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ABSTRACT — A catalogue of Parasitidae, Veigaiidae and Zerconidae (Acari: Mesostigmata) families from Iran is presented. Based on information from published studies, the following taxa are known to inhabit the various parts of this country: 10 genera and 21 determined species of Parasitidae, 2 genera and 4 determined species of Veigaiidae and 2 genera and 1 identified species of Zerconidae.

KEYWORDS — catalogue; Acari; Mesostigmata; Parasitidae; Veigaiidae; Zerconidae

INTRODUCTION

The mites of the family Parasitidae form one of the dominant components of the hemiedaphic fauna of temperate soils and of temporary accumulations of organic debris. They are free-living and predatory, feeding on the eggs and immature stages of other soil-inhabiting microarthropods and nematodes (Evans and Till, 1979). Its two constituent subfamilies, the Parasitinae and Pergamasinae, have been treated as separate families in some work (Woolley, 1988). Systematists have disagreed on the number of genera, subgenera, and species represented in the family. For example, parasitids are classified into relatively few genera by some authors (Micherdzinski, 1969; Tichomirov, 1969), but into considerably more by others (Athias-Henriot 1965, 1967a,b,c, 1968, 1969, 1971, 1972a,b, 1977, 1979a,b,c,d, 1980, 1982a,b; Evans and Till, 1979). The Iranian mite fauna of the family Parasitidae comprises representatives of both subfamilies.

The family Veigaiidae is well-defined, morphologically homogeneous, and has a stable and generally-accepted genus-level classification (Masan et al., 2008). This family contains three described genera: Cyrhydrolaelaps Berlese, Gamasolaelaps Berlese and Veigaia Oudemans (Krantz and Walter, 2009). Only two of the known genera have been recorded in Iran, namely Veigaia and Gamasolaelaps Berlese and Veigaia Oudemans (Krantz and Walter, 2009). Only two of the known genera have been recorded in Iran, namely Veigaia and Gamasolaelaps, with most of the recorded species in the genus Veigaia. Species of the genus Veigaia are free-living and are mostly associated with soil, decomposed litter, leaf mould, plant parts, mammalian nests etc. This genus is estimated to include around 70 species world-wide (Bhattacharyya, 2006). In Iran, five species of genus Veigaia, as well as two unknown species (Veigaia sp.), have been reported to date.

Members of the family Zerconidae are widely prevalent in the Holarctic region and are repre-
sented by 35 genera and more than 300 species. They are all free-living predators, occurring mostly in moss and leaf litter, and constitute an important part of the soil fauna (Ujvari, 2008). The Iranian fauna of Zerconidae is currently unknown. The only mentioned species from Iran is Prozercon cf. traegardhi (Halbert), which was reported from the Hamadan province (Kamali et al., 2001).

The purpose of this paper is to summarize previous works and complete these records with new distributional data in order to provide a complete catalogue of the mentioned mite families in the different microhabitats of Iran. This is the fourth part of our catalogue of Iranian mesostigmatid mites. In three previous works, we dealt with other mesostigmatid families as follows: Ascidae (part 1), Blattisosociidae (part 2) and Ameroseiidae (part 3) (Nemati et al. 2012a,b; Nemati et al., 2013).

MATERIALS AND METHODS

The information on recorded species and their habitats or hosts were obtained from previous records in the literature about the mite fauna of Iran. In addition, new records and new distributional data of previously recorded species were provided following the procedures outlined below.

Materials were collected sporadically from different microhabitats and different parts of Iran. The soil mesofauna was extracted from the samples with Berlese funnels. The specimens were collected in beakers of 75 % ethanol, and then fixed on permanent slides in Hoyer’s medium. The list of species was sorted by genera in each family, and includes sampling information (date of collection, locality, microhabitat or host). For some localities, only the name of province was presented.

Except for newly recorded taxa and previously published by authors of this paper, we can not confirm the identification of the reported species.

RESULTS AND DISCUSSION

Based available published studies a total of 10 genera and 21 determined species of Parasitidae, 2 genera and 4 determined species of Vegaiidae and 2 genera and 1 identified species of Zerconidae, are known to inhabit the various parts of Iran. Some undetermined species in various genera are also present.

