



Fungus-feeding thrips in Iran with a new species of *Stictothrips* (Thysanoptera: Phlaeothripidae)

MAHSA HAKIMARA¹, KAMBIZ MINAEI², SABER SADEGHI¹ & LAURENCE MOUND³

¹Department of Biology, Faculty of Science, Shiraz University, Shiraz, Iran. E-mail: mahsa.hakimara@gmail.com; ssadeghi@shirazu.ac.ir

²Department of Plant Protection, College of Agriculture, Shiraz University, Iran. E-mail: kminaei@shirazu.ac.ir

³CSIRO Australian National Insect Collection, PO Box 1700, ACT 2601, Australia. E-mail: laurence.mound@csiro.au

Abstract

An illustrated key is provided to distinguish 13 genera of fungus-feeding thrips recorded from Iran in both subfamilies of Phlaeothripidae (Idolothripinae, Phlaeothripinae). Information is provided concerning 16 species recorded from this country. A curious new species of *Stictothrips* is described from both sexes collected from dead leaves in Fars province, southern Iran.

Key words: key, leaf litter, new species

Introduction

About 50% of the known species of Thysanoptera feed only on fungus in leaf litter or on decaying wood (Morse & Hoddle 2006). These fungivorous species are members of the Phlaeothripidae, the largest family of Thysanoptera and the only extant family of suborder Tubulifera. The Phlaeothripidae, with about 3600 species, comprises two subfamilies: Idolothripinae and Phlaeothripinae. Species of Phlaeothripinae are biologically diverse and some, from the *Phlaeothrips*-lineage, feed on fungal hyphae (Mound & Marullo 1996). This lineage is a particularly large group, with species living and breeding on dead leaves and dead branches (Dang *et al.* 2014). Members of the subfamily Idolothripinae have broad maxillary stylets and feed on fungal spores. Among Idolothripinae, some species are particularly associated with dead hanging leaves where they are exposed to sunlight and there is good air circulation. However, some individuals will, at times, be found on dead twigs and even on dead leaves on the ground. In contrast, equally large species form large colonies on fallen tree trunks and dead branches that provide a habitat for a wide range of spore-feeding species. A very different habitat, leaf-litter that is often rather moist, seems to be favored by some spore-feeding species whereas others are probably associated with rather well drained leaf-litter. At ground level, specifically at the base of tussocks of grass, is another suite of Idolothripinae species (Eow *et al.* 2011). Fungus-feeding thrips species commonly live in the relatively moist forest (Mound & Tree 2014).

While there are many reports about the Thysanoptera fauna of Iran (Bhatti *et al.* 2009), these are mostly focused on species of agricultural interest (Minaei *et al.* 2007) and there are only a few scattered studies on fungus-feeding thrips. As a result, studies are needed on the Iranian fauna of these species, because previous studies on the thrips of Iran were aimed primarily at economically important species associated with crop damage. So far, only 16 species with the fungus-feeding habit have been reported from Iran, including both Idolothripinae and Phlaeothripinae. This number appears to be just 7% of the nearly 230 species of Thysanoptera that have been reported for this country (Minaei 2017), and this low percentage results mainly from lack of studies on these insects. Most of the fungus-feeding thrips known from Iran have been collected from leaf litter rather than from dead branches, and this contrasts with the situation in more temperate countries (Mound *et al.* 2018). In previous studies on fungus feeding Tubulifera (Dang *et al.* 2014; Dang & Qiao 2013; Eow *et al.* 2011; Mound *et al.* 2013; Mound & Palmer 1983), leaf litter is the most common habitat amongst this group of insects with moisture required for fungus to grow as food and thick layers of dead leaves and branches as a good shelter. However, the number of extracted specimens from

Berlese funnels is mostly low, and this limitation leads to problems in evaluating morphological variation among samples.

The first objective of this paper is to provide an identification key for fungus-feeding thrips genera of Iran. The second objective is to describe a curious *Stictothrips* species from Fars province, southern Iran.

