Acarologia 57(4): 1103-1111 (2017)
DOI: 10.24349/acarologia/20174222

A contribution to the knowledge of scutacarid mites (Acari: Pygmephoroidea: Scutacaridae) associated with Coleoptera and Hymenoptera (Arthropoda: Insecta) from northwestern Iran

Mohammad SOBHI, Hamidreza HAJIQANBAR✉ and Azim MORTAZAVI

(Received 07 June 2017; accepted 18 July 2017; published online 29 September 2017; edited by Marie-Stéphane TIXIER)

Department of Entomology, Faculty of Agriculture, Tarbiat Modares University, 14115-336, Tehran, Iran. Sobhimohammad7@yahoo.com; (✉) hajiqanbar@modares.ac.ir; azim.mortazavi@yahoo.com

ABSTRACT — During the survey of heterostigmatic mites (Acari: Prostigmata) associated with insects in northwestern Iran, Ardabil province, 11 species from three genera of the family Scutacaridae were identified: *Heterodispus* (one species), *Scutacarus* (three species) and *Imparipes* (seven species). Among these, three species are recorded for the first time in Asia including Iran: *Imparipes* (*Imparipes*) *rafalskii* Dastych, 1978, *I.* (*I.*) *comatus* Mahunka, 1970 and *Scutacarus remissus* Khaustov, 2008. *I.* (*I.*) *lentus* Khaustov, 2008 is recorded for the first time in Iran. All host insects were captured directly from their habitats. Eight new insect host records are reported and the world distribution of these mites is reviewed. A key to Iranian scutacarid mites is also provided.

KEYWORDS — Heterostigmatina; new hosts record; *Scutacarus*; *Imparipes*; *Heterodispus*

ZOOBANK — 2AF34089-9D27-4A3E-B868-C6D19D7F747F

INTRODUCTION

The family Scutacaridae Oudemans, 1916 (Acari: Heterostigmatina) includes 25 genera and more than 800 species; all of them are fungivorous (Khaustov, 2008; Zhang *et al.*, 2011; Khaustov *et al.*, 2017). Most scutacarid mites are mainly associated with beetles, flies, and hymenopterans, especially various ants and bees (Ebermann, 1988; Khaustov, 2008; Ebermann and Moser, 2008; Ebermann *et al.*, 2013). All species of this family have free living habits and some of them have both phoretic and non phoretic female forms (dimorphism) for example, the genus *Archidispus* Karafiat, 1959 which dimorphic forms are typical for these mites (Ebermann, 1990, 1991a, b). Among the 25 described genera of this family, only six have been recorded from Iran until now: *Heterodispus* Paoli, 1911; *Scutacarus* Gros, 1845; *Imparipes* Berlese, 1903; *Pygmodispus*, *Archidispus* Karafiat, 1959 and *Lophodispus* Kurosa, 1972 (Mahunka and Rohde, 1970; Ebermann *et al.*, 2003; Hajiqanbar and Khaustov, 2014; Loghmani *et al.*, 2014; Katlav *et al.*, 2015, 2016; Sobhi *et al.*, 2017). In order to better characterize the fauna of this country, surveys were carried out in northwestern Iran.

MATERIALS AND METHODS

The study was conducted from June 2015 to May 2016 in northwestern Iran. The insect specimens were captured directly from their habitats and all sampled specimens were adults. Mite specimens were retrieved from their hosts using an Olympus stereomicroscope. Mites were cleared in lacto-Nesbitt solution and mounted on slides in Hoyer's medium. The morphology of mites was studied using a compound microscope (model BX51, Olympus, Tokyo, Japan) equipped with phase contrast illumination. The bee genus *Andrena* was identified with the help of Dr. A. Talebi (Department of Entomology, Faculty of Agriculture, Tarbiat Modares University, Tehran, Iran). The Tenebrionidae beetles were identified with the help of Maxim Nabozhenko (Russian Academy of Science, Russia). All ants were identified with the help of Dr. Bernhard Seifert (Department of Entomology, Senckenberg Museum für Naturkunde, Berlin, Germany). Materials were collected by the senior author and deposited in the Acarological Collection, Department of Entomology, Faculty of Agriculture, Tarbiat Modares University (TMU), Tehran, Iran.

RESULTS

SYSTEMATICS

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

Type species: *Imparipes elongates* Tragardh, 1904, by original designation.

***Heterodispus* (*Heterodispus*) *turkmenistaniensis* Khaustov and Chydyrov, 2005**

Heterodispus (*Heterodispus*) *turkmenistaniensis* Khaustov and Chydyrov, 2005, p. 155, Figures 1-5.

