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A checklist of Iranian Eupodoidea (Acari: Prostigmata)

Maryam Darbemamieh[1], Hamidreza Hajiqanbar[1*] and Mohammad Khanjani[2]

1. Department of Entomology, Faculty of Agriculture, Tarbiat Modares University, 14115-336, Tehran, Iran.
2. Department of Plant Protection, College of Agriculture, Bu Ali-Sina University, Hamedan, Iran.

Abstract: The present checklist is a compilation of the eupodoid mites of Iran using published records and original data from recent researches. It contains 19 species belonging to 13 genera and five families. Family Cocceupodidae Jesionowska, 2010 (because of moving the genera to a new family) and two species i.e. *Foveacheles* (*Foveacheles*) *cegetensis* Zacharda, 1983 and *Linopodes antennaepes* Banks, 1894 are new records for Iranian mite fauna. In addition to some corrections to specific identities which have been previously reported in Iranian literature, we report here the known geographical distribution and habitats in Iran and distribution in the world as well.

Keywords: Eupodoid mites, checklist, new record, *Foveacheles* (*Foveacheles*) *cegetensis*, *Linopodes antennaepes*, Iran

Introduction

According to Zhang *et al*., 2011, nine families have been distinguished in the superfamily Eupodoidea Koch, 1842. These families have been listed as Eupodidae Koch, 1842 (10 genera, 69 species), Penthaleidae Oudemans, 1931 (five genera, 16 species), Penthalodidae Thor, 1933 (six genera, 35 species), Rhagidiidae Oudemans, 1922 (28 genera, 157 species), Strandtmanniidae Zacharda, 1979 (one genus, two species), Eriorhynchidae Qin & Halliday, 1997 (one genus, five species), Pentapalpidae Olivier & Theron, 2000 (one genus, one species), Dendrochaetidae Olivier, 2008 (one genus, one species) and Cocceupodidae Jesionowska, 2010 (three genera, 23 species). Eupodoids are worldwide in distribution and often are found in extreme environments including high alpine and polar habitats. They are predaceous, fungivorous, bryophagous or phytophagous and not known to be symbiotic on other animals (Krantz and Walter, 2009; Qin, 1996).

The present checklist is a survey to collect the results of all identified eupodoid mites in Iran and to indicate their taxonomic status, habitats and distribution. Some name changes, new records and/or new location reports are added to previous reports. Distribution in the world is added as much as possible.

Materials and Methods

The authors checked all available papers including new taxa collected from Iran till 2012, and new reports of the families, genera and species. Collected samples from soil, mushroom, stored products, litter and moss were extracted using Berlese-Tullgrens over a period of 48 hours. Some species were removed directly using a stereomicroscope. Specimens were cleared in lactic acid and mounted on permanent slides using Hoyer's medium (Krantz and Walter, 2009). Identification of rhagidiid species was verified by Dr Miloslaw Zacharda. The used taxonomy method, followed that of Qin (1996), Zacharda (1980) and Jesionowska (2010 b). All mounted specimens of new records are deposited