Family Parasitidae Oudemans, 1901

Genus Amblygammasus Berlese, 1903

Jalaeian et al. (2004) reported an undetermined species of this genus from soil of fruit orchards, Esfahan (32°39’37”N, 51°41’22”E, H: 1608 m).

Genus Eugamasus Berlese, 1893

Two unidentified species of this genus were recorded from the Khuzestan province (31°19’22”N, 48°40’50”E, H: 16 m) in honey bee hives (Mosaddegh, 1997; Ostovan and Mosaddegh, 1999) and from soil from Tehran (35°42’2”N, 51°21’20”E, H: 1200 m) (Kamali et al., 2004).

Genus Gamasodes Oudemans, 1939

Jalaeian et al. (2004) reported a species of this genus as Gamasodes sp. from soil of fruit orchards, Esfahan (32°39’37”N, 51°41’22”E, H: 1608 m).

Genus Holoparasitus Oudemans, 1936

Holoparasitus minimus (Holzmann, 1955)

Recorded in the provinces of Semnan (35°15’17”N, 53°51’03”E, H: 1117 m) and Tehran (35°42’2”N, 51°21’20”E, H: 1200 m) in leaf compost (Kamali et al., 2001).

Two species of this genus were reported as Holoparasitus sp. by Jalaeian et al. (2006) and Farshiani et al. (2010) from the orchards of Esfahan (32°39’37”N, 51°41’22”E, H: 1608 m) and the soil of Eucalyptus camaldulensis plants, respectively.

Genus Leptogamasus Tragardh, 1936

Leptogamasus bidens (Sellnick, 1950)

Recorded from Tehran (35°42’2”N, 51°21’20”E, H: 1200 m) in soil (Pakyari et al., 2006).

Leptogamasus leruthi (Cooreman, 1951)
Recorded in the provinces of Semnan (35°15'17"N, 53°51'03"E, H: 1117 m) and Tehran (35°42'2"N, 51°21'20"E, H: 1200 m) from buttonwood, leaf compost and livestock manure (Kamali et al., 2001).

Genus Neogamasus Tichomirov, 1969

Neogamasus cervicornis (Van-Daele, 1975)
Recorded from Shiraz (29°37'32"N, 52°31'08"E, H: 1810 m) in orchard soil (Khezri et al., 2006).


Jalaeian et al. (2004) reported an undetermined species of this genus from Esfahan (32°39'37"N, 51°41'22"E, H: 1608 m) in fruit orchard soils.

Neogamasus islandicus (Sellnick, 1940)
Recorded in Tehran (35°42'2"N, 51°21'20"E, H: 1200 m) from soil (Pakyari et al., 2006).

Genus Parasitus Latreille, 1795

Parasitus americanus (Berlese, 1905)
Recorded from Esfahan (32°39'37"N, 51°41'22"E, H: 1608 m) on alfalfa (Hatami, 1991; Modarres-Awal, 1997).

Parasitus cavernicolus (Tragardh, 1912)
Recorded from the provinces of Semnan (35°15'17"N, 53°51'03"E, H: 1117 m) and Tehran (35°42'2"N, 51°21'20"E, H: 1200 m) from bird nests (Kamali et al., 2001).

Parasitus concolor (Oudemans and Voigts, 1904)
Recorded from the provinces of Semnan (35°15'17"N, 53°51'03"E, H: 1117 m) and Tehran (35°42'2"N, 51°21'20"E, H: 1200 m) in livestock manure (Kamali et al., 2001).

Parasitus congener (Oudemans and Voigts, 1904)
Recorded from the provinces of Semnan (35°15'17"N, 53°51'03"E, H: 1117 m) and Tehran from cattle carcasses and livestock manure (Kamali et al., 2001).