Material examined — Eight females, Ardabil province, Meshgin-shahr, Koli Olia village, 38°41′N, 47°55′E, 29 May 2015, phoretic on the beetle *Blaps mortisaga* Reitter, 1904 (Coleoptera: Tenebrionidae).

World distribution — Turkmenistan, collected from soil of cucumbers (Khaustov and Chydyrov, 2005); Iran, Kerman province, associated with beetle *Scarites* (*Scarites*) *procerus eurytus* Fischer von Waldheim (Coleoptera: Carabidae) (Mortazavi, 2010), Northeastern Iran, associated with beetle *Gonocephalum pubiferum* Reitter (Coleoptera: Tenebrionidae) (Loghmani, 2013), Northwestern Iran, Ardabil province (current study).

Remarks — Association between this mite and beetles of the tenebrionid genus *Blaps* is new. Considering previous and current records of this mite in Iran, it probably has a preference to be phoretic on beetles than on other insects.

Genus *Imparipes* Berlese, 1903

Type species: *Imparipes histricinus* Berlese, 1903, by original designation.

***Imparipes* (*Imparipes*) *comatus* Mahunka, 1970**

Material examined — Two females, Ardabil province, Meshgin-shahr, Ahmad Abad village, 38°21′N, 47°35′E, 14 May 2016, on ants *Tapinoma tauridis* Emery, 1925 (Hymenoptera: Formicidae).

World distribution — Hungary, from nest of *Formica* sp. (Hymenoptera: Formicidae) (Mahunka, 1970). It was also reported from France and Crimea to be phoretic on ants *Tapinoma erraticum* (Latreille) (Hymenoptera: Formicidae), *Lasius niger* (L.), *Myrmica rufa* Jerdon and *Tetramorium caespitum* (L.) (Khaustov, 2008); Iran (current study).

Remarks — Record of this species is new for mite fauna of Asia. Association between this mite and ant species *Tapinoma tauridis* is also new.

***Imparipes* (*Imparipes*) *histricinus* Berlese, 1903**

Material examined — Two females, Ardabil province, Meshgin-shahr, Koli Olia village, 38°41′N, 47°55′E, 25 May 2016, on ants *Messor* sp. (Hymenoptera: Formicidae).

World distribution — Angola, Australia, Austria, Bolivia, Brazil, Denmark, France, Germany, Hungary, Ireland, Italy, Lithuania, Malaya, Mongolia, Russia, Tunisia, Ukraine and former Yugoslavia associated with ants *Tetramorium caespitum* L. and *Messor* sp. (Hymenoptera: Formicidae) (Khaustov, 2008; Khaustov and Tolstikov, 2016); Iran, Razavi Khorasan province, associated with

Cataglyphis cf. *nodus* (Brulle) (Hymenoptera: Formicidae) (Hajiqanbar, 2010); Northeastern Iran, associated with *Temnothorax* sp. (Hymenoptera: Formicidae) (Loghmani *et al.*, 2014); Northwestern Iran, Ardabil province (current study).

Imparipes (*Imparipes*) *imaginatus* Mahunka, 1981

Imparipes (*Imparipes*) *imaginatus* Mahunka, 1981: p. 355, Figures 29-35.

Material examined — Four females, Ardabil province, Meshgin-shahr, 38°21′N, 47°43′E, 25 May 2016, on ants *Tetramorium* sp. (Hymenoptera: Formicidae).

World distribution — Hungary, from ant nest (Mahunka, 1981); Austria (Ebermann, 2004); Russia, on ant *Tetramorium caespitum* L. (Khaustov and Tolstikov, 2016); Iran, Golestan province, phoretic on an unidentified ant (Hymenoptera: Formicidae) (Badoodam, 2014); Ardabil province (current study).

Remarks — The ant genus *Tetramorium* is a new phoretic host for this mite species.

Imparipes (*Imparipes*) *lentus* Khaustov, 2008

Imparipes (*Imparipes*) *lentus* Khaustov, 2008: p. 120, Figures 76 (1-4).

Material examined — Five females, Ardabil province, Meshgin-shahr, altitudes of Mount Sabalan, 38°21′N, 47°54′E, 25 May 2016, on ants *Tetramorium* sp. (Hymenoptera: Formicidae).

World distribution — Crimea, Western Siberia, on ants *Tetramorium caespitum* L. (Hymenoptera: Formicidae) (Khaustov, 2008; Khaustov and Tolstikov, 2016); Iran (current study).

Remarks — This species is new for mite fauna of Iran.

Imparipes (*Imparipes*) *placidus* Khaustov and Chydyrov, 2004

Imparipes (*Imparipes*) *placidus* Khaustov and Chydyrov, 2004: p. 97, Figures 35-41.