Materials and methods

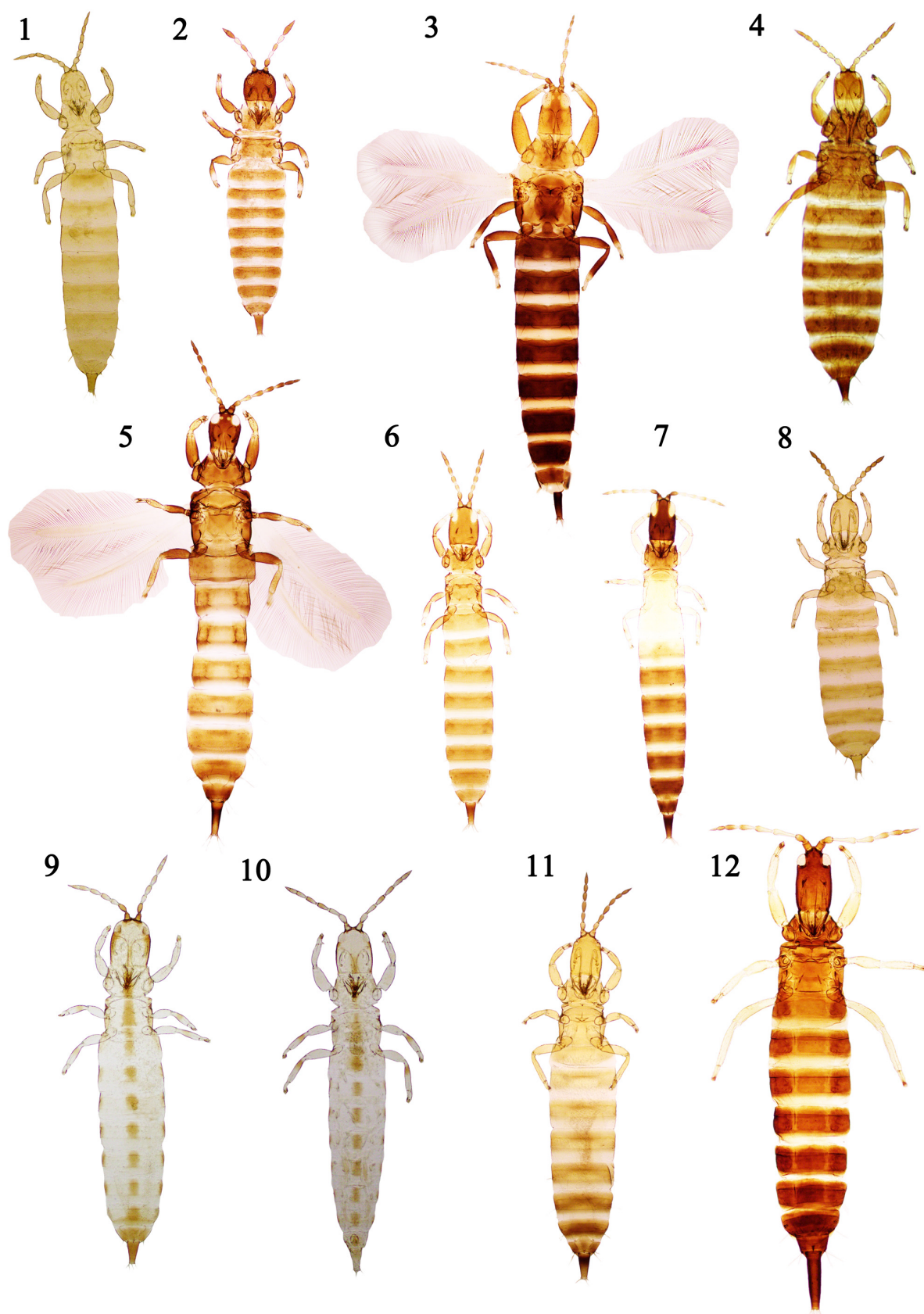
Structural observations were made using an Olympus BX51 phase-contrast microscope, and most photomicrographs and measurements were made using this microscope with DP27 digital camera and cellSens software. Figures 40 and 43 were prepared with a Leica DM2500 microscope with Nomarski illumination, and processed through Automontage software. Figures 27 and 36 were taken from “Thysanoptera Britannica et Hibernica” https://keys.lucidcentral.org/keys/v3/british_thrips (Mound *et al.* 2018). The holotype of the new species described below is deposited in the Natural History Museum, London, United Kingdom (NHM). Two paratypes (one male and one female) are deposited in the Australian National Insect Collection (ANIC), Canberra, Australia. Other specimens are deposited in the Department of Plant Protection, College of Agriculture, Shiraz University, Shiraz, Iran (PPSU). Full nomenclatural information about Thysanoptera is available at ThripsWiki (2019).

Key to genera of fungus-feeding thrips of Iran

1. Head with maxillary stylets broad ($> 5\mu\text{m}$) (Fig. 22); male sternite VIII without any pore plate; male tergite IX setae S2 as long and slender as setae S1 (Idolothripinae)
- Head with maxillary stylets narrow (3-5 μm) (Figs 23–24, 26–29, 31–32), male sternite VIII usually with pore plate present (Fig. 43); male tergite IX setae S2 shorter and stouter than setae S1 6 (Phlaeothripinae)
2. Tube long with numerous lateral setae (Fig. 41); pelta with broad lateral lobes close to center (Fig. 38) *Megathrips*
- Tube short without lateral setae (Fig. 44); pelta without broad lateral lobes 3
3. Eyes with many facets dorsally; maxillary palps without a large terminal sensorium. 4
- Eyes with less than 10 facets dorsally (Fig. 22); maxillary palps with a large terminal sensorium which looks like a third segment (Fig. 25). 5
4. Body constricted at metathorax; antennal segment IV with 2 sense cones *Compsothrips*
- Body not constricted at metathorax; antennal segment IV with 4 sense cones *Nesothrips*
5. Antennae 8-segmented (Fig. 18), segment IV with 4 sense cones *Pseudocryptothrips*
- Antennae 7-segmented (Fig. 20), segment IV with 2 sense cones *Allothrips*
6. Antennae 7-segmented (Fig. 17); apterous, body surface with sculpture (Fig. 2) *Idiothrips*
- Antennae 8-segmented (Figs 15, 16, 19, 21); apterous or macropterous; body surface with or without sculpture 7
7. Antennal segments III and IV with 3 and 4 sense cones respectively (Figs. 13, 14); head with or without setal bearing tubercles on genae 8
- Antennal segments III and IV with maximum 2 and 3 sense cones respectively; head without tubercles on genae (Figs 23, 28–29, 31–32) 10
8. Head with genae almost smooth, without setal-bearing tubercles (Fig. 24); forewings parallel-sided (Fig. 34). ... *Hoplothrips*
- Head with setal-bearing tubercles on genae (Figs. 26, 27); forewings parallel-sided or constricted. 9
9. Fore wings constricted medially with duplicated cilia (Fig. 35) *Hoplandrothrips*
- Forewings parallel-sided (Fig. 36) *Phlaeothrips*
10. Antennal segments IV with 3 sense cones (Figs 15, 21); prosternal basantra present (Fig. 28) 11
- Antennal segments IV with 2 or 3 sense cones (Fig. 14); prosternal basantra absent (Figs 23, 30) 12
11. Body usually bicolored and body surface with complex sculpture (Figs 9, 10); head often longer than broad (Figs 31, 32). ...
..... *Stictothrips*
- Body unicolored and body surface without sculpture (Fig. 1); head as wide as long (Fig. 28). *Hindsiothrips*
12. Antennal segment IV with 3 sense cones (Fig. 16); mouth cone pointed, extending to mesosternum (Fig. 30); post ocular setae extending beyond hind margin of eye (Fig. 29) *Liophloeothrips*
- Antennal segment IV with 2 sense cones (Fig. 19); mouth cone short and rounded (Fig. 23); post ocular setae short (Fig. 23) .
..... *Cephalothrips*

PHLAEOTHRIPIIDAE - PHLAEOTHRIPIINAE

Phlaeothrips-lineage



FIGURES 1–12. Fungus feeding thrips species of Iran (1) *Hindsiothrips sisakhti* (female); (2) *Idiothrips bellus* (female); (3) *Hoplandrothrips bidens* (female); (4) *Liophloeothrips arganicus* (female); (5) *Hoplothrips* (female); (6) *Cephalothrips monilicornis* (female); (7) *Cephalothrips coxalis* (female); (8) *Allothrips bournieri* (female); (9) *Stictothrips farsi* **sp. n.** (female); (10) *Stictothrips farsi* **sp. n.** (male); (11) *Pseudocryptothrips meridionalis* (female); (12) *Megathrips flavipes* (female).

