Iranian Journal of Animal Biosystematics (IJAB)
Vol.18, No.2, 109-120, 2022
DOI: 10.22067/ijab.2022.76689.1031

IJAB
ISSN: 1735-434X (print); 2423-4222 (online)

RESEARCH ARTICLE Open access

Edaphic Mesostigmata mites in central Iran: Twelve new country and local records

Maryam Karbasian[1], Alireza Jalali Zand[1*], Hadi Ostovan[2], & Ebrahim Soleiman Nejadian[1]

[1]Department of Plant Protection, Faculty of Agriculture, Isfahan (Khorasgan) Branch, Islamic Azad University, Isfahan, Iran
[2] Department of Plant Protection, Faculty of Agriculture, Shiraz Branch, Islamic Azad University, Fars, Iran

(Received: *15 May 2022*; Accepted: *08 October 2022*)

Abstract
Agroecosystems containing edaphic Mesostigmata are considered important predators of nematodes, collembola, and insects, and those living on plants may be effective at controlling pests like spider mites. In this research study we provide new information about Edaphic Mesostigmata mites known from Isfahan in central Iran based on new field collection. In this publication, we give records of thirty-two edaphic species belong to 13 families, and 25 genera collected in Isfahan province (Iran), which four species are new records for the Iran (indicated as a rec. new). Twelve new provincial distribution records viz., *Asca aphidioides* (Linnaeus, 1758), *Blattisocius tarsalis* (Berlese, 1918), *Cosmolaelaps claviger* (Berlese, 1883), *Gaeolaelaps neoaculeifer* (Hrischmann, 1966) a rec. new, *Gymnolaelaps obscuroides* (Costa, 1968), *Hypoaspis quadridentatus* (Allred, 1970) a rec. new, *Hypoaspisella asperatus* (Berlese, 1904) a rec. new, *Hypoaspisella patagoniensis* (Sheals, 1962) a rec. new, *Neoseiulus bicadus* (Wainstein, 1962), *Parasitus mycophilus* (Karg, 1971), *Pogonolaelaps canestrinii* (Berlese, 1903), *Polyaspis berlesei* (Camin, 1954) are presented.

Key words: *Mesostigmata, new records, distribution, Iran, Agroecosystem.*

INTRODUCTION

Soil is one of the most important and diverse ecological habitats (Dustar Sharaf et al., 2016). Soil organisms play an important role in performing soil functions in the environmental system and can be used as indicators to assess soil quality (Schloter et al., 2003). Arthropods are an important component of soil fauna and mites are considered to be the best representatives of arthropods in the soil due to their species diversity, ecological niche and behavior (Bedano et al., 2005). Mites are used as an indicator of soil quality and to inform the soil status of agricultural and forestry environments (Speight et al., 2008).

The number of Iranian Mesostigmata except for the Phytoseiidae family is 348 species belonging to 128 genera from 39 families and 17 superfamilies (Kazemi & Rajaei 2013), while there are more than 12,000 species of Mesostigmata in the world. Comparison of these two numbers shows that the faunistic study of Iranian Mesostigmata mites requires more extensive and more serious studies (Abbaspour et al., 2017). Soil type, moisture, pH, and geographical location cause differences in the density of mites in the soil (Manu, 2013). Management strategies, the vegetation of forests, and human activities can play a significant role in reducing the quantity and quality of Mesostigmata mites in terms of the diversity of

Corresponding Author: arjalalizand@gmail.com

species (Sabbatini et al., 2011). The diversity of soil mites in habitats with more vegetation and of course pristine is higher compared to habitats with less vegetation and use pesticides and chemical fertilizers (Perez Velazquez et al., 2011).

The study of Mesostigmata mite diversity in green space determines the stability and dynamics of the ecosystem, soil quality and evaluation of management in green space (Maleki et al., 2016). So far, little research has been done in this field in Iran and the world. During the study of soil Mesostigmata mites in parks located in Kerman (Iran), 21 species belonging to 17 genera were identified and only reported one species for the first time from Iran (Kazemi, 2011). In another study, the biodiversity of soil inhabiting Mesostigmata was studied in one of the parks of Tehran and it was found that species diversity is directly related to soil moisture, pH and diversity of vegetation and management applied to the soil. The highest biodiversity was reported in the third quarter of the year and the lowest in the first quarter of the year (Maleki et al., 2016).

This paper contributes to improving baseline biodiversity knowledge of edaphic Mesostigmata mites in central Iran by providing twelve new provincial species records including four new records to Iran. Preparation of a full list of the Iranian edaphic mite species increments our ability to deduce biogeographical patterns and make foresight about their biodiversity. Furthermore, upkeep current records of edaphic mites of Iran can assist us in documenting presented, or anything exclusively relevant to the study of Mesostigmata mites.