Material examined — Five females, Ardabil province, Meshgin-shahr, Mount Sabalan altitudes, 38°21′N, 47°54′E, 25 May 2016, on ants *Tetramorium* sp. (Hymenoptera: Formicidae). Five females, Ardabil province, Meshgin-shahr, Gooshe Olia village, 38°44′N, 47°56′E, 12 May 2016, on ants *Lasius obscuratus* Stitz, 1930 (Hymenoptera: Formicidae).

World distribution — Turkmenistan, associated with the ant *Messor excursionis* Ruszky (Hymenoptera: Formicidae) (Khaustov and Chydyrov, 2004); Iran, Isfahan province, phoretic on an unidentified ant (Hymenoptera: Formicidae) (Tajodin, 2013); Ardabil province (current study).

Remarks — Ants of the genera *Tetramorium* and *Lasius* are new phoretic hosts for this species.

Imparipes (*Imparipes*) *rafalskii* Dastych, 1978

Imparipes (*Imparipes*) *rafalskii* Dastych, 1978: p. 251, Figures 1-9.

Material examined — Two females, Ardabil province, Meshgin-shahr, Koli Olia village, 38°41′N, 47°55′E, 29 May 2015, phoretic on the bee *Andrena* sp. (Hymenoptera: Andrenidae).

World distribution — Poland, phoretic on *Dasypoda hirtipes* (Fabricius) (Hymenoptera: Melittidae) (Dastych, 1978); Ukraine, phoretic on *Bombus terrestris* L. (Hymenoptera: Apidae) (Zaloznaya and Khaustov, 2007); Iran (current study).

Remarks — Record of this species is new for mite fauna of Asia. Bees of the family Andrenidae are also new recorded hosts for this mite species.

Imparipes (*Imparipes*) *tenuis* Mahunka, 1981

Imparipes (*Imparipes*) *tenuis* Mahunka, 1981: p. 358, Figures 40-43.

Material examined — Three females, Ardabil province, Meshgin-shahr, altitudes of Mount Sabalan, 38°21′N, 47°54′E, 25 May 2016, on ants *Tetramorium* sp. (Hymenoptera: Formicidae).

World distribution — Hungary, from ant nests (Mahunka, 1981); Austria (Ebermann, 2004); Iran, Kerman province associated with an unidentified ant (Mortazavi *et al.*, 2016); Ardabil province (current study).

Remarks — Association between this mite and ants of the genus *Tetramorium* is new.

Genus *Scutacarus* Gros, 1845

Type species: *Scutacarus femoris* Gros,1845, by monotypy.

***Scutacarus remissus* Khaustov, 2008**

Scutacarus remissus Khaustov, 2008: p. 246, Figures 173 (1-3).

Material examined — Five females, Ardabil province, Meshgin-shahr, Koli Olia village, 38°41′N, 47°55′E, 25 May 2016, on ants *Messor* sp. (Hymenoptera: Formicidae).

World distribution — Crimea, phoretic on *Messor* sp. (Hymenoptera: Formicidae) (Khaustov, 2008); Iran (current study)

Remarks — This species is new for mite fauna of Asia.

Scutacarus shivicki
Lazauskene and Sevastianov, 1974

Synonyms: *S. frumentaceus* Sevastianov, 1983; *S. iharosi* Mahunka & Zaki, 1985; *S. diversisetus* Sevastianov & Chydyrov, 1992; *S. furatensis* Sevastianov & Zahida Al Douri, 1988.

Material examined — One female, Ardabil province, Meshgin-shahr, Koli Olia village, 38°41′N, 47°55′E, 25 May 2016, on ants *Messor* sp. (Hymenoptera: Formicidae).

World distribution — Russia, Kazakhstan, Turkmenistan, Lithuania and Hungary from Soil and litter (Lazauskene and Sevastianov, 1974; Sevastianov, 1983; Mahunka and Zaki, 1985; Sevastianov and Chydyrov, 1992; Sevastianov and Zahida Al Douri, 1988); Iran, East Azarbaijan province, soil of alfalfa fields (Lotfollahy *et al.*, 2009); Ardabil province (current study).

Remarks — This species has been recorded several times from soil and litter, and its phoretic relationship was hitherto unknown. Therefore, it is first record of phoresy (including ant genus *Messor*) for this mite species.

Scutacarus subquadratus
Khaustov and Chydyrov, 2004

Scutacarus subquadratus Khaustov and Chydyrov, 2004: p. 101, Figures 53-58.