***Hindsiothrips* Stannard**

All six described species in this genus are from the Holarctic (ThripsWiki 2019). The genus was described for a North American species and currently two Nearctic species are known, *H. pullatus* and *H. robustisetis* (Mound & Marullo 1996). In contrast, three species are described from Europe (*H. bonessi*, *H. navarrensis* and *H. oettingeni*) (Goldarazena & Mound 1998). The sixth species, *H. sisakhti* Minaei (Fig. 1) was described from Iran collected at Sisakht, the capital of Dena County, Kohgiluyeh and Boyer-Ahmad province (Minaei 2013). In this study several specimens of the species have been collected from leaf litter around Fars province.

***Hoplandrothrips* Hood**

This genus includes 117 species worldwide, presumably feeding and breeding on fungi on dead branches (ThripsWiki 2019). More than 20 are described from North America, and Stannard (1968) provided a key to seven species from Illinois. Mound and Marullo (1996) provided a key to 18 Neotropical species, and Mound and Tree (2013) recorded 16 species from Australia. Two species of this genus are recorded from Iran. *H. bidens* Bagnall is common and widespread in the Palearctic region on dead branches (Priesner 1964), and also reported from New Zealand (Mound & Walker 1986). In Iran, *H. bidens* (Fig. 3) was recorded for the first time by Mortazawiha and Dern (1977) on the basis of two females and two males collected under the bark of trees infested by scolytids in central Iran. Subsequently it was reported from Shiraz, Fars province, on the basis of five females and five males on *Prunus* branches (Minaei 2013). Although *H. bidens* is usually collected from branches, in the present study one male was collected from leaf litter. The second species of *Hoplandrothrips* recorded from Iran, the European *H. hungaricus* Priesner, is recorded only on the basis of one female collected on leaves of *Malus domestica* from Bojnourd region, Khorasan province (Alavi & Kamali 2002; 2003).

***Hoplothrips* Amyot & Serville**

This genus of 120 fungus-feeding species worldwide is one of the largest genera of Phlaeothripinae (ThripsWiki 2019). The species frequently exhibit considerable dimorphism associated with sex and also with wing length, and there is often great variation in body size often involving allometry in some structural characters of males. Consequently, it is difficult to identify many of species of this widespread genus, as many are known only from few specimens (Hoddle *et al.* 2019, Mound 2017). These thrips are usually found on dead branches, although some are associated with leaf litter. From this genus only one unidentified species (Fig. 5) is recorded from Iran, with two females taken in the north of Iran (Jalali Sendi *et al.* 2011).

