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An illustrated key to species of the genus *Thrips* Linnaeus (Thysanoptera: Thripidae) from Iran, with an updated checklist

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ABSTRACT. The genus *Thrips* Linnaeus (Thripidae: Thripinae) is one of the largest groups of thrips in Iran, which include some important pests. Majority species of the genus *Thrips* are herbivorous living on leaves and flowers on different plant families. In this paper, a key to 31 Iranian *Thrips* species is provided, along with additional new distribution information of 17 species in Iran.

Key words: *Thrips*, key, Thripinae, thrips fauna, Iran.

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Introduction

The genus *Thrips* Linnaeus (Thysanoptera: Thripidae) is the largest in the subfamily Thripinae, with about 293 described species in the world (ThripsWiki 2016). Most species of *Thrips* are flower-living, and several species are considered as crop pests in various parts of the world (Mound and Ng 2009). In Iran, some of *Thrips* species such as *T. tabaci* Lindeman and *T. meridionalis* Priesner are well known as the most important pests of different plant families (Mirab-balou *et al.* 2009, 2014c), and it is a carrier of some Tospovirus diseases on ornamental plants (Ghotbi *et al.* 2003).

In Iran, 29 *Thrips* species and their important characteristics, together with the geographical distribution information, were listed by Mirab-balou (2012). Since then, the following species

have added to *Thrips* species in Iran: (1) *Thrips australis* (Bagnall) was collected on *Eucalyptus* from Fars province (Minaei 2012), (2) *Thrips longiceps* (Bagnall) was collected on rose flowers from Kermanshah province (Mirab-balou 2013a), (3) *Thrips italicus* (Bagnall) collected on leaves of red apple trees from Kohgiluyeh and Boyer-Ahmad province (Jahangiri *et al.* 2013), and (4) *Thrips juniperinus* L. collected on *Acanthophyllum* sp. from Khorasan-e Razavi province (Gholami *et al.* 2014). *Thrips viminalis* Uzel was collected on leaf buds of willow trees from Alborz and Azarbayjan-e-Gharbi provinces (Rahemi *et al.* 2010).

In this paper, an illustrated key is prepared for Iranian *Thrips* species, and new distribution records for 17 species in Iran are mentioned (Table 1).

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Table 1. Checklist of *Thrips* species (Thysanoptera: Thripidae) recorded in Iran

<i>Thrips</i> species	Distribution in Iran (*first recorded for each province)
<i>T. alavii</i> Mirab-balou, Tong and Chen	Hamadan
<i>T. alliorum</i> (Priesner)	Hamadan
<i>T. angusticeps</i> Uzel	Kerman, Hamadan, Kermanshah
<i>T. atratus</i> Haliday	Khorasan-e-Shomali, Golestan, Tehran, Markazi, Kerman, Yazd, Hamadan, Kermanshah, Kordestan, Mazandaran, Zanjan, Sistan and Baluchestan* ¹ , Khorasan-e-Razavi* ² , Kohgiluyeh and Boyer-Ahmad* ³
<i>T. australis</i> (Bagnall)	Fars
<i>T. coloratus</i> Schmutz	Tehran
<i>T. dubius</i> Priesner	Alborz, Hamadan
<i>T. euphorbiae</i> Knechtel	Fars, Hamadan
<i>T. flavus</i> Schrank	Khorasan-e-Shomali, Hamadan
<i>T. fraudulentus</i> (Priesner)	Fars, Hamadan, Qazvin, Khorasan-e-Razavi* ²
<i>T. fuscipennis</i> Haliday	Mazandaran
<i>T. hawaiiensis</i> (Morgan)	Isfahan, Hamadan, Qazvin* ⁴ , Mazandaran, Golestan* ⁵
<i>T. iranicus</i> Yakhontov	Kerman
<i>T. italicus</i> (Bagnall)	Kohgiluyeh and Boyer-Ahmad* ³
<i>T. juniperinus</i> Linnaeus	Khorasan-e Razavi* ²
<i>T. longiceps</i> (Bagnall)	Kermanshah* ⁶
<i>T. major</i> Uzel	Khorasan-e-Shomali, Golestan, Fars, Khuzestan, Tehran, Kerman, Mazandarn, Hamadan, Alborz, Khorasan-e-Razavi* ² , Kohgiluyeh and Boyer-Ahmad* ³
<i>T. mareoticus</i> (Priesner)	Azarbajjan-e-Sharghi, Hamadan
<i>T. meridionalis</i> (Priesner)	Khorasan-e-Shomali, Golestan, Fars, Khuzestan, Lorestan, Tehran, Markazi, Kerman, Yazd, Mazandaran, Hamadan, Kermanshah, Zanjan, Alborz, Qazvin* ⁴ , Sistan and Baluchestan* ¹ , Khorasan-e-Razavi* ² , Kohgiluyeh and Boyer-Ahmad* ³
<i>T. minutissimus</i> Linnaeus	Golestan, Mazandaran, Khorasan-e-Shomali, Fars, Kohgiluyeh and Boyer-Ahmad* ³
<i>T. nigropilosus</i> Uzel	Khuzestan, Khorasan-e-Shomali, Guilan, Hamadan, Markazi* ⁷
<i>T. pelikani</i> Schliephake	Alborz
<i>T. physapus</i> Linnaeus	Teharan, Markazi, Khorasan-e-Shomali, Hamadan, Zanjan, Kordestan, Qazvin, Khorasan-e-Razavi* ²
<i>T. pillichii</i> Priesner	Khorasan-e-Shomali, Tehran, Markazi, Kerman, Khorasan-e-Razavi* ²
<i>T. pistaciae</i> Yakhontov	Kerman
<i>T. simplex</i> (Morison)	Tehran
<i>T. tabaci</i> Lindeman	Widely distributed
<i>T. trehernei</i> Priesner	Khorasan-e-Shomali, Isfahan, Kerman, Markazi, Qazvin, Tehran, Hamadan, Lorestan* ⁸
<i>T. trybomi</i> (Karny)	Fars, Kohgiluyeh and Boyer-Ahmad* ³
<i>T. verbasci</i> (Priesner)	Khorasan-e-Shomali
<i>T. viminalis</i> Uzel	Alborz* ⁹ , Azarbajjan-e-Gharbi* ⁹
<i>T. vUILleti</i> (Bagnall)	Khorasan-e-Shomali, Khuzestan, Lorestan, Alborz, Azarbajjan-e-Gharbi, Azarbajjan-e-Sharghi, Guilan, Tehran, Hamadan, Kordestan, Kermanshah, Qazvin, Fars, Ilam* ¹⁰ , Golestan* ⁵
<i>T. vulgatissimus</i> Haliday	Tehran, Markazi, Hamadan, Kermanshah, Zanjan, Khorasan-e-Shomali, Lorestan* ⁸ , Ilam* ^{10, 11, 12}