Material examined — Six females, Ardabil province, Meshgin-shahr, Guda Kahriz village, 38°36′N, 47°48′E, 7 May 2016, on ants *Cataglyphis* sp. (Hymenoptera: Formicidae).

World distribution — Turkmenistan, associated with *Tetramorium schneideri* Emery (Hymenoptera: Formicidae) (Khaustov and Chydyrov, 2004); Iran, East Azarbaijan province, soil of alfalfa fields (Lotfollahy *et al.*, 2009); Razavi Khorasan province associated with *Cataglyphis* cf. *nodus* (Brulle) (Hymenoptera: Formicidae) (Hajiqanbar, 2010); Northeastern Iran, associated with *Tricholabiodes* sp. (Hymenoptera: Mutillidae) and *Cataglyphis* cf. *nodus* (Loghmani *et al.*, 2014); Ardabil province (current study).

Discussion on the scutacarid-fauna of Iran

Forty five species of scutacarid mites recorded from Iran are distributed in genera *Scutacarus* (17 species), *Imparipes* (16), *Archidispus* (7), *Heterodispus* (2), *Pygmodispus* (2) and *Lophodispus* (1). Some species are well adapted to live in soil and litter, such as both representatives of the genus *Pygmodispus* (Ebermann *et al.*, 2003) and some species of the genera *Scutacarus* and *Imparipes* (see Kamali *et al.*, 2001; Lotfollay *et al.*, 2009; Hashemi Khabir *et al.*, 2013). All *Archidispus* species, *Lophodispus* and many *Scutacarus* and *Imparipes* species have been found associated to various coleopterans and hymenopterans. Mites were found on beetles of the families Carabidae and rarely Staphylinidae (Hajiqanbar and Khaustov, 2014; Loghmani *et al.*, 2014; Katlav *et al.*, 2015, 2016). Ants constitute the most dominant insect hosts for *Lophodispus*, *Imparipes* and *Scutacarus* species (Loghmani *et al.*, 2014; Katlav *et al.*, 2015; Sobhi *et al.*, 2017a, b). However, a few species of *Imparipes* (*I. paulyi*, *I. burgeri* and *I. rafalskii*) and *Scutacarus acarorum* are phoretic on bees (Kazemi and Kamali, 2006; Loghmani *et al.*, 2014;

Kiani Bakiani *et al.*, 2016). All 45 Iranian scutacarids could be identified using the following key.

Key to Iranian scutacarid mites (females)

1. Legs IV with four segments 29

— Legs IV with five segments 2

2. Tibia IV with four setae ...... *Pygmodispus*...... 3

— Tibia IV with three setae 4

3. Posterior sternal plate expanded; setae c_2 longer than c_1; setae 4*c* spine-like.......................... .... *P.* (*Allodispus*) *latisternus* Paoli, 1911

— Posterior sternal plate not expanded; setae c_2 and c_1 subequal; setae 4*c* setiform........................ .... *P.* (*Pygmodispus*) *calcaratus* Paoli, 1911

4. Setae c_1 inserted on free margin of tergite C; tarsus IV seta u' absent .... *Heterodispus*...... 5

— Setae c_1 inserted on central part of tergite C; tarsus IV seta u' usually present 6

5. Tibia IV seta l' extending beyond base of pretarsus; femur IV seta *d* longer than genu IV seta v'......... *H. verrucosus* Mahunka and Rohde, 1970

— Tibia IV seta l' never reaching to base of pretarsus; femur IV seta *d* shorter than genu IV seta v'. .... *H. turkmenistaniensis* Khaustov and Chydyrov, 2005

6. Second pharyngeal pump weakly discernible; anterior margin of anterior sternal plate with crown of thin process .... *Lophodispus tapinoma* Sobhi and Hajiqanbar, 2017

— Second pharyngeal pump much larger than first and third; anterior margin of anterior sternal plate without process 7

7. Tarsus IV gradually tapering to the apex; with two types of females, non-phoretic and phoretic, the latter with massive tibiotarsus I and large claw............................ *Archidispus*...... 8

— Tarsus IV with expanded base and abruptly becoming thin distally; with only one type of females, tibiotarsus I with middle-size claw, sometimes absent .... *Imparipes*...... 14

8. Setae ps_2 apart from ps_1; pretarsus IV short (6-7); setae 4*c* modified, thickened basally................ . ... *A. irregularis* Katlav and Hajiqanbar, 2016

— Setae ps_2 and ps_1 generally with joined basal rings; pretarsus IV with various sizes but longer than 7; setae 4*c* not modified 9

9. At least dorsal setae c_1, *d* and *f* modified, expanded basally 10

— All dorsal setae not modified, setiform 11

10. Dorsal setae c_2 modified, expanded basally; among ventral setae, only setae 4*a* modified, dilated... .... *A. armatus* (Karafiat, 1959)