MATERIAL AND METHODS

Faunistic study of soil mites in urban green spaces of Isfahan from 24 stations -each of which had different characteristics in terms of vegetation, ecological and geographical aspects - in four seasons (six times per season) was done in 2019 (Table 1). Samples were randomly selected from four points in each station and in a zigzag pattern once every 15 days from a depth of 10–15 cm of soil surface by shovel and in the amount of 500 cm^3 and poured into dark plastic bags and subsequently labeled with information on each the bag separately. The bags containing the samples were then transported to the laboratory. The soil samples of each station were mixed together and a sample of this mixture at a rate of one kilogram was placed in a Berlese funnel for 48 to 72 hours. Collected mites were separated under a stereomicroscope (Olympus, Japan) using special needles and in AG solution (95 parts **A**lcohol 70% + 5 parts **G**lycerin 1–3%). Afterward, the specimens were transferred to small containers containing the lactic acid in order to clear the mites. After clarification, the specimens were mounted using Hoyer fixation solution. The prepared slides were identified according to valid taxonomic sources. A number of samples were also sent to Iranian acarologists for approval. The mite species information is included in table 2.

RESULTS

Following is a list of all the species that were collected and could be identified. A total of thirty-two species belong to 13 families, and 25 genera are treated that contains four new records for Iran (indicated as rec. new). Twelve new provincial distribution records *viz.*, *Asca aphidioides* (Linnaeus, 1758), *Blattisocius tarsalis* (Berlese, 1918), *Cosmolaelaps claviger* (Berlese, 1883), *Gaeolaelaps neoaculeifer* (Hrischmann, 1966) rec. new, *Gymnolaelaps obscuroides* (Costa, 1968), *Hypoaspis quadridentatus* (Allred, 1970) rec. new, *Hypoaspisella asperatus* (Berlese, 1904) rec. new, *Hypoaspisella patagoniensis* (Sheals, 1962) rec. new, *Neoseiulus bicadus* (Wainstein, 1962), *Parasitus mycophilus* (Karg, 1971), *Pogonolaelaps canestrinii* (Berlese, 1903), *Polyaspis berlesei* (Camin, 1954) are presented.

List the Mesostigmata species in the urban green spaces of central Iran (Isfahan province)

Kingdom Animalia Linnaeus, 1758
Phylum Arthropoda von Siebold, 1848
Subphylum Chelicerata Heymons, 1901
Class Arachnida Lamarck, 1801
Superorder Parasitiformes Leach, 1815
Order Mesostigmata G. Canestrini, 1891

FIGURES 1–2. Sampling areas in the Isfahan province, Iran. 1. Area 1 (East); 2. Area 2 (West).

FIGURES 3–4. Sampling areas in the Isfahan province, Iran. 3. Area 3 (North); 4. Area 4 (South).

FIGURE 5. Sampling area 5 (Center) in the Isfahan province, Iran.

Family Ameroseiidae Evans, 1961
Ameroseius lidiae Bregetova, 1997 (Figs 6–13)
Distribution in Iran. Fars, Kerman, Zanjan provinces (Kazemi & Rajaei 2013).

Ameroseius plumosus (Oudemans, 1902) (Figs 14–17)
Distribution in Iran. East Azerbaijan, Isfahan, Khuzestan, Sistan and Baluchestan, West Azerbaijan provinces (Kazemi & Rajaei 2013).

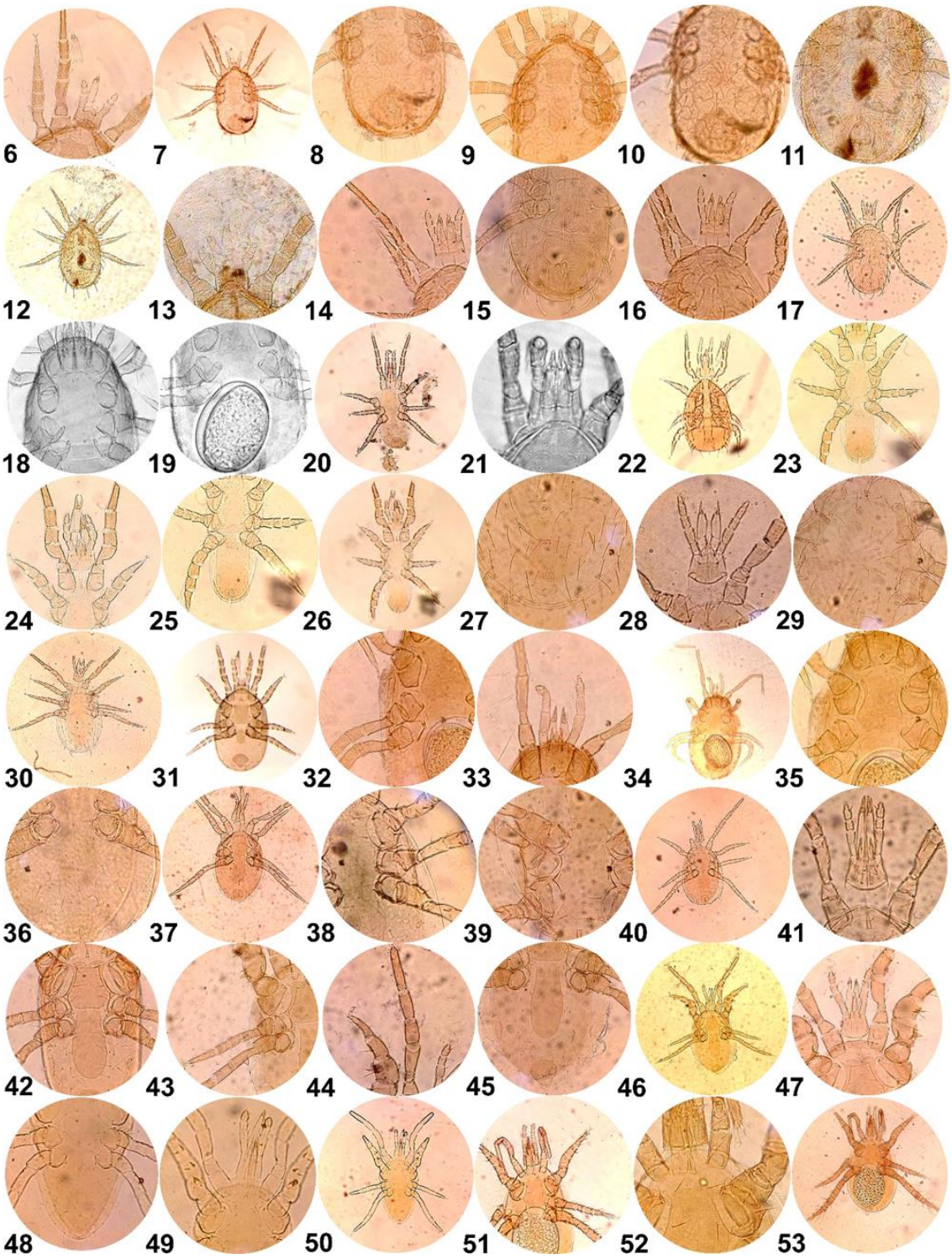
Family Ascidae Voigts & Oudemans, 1905
Antenoseius bacatus Athias-Henriot, 1961 (Figs 18–19)
Distribution in Iran. Chaharmahal and Bakhtiari, Fars, Kerman, Kohkiluyeh and Boyer-Ahmad, Khuzestan provinces (Kazemi & Rajaei 2013).