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* **Corresponding author**, e-mail: hajiqanbar@modares.ac.ir
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Superfamily Eupodoidea Koch, 1842
Family Cocceupodidae Jesionowska, 2010
Cocceupodes Thor, 1934
***Cocceupodes* sp.**
Distribution and habitat in Iran: Mazandaran, Citrus (Faraji and Kamali, 1993); Guilan, soil of tea fields (Nejadghanbar *et al*., 2010).
World Distribution: Palaearctic [Austria, Britain, Belgium (Ducarme *et al*., 2004), Denmark, Germany (Strandtmann and Goff, 1978), Ireland, Italy, Norwegian mainland, Poland (Jesionowska, 2010), Norway, Sweden, Switzerland], Nearctic (United States) (Strandtmann and Goff, 1978), Australian (New Zealand) (Qin, 1998), Afrotropical (Southern Africa) (Olivier and Theron, 2003), (Egypt) (Abou-Awad *et al*., 2006).
Linopodes Koch, 1835
***Linopodes* sp.**
Distribution and habitat in Iran: East Azerbaijan, Soil (Fathipour, 1994); Kermanshah, Soil (New location).
World Distribution: Palaearctic (Austria, Britain, Denmark, Hungary, Poland, Switzerland, Japan) (Banks, 1915; Shiba, 1976; Clancy, 1981); Nearctic (United States) (Banks, 1915), Australian (Australia, New Zealand) (Qin, 1998), Oriental region (Malaysia) (Shiba, 1976); Ethiopian region (Egypt, South Africa) (Abou-Awad *et al*., 2006).
Linopodes antennaepes Banks, 1894
Distribution and habitat in Iran: Kermanshah and Kamyaran, Mushroom (New record for Iran).
World Distribution: Palaearctic (Italy, Britain), Nearctic (United States), Australian (Australia) (Banks, 1915; Clancy, 1981).
Linopodes cameronensis Shiba, 1976
Distribution and habitat in Iran: Gachsaran, Soil (Moradian and Ostovan, 2011)
World Distribution: Oriental region (Malaysia) (Shiba, 1976)
Family Eupodidae Koch, 1842
Eupodes Koch, 1835
***Eupodes* sp.**
Distribution and habitat in Iran: East Azarbaijan (Miandoab), sugar beet soil (Haddad *et al*., 2005).
World Distribution: Afro-tropical (North Africa) (Abou-Awad *et al*., 2006), Nearctic (Mexico, USA) (Sepedap and Withford, 1990), Palaearctic (Austria, Britain, France, Germany, Iceland, Italy, Norway, Switzerland) (Strandtmann and Goff, 1978; Olivier, 1997).
Eupodes crozetensis Strandtmann & Davies, 1972.
Distribution and habitat in Iran: East Azerbaijan, Soil (Fathipour, 1994); Fars, Stored hay (Ostovan, 1993).
World distribution: Southern Indian Ocean (Possession Island, Crozet Islands) (Strandtmann and Davies, 1972).
Eupodes sigmoidensis Stradtmann & Goff, 1978.
Distribution and habitat in Iran: Hamedan, Bean (Khanjani, 1996); East Azerbaijan, Alfalfa Soil (Lotfollahi *et al*., 2010)
World Distribution: West Africa (Ivory Coast, Lamto-Pakobosavanna), Nearctic (USA) (Stradtmann and Goff, 1978).
Eupodes voxencollinus Thor, 1934
Distribution and habitat in Iran: Hamedan, Bean (Khanjani, 1996).
World Distribution: Nearctic and Palaearctic (North Africa, Poland, Norway, Germany, Britain) (Fauna Europaea, 2012; Jesionowska, 2003; Stradtmann and Goff, 1978).
***Benoinyssus* sp.**
Distribution and habitat in Iran: Miandoab, sugar beet soil (Haddad *et al*., 2005).
World Distribution: Palaearctic (Britain, Germany, Poland) (Fauna Europaea, 2012), Nearctic (Mexico), Ethiopian (Southern Africa) (Sepedap and Withford, 1990; Olivier and Theron, 2003).
Claveupodes Strandtmann & Prasse, 1977
***Claveupodes* sp.**
Distribution and habitat in Iran: East Azerbaijan, Alfalfa Soil (Lotfollahi *et al*., 2010); East Azerbaijan (Miandoab), sugar beet soil (Haddad *et al*., 2005).
World Distribution: Palaearctic (Belgium, Britain, Germany, Poland), Australian region

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(Fauna Europaea, 2012; Russell *et al*., 2010; Ducarme *et al*., 2004).