— Dorsal setae c_2 not modified, setiform; among ventral setae, 4*a* and 4*b* modified, expanded basally.................. *A. insolitus* (Kurosa, 1974)

11. Setae *f* distinctly longer than h_2; setae 2*b* shorter than 2*a* .... *A. bembidii* (Karafiat, 1959)

— Setae *f* distinctly shorter than h_2; setae 2*b* longer than 2*a* 12

12. Setae 3*b* and 4*a* not modified, setiform.............. .... *A. esfarayenicus* Hajiqanbar and Khaustov, 2014

— Setae 3*b* and 4*a* modified 13

13. Setae 4*b* modified, thickened basally; setae 1*a* setiform .... *A. minor* Karafiat, 1959

— Setae 4*b* not modified, setiform; setae 1*a* modified, dilated .... *A. conspicuus* Kurosa, 1978

14. Gnathosoma very wide, with subequal length and width .... Subgenus *I.* (*Sporichneutes*)... .... *I.* (*S.*) *intermedius* Paoli, 1911

— Gnathosoma always longer than its width 15

15. Tibiotarsus I with three solenidia; pretarsus IV with no claws .... Subgenus *I.* (*Apidacarus*)... .... *I.* (*A.*) *paulyi* Ebermann and Fain, 2002

— Tibiotarsus I with four solenidia; pretarsus IV usually with claw ..... Subgenus *I.* (*Imparipes*)... 16

16. Pretarsus IV very short, with thickening end...... .... *I. rafalskii* Dastych, 1978

— Pretarsus IV not as above 17

17. Setae 3*b*, 4*a* and 4*b* modified, expanded basally............ .... *I. insulanus* Delfinado *et al.* 1976

— Setae 3*b*, 4*a* and 4*b* not modified, setiform 18

18. Setae *f* and h_1 lanceolate .... *I. tataricus* Sevastianov, 1964

— Setae *f* and h_1 not lanceolate 19

19. Setae 3*c* at the same level or posterior to 3*b*... 20

— Setae 3*c* anterior to 3*b* 21

20. Setae c_1 and *d* subequal; setae *f* longer than h_1; setae 4*a* shorter than ps_1 .... *I. imaginatus* Mahunka, 1981

— Setae c_1 shorter than *d*; setae *f* and h_1 subequal; setae 4*a* longer than ps_1 .... *I. tenuis* Mahunka, 1981

21. Setae ps_2 longer than half of ps_1 length 22

— Setae ps_2 not longer than half of ps_1 length 23

22. Setae *e* and h_2 longer than *f* and h_1; interval between setae 4*a* longer than that between 4*b*.......... .... *I. longisetosus* Willman, 1951

— Setae *e* and h_2 shorter than *f* and h_1; interval between setae 4*a* shorter than that between 4*b*.......... .... *I. comatus* Mahunka, 1970

23. Setae ps_2 equal to half of ps_1 length.............. ... . *I. longitarsus* Delfinado *et al.*, 1976

— Setae ps_2 shorter than half of ps_1 length 24

24. Setae *f* longer than h_1 25

— Setae *f* not longer than h_1 26

25. Setae *d* longer than h_2; trochanter IV seta *d* not reaching to base of tarsus .... *I. placidus* Khaustov and Chydyrov, 2004

— Setae *d* shorter than h_2; trochanter IV seta *d* protruding base of tarsus ...... *I. lentus* Khaustov, 2008

26. Setae *f* shorter than interval between their bases.. 27

— Setae *f* longer than interval between their bases........ 28

27. Setae *d* never reaching to bases of tergite EF setae; setae 4*b* never reaching to posterior border of idiosoma .... *I. kugitangensis* Khaustov and Chydyrov, 2004

— Setae *d* extending beyond bases of tergite EF setae; setae 4*b* reaching to posterior border of idiosoma....... .... *I. burgeri* Ebermann and Jagersbacher-Baumann, 2013

28. Setae h_1 distinctly longer than h_2; setae ps_1 and h_2 subequal .... *I. histricinus* Berlese, 1903

— Setae h_1 shorter than h_2; setae h_2 distinctly longer than ps_1 .... *I. parapicola* Delfinado *et al.*, 1976

29. Tibiotarsus I without claw 30

— Tibiotarsus I with claw 32

30. Setae h_1 and h_2 distinctly thickened, with extremely large barbs ...... *S. eucomus* (Berlese, 1908)

— Setae h_1 and h_2 not thickened, with no large barbs.. 31

31. Setae h_1 shorter than interval between their bases; setae 4*a* and h_1 subequal .... *S. quadrangularis* (Paoli, 1911)