[(1) Zolfaghari *et al.*, 2015; (2) Fekrat and Manzari, 2014; (3) Jahangiri *et al.*, 2014, 2015; (4) Dosty and Mirab-balou, 2014; (5) Mirab-balou *et al.*, 2015a; (6) Mirab-balou, 2013a; (7) Mirab-balou *et al.*, 2015b; (8) Horri *et al.*, 2012; (9) Rahemi *et al.*, 2010; (10) Mirab-balou, 2014a; (11) Mirab-balou, 2014b; (12) Mirab-balou *et al.*, 2015c].

Materials and Methods

This study based on published literatures and specimens deposited in the following collections: Department of Plant Protection, College of Agriculture, Ilam University, Iran (ILAMU), Institute of Insect Sciences, Zhejiang University, Hangzhou, China (ZJUH), and Insect Collection of Department of Entomology, South China Agricultural University, Guangzhou, China (SCAU).

The terminology follows Bhatti (1980), Palmer (1992), Nakahara (1994), Mound and Masumoto (2005) and Mirab-balou *et al.* (2012). All descriptions and photos were made with a Leica DM IRB microscope, with a Leica Image 1000 system. Some important characters of this genus are shown in figure 1.

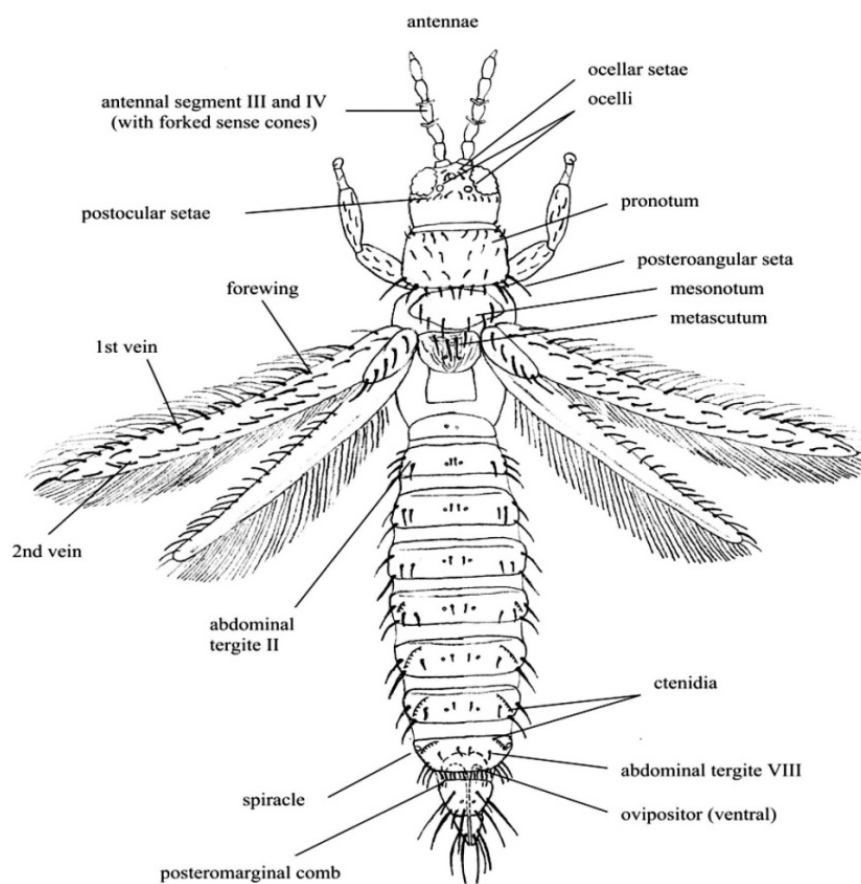


Figure 1. General characters of *Thrips* (female - dorsal view) (Lewis, 1997)

