

A Checklist of the Trombidioidea (Acari: Prostigmata) of Iran

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Abstract: This paper reviews the research on taxonomy of the Trombidioidea in Iran, with an updated checklist of 32 species (+5 undetermined species) belonging to five families and 22 genera. Among them, 27 species (+1 undetermined species) are reported based on larvae only, three undetermined species based on adults only, and six species based on both larval and post-larval stages. Also, 14 species (+3 undetermined species) and 10 genera belonging to the family Trombidiidae, one undetermined species belonging to the family Podothrombidiidae, 13 species (+1 undetermined species) and seven genera belonging to the family Microtrombidiidae, three species, three genera belonging to the family Neothrombidiidae and two species and one genus belonging to the family Achaemenothrombidiidae. Major contributions to the Iranian fauna of the Trombidioidea were made by Alireza Saboori and his colleagues, and Zhi-Qiang Zhang. There have been some studies on the biology and the application of the Trombidioidea in biological control in Iran.

Keywords: velvet mites, larvae, predators, Trombidioidea, ectoparasites, faunistics, biology

Introduction

The Parasitengona is one of the most diverse groups of the Trombidiformes (Zhang, 2010). It includes about 15 superfamilies, over 60 families and 8000 species and includes over half of all species of the Trombidiformes (Smith *et al.*, 2001; Zhang and Fan, 2007; Walter *et al.*, 2009; Zhang, 2010). Mąkol & Wohltmann (2012) listed 1784 species of terrestrial Parasitengona excluding Trombiculidae and Walchiidae. Many known species of the Trombidina are water mites (over 6000 species, mostly known from adults) and chiggers (over 2000 species of Trombiculidae and Leewenhoekiidae, mostly known from larvae parasitic on vertebrates). Trombidina

except chiggers were mostly described as post-larval forms in early years but larvae have been of interest for description in the last few decades (Zhang, 2010). Kamali *et al.* (2001) listed 1040 species from 430 genera of Acari of Iran and most of their records were undescribed species which were reported in M. Sc. theses and Ph. D. dissertations. For this reason, we ignored this reference but for described species we used the original papers. Saboori *et al.* (2007) presented a checklist of terrestrial Parasitengona of Iran including species which were reported until 2005. We hope that this paper will help stimulate further studies of this important group of mites in Iran and also facilitate access to Iranian literature for researchers outside Iran.

Material and Methods

The following abbreviations were used: L = Larva, DN = Deutonymph and AD = Adult.

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Historical review

Trombidiidae

Allothrombium pulvinum Ewing, 1917 is the first record of Trombidoidea from Sari, Mazandaran province, Iran (Zhang and Faraji, 1994). Zhang and Norbakhsh (1995) described a new genus i.e. *Monotrombium* and three new species of *Allothrombium* as ectoparasites of wheat aphids and presented a key to world larval genera of Trombidiidae and a key to world larval species of *Allothrombium*. Later, one of these species i.e., *A. triticium* was considered as junior synonym of *A. meridionale* Berlese, 1910 by Wohltmann and Maqol (2009). They added a comment about this synonymy and mentioned both species separately in their checklist (Maqol & Wohltmann, 2012). *Allothrombium shirazicum* Zhang, 1996 was described as ectoparasite of *Forda marginata* Koch (Pemphigidae) from Shiraz, Fars province (Zhang and Rastegari 1996). Zhang and Rastegari (1996) presented a key to Iranian larval species of *Allothrombium*. Biology of *A. pulvinum* was reported from West Mazandaran by Saboori and Zhang (1996). All active instars of *Trombidium southcotti* Zhang and Saboori, 1996 were described from Koliak village, Nowshahr, Mazandaran province and a new host for *Allothrombium triticium* was recorded by Zhang and Saboori (1996a, b).

Description of deutonymph and adult and brief biology of *Allothrombium shirazicum* were reported in 1997–1999, respectively (Saboori and Zhang, 1997; Saboori, 1998, 1999; Saboori & Kamali, 1999). A checklist of Iranian Trombidiidae was presented by Saboori (1998). Adult of *Allothrombium triticium* was described from Tehran (Saboori and Kamali, 2000). Hosseini *et al.* (2002) investigated host preference of *A. pulvinum* larvae on three aphid species.

