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Article

New records and remarks on Tydeoidea (Acari: Trombidiformes) from Mazandaran province of Iran

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ABSTRACT
Two collections of Tydeoidea from Mazandaran province revealed 16 species from six genera in two families. Of these, *Tydeus lindquisti* (Marshall, 1970) is a new record for Iran and 12 species are new records for the province. Photographs and supplementary data are provided for some species.

KEY WORDS: *Homeopronematus*; Iolinidae; *Lorryia*; *Neopronematus*; *Proctotydaeus*; *Pronematus*; *Tydeus lindquisti*.

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INTRODUCTION

The superfamily Tydeoidea Kramer, 1877 is found worldwide and contains over 700 species and four families: Triophtydeidae André, 1980, Ereynetidae Oudemans, 1931, Tydeidae Kramer, 1877 and Iolinidae Pritchard, 1956 (André and Fain 2000; Zhang *et al.* 2011; Darbemamieh *et al*. 2015; Silva *et al*. 2016). Although these mites are numerous and common in soil, litter or moss, and on plants, information about their distribution, biology, feeding specialization and zoogeography is rudimentary (Kaźmierski 2008). On the other hand, some arboreal tydeoids have an important role in providing alternative food for phytoseiid mites in absence of other prey (Flaherty and Hoy 1971; Calvert and Huffaker 1974; Niemczyk and Kaźmierski, 2002). Some others are scavengers on the leaf surface and may have an important role in health of ecosystems and decreasing the effects of other pests or in the biological control of plant pathogens (English-Loeb *et al*., 1999). Herbivory is also known for *Tydeus californicus* (Fleschner and Arakawa, 1953). However, some species are also associated with insects (Treat 1970), are predators of eriophyids (Ahmad-Hosseini *et al*. 2019) or are harmful to human and livestock (Kaźmierski 1998).

According to checklist of Kamali *et al*. (2001) and Sadeghi *et al*. (2012), 13 tydeoid species were previously recorded from Mazandaran province including *Pausia magdalenae* (Baker & Delfinado,

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1976) from citrus, *Triophtydeus immanis* Kuznetzov, 1972 from citrus, tea and pine, *Pronematus sextoni* Baker, 1968, *Lorryia formosa* Cooreman, 1958 from citrus, *L. longina* (Kaźmierski, 1981) from *Cedrus libani* Barrel, *Lorryia obstinata* (Livshitz, 1973) from citrus, *L. oregonensis* (Baker, 1970) from tea and pine, *L. reticulata* (Oudemans, 1928), *Neoapolorryia hippocastani* Kaźmierski, 1998, *Tydeus calabrus* (Castagnoli, 1984) and *Tydeus californicus* (Banks, 1904), all from citrus, *T. gloveri* (Ashmead, 1879) from unknown plant, and *T. inclutus* Livshitz, 1973 from tea, Austrian pine and oriental arborvitae.

The climate of this province is humid, with rich flora, and would potentially harbor a great diversity of tydeoid mites. Our survey presents the results of an investigation in two previous collections made by first and third authors and adds some new records to the Tydeoidea of Mazandaran and Iran. Additional and specific studies will be helpful to illuminate variations and distribution of these mites in northern Iran as well as their importance in agricultural and forest ecosystems.

MATERIAL AND METHODS

Foliage mites were collected by beating branches over a white plastic board (with a screen above to prevent unwanted material and insects), then transferred into 75% ethanol by means of a fine brush. Also soil mites were extracted by Tullgren funnel, removed with the aid of a stereomicroscope and transferred into 75% ethanol. Some bigger specimens were macerated in lactic acid for a few days prior to being permanently mounted in Hoyer's medium (Walter and Krantz 2009). The preparations were dried in an oven at 50 °C for two weeks. Specimens were examined by means of a phase-contrast microscope (Olympus® BX 51). The nomenclatural terms and setal notations of the idiosoma follows Kaźmierski (1998); those for appendages follows André (1981). We continue to regard *Lorryia* as the senior synonym of *Brachytydeus* as explained by Mondin *et al*. (2016) based on Kaźmierski (1989) and Kaźmierski and Sikora (2008). The measurements are in micrometers (µm). All specimens were deposited in the Acarological collection at Department of Plant Protection, Razi University, Kermanshah, Iran.

RESULTS

Family Tydeidae Kramer, 1877
Subfamily Tydeinae André, 1979 sensu Kaźmierski, 1996
Genus *Tydeus* Koch, 1835 sensu Kaźmierski, 1989

Tydeus caudatus (Duges, 1834) sensu Baker, 1970

Remarks – Some females had several eggs (up to 10 eggs) inside their body. The taxonomic status and some challenges about this species were explained in Darbemamieh *et al*. (2016b). This species has been collected from some other parts of the country (Darbemamieh *et al*. 2010; Akbari *et al*. 2015) but this is the first record from Mazandaran province.
Examined material – Angaetaroud village, Noor, 36° 25′ 24″ N, 52° 13′ 14 ″ E, H: 191 m a.s.l., 20 May 2013, soil, 3♀♀.