Arctoseius cetratus (Sellnick, 1940) (Fig. 20)
Distribution in Iran. Alborz, Chaharmahal and Bakhtiari, Fars, Golestan, Guilan, Hamedan, Isfahan, Kerman, Khuzestan, Kohkiluyeh and Boyer-Ahmad, Semnan, Tehran, West Azerbaijan, Zanjan provinces (Kazemi & Rajaei 2013).

Arctoseius pristinus Karg, 1962 (Fig. 21)
Distribution in Iran. Isfahan province (Kadkhodae Eliaderani et al. 2013).

Asca aphidioides (Linnaeus, 1758) (Fig. 22)
Distribution in Iran. Golestan, Kohkiluyeh and Boyer-Ahmad, Mazandaran provinces (Kazemi & Rajaei 2013).

Protogamasellus massula (Athias Henriot, 1961) (Figs 23–26)
Distribution in Iran. Fars, Isfahan, Kerman, Semnan, Tehran, West Azerbaijan provinces (Kazemi & Rajaei 2013).



Figures 6–53. 6–13. *Ameroseius lidiae* Bregetova, 1997; 14–17. *Ameroseius plumosus* (Oudemans, 1902); 18–19. *Antenoseius bacatus* Athias-Henriot, 1961; 20. *Arctoseius cetratus* (Sellnick, 1940); 21. *Arctoseius pristinus* Karg, 1962; 22. *Asca aphidioides* (Linnaeus, 1758); 23–26. *Protogamasellus massula* (Athias Henriot, 1961); 27–30. *Blattisocius tarsalis* (Berlese, 1918); 31. *Alliphis halleri* (G. & R.Canestrini, 1881); 32–35. *Cosmolaelaps claviger* (Berlese, 1883); 36–41. *Cosmolaelaps lutegiensis* (Shcherbak, 1971); 42–50. *Euandrolaelaps karawaiewi* (Berlese, 1903); 51–53. *Gaeolaelaps aculeifer* (Canestrini, 1884).

Family Blattisociidae Garman, 1948
Blattisocius tarsalis (Berlese, 1918) (Figs 27–30)
Distribution in Iran. Fars, Golestan, Guilan provinces (Kazemi & Rajaei 2013).

Family Eviphididae Berlese, 1913
Alliphis halleri (G. & R. Canestrini, 1881) (Fig. 31)
Distribution in Iran. East Azerbaijan, Fars, Golestan, Hamedan, Isfahan, Kerman, Markazi, North Khorasan, Tehran, West Azerbaijan provinces (Kazemi & Rajaei 2013).

Family Laelapidae Berlese, 1892
Cosmolaelaps claviger (Berlese, 1883) (Figs 32–35)
Distribution in Iran. Tehran province (Ramroodi et al. 2014).

Cosmolaelaps lutegiensis (Shcherbak, 1971) (Figs 36–41)
Distribution in Iran. Golestan, Guilan, Isfahan, Kerman, Mazandaran, Tehran, West Azerbaijan provinces (Kazemi & Rajaei 2013).