Notes: (1) The following *Thrips* species have not examined by the author, and included here according to the original descriptions or other available keys: *italicus*, *minutissimus*, *trybomi*, *verbasci* and *viminalis*; (2) The following figures obtained from Mirab-balou *et al.* (2012): 2 (a,b), 3b, 4 (a,b), 5 (b,c), 6, 9 (a,b), 13 (c,d,e), and 16b.

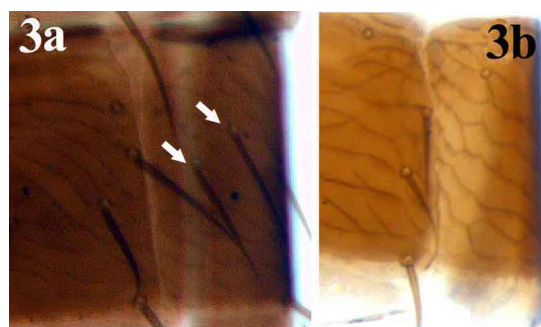
Key to species of the genus *Thrips* from Iran

- 1. Abdominal sternites with at least one pair of discal setae (Fig. 2a)2
- Abdominal sternites without discal setae (Fig. 2b).....3



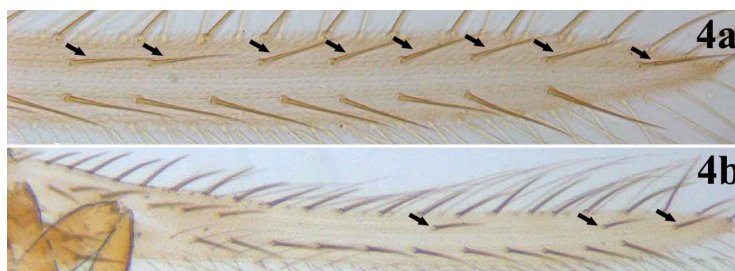
2. Pleurotergites III-VII with discal setae (Fig. 3a).....3

- Pleurotergites III-VII without discal setae (Figs. 3b).....14



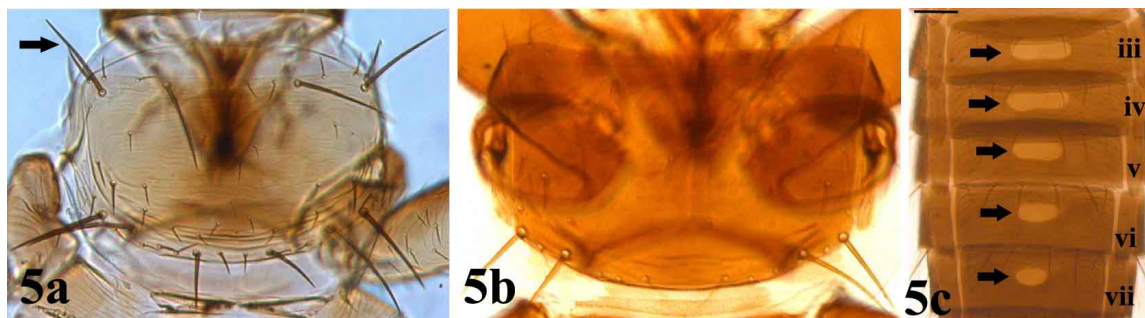
3. Fore wing first vein with five or more distal setae (Fig. 4a).....4

- Fore wing first vein with three or rarely four distal setae (Fig. 4b).....8



4. Pronotum with two pairs of long setae on anterior (same as *Frankliniella*) (cf. Fig. 5a). [Male with pore plates on abdominal sternites III-VII (cf. Fig. 5c)].....*verbasci*