Two new genera, *Iranitrombium* and *Azaritrombium* were described from East and West Azarbaijan provinces, respectively (Saboori *et al.*, 2003, 2005). The latter was considered as a junior synonym of *Dolichoallothrombium* by Maqol and Sevsay (2011) after rearing its adults in the laboratory. A key to

world larval genera of Trombidiidae was presented by Saboori *et al.* (2003). Preference of adults of *A. pulvinum* for eggs of *Planococcus citri* (Risso) and *Pulvinaria aurantii* Cockerell on citrus leaves was studied by Saboori *et al.* (2003). Hosseini *et al.* (2005) studied predation rate, prey preference and functional response of *A. pulvinum* deutonymphs on *Tetranychus urticae* and *Amphitetranynchus viennensis*. Saboori *et al.* (2006) described a new genus and species from larvae ectoparasitic on *Hyalopterus pruni* (Geoffroy) (Hemiptera: Aphididae) from Oskoo, East Azarbaijan province.

Two new species of larval *Trombidium* were described from East Azarbaijan province and a key to Iranian genera of Trombidiidae (larva) was presented (Saboori and Haddad Irani-nejad 2007; Saboori *et al.* 2008). Saboori and Lazarboni (2008) described a new genus and species, *Cicaditrombium weni* from Astaneh, Markazi province. New morphological data for the larva of *Allothrombium neapolitanum* Oudemans, 1910 has been presented by Saboori *et al.* (2008) for specimens that were collected from Tonekabon, Mazandaran province. They also presented distribution and host record of *Allothrombium* larvae. Genetic variation in populations of *A. pulvinum* from Northern Iran revealed by mitochondrial coxI and nuclear rDNA ITS2 sequences was studied by Khalili Mahani *et al.* (2009). Shirafkan *et al.* (2012) studied proteinase, carbohydrase and lipase activities in the gut of *A. pulvinum*.

Podotrombidiidae

Deutonymph of an undetermined species of *Podotrombium* was collected from soil surface in Koliak village, Nowshahr, Mazandaran province (Saboori 1998; Saboori *et al.*, 2007).

Microtrombidiidae

Willmannella kazerunica Zhang and Saboori, 1997 is the first record of the family Microtrombidiidae in Iran. It was described as an ectoparasite of an undetermined Diptera from Kazerun, Fars province (Zhang and Saboori, 1997). Saboori *et al.* (2000) and Saboori and Nemati (2001) described two new

species of *Eutrombidium* from Ahwaz, Khuzestan province as ectoparasite of *Gryllus domesticus* L. and *G. desertus* L. (Orthoptera: Gryllidae), both with deeply cleft lateral coxala I, coxalae II and III. Karimi Irvanlou *et al.* (2000) described three new species of larval *Eutrombidium* from Alborz and Tehran provinces. In 2002, *Trichotrombidium rafieiae* Saboori was described as ectoparasite of a house fly, *Musca domestica* L. (Diptera: Muscidae) and a key to world larval species of *Trichotrombidium* was presented (Saboori 2002a).

Saboori *et al.* (2009) described the first Asian species of the genus *Enemothrombium* from larvae as ectoparasite of undetermined Chironomidae (Diptera) from Kaka Reza village, Khorram Abad, Lorestan province and presented a key to world larval species. *Empitrombium pesici* Saboori and Hakimitabar was described as the first non-American species of the genus from larvae reared from eggs in the laboratory at room temperature collected from Ramsar, Mazandaran province (Saboori *et al.*, 2009b). They presented a key to world larval species of *Empitrombium*. A new genus and species, *Persianthrombium farajii* Sedghi, Saboori and Hakimitabar, 2010 was described from larvae ectoparasitic on *Locusta* sp. (Orthoptera: Acrididae) from Jahrom, Fars province and a key to world larval genera of Microtrombidiidae with three dorsal scuta was presented (Sedghi *et al.*, 2010). Azimi *et al.* (2011) reported *Eutrombidium sorbasiensis* from Marand city, East Azarbaijan province for the first time and presented its new morphological data. Hakimitabar *et al.* (2012) reported *Fissitrombium* sp. from Alborz and Razavi Khorasan provinces but our re-analysis has shown that it belongs to *Atractothrombium* Feider.

Neothrombiidae

Neothrombium neglectum (Bryant, 1909) is the first larval species of this family from Kazerun, Fars province. This species was initially recorded as a new species, *N. mojdehii*, by Saboori and Ostovan (2001) but recently it was considered as a junior synonym of *N. neglectum* by Maqol *et al.* (2009). It is a

common ectoparasite of *Gryllotalpa gryllotalpa* L. (Orthoptera: Gryllotalpidae). Saboori (2002b) described a new genus and species, *Southcotella nematii*, as ectoparasite of *Gryllus domesticus* L. (Orthoptera: Gryllidae) from Ahwaz, Khuzestan province and presented a key to world larval genera of the Neothrombiidae.