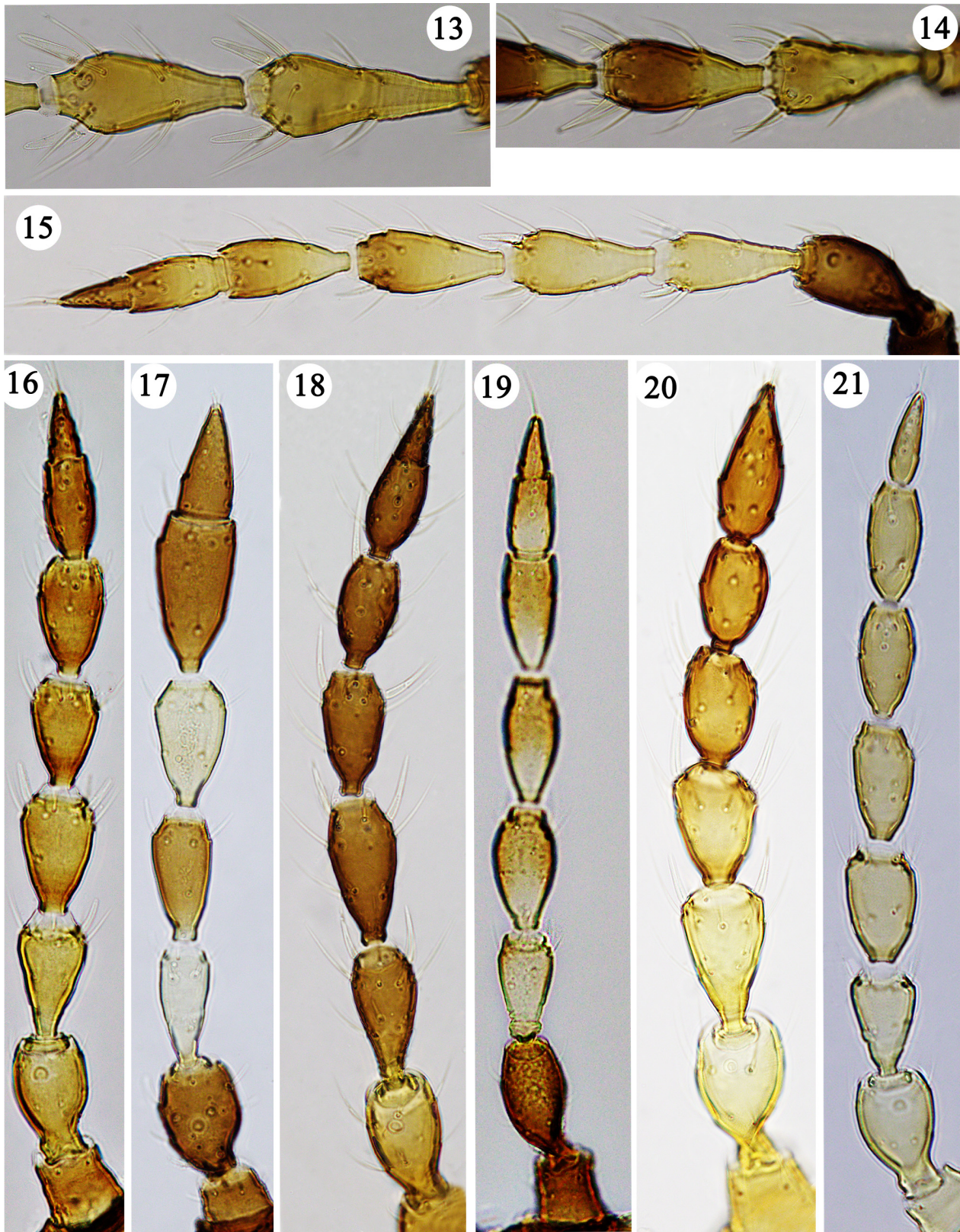
***Idiothrips* Faure**

This genus comprises only two species which are reported from Africa and Asia (ThripsWiki 2019). Faure (1933) described *I. bellus* from South Africa, and this species was subsequently reported from India (Ananthkrishnan 1964) and then from Kerman province, southern Iran (Kheyrandish Koshkoei 2000). Minaei (2013) recorded *I. bellus* (Fig. 2) in Fars province, and one female has been collected from leaf litter of *Quercus* sp. The only other species in the genus, *I. maghrebicus* remains known from a single female taken in flowers of *Phillyrea angustifolia* at Asni, Morocco (zur Strassen 1968).

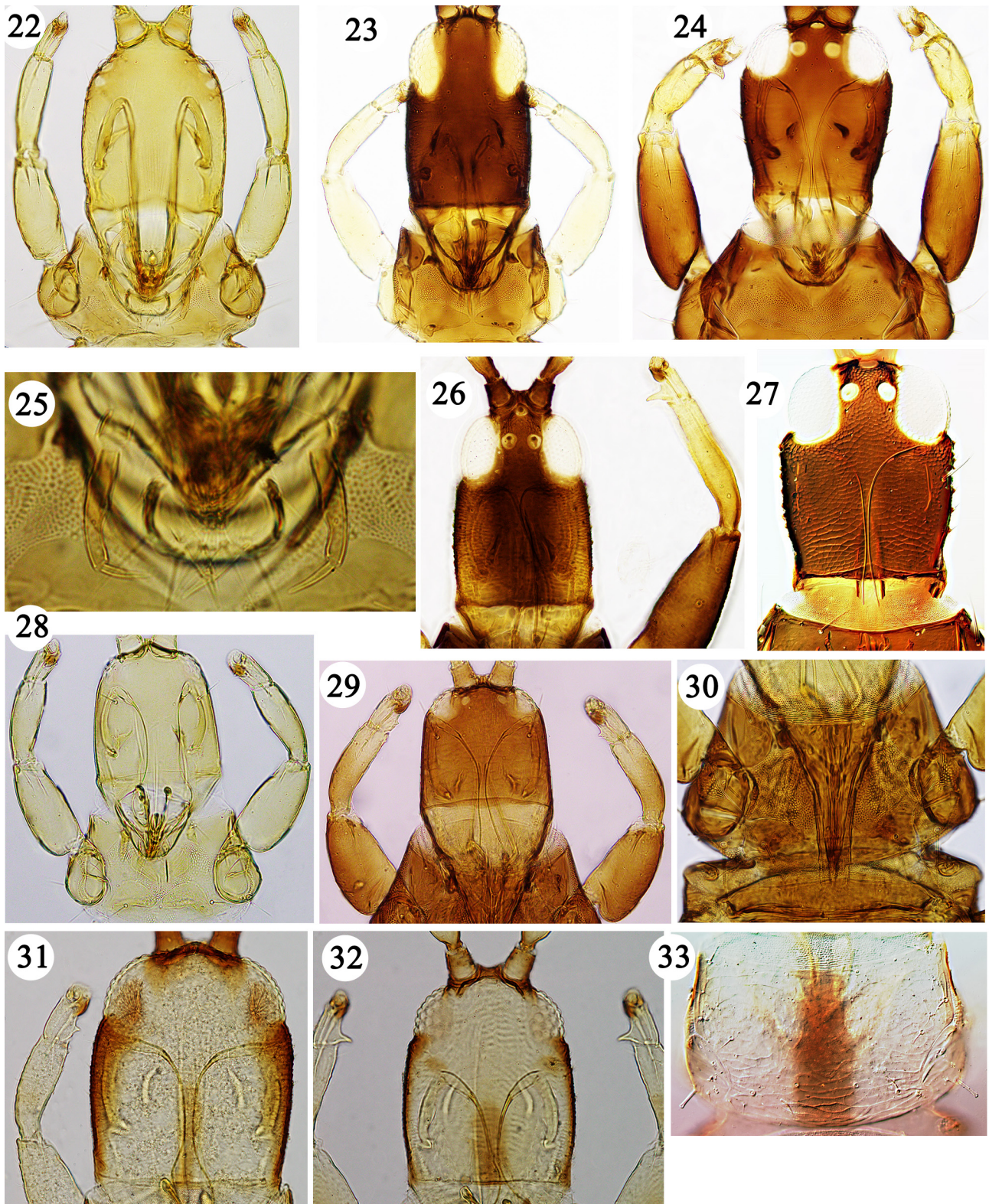
***Phlaeothrips* Haliday**

This genus includes 24 species, of which one is a fossil, and two or more Asian species are known only from descriptions (ThripsWiki 2019). The species listed in this genus were described from many parts of the world, but their systematic relationships have never been examined, and there is no satisfactory generic diagnosis. In particular,

Phlaeothrips is not clearly distinguished from the much larger genus *Hoplandrothrips*. *Phlaeothrips coriaceus* Haliday, the type species of the genus, is widespread across Europe, reported from California (Hodde *et al.* 2019) and recorded from north of Iran based on two females beaten from shrubs (zur Strassen 2003).



FIGURES 13–21. Fungus feeding thrips species of Iran, Antennae (13) *Hoplandrothrips bidens* (segments III & IV); (14) *Hoplothrips* (segments III & IV); (15) *Stictothrips farsi* sp. n.; (16) *Liophloeothrips arganicus*; (17) *Idiothrips bellus*; (18) *Pseudocryptothrips meridionalis*; (19) *Cephalothrips coxalis*; (20) *Allothrips bourneri*; (21) *Hindsiothrips sisakhti*.