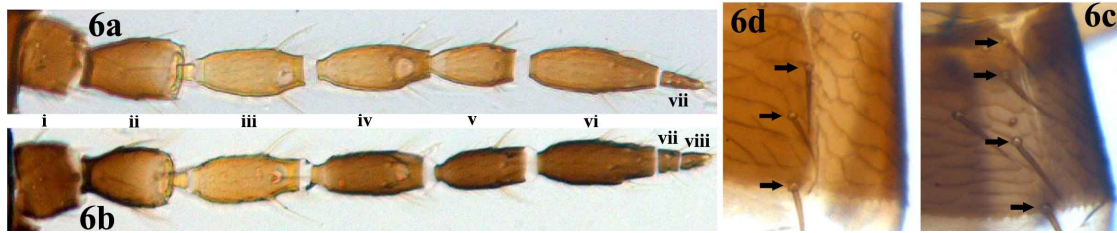
- Pronotum without long setae on anterior (Fig. 5b).....5



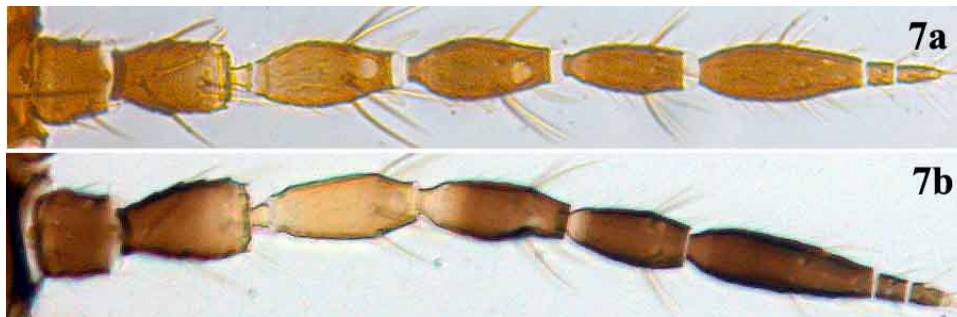
5. Antennae 7-segmented (Fig. 6a); abdominal tergite II with 4 lateral setae

(Fig. 6c). [Male with small pore plate on abdominal sternites III-V].....*minutissimus*

- Antennae 8-segmented (Fig. 6b); abdominal tergite II with 3 lateral setae (Fig. 6d).....6



- 6. Antennal segments generally dark (Fig. 7a). [Male with pore plates on abdominal sternites III-VII].....*atratus*
- Antennal bicolored, yellow and brown (Fig. 7b).....7

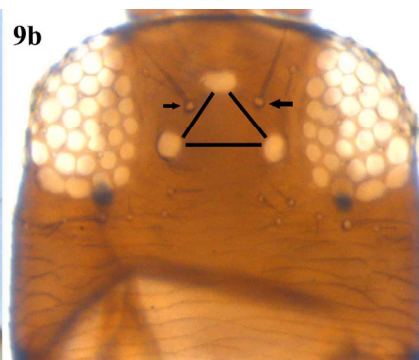


- 7. Body dark (cf. Fig. 8a); antennal segments I-III pale. [Male with pore plates on abdominal sternites III-VII].....*italicus*
- Body pale (cf. Fig. 8b); antennal segment III pale yellow in basal third. [Male unknown].....*fraudulentus*



8. Abdominal tergite II with 4 setae laterally (Fig. 6c); ocellar setae pair III situated inside of ocellar triangle (Fig. 9a). [Male with small transverse pore plates on abdominal sternites III-VII].....*australis*

- Abdominal tergite II with 3 setae laterally (Fig. 6d); ocellar setae pair III situated outside of ocellar triangle (Fig. 9b).....9



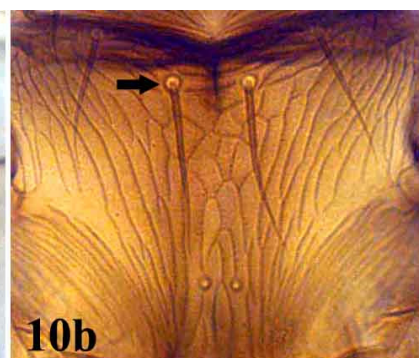
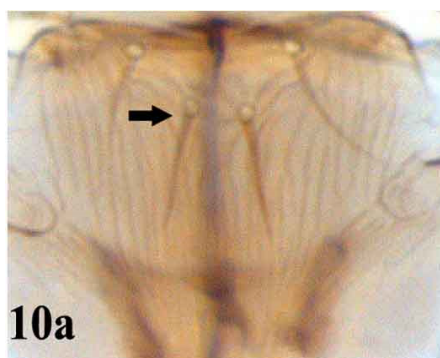
9. Body yellow or light brown with a darker abdomen (Fig. 8b); antennae 7- or 8-segmented (Figs. 6a,b, 7a,b).....10

campaniform sensilla) absent. [Male with pore plates on abdominal sternites III-VII].....*pillichii*

- Body dark brown to black (Fig. 8a); antennae 8-segmented (Figs. 6b, 7a,b).....11