Euandrolaelaps karawaiewi (Berlese, 1903) (Figs 42–50)
Distribution in Iran. Chaharmahal and Bakhtiari, Fars, Guilan, Hamedan, Isfahan, Kerman, Khuzestan, Kohkiluyeh and Boyer-Ahmad, Markazi, Razavi Khorasan, Tehran, West Azerbaijan, Yazd, Zanjan provinces (Kazemi & Rajaei 2013).

Gaeolaelaps aculeifer (Canestrini, 1884) (Figs 51–55)
Distribution in Iran. Chahrmahal and Bakhtiari, East Azerbaijan, Fars, Golestan, Guilan, Hamedan, Isfahan, Kerman, Khuzestan, Markazi, Mazandaran, Razavi Khorasan, Sistan and Baluchestan, Tehran, West Azerbaijan, Yazd, Zanjan provinces (Kazemi & Rajaei 2013).

Gaeolaelaps neoaculeifer (Hrischmann, 1966), rec. new, (Figs 56–62)
Distribution in Iran. Isfahan province (present study).

Gaeolaelaps queenslandica (Womersley, 1956) (Figs 63–68)
Distribution in Iran. Chaharmahal and Bakhtiari, Fars, Guilan, Isfahan, Kerman, Khuzestan, Mazandaran, Razavi Khorasan, Tehran, West Azerbaijan, Yazd provinces (Kazemi & Rajaei 2013).

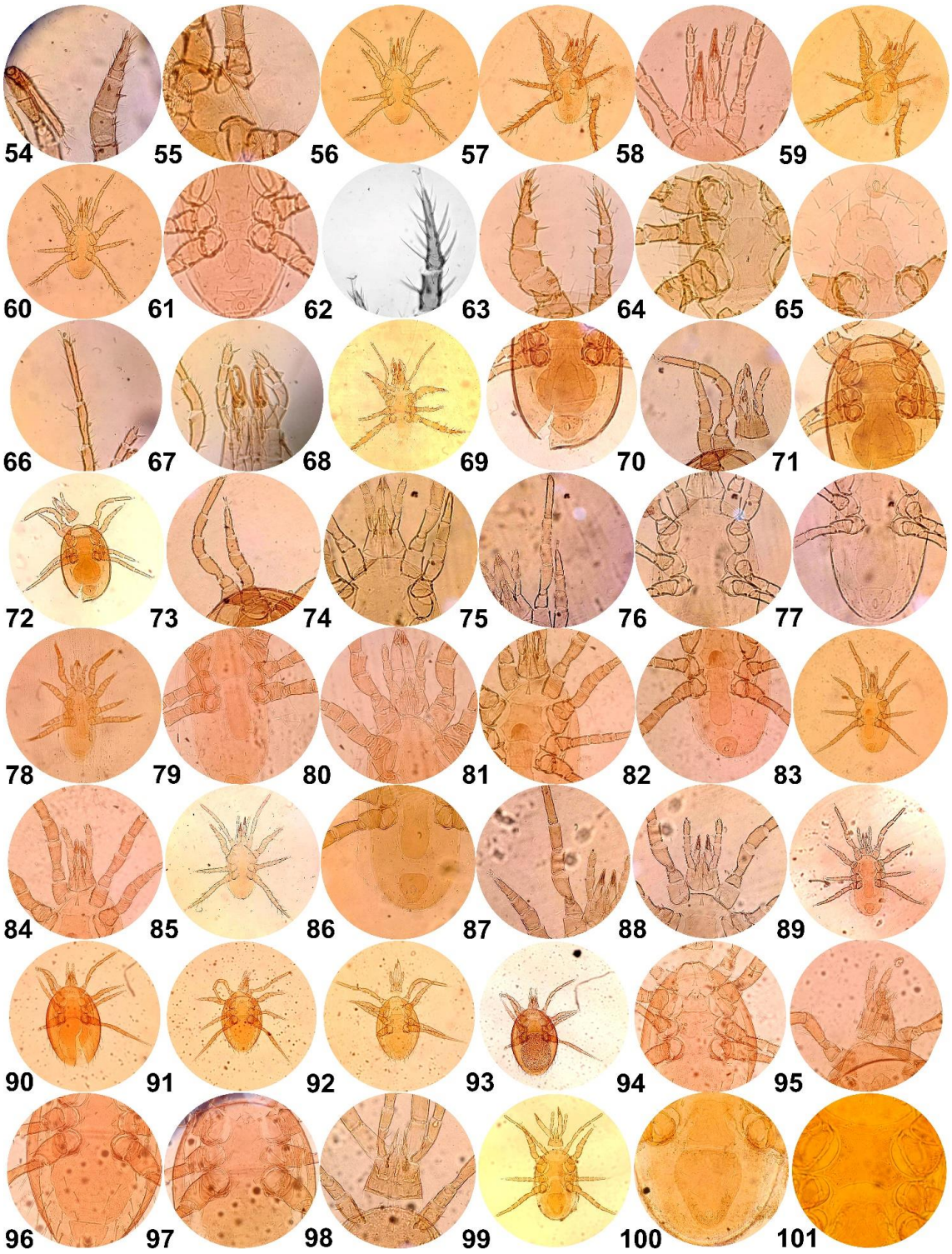
Gymnolaelaps obscuroides (Costa, 1968) (Figs 69–73)
Distribution in Iran. Fars, Isfahan provinces (Kazemi & Rajaei 2013).