FIGURES 22–33. Head, forelegs & pronotum (22–24): (22) *Allothrips bournieri*; (23) *Cephalothrips coxalis*; (24) *Hoplothrips*. (25) *Allothrips bournieri* (maxillary palps); (26) *Hoplandrothrips bidens* (head & fore leg); (27) *Phlaeothrips coriaceus* (head); (28) *Hindsiothrips sisakhti* (head, fore legs & pronotum); (29) *Liophloeothrips arganicus* (head & forelegs); (30) *Liophloeothrips arganicus* (mouthcone, pro & mesonotum); (31) *Stictothrips farsi* sp. n. (female head & fore leg); (32) *Stictothrips farsi* sp. n. (male head & fore legs); (33) *Stictothrips farsi* sp. n. (female pronotum).

Genus *Stictothrips* Hood

Currently this genus comprises five fungus-feeding species (ThripsWiki 2019) that have been described from several different parts of the world. The type species, *S. maculatus* Hood, is known from various parts of North America, with both sexes fully winged (Hoddle *et al.* 2019). *S. faurei* was described from South Africa and subsequently recorded (as *S. fimbriata*) from India (Bhatti *et al.* 2009); moreover Cheraghian (1996) recorded this species in low density from *Ficus bengalensis* in Khuzestan province, south of Iran. *S. leopardinus* was described from northern Egypt (Priesner 1965); and *S. aoristus* and *S. namadji* were described from Australia (Mound & Tree 2015). To these five species, the following new species is described here from Iran.

Stictothrips farsi sp.n.

Female aptera (Fig. 9). Body yellow with light brown markings and fine complex reticulate sculpture, distal part of tibiae and tarsi yellow, antennal segments II–III light brown, major setae light brown. Antennae 8-segmented, III with one sense cone, IV with two major sense cones, VIII narrowed at base but not constricted (Fig. 15). Head longer than wide, post ocular setae capitate, placed laterally on head, not extending beyond hind margin of eye (Fig. 31); mouth cone short. Pronotum with 4 pairs of relatively well-developed major setae (anteroangulars, midlaterals, epimerals, and posteroangulars), anteromarginals scarcely longer than discal setae, all pointed except epimeral that is blunt (Fig. 33); notopleural sutures complete. Prosternal ferna developed. Fore tarsal tooth developed (Fig. 31). Meso and metanotum very weakly sculptured. Metathoracic sternopleural sutures extend posteriorly from the mid-coxal cavities. Pelta trapezoidal, with weak sculpture, campaniform sensilla present (Fig. 40); abdominal tergites II–VII with one pair of wing-retaining setae; segment IX with seta S1 and S2 pointed, about half as long as the tube; tube short, length less than twice basal width, shorter than head (Fig. 42).

Measurements (holotype female in microns): Body distended length 1752. Head, length 228; width across genae 173; post ocular setae 14. Pronotum, length 116; median width 176; major setae, anteromarginals 7, anteroangulars 15, midlaterals 18, epimerals 20, posteroangulars 15. Tergite IX setae S1 40, S2 50. Tube, length 99; basal width 53. Antennal segments I–VIII length 34, 50, 58, 57, 55, 48, 33, 30.

Male aptera. Generally similar to female but smaller and paler (Fig. 10). Fore leg and fore tarsal tooth well developed (Fig. 32); sternites VII and VIII with large poorly defined pore plate (Fig. 43). Aedeagus spoon shaped (Fig. 39).

Measurements (paratype male in microns): Body distended length 1455, Head, length 190; width across genae 148; post ocular setae 17. Pronotum, length 109; median width 160; major setae, anteromarginal 10, anteroangular 12, midlateral 11, epimeral 19, posteroangular 12. Tergite IX setae S1 36, S2 23. Tube, length 90; basal width 41. Antennal segments I–VIII length 28, 44, 46, 51, 56, 46, 33, 26.

Material studied. Holotype female, **IRAN**, Fars province, Eghlid, Salicaceae and Platanaceae leaf litter, 4.ix.2015 (in NHM).

Paratypes: **IRAN**, Fars province, Arjan protected area, 60 km west of Shiraz, 2 females, 1 male from *Quercus* leaf litter, 2.v.2015 (in PPSU, 1 female in ANIC); Fasa, 2 males from *Prunus* and *Pistacia* leaf litter, 3.xii.2016 (Mohsen Kiani) (in PPSU & ANIC).

Comments. The shape of head, delicate sculpturing and the sense cone formula on antennal segments III & IV suggest that the new species belongs to *Stictothrips*. However, the curious short and laterally placed post ocular setae on the head and the paired round pore plates on sternite VIII of the male make this species unique in the genus. It shares some characters with the Australian species *S. aoristus* in the wing reduction and resultant loss of certain character states.

Liothrips-lineage

Cephalothrips Uzel

The eight species listed under this genus are mainly from the Holarctic (ThripsWiki 2019), with six of them de-

scribed from the following countries: China, Cuba, Kyrgyzstan, Morocco, North America, South Africa. The type species, *C. monilicornis* (Reuter) (Fig. 6) is known widely across Europe and is reported from North America (Mound *et al.*, 2018). In Iran, two females were taken from flowering *Carum carvi* (Apiaceae) (Alavi & Kamali 2003), and the species was also recorded from barley in Gorgan (Alavi *et al.* 2007). *C. coxalis* Bagnall (Fig. 7) was described from southern France, but it is also recorded from Iran and Morocco (Alavi & Kamali 2003; Minaei & Mound 2014). During the present study a few wingless specimens of *C. coxalis* were collected from leaf litter in Fars province.

***Liophloeothrips* Priesner**

Of the 17 species listed in this genus (ThripsWiki 2019) 13 are known only from India (Tyagi & Kumar 2011). However, the type species, *L. glaber*, and two other species, *L. hungaricus* and *L. pulchrisetis*, are described from Europe. From Iran, *L. hungaricus* has been recorded without any information concerning the locality, date of collection, or number of specimens (Mortazaviha 1995), although this species is possibly associated with the bark of certain Salicaceae (Minaei & Mound 2014). The only other species in this genus, *L. arjanicus* (Fig. 4), was described from both sexes extracted from leaf litter using a Berlese funnel, and is possibly part of the community of fungus-feeding litter thrips (Hakimara *et al.* 2019).