Parasitus consanguineus Oudemans and Voigts, 1904
Recorded in soils from Hamedan (34°18'51"N, 47°3'54"E) (Rijab area) (Babak-fard et al., 2008); from bird nests in Chaharmahal Va Bakhtiyari and Esfahan provinces (Keivani et al., 2012); from Bojnourd (20°37'N, 50°57'E, H: 1210 m) in soils of farms, gardens and manure (Mahpikaran et al., 2012); in West Azarbaijan (37°32'59"N, 45°4'32"E, H: 1349 m), Khoy region, from the soil of sunflower field (Taher et al., 2012). New Records: Shahrekord (32°19'39"N, 50°51'35"E, H: 2206 m), Baghmalek (31°31'22"N, 49°53'8"E, H: 707 m) (Khuzestan province), Ghale-tol (31°37'55"N, 49°53'20"E, H: 885 m), and Izeh (31°49'52"N, 49°52'9"E, H: 845 m) (Khuzestan province) in soil samples, coll., A. Nemati, 2011 and 2012.
Parasitus beta Oudemans and Voigts, 1904
Recorded in the provinces of Semnan (35°15′17″N, 53°51′03″E, H: 1117 m) and Tehran (35°42′2″N, 51°21′20″E, H: 1200 m) from leaf compost and livestock manure (Kamali et al., 2001); from Tehran (35°42′2″N, 51°21′20″E, H: 1200 m) in soil (Pakyari et al., 2006).

Kamali et al. (2001) and Pakyari et al. (2006) recorded this species as P. eta Oudemans and Voigts, 1904, while P. eta has been considered as a junior synonym of P. beta (Karg, 1993).

Parasitus fimetorum (Berlese, 1903)
Recorded in the provinces of Mazandaran (36°33′46″N, 53°3′15″E, H: 39 m), Semnan (35°15′17″N, 53°51′03″E, H: 1117 m) and Tehran (35°42′2″N, 51°21′20″E, H: 1200 m) from ash, butternutwood, chicken manure, decaying, honey bee hives, leaf compost, livestock manure and bird nests (Mosaddegh, 1997; Kamali et al., 2001); from soils in Ahwaz (31°19′22″N, 48°40′50″E, H: 16 m) (Baharloo et al., 2006), Kerman (30°16′39″N, 57°3′53″E, H: 1763 m) (Masnavipour et al., 2011), Orumieh (37°32′59″N, 45°4′32″E, H: 1349 m) (Rezaie et al., 2011), and Deh-Bakri (Bam region) (29°06′N, 58°21′E, H: 1060 m) (Mehrzad et al., 2012); from Khorasan Razavi (36°18′4″N, 59°35′24″E, H: 989 m) on gladiole corms and saffron (Baradaran Anaraki et al., 2012); from Bojnourd (20°37′N, 50°57′E, H: 1210 m) in the soil of farms, gardens and manure (Mahpikaran et al., 2008).

New Records: Esfahan (32°39′37″N, 51°41′22″E, H: 1608 m), Shahrekord (32°19′39″N, 50°51′35″E, H: 2206 m), Baghmalek (31°31′22″N, 49°53′8″E, H: 707 m) (Khuzestan province), Izeh (31°49′52″N, 49°52′9″E, H: 845 m) in soil samples, coll. A. Nemati, 2011 and 2012.

Parasitus hyalinus (Willmann, 1949)
Recorded in Esfahan (32°39′37″N, 51°41′22″E, H: 1608 m), Semnan (35°15′17″N, 53°51′03″E, H: 1117 m) and Tehran provinces (35°42′2″N, 51°21′20″E, H: 1200 m) from alfalfa, a rat carcass, livestock manure, bird nests and pomegranates (Hatami, 1991; Modarres-Awal, 1997; Kamali et al., 2001); from orchards in Esfahan (32°39′37″N, 51°41′22″E, H: 1608 m) (Jalaeian et al., 2006); West Azarbaijan province (37°32′59″N, 45°4′32″E, H: 1349 m), and in the Salmas region (Alizadeh and Shirdel, 2012); from soils in Jiroft (28°40′41″N, 57°44′26″E, H: 682 m) (Balooch-shahroney et al., 2012).

Parasitus insignis (Holzmann, 1955)
Recorded from livestock manure in Semnan (35°15′17″N, 53°51′03″E, H: 1117 m) and Tehran (35°42′2″N, 51°21′20″E, H: 1200 m) (Kamali et al., 2001); from soil in Tehran (35°42′2″N, 51°21′20″E, H: 1200 m) (Pakyari et al., 2006).