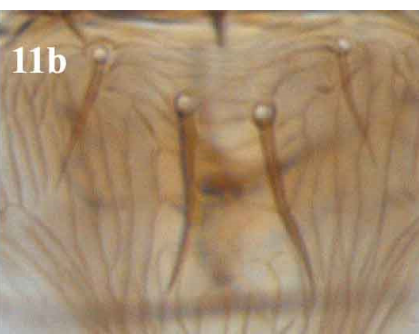
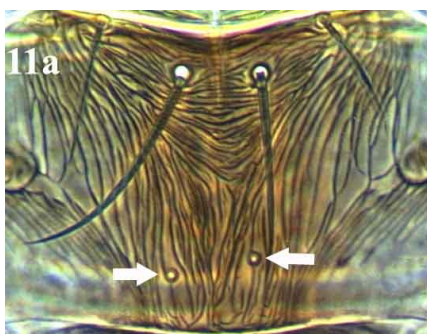
- Antennae 8-segmented; median metanotal setae situated at anterior margin (Fig. 10b); MCS present; [Male with pore plates on abdominal sternites III-VII].....*tryboni*

10. Antennae 7-segmented; median metanotal setae situated far from anterior margin (Fig. 10a); MCS (metanotal



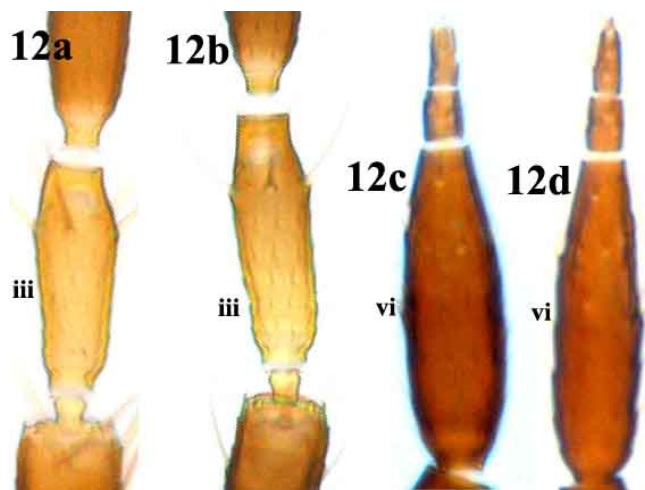
11. MCS present (Fig. 11a)..... 12

- MCS absent (Fig. 11b).....13



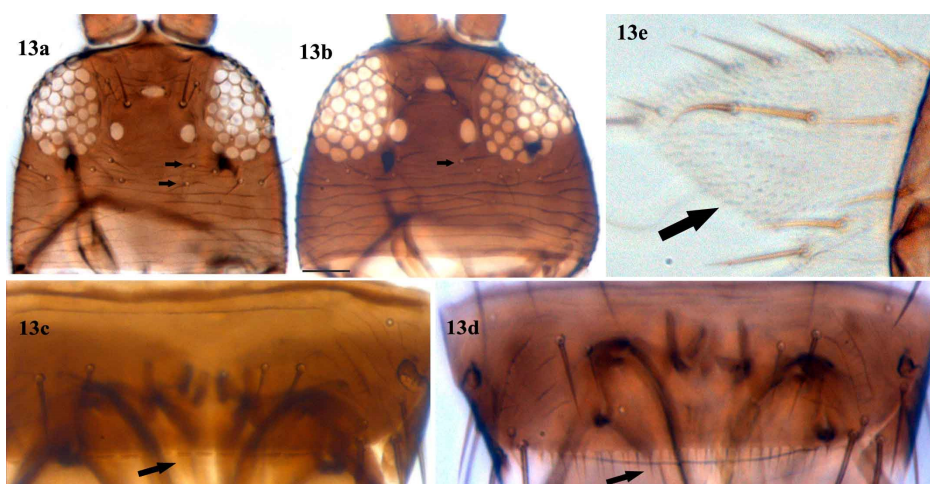
12. Antennal segment III light yellow, or yellow (Fig. 12a); segment VII and VIII in equal length. [Male with pore plates on abdominal sternites III-VI].
.....*meridionalis*

- Antennal segment III brown to light brown (Fig. 12b); segment VII about 0.6-0.7 times as length as VIII. [Male with broadly transverse pore plates on abdominal sternites III-VII]..... *vulgatissimus*



13. Postocular setae pair II small and situated well behind row (Fig. 13a); median metanotal setae situated far behind anterior margin; abdominal tergite VIII posteromarginal comb may appear, absent or represented by a few microtrichia laterally and a very short lobed flange or craspedum medially (Fig. 13c).