PHLAEOTHIRIPIDAE - IDOLOTHRIPINAE

***Allothrips* Hood**

This genus currently includes 24, usually wingless, species living in leaf litter worldwide. Although Mound (1972) treated most of these as sub-species within two nominal species, the European *A. pillichellus* Priesner (with the basal half of the tube yellow) and the North American *A. megacephalus* Hood (with the tube brown to reddish brown), these subspecies are now usually treated as full species (ThripsWiki 2019). Only *A. bournieri* Mound (Fig. 8) is reported from Iran, based on both sexes collected from leaf litter in Fars province (Minaei 2011). This species is otherwise known only from southern France and Spain.

***Compsothrips* Hood**

The 27 species listed in this genus are mainly from tropical countries, but seven described from North America, and a few from North Africa and the Mediterranean region. These species are all wingless ant-mimics, and mostly differ in the color of the basal antennal segments. The type species, *C. albosignatus* (Reuter), was described from Algeria, but is widespread in the Mediterranean area (ThripsWiki 2019). One individual of this species has been recorded from Iran (Minaei & Alichì 2002).

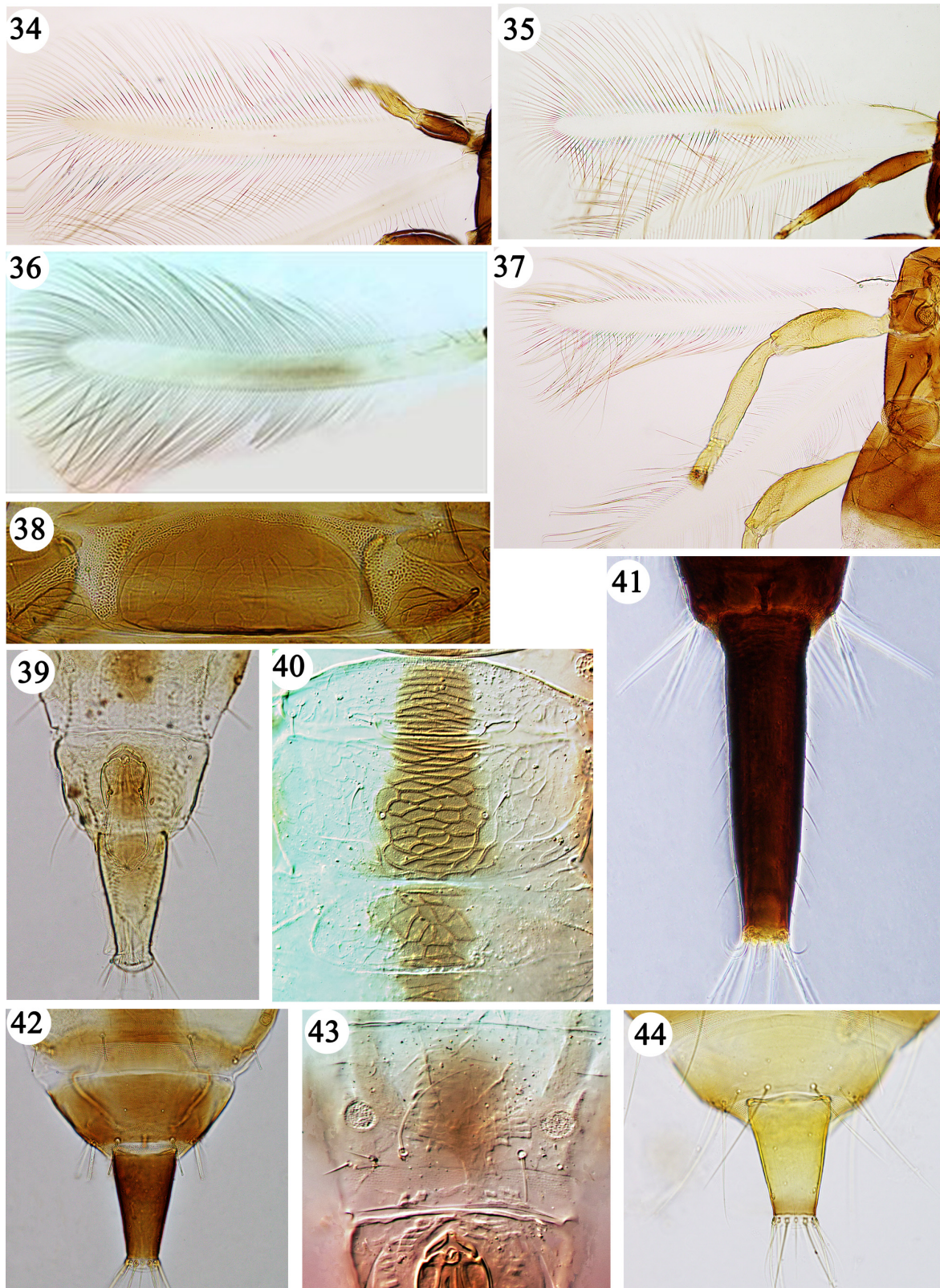
***Pseudocryptothrips* Priesner**

The three species in this genus are structurally similar to the species of *Allothrips*, and apparently share the same habitat (Minaei 2011). Two of the species are from tropical countries, but the type species, *P. meridionalis* Priesner (Fig. 11), was described from Albania and then reported from Iran (Minaei 2011). It was collected from leaf litter in south of Iran (Minaei & Alichì 2002), but in the present study it was taken in association with *Allothrips bournieri*.

***Megathrips* Targioni-Tozzetti**

Of the seven species in this genus, one is described from northern China, one from California, and five from Europe (ThripsWiki 2019). From Iran, *M. flavipes* (Fig. 12) was reported (as *M. inermis*) from leaf litter (Minaei & Alichì 2002). This species was described from Crete (Reuter 1901). During this study several specimens from both sexes

were collected from *Quercus* leaf litter in Fars province of which one female is macropterous (fore wing length 870 microns) (Fig. 37).