Haemolaelaps shealsi (Costa, 1968) (Figs 74–77)
Distribution in Iran. Fars, Razavi Khorasan, Sistan and Baluchestan, Tehran, West Azerbaijan provinces (Kazemi & Rajaei 2013).

Hypoaspis quadridentatus (Allred, 1970), rec. new, (Figs 78–80)
Distribution in Iran. Isfahan province (present study).

Hypoaspisella asperatus (Berlese, 1904), rec. new, (Figs 81–84)
Distribution in Iran. Isfahan province (present study).

Hypoaspisella patagoniensis (Sheals, 1962), rec. new, (Fig. 85)
Distribution in Iran. Isfahan province (present study).



FIGURES 54–101. 54–55. *Gaeolaelaps aculeifer* (Canestrini, 1884); **56–62.** *Gaeolaelaps neoaculeifer* (Hrischmann, 1966); **63–68.** *Gaeolaelaps queenslandica* (Womersley, 1956); **69–73.** *Gymnolaelaps obscuroides* (Costa, 1968); **74–77.** *Haemolaelaps shealsi* (Costa, 1968); **78–80.** *Hypoaspis quadridentatus* (Allred, 1970); **81–84.** *Hypoaspisella asperatus* (Berlese, 1904); **85.** *Hypoaspisella patagoniensis* (Sheals, 1962); **86–89.** *Pneumolaelaps sclerotarsus* costa, 1968; **90–97.** *Pogonolaelaps canestrinii* (Berlese, 1903); **98–101.** *Macrocheles insignitus* (Berlese, 1918).

Pneumolaelaps sclerotarsus costa, 1968 (Figs 86–89)
Distribution in Iran. Chaharmahal and Bakhtiari, East Azerbaijan, Fars, Guilan, Hamedan, Isfahan, Kerman, Khuzestan, Kohkiluyeh and Boyer-Ahmad, Tehran, Zanjan provinces (Kazemi & Rajaei 2013).

Pogonolaelaps canestrinii (Berlese, 1903) (Figs 90–97)
Distribution in Iran. Tehran province (Kazemi & Rajaei 2013).

Family Macrochelidae Vitzthum, 1930
Macrocheles insignitus (Berlese, 1918) (Figs 98–101)
Distribution in Iran. Chaharmahal and Bakhtiari, Golestan, Kerman, Kerman, Mazandaran, North Khorasan, Zanjan provinces (Kazemi & Rajaei 2013).

Family Melicharidae Hirschmann, 1962
Proctolaelaps pygmaeus (Müller, 1859) (Figs 102–105)
Distribution in Iran. Bushehr, Chaharmahal and Bakhtiari, Fars, Guilan, Hamedan, Isfahan, Kerman, Khuzestan, Kordestan, Lorestan, Mazandaran, Semnan, West Azerbaijan, Zanjan provinces (Kazemi & Rajaei 2013).

Family Pachylaelapidae Berlese, 1913
Onchodellus karawaiewi (Berlese, 1920) (Figs 106–107)
Distribution in Iran. Chaharmahal and Bakhtiari, East Azerbaijan, Fars, Golestan, Hamedan, Kerman, Kerman, Kermanshah, Khuzestan, Markazi, Mazandaran, North Khorasan, Razavi Khorasan, Tehran, West Azerbaijan provinces (Kazemi & Rajaei 2013).

Family Parasitidae Oudemans, 1901
Parasitus mycophilus (Karg, 1971) (Figs 108–111)
Distribution in Iran. Fars, Hamedan, Kerman, Razavi Khorasan, Tehran, West Azarbaijan provinces (Kazemi & Rajaei 2013).