[Male microptera (Fig. 13e), with large and transverse pore plates on abdominal sternites III-VII].....*alliorum*
- Postocular setae pair II in line with I & III (Fig. 13b); median metanotal setae situated near anterior margin; abdominal tergite VIII with complete comb on posterior margin (Fig. 13d). [Male unknown].....*alavii*

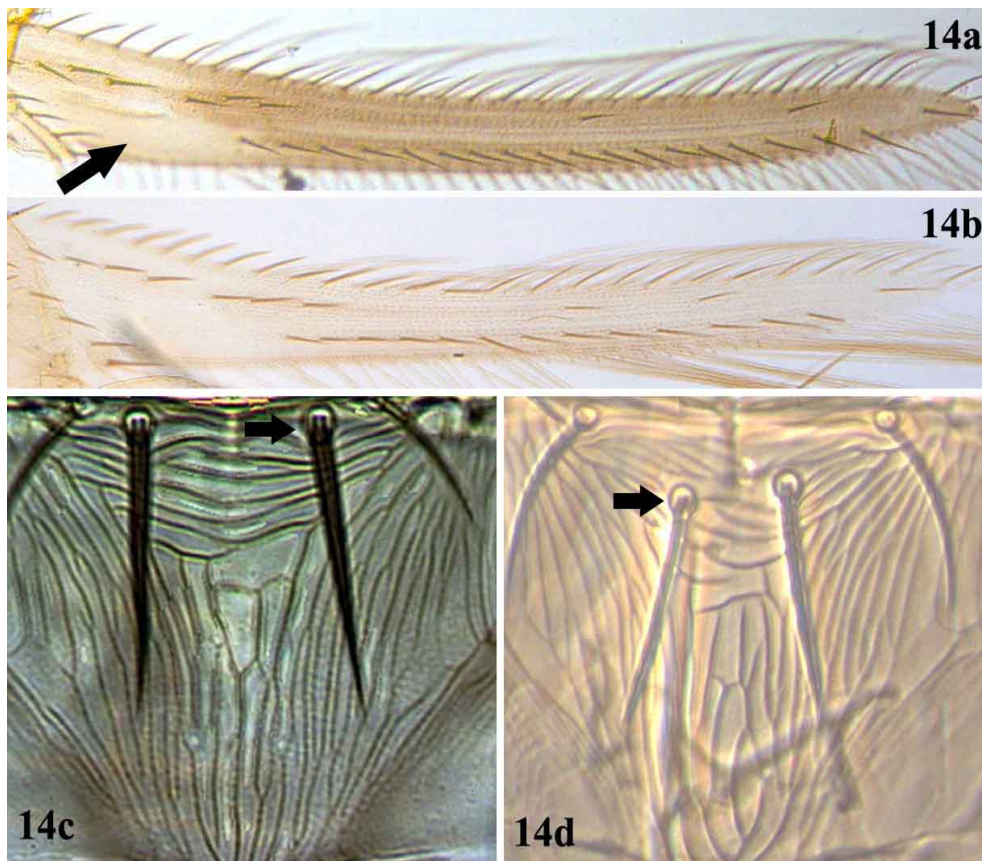


14. Abdominal sternites II-VII or III-VII with discal setae (cf. Fig. 2a).....15

- Abdominal sternites III-VI, IV-VI or V-VI with discal setae (cf. Fig. 2b).....22

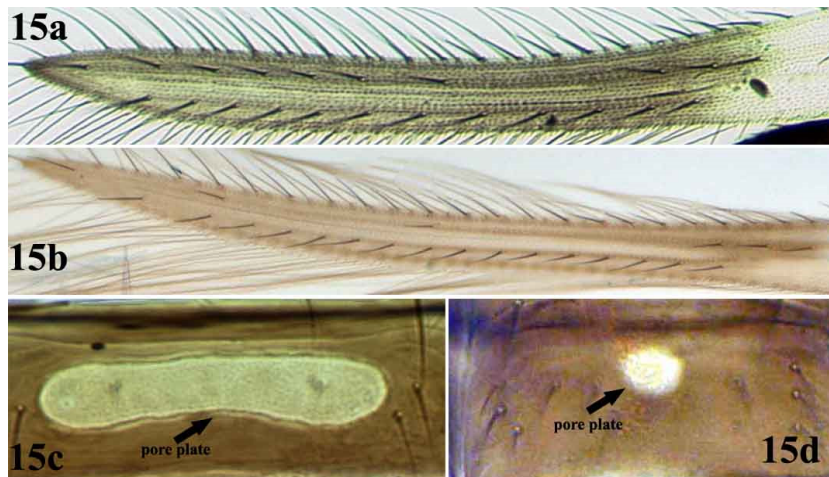
15. MCS present (cf. Fig. 11a); abdominal tergite II with 4 lateral setae (cf. Fig. 6c).....**16**
 - MCS absent (cf. Fig. 11b); abdominal tergite II with 3 lateral setae (cf. Fig. 6d).....**17**
16. Fore wings with base pale (Fig. 14a); metanotum with lines of sculpture longitudinal medially, but transverse at anterior (Fig. 14c) metanotal median setae situated on anterior margin (Fig. 14c); antennae 7- or 8-segmented. [Male with

- transverse pore plates on anterior to discal setae of abdominal sternites III-VII].....*hawaiiensis*
 - Fore wings pale or dark but without base distinctly paler (Fig. 14b); metanotum with sculpture broadly striate (Fig. 14d); metanotal median setae situated just behind anterior margin (Fig. 14d); antennae 7-segmented. [Male with transverse pore plates on abdominal sternites III-VII].....*coloratus*