FIGURES 34–44. Fungus feeding thrips of Iran, Structural details (34) *Hoplothrips* (fore wing); (35) *Hoplandrothrips bidens* (fore wing); (36) *Phlaeothrips coriaceus* (fore wing); (37) *Megathrips flavipes* (fore wing); (38) *Megathrips flavipes* (pelta with lateral wings); (39) *Stictothrips farsi* sp. n. (male tergite IX & tube) (ventral view); (40) *Stictothrips farsi* sp. n. (female meso & metanotum, pelta); (41) *Megathrips flavipes* (female tube); (42) *Stictothrips farsi* sp. n. (female tergite IX & tube); (43) *Stictothrips farsi* sp. n. (male pore plates on sternite VIII); (44) *Allothrips bournieri* (female tube).

Nesothrips Kirkaldy

This genus comprises about 30 species from the Oriental, Australian and Pacific regions, of which 16 species are from Australia and New Zealand (Eow *et al.* 2014). These species are collected mainly from leaf litter, grass or dead twigs. Only *N. brevicollis* Bagnall is recorded from Iran, collected on grass from Kurdistan province, west of Iran (Mirab-balou 2014).

Acknowledgment

Dr. Jalil Alavi, Plant Protection Research Department, North Khorasan Agricultural and Natural Resources, Research and Education Center, AREEO, Bojnourd, Iran, kindly loaned KM a specimen of *C. monilicornis*. The authors are grateful to the editor as well two anonymous referees who carefully read the text and provided us with detailed criticisms and corrections.

References

- Alavi, J. & Kamali, K. (2002) New records of seven species of Thysanoptera for Iran. *Proceedings of the 15th Iranian Plant Protection Congress, Razi University of Kermanshah, Kermanshah, Iran*, 1, 183.
- Alavi, J. & Kamali, K. (2003) The fauna of Thysanoptera in Bojnourd region of Khorasan province, Iran. *Thrips*, 2, 25–40.
- Alavi, J., Zur Strassen, R. & Bagherani, N. (2007) Thrips (Thysanoptera) species associated with wheat and barley in Golestan province, Iran. *Journal of Entomological Society of Iran*, 1, 1–28.
- Anantkrishnan, T. (1964) A contribution to our knowledge of the Tubulifera (Thysanoptera) from India. *Opuscula Entomologica Supplementum*, 25, 1–120.
- Bhatti, J., Alavi, J., Zur Strassen, R. & Telmadarraiy, Z.J.T. (2009) Thysanoptera in Iran 1938–2007. An Overview. Part 1. *Thrips*, 7, 1–82.
- Cheraghian, A. (1996) A faunistic study of Thysanoptera in Ahwaz region. M. Sc. thesis, Shahid Chamran University, Ahwaz, Iran, 118 pp. (in Persian).
- Dang, L.H., Mound, L.A. & Qiao, G.X. (2014) Conspectus of the Phlaeothripinae genera from China and Southeast Asia (Thysanoptera, Phlaeothripidae). *Zootaxa*, 3807 (1), 1–82.
<https://doi.org/10.11646/zootaxa.3807.1.1>
- Dang, L.H. & Qiao, G.X. (2013) Review of the spore-feeding Idolothropinae from China (Thysanoptera, Phlaeothripidae). *ZooKeys*, 345, 1.
<https://doi.org/10.3897/zookeys.345.6167>
- Eow, L., Mound, L.A. & Ng, Y. (2011) Genera of Spore-Feeding Thysanoptera from Southeast Asia (Phlaeothripidae, Idolothropinae), with a species checklist from Peninsular Malaysia. *Zootaxa*, 2928, 1–19.
<https://doi.org/10.11646/zootaxa.2928.1.1>
- Eow, L., Mound, L.A., Tree, D.J. & Cameron, S.L. (2014) Australian species of spore-feeding Thysanoptera in the genera *Cari-entothrips* and *Nesothrips* (Thysanoptera: Idolothropinae). *Zootaxa*, 3821 (2), 193–221.
<https://doi.org/10.11646/zootaxa.3821.2.2>
- Faure, J.C. (1933) New genera and species of Thysanoptera from South Africa. *Bulletin of the Brooklyn Entomological Society*, 28, 1–20.
- Goldarazena, A. & Mound, L.A. (1998) A new species of *Hindsiothrips* from Spain with the first record of *Tylothrips osborni* (Hinds) from Europe (Thysanoptera: Phlaeothripidae). *Entomologist's Monthly Magazine*, 134, 319–324.
- Hakimara, M., Minaei, K., Sadeghi, S. & Mound, L.A. (2019) A new species of *Liophloeothrips* (Thysanoptera, Phlaeothripidae) from leaf litter from Iran. *Zootaxa*, 4571, 138–142.
<https://doi.org/10.11646/zootaxa.4571.1.10>
- Hoddle, M., Mound, L.A. & Paris, D. (2019) Thysanoptera Californica. An identification and information system to thrips in California. Available from: https://keys.lucidcentral.org/keys/v3/thrips_of_california_2019/ (accessed 10 July 2019)
- Jalali Sendi, J., Zibae, I. & Minaei, K. (2011) An investigation on thrips fauna of Guilan province, north of Iran (Insecta: Thysanoptera). *Munis Entomology & Zoology*, 6, 325–329.
- Kheyrandish Koshkoei, M. (2000) *Faunistic survey of Thysanoptera in Kerman and study of population density of active species on rose*. M. Sc. Thesis, College of Agriculture, Tarbiat Modarres University, Tehran, Iran, 137 pp. [In Persian with English summary]
- Minaei, K. (2011) Fungal spore-feeding thrips (Thysanoptera: Phlaeothripidae: Idolothropinae) from Iran with record of a fourth genus. *Journal of Insect Science*, 11, 1–5.
<https://doi.org/10.1673/031.011.5101>

