

CATALOGUE OF MESOSTIGMATID MITES OF IRAN. PART 4: PARASITIDAE, VEIGAIIDAE AND ZERCONIDAE

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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: *Cyrtodrolaelaps* 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*, 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 Hamedan 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), Blattisociidae (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 Veigaiidae 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 *Amblygamasus* 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°31'8"E, H: 1810 m) in orchard soil (Khezri *et al.*, 2006).

New Records: Baghmalek (31°31'22"N, 49°53'8"E, H: 707m) (Khuzestan province), Ghaletol (31°37'55"N, 49°53'20"E, H: 885 m), Izeh (31°49'52"N, 49°52'9"E, H: 845 m), from soil, collected by A. Nemati in 2011 and 2012.

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 coleopratorum (Linnaeus, 1758)

Recorded from Gorgan (36°50'17"N, 54°25'39"E, H: 220 m) on Coleoptera (Bahrami *et al.*, 2011); and from Bojnourd (37°28'39"N, 57°19'22"E, H: 1070 m) in farm soils, gardens and manure (Mahpikaran *et al.*, 2012).

New Record: Esfahan (32°39'37"N, 51°41'22"E, H: 1608 m) in soil, coll., A. Nemati, 2011.

Parasitus concors (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°45'24" N, 48°39'32"E, H: 1887 m) (Kanjani and Kamali, 2000), Tehran (35°42'2"N, 51°21'20"E, H: 1200 m) (Kamali *et al.*, 2004; Pakyari *et al.*, 2006), Esfahan (32°39'37"N, 51°41'22"E, H: 1608 m) (Khalili-Moghadam *et al.*, 2012) Gorgan (36°50'17"N, 54°25'39"E, H: 220 m) (Kazemi *et al.*, 2011), Kerman (30°16'39"N, 57°3'53"E, H: 1763 m) (Masnavipour *et al.*, 2011), Deh-Bakri (Bam region) (29°06'N, 58°21'E, H: 1060 m) (Mehrzhad *et al.*, 2012) and Kashan (33°54'16"N, 51°34'33"E, H: 953 m) (Sekonji *et al.*, 2011); from potato fields in Orumieh (37°32'59"N, 45°4'32"E, H: 1349 m) (Mosavi *et al.*, 2004); from orchards in Esfahan (32°39'37"N, 51°41'22"E, H: 1608 m) (Jalaeian *et al.*, 2006); from fruit trees in Kermanshah (34°18'51"N, 47°3'54"E) (Rijab area) (Babakfard *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), 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) (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, buttonwood, 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 gladiolus 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.*, 2012).

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: 707m) (Khuzestan 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) 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-shahryari *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 soils in Hamedan (Khanjani and Kamali, 2000); from fruit trees in Kermanshah (34°18'51"N, 47°3'54"E), (Rijab area) (Babakfard *et al.*, 2008).

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) and Tehran (35°42'2"N, 51°21'20"E, H: 1200 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 noll (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 substrate types (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); Zanzan (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 Zanzan (36°39'51"N, 48°29'8"E) from soil (Rahmani and Zare, 2011).

New Record: Shahrekord (32°19'39"N, 50°51'35"E, H: 2206 m) in soil samples, coll., A. Nemati, 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 Kashmar (35°11'N, 58°27'E, H: 1215 m) (Salarzahi *et al.*, 2011).

Family Veigaiidae 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) (Kohgiluyeh 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), 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).

New Record from soil in Shahrekord (32°19'39"N, 50°51'35"E, H: 2206 m), coll., A. Nemati, 2011 and 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 berlesei 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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