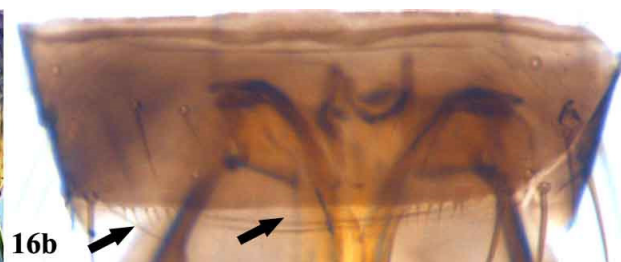
17. Antennae 8-segmented (cf. Fig. 6b).....**18**
 - Antennae 7-segmented (cf. Fig. 6a).....**19**
18. MCS absent (cf. Fig. 11b); median metanotal setae situated behind of anterior margin (cf. Fig. 14d); fore wing first vein with 5-10 setae on distal half (Fig. 15a). [Male with large transverse pore plates

- (Fig. 15c) on abdominal sternites III-VII].....*simplex*
 - MCS present (cf. Fig. 11a); median metanotal setae situated at anterior margin (cf. Fig. 11c); fore wing first vein with 3 distal setae (Fig. 15b). [Male with small circular to oval pore plates (Fig. 15d) on abdominal sternites III-VII].....*longiceps*



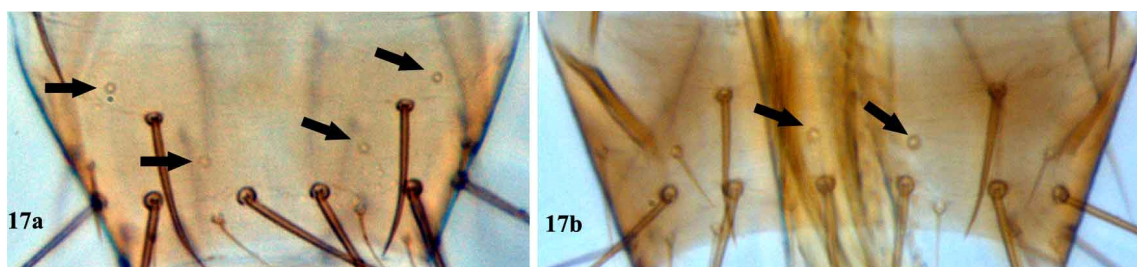
19. Fore wing first vein with 5-10 (rarely with 4) distal setae (cf. Fig. 15a). [Male with pore plates on abdominal sternites III-VII].....*angusticeps*
 - Fore wing first vein with 3 distal setae (cf. Fig. 15b).....**20**
20. Abdominal segment X more than 80 microns long; body with long major setae. [Male color brown, with broadly oval pore plates on abdominal sternites III-VII].....*trehernei*
 - Abdominal segment X less than 80 microns long; body with major setae relatively short.....**21**
21. Antennal segments III-V and half of VI yellow; abdominal segment X usually 58-73 microns long, the sides slightly concave. [Male color yellow, with broadly oval pore plates on abdominal sternites III-VII].....*physapus*
 - Antennal segments III-V white; abdominal segment X usually 69-80 microns long, the sides straight. [Male with

pore plates on abdominal sternites III-VII].....*pelikani*
22. Antennae 8-segmented (cf. Fig. 6b); abdominal tergite II with 4 lateral marginal setae (cf. Fig. 6c). [Male with pore plates on abdominal sternites III-VII].....*vuilleti*
 - Antennae 7-segmented (cf. Fig. 6a); abdominal tergite II with 3 lateral marginal setae (cf. Fig. 6d). [Male with pore plates on abdominal sternites III-VI].....*mareoticus*
23. Abdominal tergite II with 4 lateral marginal setae (cf. Fig. 6c).....**24**
 - Abdominal tergite II with 3 lateral marginal setae (cf. Fig. 6d).....**25**
24. Abdominal tergite VIII with complete posteromarginal comb. [Male with pore plates on abdominal sternites III-VII].....*flavus*
 - Abdominal tergite VIII with posteromarginal comb only laterally. [Male with transverse pore plates on abdominal sternites III-VII].....*fuscipennis*



