‌رسند: *Unguidispus japonicus* Kurosa, 1979 مرتبط با *Lasius obscuratus* Stitz, 1930. *Caesarodispus samsinaki* (Mahunka, 1967) مرتبط با *Formica modestus* (Berlese, 1903) *Formica* sp. مرتبط با *C. minutus* Sevastianov, 1981 و *Messor* sp. مرتبط با *U. japonicus* و *C. samsinaki* گونه‌های *Tetramorium* sp. مرتبط با *U. japonicus* نیز گزارش می‌شود. مناطق انتشار جهانی کنه‌های گزارش شده ارایه شده است. همچنین، تمام کنه‌های مایکرودیسپید گزارش شده از ایران همراه با زیستگاه/میزبان آنها مرور و کلیدی برای جنس‌ها و گونه‌های مزبور فراهم شده است.

واژگان کلیدی: *Formica*؛ *Formicidae*؛ *Lasius*؛ *Messor*؛ کنه‌های هم‌سفر؛ *Tetramorium*.

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