A new species of *Neosilphitrombium* was described from larvae ectoparasitic on *Opatroides punctatus* Brullé, 1832 (Coleoptera: Tenebrionidae) from Mashhad and Gonabad, Khorasan Razavi province by Saboori *et al.* (2011). They presented a key to world larval species of the genus.

Achaemenothrombiidae

This family was established by Saboori *et al.* (2010) to accommodate the new genus *Achaemenothrombium*. One species, *A. cyrusi*, was collected as ectoparasite of *Catocala* sp. (Lepidoptera: Noctuidae) from Tehran and another one, *A. talebii* (Karimi Irvanlou and Kamali, 2001) was collected from Varamin, both from Tehran province. A key to families of larval Trombidoidea and to species of *Achaemenothrombium* (larva) is presented as well (Saboori *et al.*, 2010). Saboori *et al.* (2010) suggested that the collection date of the latter may be incorrect while its host record (grasshopper) is correct but collecting an undescribed species of the genus as ectoparasite of a moth (unpublished data) supported this assumption that members of this genus have an association with Lepidoptera and that the host record of *A. talebii* may be incorrect.

Results

Superfamily TROMBIDIOIDEA Leach, 1815

Family TROMBIDIIDAE Leach, 1815

Subfamily ALLOTHROMBIINAE Thor, 1935

Genus *Allothrombium* Berlese, 1903

Allothrombium pulvinum Ewing, 1917 (AD, DN, L)

New record: Tehran Province.

Previous records: Mazandaran, Guilan, North Khorasan, Razavi Khorasan, West and East

Azerbaijan and Ardebil provinces (Zhang and Faraji; 1994; Saboori and Zhang, 1996; Saboori, 1998; Khalili Mahani *et al.*, 2009)

Distribution: UK, Spain, Iran, China, USA (Zhang and Faraji; 1994; Saboori and Zhang, 1996; Saboori, 1998; Haitlinger, 2006a; Saboori *et al.* 2007, 2008; Khalili Mahani *et al.*, 2009).

A. mossi Zhang, 1995 (L)

Previous record: Chaharmahal va Bakhtiari Province (Zhang and Norbakhsh, 1995).

Distribution: Iran.

A. neapolitanum Oudemans, 1910 (L)

Previous record: Mazandaran province (Saboori *et al.*, 2008).

Distribution: Italy, Switzerland, Iran (Oudemans, 1910; Mąkol & Wohltmann, 2012; Saboori *et al.*, 2008).

A. shirazicum Zhang, 1996 (AD, DN, L)

Previous records: Fars Province (Zhang and Rastegari, 1996), Markazi and Semnan provinces (Saboori, 1999; Saboori and Zhang, 1997; Saboori and Kamali, 1998, 1999).

Distribution: Iran.

A. triticium Zhang, 1995 (AD, L)

New records: Alborz and Tehran provinces.

Previous records: Mazandaran province (Zhang and Saboori, 1996a), Chaharmahal va Bakhtiari province (Zhang and Norbakhsh, 1995).

Distribution: Turkey (Haitlinger, 2000), Spain (Goldarazena and Zhang, 1997), Greece (Haitlinger, 2006b), Moldova & Ukraine (Haitlinger, 2008), Iran (Zhang and Norbakhsh, 1995; Zhang and Saboori, 1996a; Saboori and Kamali, 2000; Saboori *et al.*, 2008).

Monotrombium simplicium Zhang, 1995 (L)

New record: East Azarbaijan

Previous records: Chaharmahal va Bakhtiari province (Zhang and Norbakhsh, 1995); Fars province (Zhang and Rastegari, 1996).

Distribution: Iran.

Ronaldothrombium bellator (Southcott, 1986) (L)

New record: Fars province.

Distribution: Australia (Mąkol, 2007), Iran.

Dinothrombium sp. (AD)

New record: Boushehr province.

Previous records: Sistan va Balouchestan and Hormozgan provinces (Saboori *et al.*, 2007).

Subfamily **TROMBIDIINAE Leach, 1815**

Trombidium southcotti Zhang and Saboori, 1996 (AD, DN, L)

Previous record: Mazandaran (Zhang and Saboori, 1996b).