Family Penthaleidae Oudemans, 1931

Penthaleus Koch, 1835

Penthaleus major (Duges, 1834)

Distribution and Habitat in Iran: Chahar Mahal & Bakhtiari, Cereals soil (Noorbakhsh, 1993), (Noorbakhsh and Kamali, 1995); East Azerbaijan, soil (Fathipour, 1994); Hamedan, pagoda tree (*Sophora alopecuroides* L.) soil, (Khanjani, 1996), (Khanjani and Kamali, 1993), Khorasan, saffron soil (Rahimi, 1991); *Acroptilon* sp., soil (Modarres Awal, 1997), Khuzestan, soil (Sadeghi Nameghi, 1990), (Sadeghi Nameghi and Kamali, 1993).

World Distribution: Worldwide (Umina *et al*., 2004).

Penthaleus minor (Canestrini, 1886)

Distribution and habitat in Iran: East Azerbaijan, soil (Fathipour, 1994).

World Distribution: Australian (Australia) (Qin, 1998), Palaearctic (Britain, Germany, Italy, Switzerland), Nearctic (Qin, 1998, Fauna Europaea, 2012).

Family Penthalodidae Thor, 1933

Penthalodes Murray, 1877

Penthalodes polonicus Jesionowska, 2010 (correct name used in Jesionowska, 2010a).

Penthodes polonica, Jesionowska, 2010 (incorrect name used in Hajizadeh and Noei, 2012).

Distribution and habitat in Iran: Guilan (Fuman, Rud-khan castle, Shaft, chubar), unknown plant Soil (Hajizadeh and Noei, 2012).

World Distribution: Poland (Jesionowska, 2010a).

Family Rhagidiidae Thor & Willmann, 1941

Brevipalpia minima Zacharda, 1980

Distribution and habitat in Iran: Hamedan (Emamzade), sour cherry orchard (Zacharda *et al*., 2012).

World Distribution: Czech Republic (Central Bohemia), Iran (Zacharda *et al*., 2012).

Coccorhagidia Thor, 1934

Coccorhagidia clavifrons (Canestrini, 1886)

Distribution and habitat in Iran: Hamedan, Alfalfa (Khanjani, 1996); Hamedan-Shokriyeh, peach, sour cherry and apple orchard soil (Zacharda *et al*., 2012); Tehran, soil (new location).

World Distribution: Holarctic (Italy, Czech Republic, Slovak Republic, Russia, Canada, Hawaii, USA) (Zacharda *et al*., 2012; Fauna Europaea, 2012).

Coccorhagidia pittardi Strandtmann, 1971

Distribution and habitat in Iran: Ardabil, hazelnut orchard soil; Hamedan-Shokriyeh, Peach orchard soil (Zacharda *et al*., 2012).

World Distribution: Holarctic (Russia, Austria, Slovak Republic, United States) (Zacharda *et al*., 2012).

Foveacheles Zacharda, 1980

***Foveacheles* sp.**

Distribution and habitat in Iran: Hamedan (Shokriyeh), peach orchard soil (Zacharda *et al*., 2012); Esfahan, soil (new location).

World Distribution: Palaearctic (Austria, Belgium, Britain, Czech Republic, France, Germany, Hungary, Ireland, Norway, Poland, Slovakia, Spain, Sweden, Switzerland, Netherland), Nearctic (Zacharda *et al*., 2012; Fauna Europaea, 2012).

Foveacheles* (*Foveacheles*) *brevichelae Zacharda, 1980

Distribution and habitat in Iran: Hamedan (Shokriyeh), peach orchard soil, (Zacharda *et al*., 2012).

World Distribution: Holarctic region (Czech Republic; the Otztal Alps in Austria; Elbrus, Central Caucasus, Russia; Tuktoyaktuk, Northwest Territory, Canada) (Zacharda *et al*., 2012).

Foveacheles* (*Foveacheles*) *cegetensis Zacharda, 1983.

Distribution and habitat in Iran: Tehran, unknown plant soil (New record for Iran).

World Distribution: Czech Republic (Zacharda, 1983; Fauna Europaea, 2012).