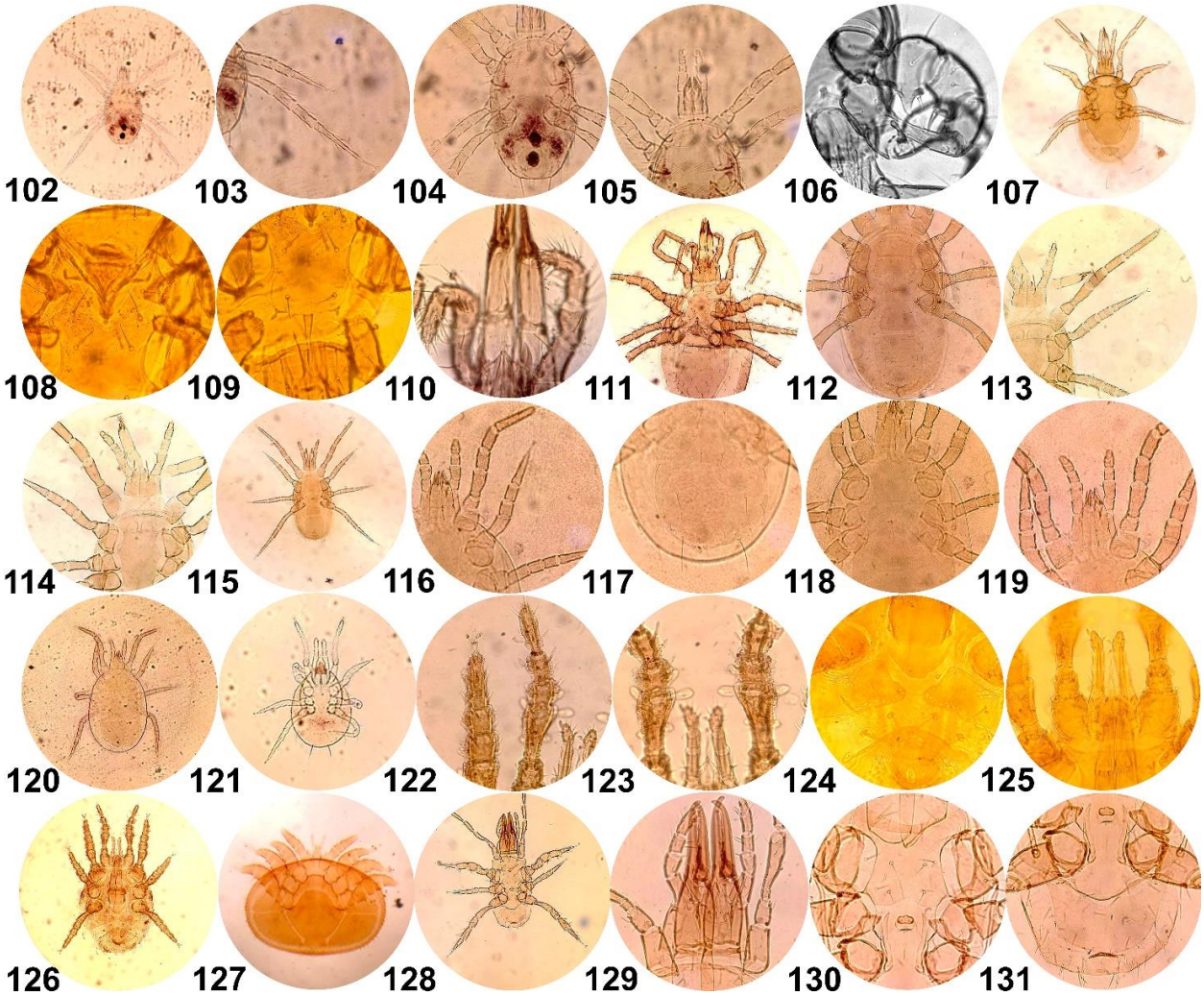
Family Phytoseiidae Berlese, 1916
Neoseiulus barkeri Hughes, 1948 (Figs 112–115)
Distribution in Iran. Isafahan, Kurdistan, Lorestan, Zanjan provinces (widely distributed; e.g., Jafari et al. 2011).

Neoseiulus bicaudus (Wainstein, 1962) (Figs 116–120)
Distribution in Iran. Ardebil, Isafahan, Kurdistan provinces (widely distributed; e.g., Rahmani et al. 2010).

Proprioseiopsis messor (Wainstein, 1960) (Fig. 121)
Distribution in Iran. Fars, Isafahan, Kurdistan, Razavi Khorasan provinces (widely distributed; e.g., Panahi Laeen et al. 2014).

Family Polyaspididae Berlese, 1913
Polyaspis berlesei (Camin, 1954) (Figs 122–126)
Distribution in Iran. Isafahan, Hormozgan provinces (widely distributed; e.g., Nemati et al. 2018).

Family Varroidae Delfinado & Baker, 1974
Varroa destructor Anderson & Trueman, 2000 (Fig. 127)



FIGURES 102–131. 102–105. *Proctolaelaps pygmaeus* (Müller, 1859); 106–107. *Onchodellus karawaiewi* (Berlese, 1920); 108–111. *Parasitus mycophilus* (Karg, 1971); 112–115. *Neoseiulus barkeri* Hughes, 1948; 116–120. *Neoseiulus bicaudus* (Wainstein, 1962); 121. *Proprioseiopsis messor* (Wainstein, 1960); 122–126. *Polyaspis berlesei* (Camin, 1954); 127. *Varroa destructor* Anderson & Trueman, 2000; 128–131. *Veigaia planicola* (Berlese, 1892).

Distribution in Iran. Ardebil, Bushehr, Chaharmahal and Bakhtiari, Fars, Guilan, Isfahan, Kerman, Kermanshah, Khuzestan, Mazandaran, North Khorasan, Qazvin, Razavi Khorasan, Sistan and Baluchestan, South Khorasan, Tehran, Yazd provinces (Kazemi & Rajaei 2013; Hajializadeh et al. 2019).

Family Veigaiidae Oudemans, 1939

Veigaia planicola (Berlese, 1892) (Figs 128–131)

Distribution in Iran. Ardebil, Chaharmahal and Bakhtiari, East Azarbaijan, Isfahan, Kerman, Kermanshah, Tehran, West Azarbaijan provinces (Kazemi & Rajaei 2013; Nemati et al. 2013).

TABLE 1. Five sampling areas in the parks of Isfahan province, Iran.