Distribution: Iran.

T. barooghi Saboori and Haddad Irani-nejad, 2007 (L)

Previous record: East Azarbaijan province (Saboori and Haddad Irani-nejad, 2007).

Distribution: Iran.

T. payamiensis Saboori, Lotfollahi and Haddad Irani-nejad, 2008 (L)

Previous record: East Azarbaijan province (Saboori *et al.*, 2008)

Distribution: Iran.

Cicaditrombium weni Saboori and Lazarboni, 2008 (L)

New records: Fars and Alborz provinces.

Previous record: Markazi province (Saboori and Lazarboni, 2008).

Distribution: Iran.

Subfamily **DOLICHOThROMBIINAE Mąkol, 2007**

Dolichothrombium raphanicum (Saboori, Bagheri and Haddad Irani-nejad, 2005) (L)

Previous record: East Azarbaijan province (Saboori *et al.*, 2005)

Distribution: Iran.

Dolichothrombium sp. (AD)

New record: Tehran province.

Previous records: North Khorasan and Hormozgan provinces (Saboori *et al.*, 2007).

Subfamily **PARATROMBIINAE Mąkol, 2007**

Paratrombium sp. (AD, L)

Previous records: Mazandaran and Semnan provinces (Saboori *et al.*, 2007).

TROMBIDIIDAE incertae sedis

Note. Of the following genera and species, the set of characters or the quality of descriptions do not allow appropriate affiliation to any of the subfamilies within Trombidiidae (Mąkol and Wohltmann, 2012).

Iranitrombium miandoabicum Saboori, Hajiqanbar and Haddad Irani-nejad, 2003 (L)

Previous record: West Azerbaijan (Saboori *et al.*, 2003).

Distribution: Iran.

Oskootrombium prasadi Saboori, Bagheri and Haddad Irani-nejad, 2006 (L)

Previous records: East Azarbaijan Province (Saboori *et al.*, 2006).

Distribution: Iran.

Family PODOTHROMBIDIIDAE Thor, 1935

Podothrombium sp. (AD, L)

New record: Ardebil province.

Previous record: Mazandaran province (Saboori *et al.*, 2007).

Family MICROTROMBIDIIDAE Thor, 1935

Subfamily VALGOTHROMBIINAE Gabryś, 1999

Enemothrombium Berlese, 1910

E. wohltmanni Saboori, Shojaei and Hakimitabar, 2009 (L)

Previous records: Lorestan province (Saboori *et al.*, 2009).

Distribution: Iran.

Subfamily EUTROMBIDIINAE Thor, 1936

Eutrombidium Thor, 1935

E. djordjevici Saboori and Pešić, 2006 (L)

New records: Markazi, Fars and East Azerbaijan provinces.

Distribution: Iran, Montenegro (Saboori and Pešić, 2006a).

E. elburzensis Karimi Irvanlou, Kamali and Talebi, 2000 (L)

Previous records: Alborz and Tehran provinces (Karimi Irvanlou *et al.*, 2000).

Distribution: Iran.

E. fathipouri Karimi Irvanlou, Kamali and Talebi, 2000 (L)

Previous record: Alborz province (Karimi Irvanlou *et al.*, 2000).

Distribution: Iran.

E. mossadeghi Saboori and Nemati, 2001 (L)

Previous record: Khouzestan province (Saboori and Nemati, 2001).

Distribution: Iran.

E. sepasgosariani Saboori, Nemati and Mosaddegh, 2000 (L)

Previous record: Khouzestan province (Saboori *et al.*, 2000)

Distribution: Iran.

E. sorbasiensis Mayoral and Barranco, 2004 (L)

New records: Alborz and Razavi Khorasan provinces.

Previous records: East Azerbaijan province (Azimi *et al.*, 2011).

Distribution: Spain (Mayoral and Barranco, 2004), Iran (Azimi *et al.*, 2011).

E. tehranicum Karimi Irvanlou, Kamali and Talebi, 2000 (L)

Previous records: Tehran and Alborz provinces (Karimi Irvanlou *et al.*, 2000).

Distribution: Iran.

E. aegyptium Karimi Irvanlou, Kamali and Talebi, 2000 (L)

Previous record: Alborz province (Karimi Irvanlou *et al.*, 2000).

Distribution: Iran.