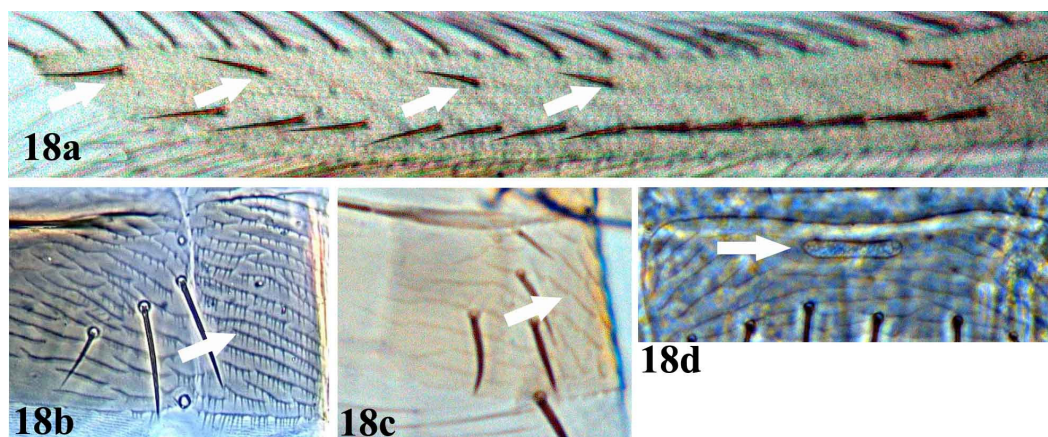
25. MCS present (cf. Fig. 11a). [Male with pore plates on abdominal sternites III-VI]
*viminalis*
 - MCS absent (cf. Fig. 11b).....26
 26. Abdominal tergite VIII with postero-
 marginal comb complete (cf. Fig. 16a).....27
 - Abdominal tergite VIII with postero-
 marginal comb incomplete (cf. Fig. 16b).....30

27. Metanotal median setae situated at
 anterior margin (cf. Fig. 14c); abdominal
 tergite IX with two pair of campaniform
 sensilla (cf. Fig. 17a). [Male with pore plates
 on abdominal sternites III-VII].....*dubius*
 - Metanotal median setae situated behind
 anterior margin (cf. Fig. 14d); abdominal
 tergite IX with one pair of campaniform
 sensilla (Fig. 17b).....28



28. Fore wings first vein with 4-7 distal
 setae (Fig. 18a); abdominal pleurotergites
 with rows of ciliate microtrichia (Fig. 18b);
 ocellar setae pair III situated inside of
 ocellar triangle (cf. Fig. 9a). [Male with
 narrow transverse pore plates (Fig. 18d) on
 abdominal sternites III-V]..... *tabaci*

- Fore wings first vein with at most 3
 distal setae (cf. Fig. 15b); abdominal
 pleurotergal sculpture different, without
 closely spaced rows of microtrichia (Fig.
 18c); ocellar setae pair III situated outside
 of ocellar triangle (cf. Fig. 9b)29



29. Body yellow; macroptera (Fig. 19a) or
 microptera (Fig. 19b). [Male microptera,
 with transverse pore plates on abdominal
 sternites III-VII].....*nigropilosus*

- Body dark brown (Fig. 19c); macroptera.
 [Male with light-colored pore plates on
 abdominal sternites III-VII].....*euphorbiae*



30. Body yellowish, or yellowish-brown to brown; abdominal sternite I with 2-3 short setae at anterior margin. [Male with pore plates on abdominal sternites III-VI].....*juniperinus*

- Body brown to dark brown; abdominal sternite I with no setae at anterior margin. [Male with transverse pore plates on abdominal sternites III-VII].....*major*

Discussion

Of the 6,000 species of Thysanoptera that exist in the world, less than 5 percent has been recorded in Iran (Mirab-balou 2013b), which indicates the fauna of Iran is little known. This study revealed 33 *Thrips* species were recorded for the fauna of Iran (Table 1); however, there are no sufficient data on most of them i.e. the number of specimens of female and male, host plants, the date of sample collection, their biology and depository. Amongst Iranian *Thrips* species, *T. tabaci* is one of the important pests and is widely distributed in this country (Mirab-balou et al. 2009, 2014c), and recently, high number of this species were also collected from the northern provinces of Iran (Mirab-balou et al. 2015a). In addition, *T. meridionalis* is another important pest in Iran and it has been recorded as a pest of stone fruit trees in Fars province (Alavi et al. 2012), and it was the most common species in Khorasan-e-Razavi Province (Fekrat and Manzari 2014).

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کلید مصور گونه‌های جنس *Thrips* Linnaeus (Thysanoptera: Thripidae) در ایران، به همراه لیست به‌روز شده گونه‌ها

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چکیده: جنس *Thrips* Linnaeus (Thripidae: Thripinae) یکی از بزرگترین گروه‌های تریپس‌ها در ایران است که شامل تعدادی از مهمترین آفات می‌باشد. اکثر گونه‌های جنس *Thrips* دارای رفتار گیاه‌خواری هستند و روی برگ‌ها و گل‌های خانواده‌های مختلف گیاهان زندگی می‌کنند. در این مقاله کلید شناسایی ۳۱ گونه از جنس *Thrips* در ایران تهیه شده است همچنین اطلاعات جدیدی در مورد انتشار جغرافیایی ۱۷ گونه در ایران ارائه شده است.

واژگان کلیدی: *Thrips*، کلید شناسایی، Thripinae، فون تریپس‌ها، ایران