— Setae h_1 longer than interval between their bases; setae h_1 longer than 4*a* .... *S. contiguus* Delfinado *et al.*, 1976

32. Setae 4*b* absent .... *S. ebermanni* Sobhi and Hajiqanbar, 2017

— Setae 4*b* present 33

33. Setae *e* and h_2 reduced 34

— Setae *e* and h_2 well developed 36

34. Apodemes 5 well developed; secondary transverse apodeme (sta) present .... *S. shajariani* Sobhi and Hajiqanbar, 2017

— Apodemes 5 reduced; secondary transverse apodeme (sta) absent 35

35. Setae ps_1 and ps_2 subequal, barbed, longer than 4*a* .... *S. remissus* Khaustov, 2008

— Setae ps_1 longer than ps_2; ps_1 weakly barbed, ps_2 smooth, both shorter than 4*a* .... *S. iranicus* Ebermann *et al.*, 2003

36. Setae *f* characteristically short, at least five times shorter than *e* and h_2 .... *S. transfusionis* Mahunka and Mahunka-Papp, 1980

— Setae *f* well developed, not as above 37

37. Tibiotarsus IV with six setae 38

— Tibiotarsus IV with seven setae 39

38. Setae 4*b* more than four times longer than 4*a*; setae ps_1 and ps_2 subequal .... *S. subquadratus* Khaustov and Chydyrov, 2004

— Setae 4*b* about twice as long as 4*a*; setae ps_1 twice as long as ps_2 .... *S. apodemi* Mahunka, 1963

39. Setae *f* and h_1 pinnate; h_2 thickened with large barbs .... *S. plumosus* (Paoli, 1911)

— Setae *f*, h_1 and h_2 not as above 40

40. Setae c_1, *d*, *f* and h_1 clavate .... *S. claviger* (Paoli, 1911)

— Setae c_1, *d*, *f* and h_1 not clavate 41

41. Setae *e* and h_2 subequal, spine-like . . *S. acarorum* (Goeze, 1780)

— Setae *e* and h_2 in various length, not spine-like... 42

42. Barbed setae *f* at least eight times longer than smooth setae *e* . . . *S. communis* Delfinado *et al.*, 1976

— Setae *e* longer than *f* or *f* only slightly longer than *e* 43

43. Setae *e* distinctly longer than *f*; setae *f* and h_1 lanceolate...............................*S. shivicki* Lazauskene and Sevastianov, 1974

— Setae *f* slightly longer than *e*; setae *f* and h_1 not lanceolate...................................... 44

44. Setae ps_1 and ps_2 subequal, longer than ps_3; setae *f* and h_1 subequal .... *S. fragariae* Rack, 1975

— Setae ps_1 longer than subequal setae ps_2 and ps_3; setae h_1 longer than *f* .... *S. serotinus* Sevastianov and Chydyrov, 1992

Acknowledgements

We are grateful to the following persons for help to identify the insect hosts: Drs. Ali Asghar Talebi, Maxim Nabozhenko and Bernhard Seifert.

References

Badoodam S. 2014 — Heterostigmatic mite (Acari: Heterostigmata) associated with insect in East of Golestan Province [MSc Thesis] — Iran, Tehran: Tarbiat Modares University. 87pp, p 32.

Dastych H. 1978 — *Imparipes* (*Imparipes*) *rafalskii* sp. nov. (Acari: Tarsonemina) a new species of Scutacarid mite from Poland — Bull. Acad. Pol. Sci., 26(4): 251-255.

Ebermann E. 1988 — *Imparipes* (*Imparipes*) *pselaphidorum* n. sp., a new scutacarid species phoretic upon African beetles (Acari, Scutacaridae; Coleoptera, Pselaphidae) — Acarologia, 29: 35-42.

Ebermann E. 1990 — Taxonomic consequences of the polymorphism found in scutacarids (Acari, Scutacaridae) — Ent. Mitt. Zool. Mus. Hamburg, 10(139-140): 29-42.

Ebermann E. 1991a — Records of polymorphism in the mite family Scutacaridae (Acari, Tarsonemina, Scutacaridae) — Acarologia, 32(2): 119-138.

Ebermann E. 1991b — Das Phänomen Polymorphismus in der Milbenfamilie Scutacaridae (Acari, Heterostigmata, Tarsonemina, Scutacaridae) — Zoologica, 47(141): 1-76.

Ebermann E. 2004 — Scutacaridae (Arachnida: Acari) — In: Schuster R. (Ed.) Checklisten der Fauna Österreichs, No. 1, Biosystematics and Ecology Series, Österreichische Akademie der Wissenschaften, Wien, 22: 31-45.