Subfamily MICROTROMBIDIINAE Thor, 1935

Atractothrombium Feider, 1952

Atractothrombium sp. (L)

Previous record: Alborz and Razavi Khorasan provinces (Hakimitabar *et al.*, 2012).

Persianthrombium Sedghi, Saboori and Hakimitabar, 2010

P. farajii Sedghi, Saboori and Hakimitabar, 2010 (L)

Previous record: Fars province (Sedghi *et al.*, 2010).

Distribution: Iran.

Trichotrombidium Kobulej, 1951

T. rafieiae Saboori, 2002 (L)

New record: Tehran province

Previous record: Markazi province (Saboori, 2002).

Distribution: Iran (Saboori, 2002), Montenegro (Saboori and Pešić, 2006b).

Willmannella Feider, 1952

W. kazerunica Zhang and Saboori, 1997 (L)

Previous record: Fars province (Zhang and Saboori, 1997).

Distribution: Iran.

Empitrombium Southcott, 1994

E. pesici Saboori and Hakimitabar, 2009 (L)

Previous record: Mazandaran province (Saboori *et al.*, 2009b).

Distribution: Iran.

Family NEOTHROMBIIDAE Feider, 1959*Neothrombium* Feider, 1959*N. neglectum* (Bruyant, 1909) (L)

New records: Khuzestan and Golestan provinces.

Previous record: Fars province (Saboori and Ostovan, 2001).

Distribution: Austria (Willmann, 1950), Bulgaria (Beron, 1995), France and Italy (Oudemans, 1912), Germany (Kneissl, 1914), Poland (Haitlinger, 1998; Małol *et al.*, 2009), Romania (Feider, 1945), former USSR (Feider, 1955), China (Fan, 1984), and Iran (Saboori and Ostovan, 2001). A collection site was not specified in Kneissl (1914) and Feider (1945).*Southcottella* Saboori, 2002*S. nematii* Saboori, 2002 (L)

Previous record: Khuzestan province (Saboori, 2002).

Distribution: Iran.

Neosilphitrombium Fain, 1992*N. tenebrionidum* Saboori, Hajiqaanbar and Hakimitabar, 2011 (L)Previous record: Razavi Khorasan province (Saboori *et al.*, 2011).

Distribution: Iran.

Family ACHAEMENOTHROMBIIDAE Saboori, Wohltmann and Hakimitabar, 2010*Achaemenothrombium* Saboori *et al.*, 2010*A. cyrusi* Saboori *et al.*, 2010 (L)Previous record: Tehran province (Saboori *et al.*, 2010).

Distribution: Iran.

A. talebii (Karimi Irvanlou and Kamali, 2001) (L)Previous record: Tehran province (Karimi Irvanlou and Kamali, 2001; Saboori *et al.*, 2010).

Distribution: Iran.

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فهرست کنه‌های بالاخانواده Trombidioidea (Acari: Prostigmata) در ایران

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چکیده: در این مقاله، پژوهش‌های مربوط به رده‌بندی بالاخانواده Trombidioidea در ایران به همراه فهرست به‌روز شده ۳۲ گونه (به اضافه ۵ گونه شناسایی نشده) متعلق به پنج خانواده و ۲۲ جنس مورد بررسی قرار می‌گیرند. در بین آنها ۲۷ گونه (به اضافه ۱ گونه شناسایی نشده) تنها براساس مرحله لاروی، سه گونه شناسایی نشده تنها براساس مرحله کامل و شش گونه براساس مراحل لاروی و پس-لاروی گزارش می‌شوند. همچنین ۱۴ گونه (به اضافه ۳ گونه شناسایی نشده) و ۱۰ جنس به خانواده Trombidiidae، یک گونه شناسایی نشده به خانواده Podothrombiidae، ۱۳ گونه (به اضافه ۱ گونه شناسایی نشده) و ۷ جنس به خانواده Microtrombidiidae، سه گونه و سه جنس به خانواده Neothrombidiidae و دو گونه و یک جنس به خانواده Achaemenothrombidiidae تعلق دارند. کارهای عمده در مورد فون بالاخانواده Trombidioidea در ایران را صبوری و همکاران، و زی-کیانگ زانگ انجام داده‌اند. مطالعاتی در زمینه زیست‌شناسی و کاربرد Trombidioidea در کنترل بیولوژیک در ایران صورت گرفته است.

واژگان کلیدی: کنه‌های مخملی، لاروها، شکارگرها، Trombidioidea، انگل‌های بیرونی، فونیسیتیک، زیست‌شناسی