Parasitus mammillatus (Berlese, 1904)
Recorded in Fars (29°37′32″N, 52°31′8″E, H: 1810 m) and Hamedan (34°45′24″N, 48°39′32″E, H: 1887 m) from alfalfa, onion and Trifolium sp. (Kamali et al., 2001); from orchards in Esfahan (32°39′37″N, 51°41′22″E, H: 1608 m) (Jalaeian et al., 2006); West Azarbaijan province (37°32′59″N, 45°4′32″E, H: 1349 m), and in the Salmas region (Alizadeh and Shirdel, 2012); from soils in Jiroft (28°40′41″N, 57°44′26″E, H: 682 m) (Balooch-shahroney et al., 2012).

Parasitus mycophilus (Karg, 1971)
Recorded from Fars (29°37′32″N, 52°31′8″E, H: 1810 m), Hamedan (34°45′24″N, 48°39′32″E, H: 1887 m) on beans, rat carcasses, livestock, manure and stored onion (Kamali et al., 2001); from Hamedan (34°45′24″N, 48°39′32″E, H: 1887 m) on bean only (Khanjani and Kamali, 2000); from soil in Marvdasht, (Soleimani et al., 2011); in apple orchards of West Azarbaijan province (37°32′59″N, 45°4′32″E, H: 1349 m), Salmas region (Alizadeh and Shirdel, 2012).

Parasitus nolli (Karg, 1965)
Recorded from Semnan (35°15′17″N, 53°51′03″E, H: 1117 m) and Tehran (35°42′2″N, 51°21′20″E, H: 1200 m) on leaf compost, livestock, chicken, bird nests and pine (Kamali et al., 2001); from Karaj (35°48′N, 50°59′E, H: 1384 m) in a fungal training bed (Arbabi and Baradaran, 2006).
Parasitus numerus (Karg, 1965)

Recorded in soils of Esfahan (32°39'37"N, 51°41'22"E, H: 1608 m) (Khalili-Moghadam et al., 2012).

Two species were reported as Parasitus cf. fimetorum Berlese and P. cf. hyalinus (Willmann) from soil in Tehran (35°42'2"N, 51°21'20"E, H: 1200 m) (Kamali et al., 2004). Bahrami et al. (2011) reported two species as P. cf. copridis and P. cf. kempersi from Coleoptera in Golestan province.

Some unnamed species of this genus were also recorded from Hamedan (34°45'24"N, 48°39'32"E, H: 1887 m), Mazandaran (36°33'46"N, 53°3'15"E, H: 39 m), Semnan (35°15'17"N, 53°51'03"E, H: 1117 m) and Tehran (35°42'2"N, 51°21'20"E, H: 1200 m) from a series of different substrates (elm, honey bee hive, leaf compost, liquorice-livestock manure, bird nests and pomegranate) (Mosaddegh, 1997; Kamali et al., 2001), Dezful (32°22'13"N, 48°25'15"E, H: 126 m), citrus (Malekzadeh et al., 2000); Zanjan (36°39'51"N, 48°29'8"E), soil (Rahmani and Zare, 2011) and from Larestan (35°44'24"N, 54°7'12"E, H: 1490 m), cotton and wheat fields (Khadempour et al., 2012).

Genus Poecilochirus G. Canestrini and R. Canestrini, 1882

Poecilochirus carabi (G. and R. Canestrini, 1882)

Recorded in Zanjan (36°39'51"N, 48°29'8"E) from soil (Rahmani and Zare, 2011).


Genus Trachygamasus Berlese, 1906

Trachygamasus gracilis (Karg, 1965)

Recorded from rat carcasses in Semnan (35°15'17"N, 53°51'03"E, H: 1117 m) and Tehran (35°42'2"N, 51°21'20"E, H: 1200 m) (Kamali et al., 2001).

One species of this genus, was recorded as Trachygamasus sp. in orchards in Esfahan (32°39'37"N, 51°41'22"E, H: 1608 m) (Jalaeian et al., 2006).

Genus Vulgarogamasus Tichomirov, 1969

Some undetermined species were reported as Vulgarogamasus sp. from soil in East Azarbaijan (38°4' 36" N, 46° 17" 5" E, H: 1386 m) (Kamali et al., 2001) and Tehran (35°42'2"N, 51°21'20"E, H: 1200 m) (Kamali et al., 2004). Other records come from green parts and soil of tea plant gardens in eastern parts of Gilan (37°17'15"N, 49°35'28"E, H: 100 m) (Nejadghanbar et al., 2010) and soil in Kashmir (35°11'N, 58°27"E, H: 1215 m) (Salarzehi et al., 2011).