Tydeus electus Kuznetzov, 1973

Remarks – In this specimen, setae *h2* and *ps1* were clavate to lanceolate, differing from the original description of this species. Other characters match the specific description except the size of the caudal setae that measured about 40 µm. Only one egg was observed inside the female's body. This is the first record of this species from Mazandaran province.

Examined material – Chaloos, 36° 39′ 41″ N, 51° 25′ 31″ E, H: 10 m a.s.l., orange garden, soil, 4 August 2018, 1♀.

Tydeus kochi Oudemans, 1928

This is the first record of this species from Mazandaran province.
Examined material – Izadshahr, 36° 36′ 38″ N, 52° 10′ 26″ E, H: −17 m b.s.l., orchard soil, 20 August 2019, 2♀♀.

Tydeus calabrus (Castagnoli, 1984)

Examined material – Rostamrood, 36° 35′ 21″ N, 52° 05′ 45″ E, H: −21 m b.s.l., apple bark, 20 August 2019, 1♀.

Tydeus californicus (Bank, 1904) sensu Baker, 1970

Examined material – Izadshahr, 36° 36′ 38″ N, 52° 10′ 26 ″ E, H: −17 m, orchard soil, 20 August 2019, 1♀.

Tydeus lindquisti (Marshall, 1970)

Diagnosis – Body covered with striation and lacking basket weave ornamentation. Dorsal idiosomal setae similar in shape, finely roughened. Cheliceral stylet shorter than palp tarsus. Dorsal striae broad and widely separated and connected in some places. Less than 20 striae between bothridial setae (bo).
Remarks – The examined specimens had 17 or 18 striae between the bothridials.
This is the first record of this species from Iran (Fig. 1). This species was categorized in genus *Lorryia* in its first description (Marshall, 1970) and then Kaźmierski (1998) moved it to genus *Tydeus*.
Examined material – Alikia-Soltan region, Amol city, 33° 22′ 58.26″ N, 52° 18′ 17.34″ E, H: 252 m a.s.l., 5 May 2013, soil, 1♂.

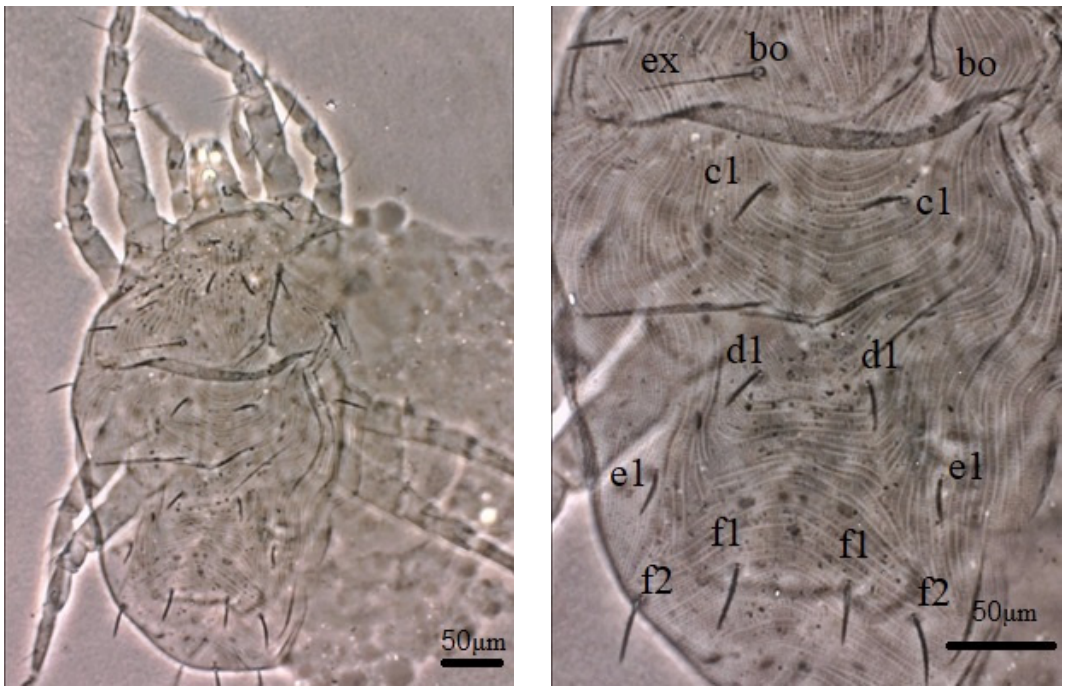

Figure 1. Habitus of *Tydeus lindquisti* (left) and its dorsal idiosomal striae (right).

Genus *Lorryia* Oudemans, 1925

Synonyms: listed in Kaźmierski (1989), and *Quadrotydeus* Momen & Lundqvist 1996 (synonymy by Kaźmierski 1998), *Brachytydeus* Thor, 1931.