No. Area	Direction	Coordinates	Vegetation
1	East	32° 38' 32"N, 51°42' 50"E	Conifers and shrubs
2	West	32° 38' 17"N, 51°38' 16"E	Broad-leaved trees and vegetation
3	North	32° 40' 53"N, 51°38' 22"E	Conifers, shrubs, and vegetation
4	South	32° 35' 42"N, 51°39' 11"E	Broad-leaved trees and vegetation
5	Center	32° 38' 26"N, 51°38' 59"E	Conifers, shrubs, and vegetation

TABLE 2. Number of Mesostigmata mites for each sampling area in parks of Isfahan province, Iran.

No.	Family	Species name	Total	Area 1	Area 2	Area 3	Area 4	Area 5
1	Ascidae	*Arctoseius cetratus*	101	17	19	5	31	29
2	Pachylaelapidae	*Onchodellus karawaiewi*	78	13	28	–	23	14
3	Phytoseiidae	*Neoseiulus barkeri*	56	8	16	14	16	2
4	Ameroseiidae	*Ameroseius lidiae*	34	4	10	10	2	8
5	Laelapidae	*Euandrolaelaps karawaiewi*	32	3	3	4	18	4
6	Laelapidae	*Haemolaelaps shealsi*	26	7	–	3	16	–
7	Laelapidae	*Gaeolaelaps queenslandica*	24	–	3	2	15	4
8	Laelapidae	*Cosmolaelaps lutegiensis*	22	5	5	7	–	5
9	Laelapidae	*Pogonolaelaps canestrinii*	16	–	7	7	2	–
10	Phytoseiidae	*Proprioseiopsis messor*	11	–	5	1	–	5
11	Parasitidae	*Parasitus mycophilus*	9	–	5	–	3	1
12	Laelapidae	*Pneumolaelaps sclerotarsus*	7	–	1	2	4	–
13	Laelapidae	*Gymnolaelaps obscuroides*	7	–	6	1	–	–
14	Laelapidae	*Hypoaspisella asperatus*	7	–	–	2	3	2
15	Laelapidae	*Gaeolaelaps aculeifer*	5	3	–	–	2	–
16	Ascidae	*Asca aphidioides*	4	2	2	–	–	–
17	Laelapidae	*Cosmolaelaps claviger*	4	–	–	–	2	2
18	Varroidae	*Varroa destructor*	3	–	2	–	1	–
19	Laelapidae	*Hypoaspis quadridentatus*	3	–	3	–	–	–
20	Ascidae	*Antenoseius bacatus*	3	–	–	–	3	–
21	Ascidae	*Arctoseius pristinus*	3	–	3	–	–	–
22	Ascidae	*Protogamasellus massula*	2	–	–	2	–	–
23	Polyaspididae	*Polyaspis berlesei*	2	–	–	–	2	–
24	Phytoseiidae	*Neoseiulus bicadus*	2	–	–	2	–	–
25	Macrochelidae	*Macrocheles insignitus*	2	–	–	2	–	–
26	Ameroseiidae	*Ameroseius plumosus*	2	–	–	–	–	2
27	Melicharidae	*Proctolaelaps pygmaeus*	2	–	–	–	2	–
28	Laelapidae	*Hypoaspisella patagoniensis*	2	1	–	–	–	1
29	Laelapidae	*Gaeolaelaps neoaculeifer*	2	–	–	–	2	–
30	Eviphididae	*Alliphis halleri*	1	1	–	–	–	–
31	Veigaiidae	*Veigaia planicola*	1	–	1	–	–	–
32	Blattisociidae	*Blattisocius tarsalis*	1	1	–	–	–	–
Total			474	65	119	64	147	79

DISCUSSION

This data shows that the edaphic Mesostigmata mite fauna in Iran is poorly studied. On the basis of previously published data and current fieldwork, we believe that the Iranian edaphic Mesostigmata is exceptionally rich and there will undoubtedly be more species added to the list as more research is conducted. This is because most samplings were restricted to Kerman, and Tehran provinces (Kazemi 2011; Maleki et al., 2016) and are extremely scarce in information, while other provinces i.e., Bushehr, Semnan, Sistan and Baluchestan, South Khorasan remained unexplored.

The present study showed that the areas where broad-leaved trees were densely planted had a richer variety of soil mites than areas with predominantly coniferous vegetation or other ornamental shrubs (Table 1). This is well justified due to the higher shading level of these trees and the retention of more moisture in the soil at the base of the trees. Also, areas that were exposed to direct sunlight and had poor vegetation, such as grasslands and short ornamental shrubs, had less species diversity (Table 1). This may be due to the faster evaporation of soil moisture due to sunlight. Areas one, three and five (north,

south and center) had the lowest number of species and areas two and four (west and south) had the highest number of species. Southern parks of Isfahan, such as Soffeh Mountain Park, due to the forest ecosystem and virginity compared to other parks in Isfahan, the increase in the number of species is justified (e.g., Santamaria et al., 2012). However, considering that the central parks of Isfahan are exposed to pollutants, environmental pollution and also human manipulations, the existence of less species diversity in these areas is not far from the mind.