Family Veigaillidae Oudemans, 1939

Genus Gamasolaelaps Berlese, 1904

An unidentified species of this genus was recorded from Ardebil (48°31'33"N, 37°37'08"E, H: 1500 m) in cotton field soil and was labelled as a species of Gorirossia Farrier, 1957 (Kamali et al., 2001). However, this genus has been considered as a junior synonym of Gamasolaelaps (Bregetova, 1977).

Genus Veigaia Oudemans, 1905

Veigaia decurtata Athias-Henriot, 1961

Recorded in fruit orchard soil from Esfahan (32°39'37"N, 51°41'22"E, H: 1608 m) (Jalaeian et al., 2004).

Veigaia exigua (Berlese, 1916)

Recorded in Kerman (30°16'39"N, 57°3'53"E, H: 1763 m) in soil (Masnavipour et al., 2011).

Veigaia nemorensis (Koch, 1839)

Recorded in Kermanshah (34°18'51"N, 47°3'54"E) (Rijab) from soil (Babakfard et al., 2008); from Gachsaran (30°22'7"N, 50°48'24"E, H: 1279 m) (Kohgiloyeh Va Boir Ahmad province) in soils of rape seed and corn farms (Moradian et al., 2011); from the Homayjan region (30°14'33"N, 51°59'22"E, H: 2184 m) (Sepidan county) and Fars province (29°37'32"N, 52°31'8"E, H: 1810 m) from soils under apple trees (Maneshi et al., 2012).

New Records include reports from soil in Esfahan (32°39'37"N, 51°41'22"E, H:1608 m), Shahrekord (32°19'39"N, 50°51'35"E, H: 2206 m), Baghmalek (31°31'22"N, 49°53'8"E, H: 707 m) (Khuzestan Province) and other locations in Iran.
province), Ghaletol (31°37’55”N, 49°53’20”E, H: 885 m), and Izeh (31°49’52”N, 49°52’9”E, H: 845 m), coll., A. Nemati, 2011 and 2012.

Veigaia planicola (Belese, 1892)
Recorded in Esfahan (32°39’37”N, 51°41’22”E, H: 1608 m), Kermanshah (34°18’51”N, 47°3’54”E) (Rijab), and Tehran (35°42’2”N, 51°21’20”E, H: 1200 m) from soil (Babakfard et al., 2008; Jalaeian et al., 2004; Kamali et al., 2004); from Salmas region (West Azarbaijan province) in apple orchard soil (Alizadeh and Shirdel, 2012).


Kamali et al. (2001) reported V. serrata Willmann, 1936 from soils in E. Azarbaijan (38°4’36”N, 46°17’5”E, H: 1386 m), but this species has been considered as a junior synonym of V. planicola.

Two unidentified species of this genus were recorded from cow manure in Kerman (30°16’39”N, 57°3’53”E, H: 1763 m) (Arjomandi et al., 2011) and from cotton field soil in Ardebil (48°31’33”N, 37°37’08”E, H: 1500 m) (Kamali et al., 2001).

Family Zerconidae Berlese, 1892
Genus Prozercon Sellnick, 1943
Prozercon cf. traegardhi (Halbert, 1923)
Recorded from Hamedan (34°45’24”N, 48°39’32”E, H: 1887 m), on Astragalus sp. (Kamali et al., 2001).

Genus Zercon Koch, 1836
Zercon berlesi Sellnick, 1958
Recorded from soil in Lordegan (31°30’30”N, 50°49’39”E, H: 1594 m) and Baghmalek (31°31’22”N, 49°53’8”E, H: 707 m) (Khuzestan province), coll., A. Nemati, 2012. This is the first record of this genus and species from Iran.

CONCLUSION
Iran is a large country with varied climatic and geographic conditions. Detailed studies of the various aspects of mesostigmatid mite biology and distribution in different habitats are therefore needed to obtain a better understanding of their general zoogeography, biology and ecology. Our current records are still incomplete and the work presented here should therefore be extended to obtain better information on particular species.

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