Foveacheles* (*Foveacheles*) *osloensis (Thor, 1934)

Syn.: *Rhagidia osloensis* Thor, 1934

Distribution and habitat in Iran: East Azerbaijan, soil (Fathipour, 1994).

World Distribution: Palaearctic (Austria, Czech Republic, Germany, Norway, Sweden) (Zacharda, 1980; Fauna Europaea, 2012).

Rhagidia Thorell, 1871

***Rhagidia* sp.**

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Distribution and habitat in Iran: East Azarbaijan (Miandoab), sugar beet soil (Haddad *et al.*, 2005); Hamedan (Shokriyeh), peach orchard soil (Zacharda *et al*., 2012).
World Distribution: Palaearctic (Austria, Belgium, Britain, Czech Republic, Denmark, France, Germany, Italy, Poland, Romania, Slovakia, Norway, Sweden, Switzerland, The Netherlands), Nearctic, Oriental (Fauna Europaea, 2012; Zacharda *et al*., 2012).
Rhagidia* cf. *breviseta Zacharda, 1995
Distribution and habitat in Iran: Hamedan (Absineh), apple orchard soil (Zacharda *et al*., 2012).
World Distribution: Holarctic (Canada, Alaska, Slovakia, Finland, Russia) and prefers cooler habitats such as caves, peat bogs and moss pads (Zacharda *et al*., 2012).
Robustocheles Zacharda, 1980
Robustocheles mucronata (Willmann, 1936)
Distribution and habitat in Iran: Fars, Bed of humid stores (Ostovan, 1993); Ardabil, hazelnut orchard soil (Zacharda *et al*., 2012); Hamedan-Ganjnameh, plum orchard soil (Zacharda *et al*., 2012); Hamedan (Heydareh), apple orchard soil (Zacharda *et al*., 2012); Golestan, soil (New location).
World Distribution: worldwide distribution [Russia (Central Siberia, Elbrus mountain), Poland, Slovak Republic, Czech Republic (North Bohemia), Thailand, North Vietnam, Brazil, Alaska] (Zacharda *et al*., 2012).
Robustocheles hamedanensis Zacharda, 2012
Distribution and habitat in Iran: Hamedan (Shokriyeh) litter in peach orchard (Zacharda *et al*., 2012).
World Distribution: Iran (Zacharda *et al*., 2012)
Shibaia Zacharda, 1980
Shibaia heteropoda (Berlese, 1910)
Distribution and habitat in Iran: East Azarbaijan (Miandoab), sugar beet soil (Haddad *et al.*, 2005).
World Distribution: Palaearctic and Nearctic (Zacharda, 1980).
Shibaia longisensilla (Shiba, 1969), correct name in Zacharda, 1980
Shibaia longicornis (Shiba, 1969), incorrect name in Iranian records.
Distribution and habitat in Iran: Hamedan, Alfalfa (Khanjani and Kamali, 1993), Sainfoin (*Onobrychis viciifolia*) (Modarres Awal, 1997).
World Distribution: Holarctic region (abundant in Czech Republic) (Zacharda, 1980).