Ebermann E., Hajiqanbar H., Haddad Irani-Nejad K. 2003 — New records of phoretic and soil-living mites from Iran (Acari, Heterostigmata, Scutacaridae) — Rev. Suisse. Zool., 110: 247-253. doi:10.5962/bhl.part.80185

Ebermann E., Hall M., Hausl-Hofstätter U., Jagersbacher-Baumann J.M., Kirschner R., Pfingstl T., Plassnig E. 2013 — A new phoretic mite species with remarks to the phenomenon "sporothecae" (Acari, Scutacaridae; Hymenoptera, Aculeata) — Zool. Anz., 252: 234-242. doi:10.1016/j.jcz.2012.06.003

Ebermann E., Moser J.C. 2008 — Mites (Acari: Scutacaridae) associated with the red imported fire ant, *Solenopsis invicta* Buren (Hymenoptera: Formicidae) from Louisiana and Tennessee, U.S.A — Internat. J. Acarol., 34: 55-69. doi:10.1080/01647950808683706

Hajiqanbar H. 2010 — Some scutacarid mites (Acari: Scutacaridae) associated with ants (Hym.: Formicoidea) and their nests from Iran — 9th European Congress of Entomology, Budapest, Hungary, p. 238.

Hajiqanbar H., Khaustov A.A. 2014 — First record of the genus *Archidispus* (Acari: Scutacaridae) from Iran with description of a new species — Pers. J. Acarol., 3:1-8. doi:10.22073/pja.v3i1.10124

Hashemi Khabir Z., Haddad Irani Nejad K., Akbari A. 2013 — Some of edaphic mesostigmatic and prostigmatic mites in Southwest of East Azerbaijan Province, Iran — In: Abstract Book of the 2nd International Persian Congress of Acarology, 29-30 August 2017, Karaj, Iran, p. 13.

Kamali K., Ostovan H., Atamehr A. 2001 — A catalog of mites and ticks (Acari) of Iran — Islamic Azad University Scientific Publication Center, Tehran, 192 pp.

Katlav A., Hajiqanbar H., Talebi A.A. 2015 — A contribution to the knowledge of heterostigmatic mites (Acari: Prostigmata) in western Mazandaran Province, Northern Iran — Acarologia, 55: 311-320. doi:10.1051/acarologia/20152175

Katlav A., Hajiqanbar H., Talebi A.A. 2016 — Two remarkable new species of the superfamily Pygmephoroidea (Acari: Heterostigmata) associated with beetles (Coleoptera: Carabidae, Staphylinidae) — Ann. Entomol. Soc. Am., 109: 136-144. doi:10.1093/aesa/sav099

Kazemi Sh., Kamali K. 2006 — New records of mites (Astigmata, Mesostigmata, Prostigmata) associated with *Bombus argillaceus* (Hymenoptera, Apoidea) from Iran — In: Abstract Book of the 12th International Congress of Acarology, 21-26 August 2006, Amsterdam, The Netherlands, p. 90.

Khaustov A.A. 2008 — Mites of the family Scutacaridae of Eastern Palaearctic — Kiev. Akademperiodyka. pp. 291.

Khaustov A.A., Chydyrov P.R. 2004 — A new species of mites of the family Scutacaridae (Acari: Heterostigmata) associated with ants (Hymenoptera: Formicidae) from Turkmenistan — Acarina, 13(2): 155-157.

Khaustov A.A., Chydyrov P.R. 2005 — A new species of mites of the genus *Heterodispus* (Acari: Heterostigmata: Scutacaridae) from Turkmenistan — Acarina, 13(2): 155-157.

Khaustov A.A., Hugo-Coetzee E.A., Ermilov S.G. 2017 — A new genus of the mite family Scutacaridae (Acari: Heterostigmata) associated with *Trinervitermes trinervoides* (Isoptera: Termitidae) from South Africa — Zootaxa, 4258(5): 462-476. doi:10.11646/zootaxa.4258.5.4

Khaustov A.A., Tolstikov A.V. 2016 — The diversity, mite communities, and host specificity of pygmephoroid mites (Acari: Pygmephoroidea) associated with ants in Western Siberia, Russia — Acarina, 21(2): 113-136. doi:10.21684/0132-8077-2016-24-2-113-136

Kiani Bakiani S., Monfared A., Hajiqanbar H., Azhari Sh. 2016 — A survey on Apoidea (Insecta: Hymenoptera) bees and their associated mites in Fars Province, Iran — J. Insect Biodiver. Syst., 2(2): 285-299.