- Minaei, K. (2013) The *Phlaeothrips*-lineage of fungus feeding thrips (Thysanoptera: Phlaeothripidae) in Iran with a new species of *Hindsiothrips*. *Zootaxa*, 3599 (3), 279–290.
<https://doi.org/10.11646/zootaxa.3599.3.5>
- Minaei, K. (2017) *Thrips, minute insects but opportunist*. Shiraz University Press, Shiraz, Iran, 254 pp. [in Persian]
- Minaei, K. & Alich, M. (2002) The first record of subfamily Idolothripinae (Thysanoptera: Phlaeothripidae) for Iran. *Proceedings of the 15th Iranian Plant Protection Congress, Razi University of Kermanshah, Kermanshah, Iran*, 1, 181.
- Minaei, K., Azmayeshfard, P. & Mound, L. (2007) The *Thrips* genus-group (Thysanoptera: Thripidae) in Iran. *Journal of Entomological Society of Iran*, 27, 29–36.
- Minaei, K. & Mound, L. (2014) The *Liothrips*-lineage of thrips (Thysanoptera: Phlaeothripidae) from Iran with the first record of micropterous morph of a *Liothrips* species. *Zootaxa*, 3889 (1), 107–117.
<https://doi.org/10.11646/zootaxa.3889.1.6>
- Mirab-balou, M. (2014) First report of the genus and species *Nesothrips brevicollis* (Bagnall) (Thysanoptera: Phlaeothripidae: Idolothripinae) from Iran. *Journal of Crop Protection*, 3, 99–103.
- Morse, J.G. & Hoddle, M.S. (2006) Invasion biology of thrips. *Annual Review of Entomology*, 51, 67–89.
<https://doi.org/10.1146/annurev.ento.51.110104.151044>
- Mortazaviha, A. (1995) Introduction of 15 species of thrips (Thysanoptera) collected in Iran. *Proceedings of the 12th Iranian Plant Protection Congress, Junior College of Agriculture, Karaj, Iran*, 1, 341.
- Mortazaviha, A. & Dern, R. (1977) contribution to the Thysanoptera fauna of Iran. *Entomol Phytopathol Appl Plant Pests Dis Res Inst*, 45, 29–31.
- Mound, L.A. (1972) Polytypic species of spore-feeding Thysanoptera in the genus *Allothrips* Hood (Phlaeothripidae). *Australian Journal of Entomology*, 11, 23–36.
<https://doi.org/10.1111/j.1440-6055.1972.tb01602.x>
- Mound, L.A. (2017) Intra-specific structural variation among Hawaiian *Hoplothrips* (Thysanoptera, Phlaeothripidae), with ten new synonymies and one new species. *ZooKeys*, (722), 137–152.
<https://doi.org/10.3897/zookeys.722.22131>
- Mound, L.A., Collins, D. & Hastings, A. (2018) Thysanoptera Britannica et Hibernica. A guide to British thrips. Lucidcentral.org, Identic Pty Ltd, Queensland, Australia. Available form : https://keys.lucidcentral.org/keys/v3/british_thrips/ (accessed 20 June 2019)
- Mound, L.A., Dang, L.H. & Tree, D.J. (2013) Genera of fungivorous Phlaeothripinae (Thysanoptera) from dead branches and leaf-litter in Australia. *Zootaxa*, 3681, 201–224.
<https://doi.org/10.11646/zootaxa.3681.3.1>
- Mound, L.A. & Marullo, R. (1996) The thrips of Central and South America: an introduction. *Memoirs on Entomology, International*, 6, 1–488.
- Mound, L.A. & Palmer, J.M. (1983) The generic and tribal classification of spore-feeding Thysanoptera (Phlaeothripidae: Idolothripinae). *Bulletin of the British Museum (Natural History) Entomology*, 46, 1–174.
- Mound, L.A. & Tree, D.J. (2015) Fungus-feeding Thysanoptera: Phlaeothripinae of the *Idiothrips* genus-group in Australia, with nine new species. *Zootaxa*, 4034 (2), 325–341.
<https://doi.org/10.11646/zootaxa.4034.2.5>
- Mound, L.A. & Tree, D.J. (2013) Fungus-feeding thrips from Australia in the worldwide genus *Hoplandrothrips* (Thysanoptera, Phlaeothripinae). *Zootaxa*, 3700, 476–494.
<https://doi.org/10.11646/zootaxa.3700.3.8>
- Mound, L.A. & Tree, D.J. (2014) The minute, fungus-feeding species of *Sophiothrips* (Thysanoptera, Phlaeothripinae) from Australia and New Zealand. *Zootaxa*, 3860, 184–194.
<https://doi.org/10.11646/zootaxa.3860.2.5>
- Mound, L.A. & Walker, A.K. (1986) Tubulifera (Insecta: Thysanoptera) *Fauna of New Zealand*, 10, 1–144.
- Priesner, H. (1964) *Ordnung Thysanoptera (Fransenflügler, Thripse)*. *Bestimmungsbücher zur Bodenfauna Europas*. Berlin (Germany): Akademie-Verlag, 242 pp.
- Priesner, H. (1965) A monograph of the Thysanoptera of the Egyptian deserts. *Publications de la Institut Desert Egypte* 13, 1–549.
- Reuter, O.M. (1901) Thysanoptera tria Mediterranea. *Öfversigt af Finska Vetenskaps-Societetens Förhandlingar* 43, 214–215.
- Stannard, L.J. (1968) The thrips, or Thysanoptera, of Illinois. *J Illinois Natural History Survey Bulletin*, 29, 213–552.
- ThripsWiki (2019) *providing information on the World's thrips*. Available from: <http://thrips.info/wiki/> (accessed 1 May 2019)
- Tyagi, K. & Kumar, V. (2011) The Indian species of *Liophloeothrips* Priesner (Thysanoptera, Phlaeothripidae) with one new species. *Zootaxa*, 2803 (1), 21–31.
<https://doi.org/10.11646/zootaxa.2803.1.2>
- zur Strassen, R. (1968) Ökologische und zoogeographische Studien über die-Fransenflügler-Fauna (Ins., Thysanoptera) des südlichen-Marokko. *Abhandlungen der senckenbergischen naturforschenden Gesellschaft*, 15, 1–125.
- zur Strassen, R. (2003) Records of some Thysanoptera from Iran. *Thysanoptera, Thrips*, 2, 11–14.