Discussion

The mites of the genus *Cocceupodes* show substantial homogeneous structure, distinctly different from species of typical genus *Eupodes*, and other species recently regarded as belonging to the family Eupodidae (e.g. *Benoinyssus* or even *Protereunetes*). This is the reason why Jesionowska (2010b) classified them as a separate family, Cocceupodidae, including three genera: *Cocceupodes*, *Filieupodes* and *Linopodes*. Main differential features are rostral setae, *ro*, located just behind a naso and not on it (differently from those in other eupodoids), and just two pairs of circumanal setae, with total number of ten pairs of setae present on opisthosoma (excluding genital region setae). The family Cocceupodidae was derived from the family Eupodidae in 2010 and therefore, the reports from the genus *Linopodes* were classified as Cocceupodidae instead of the family Eupodidae. In this study, *Linopodes antennaepes* Banks, 1894 is reported as new record of this family from Iran. Banks (1894) first described it as a reddish or yellowish mite, sometimes with some pale marks. Legs are mostly yellowish, except distal half of leg I, which is hyaline. Body oblong, rounded in front and behind; broadest at hind margin of cephalothorax; cephalothorax semicircular, with a large shining eye on each side. A narrow, emarginated, smooth band is just behind cephalothorax, which gives it a median projection reaching to the tip of the abdomen, the whole forming a T. Dorsum has a few scattered hairs. Leg I more than twice as long as body, femur I longer than body; legs II and III slender, not quite as long as body; leg IV with femur enlarged. Chelicerae are short, forming a little cone; palpi a little longer than chelicera, joints subequal, the third being the longest. It differs from the European *L. motatorius* in having tibia I nearly as long as the metatarsus, and the tarsus I being divided into three or four joints. The

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body of the male is a little more globose than that of the female. This species lives on the ground, and is most common under pieces of wood, bark, etc. that have been on the ground for some time. The first pair of legs is used as feelers; ordinarily, it walks slowly but when disturbed can move very rapidly to the rear (Banks, 1894). In current study, *L. antennaepes* was collected from cultivated and forest mushrooms in Kermanshah and Kamyaran. *Linopodes* species are present in mushroom cultivation but are not common (Hussey *et al*., 1969; Clancy, 1981). *L. antennaepes* is the only species in the genus recorded from Australia by Halliday (2001).

Other new record in this paper is *Foveacheles* (*Foveacheles*) *cegetensis* Zacharda, 1983 from the family Rhagididae which is recorded for first time from Iran. Some diagnostic features for identification of this species are as below. Proximal cheliceral seta inserted just before joint of digitus mobilis and almost reaching basis of distal cheliceral seta. Rhagidial organ I and II consist of 4 separated rhagidial setae. Stellate seta is between 1st and 2nd proximal rhagidial setae. Length of the body 970-1150 µm (Zacharda, 1983). The epimeral formula 3-1-6-3 and the location of the solenidion on genu III is medioventral, proximad of the first pair of ventral setae (Zacharda, 1993).

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فهرست کنه‌های بالاخانواده Eupodoidea (Acari: Prostigmata) در ایران

مریم درب امامیه[1]، حمیدرضا حاجی قنبر[1*] و محمد خانجانی[2]

۱- گروه حشره‌شناسی، دانشکده کشاورزی، دانشگاه تربیت مدرس، صندوق پستی ۳۳۶-۱۴۱۱۵، تهران، ایران.
۲- گروه گیاه‌پزشکی، دانشکده کشاورزی، دانشگاه بوعلی سینا همدان، همدان، ایران.
* پست الکترونیکی نویسنده مسئول مکاتبه: hajiqanbar@modares.ac.ir
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چکیده: فهرست حاضر دربرگیرنده همه گزارش‌های انجام شده از بالاخانواده Eupodoidea در ایران شامل ۱۹ گونه از ۱۳ جنس و ۵ خانواده است که از بین آنها خانواده Cocceupodidae Jesionowska, 2010 (به‌دلیل جابه‌جایی جنس‌ها به خانواده جدید) و دو گونه *Foveacheles*(*Foveacheles*) *cegetensis* Zacharda, 1983 و *Linopodes antennaepes* Banks, 1894 گزارش‌های جدید برای فون کنه‌های ایران هستند. برخی تصحیحات در اسامی گونه‌های گزارش شده قبلی به‌همراه پراکنش همه گونه‌ها در ایران، زیستگاه آنها و نیز پراکنش این گونه‌ها در نقاط مختلف جهان به‌همراه این لیست آورده شده است.

واژگان کلیدی: کنه‌های یوپودوایدآ، چک لیست، رکورد جدید، *Foveacheles* (*Foveacheles*) *cegetensis*، *Linopodes antennaepes*، ایران

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