Lazauskene L.A., Sevastianov V.D. 1974 — Four new species of mites of family Scutacaridae (Trombidiformes) — Acta. Parasitol. Lituanica, 12: 199-204.

Loghmani A. 2013 — Heterostigmatic mites (Acari: Heterostigmatina) associated with insects in some parts of Northeastern Iran [MSc Thesis] — Iran, Tehran: Tarbiat Modares University, 102pp., p. 76.

Loghmani A., Hajiqanbar H., Talebi A.A. 2014 — New records of mites of the superfamily Pygmephoroidea (Acari: Heterostigmatina) associated with insects from northeastern Iran and new host records — Syst. Appl. Acarol., 19(2): 154-159. doi:10.11158/saa.19.2.5

Lotfollahy P., Irani-Nejad K.H., Bagheri M., Valizadeh M., Khaustov A.A., Camerik A.M. 2009 — Pygmephoroid soil mite fauna of alfalfa fields and their distribution in Northwest of East Azarbaijan province, Iran — Agricul. Sci., 19: 298-317.

Mahunka S. 1970 — Considerations on the systematics of the Tarsonemina and the description of new European taxa (Acari: Trombidiformes) — Acta. Zool. Acad. Sci. Hung., 16: 137-174.

Mahunka S. 1981 — The Pygmephoroid fauna of the Hortobágy National Park (Acari: Tarsonemida) — Fauna. Horto. Nation. Park, 1: 343-370.

Mahunka S., Rohde Jr. C.J. 1970 — A new scutacarid and some pyemotid mites from Iran — Acarologia, 12: 103-105.

Mahunka S., Zaki A.M. 1985 — *Scutacarus iharosi* sp. n. and some new notes on the Tarsonemina fauna on Hungary — Mis. Zool. Hung., 3: 7-13.

Mortazavi A. 2010 — Prostigmatic mites (Acari:Prostigmata) associated with Coleoptera in some regions of Kerman province, Iran [MSc Thesis] — Iran, Tehran: Tarbiat Modares University, 146pp. p. 98.

Mortazavi A., Hajiqanbar H., Kamali K. 2016 — first record of *Imparipes* (*Imparipes*) *tenuis* Mahunka, 1981 (Acari: Scutacaridae) from Iran — In: Proceedings of 22th Iranian Plant Protection Congress, 27–30 August 2016, Karaj, Iran, p. 496.

Sevastianov V.D. 1983 — New species of mites of the genus *Scutacarus* (Trombidifoemes, Scutacaridae) — Zool. Zhurnal., 62: 1487-1495. [in Russian]

Sevastianov V.D., Chydyrov P.R. 1992 — New species of mites of family Scutacaridae (TRombidiformes) from Turkmenistan — Vestn. Zool., 1: 21-28. [in Russian]

Sevastianov V.D., Zahida N.D. Al Douri. 1988 — New species of mites of cohort Tarsonemina (Trombidiformes) from wheat crops — Zool. Zhurnal., 67(7): 1080-1083. [in Russian]

Sobhi M., Hajiqanbar H., Mortazavi A. 2017a — First record of the rare genus *Lophodispus* (Acari: Heterostigmata: Scutacaridae) from Iran with description of a new species associated with ants (Hymenoptera: Formicidae) — Int. J. Acarol., 43(3): 239-244. doi:10.1080/01647954.2016.1256910

Sobhi M., Hajiqanbar H., Mortazavi A. 2017b — Two new myrmecophilous species of the genus *Scutacarus* (Acari: Prostigmata: Scutacaridae) with world keys to related species groups — Ent. Sci., 20(1): 292-301. doi:10.1111/ens.12255

Tajodin M. 2013 — Heterostigmatic Mites (Acari: Heterostigmatina) associated with insects in west of Isfahan Province [MSc Thesis] — Iran, Tehran: Tarbiat Modares University, 87pp, p. 58.

Zaloznaya L.I., Khaustov A.A. 2007 — First find of the mite *Imparipes* (*Imparipes*) *rafalskii* (Acati, Scutacaridae) in Ukraine — Vestn. Zool., 41(3): 266 [in Russian]

Zhang Z.-Q., Fan Q.-H., Pesic V., Smit H., Bochkov A.V., Khaustov A.A., Baker A., Wohltmann A., Wen T.-H., Amrine J.W., Beron P., Lin J.-Z., Gabrys G., Husband R. 2011 — Order Trombidiformes Reuter, 1909. In: Zhang, Z-Q. (ed.) Animal biodiversity: an outline of higher-level classification and survey of taxonomic richness — Zootaxa, 3148: 129-138.

COPYRIGHT