In order to fill this void in Iranian Sciaridae studies, we have commenced data collection for the investigation of the edaphic Mesostigmata mite fauna. The results of this study may be useful for countries in the Middle East as well from the taxonomic point of view. We hope this paper will stimulate local interest in the study of Iranian soil inhabiting Mesostigmata mite and will draw more attention to encourage researchers to study this group.

ACKNOWLEDGMENTS

We would like to thank Prof. Dr. Alireza Nemati (Shahrekord University, Iran) for their assistance in confirming of identification mites.

LITERATURE CITED

Abaspour P, Sadeghi H, Fekrat L. 2017. Soil mites of mesostigmata (Acari: Mesostigmata) in Mashhad. Journal of Plant protection, 30(4): 744-753.

Bedano JC, Cantu MP, Doucet ME. 2005. Abundance of soil mites (Arachnida: Acari) in natural soil of central Argentina. Zoological Studies 44: 505-512

Dustar sharaf M, Mirfakhraie Sh, Zargaran M.R, Azimi N. 2016. Species diversity of edaphic mesostigmatid mites (Acari: Mesostigmata) of Arasbaran forest. Journal of forest research and development, 2(1) :85-96.

Hajializadeh, Z., Asadi, M., Ahmadi, K., & Balvasi, A. (2019). *Varroa destructor* (Acari: Varroidea) populations from Southern Iran belong to haplotype K of the mitochondrial COI. Persian Journal of Acarology, 8(2).

Jafari, Sh., Fathipour, Y. & Bahirai, F. (2011) Population fluctuation and spatial distribution of *Neoseiulus barkeri* (Phytoseiidae) and its prey *Tetranychus urticae* (Tetranychidae) in cucumber fields of Khorramabad, Iran. In: Kazemi, S. & Saboori, A. (eds.), Abstract and proceeding book of the First Persian Congress of Acarology, Kerman, Iran, p. 94.

Kadkhodae Eliaderani, F., Nemati, A., & Kocheili, F. (2013). Some mesostigmatid mites from Iran with their world distribution. Journal of Crop Protection, 2(2), 127-138.

Kazemi, N. 2011. Mites (Acari) in the public opinion and importance of the (Mesostigmata) in agricultural ecosystems. National Conference on Conservation of Biodiversity and Indigenous, Kerman.

Kazemi, Sh. & Rajaei, A. 2013. An annotated checklist of Iranian Mesostigmata (Acari) excluding the family phytoseiidae. Persian Journal of Acarology, 2(1): 63-158.

Maleki Sh, Ostovan H, Baniameri V and Joharchi O. 2016. Biodiversity of mesostigmatic soil mite fauna (Acari: Mesostigmata) of a city park located in Tehran, Iran. Journal of Entomological Society of Iran, 36 (3): 181-194.

Manu M. 2013. Diversity of soil mites (Acari: Mesostigmata: Gamasina) in various deciduous forest ecosystems of Muntenia region (southern Romania). Biological Lett, 50(1): 3–16.

Nemati, A., Gwiazdowicz, D. J., Riahi, E., & Mohseni, M. (2013). Catalogue of Mesostigmatid mites of Iran. Part 4: Parasitidae, Veigaiidae and Zerconidae. Acarologia, 53(3), 263-271.

Nemati, A., Riahi, E., Khalili-Moghadam, A., & Gwiazdowicz, D. J. (2018). A catalogue of the Iranian Mesostigmata (Acari): additions and updates of the previous catalogue. Persian journal of Acarology, 7(2).

Perez-Velazquez D, Castano-Meneses A, Callejas-Chavero GA, Palacios-Vargas J. 2011. Mesostigmatid mite (Acari: Mesostigmata) diversity and abundance in two sites in Pedregal de San Angel Ecological Reserve, Distrito Federal, Mexico. Zoosymposia 6, 255-259.

Rahmani, H., Kamali, K., & Faraji, F. (2010). Predatory mite fauna of Phytoseiidae of northwest Iran (Acari: Mesostigmata). Turkish Journal of Zoology, 34(4), 497-508.

Ramroodi, S., Hajizadeh, J., & Joharchi, O. (2014). Two new species of Cosmolaelaps Berlese (Acari: Laelapidae) from Iran. Zootaxa, 3847(4), 533-544.

Sabbatini Peverieri G, Romano M, Pennacchio F, Nannelli R, Roversi PF. 2011. Gamasid soil mites (Arachnida Acari) as indicators of the conservation status of forests. Redia 4,53-58.

Santamaria, J.M., Moraza, M.L., Elustondo, D., Baquero, E., Jordana, R., Bermejo, R. and Arino, A.H. 2012. Diversity of Acari and Collembola along a pollution gradient in soils ofa pre-pyrenean forests ecosestem. Environmental Engineering and Management Journal, 11(6): 1159–1169.

Schloter M, Dilly O, Munch Jc. 2003. Indicators for evaluating soil quality. Agriculture, Ecosystems and Environment, 98: 255-262.

Speight MR, Hunter MD, white AD. 2008. Ecology of insects: concepts and applications [Translated by Ashori, A. & Kheradpir, NJ. Tehran University publishing, 579pp.