Lorryia maga (Kuznetzov, 1973)

Diagnosis – Venilia-type striation (Kaźmierski 1998). Eupathidia of palps cleft distally; gnathosoma protrudes from anterior part of aspidosoma, with only its base concealed (Fig. 2).
This species was first described as *Venilia maga* (Kuznetzov, 1973). This is the first record of this species from Mazandaran province and the first photograph of its dorsum.
Examined material – Babol, 36° 32′ 58″ N, 52° 39′ 30″ E, H: −6 m b.s.l., orchard soil, 20 August 2019, 1♀.

Lorryia reticulata (Oudemans, 1928)

Remarks – This species was previously classified and described in genus *Tydeus* by Oudemans (Oudemans, 1928). He transferred it to *Lorryia* himself, one year later (Oudemans, 1929). This species is known from several combinations and synonyms summarized in Kaźmierski (1998) and Silva *et al*. (2016) (Fig. 3).
Examined material – Chamestan, Angaetaroud village, Noor city, 36° 25′ 24″ N, 52° 13′ 14″ E, H: 191 m a.s.l., moss, 1 August 2013, 2♀.

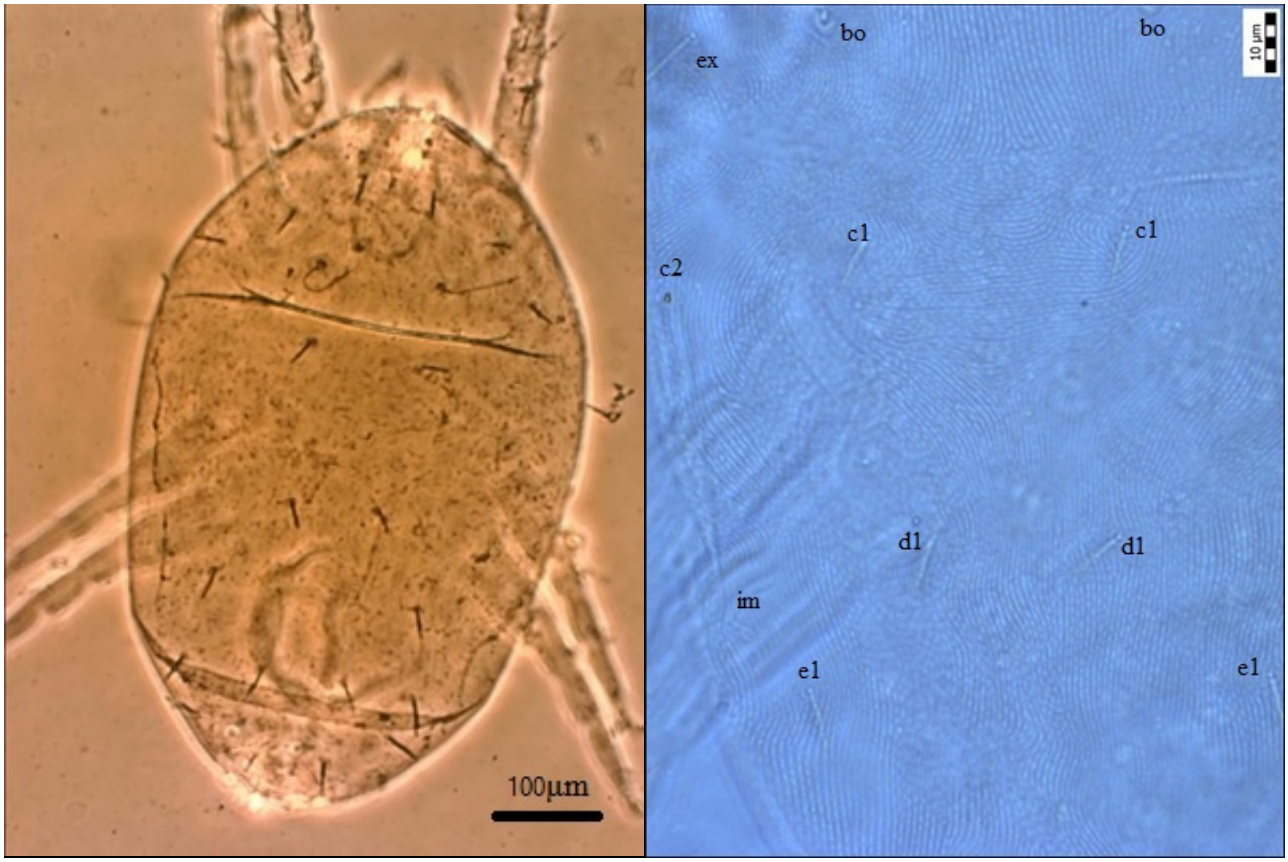

Figure 2. Habitus of *Lorryia maga* female, dorsal view (left) and dorsal idiosomal setae and striations (right).

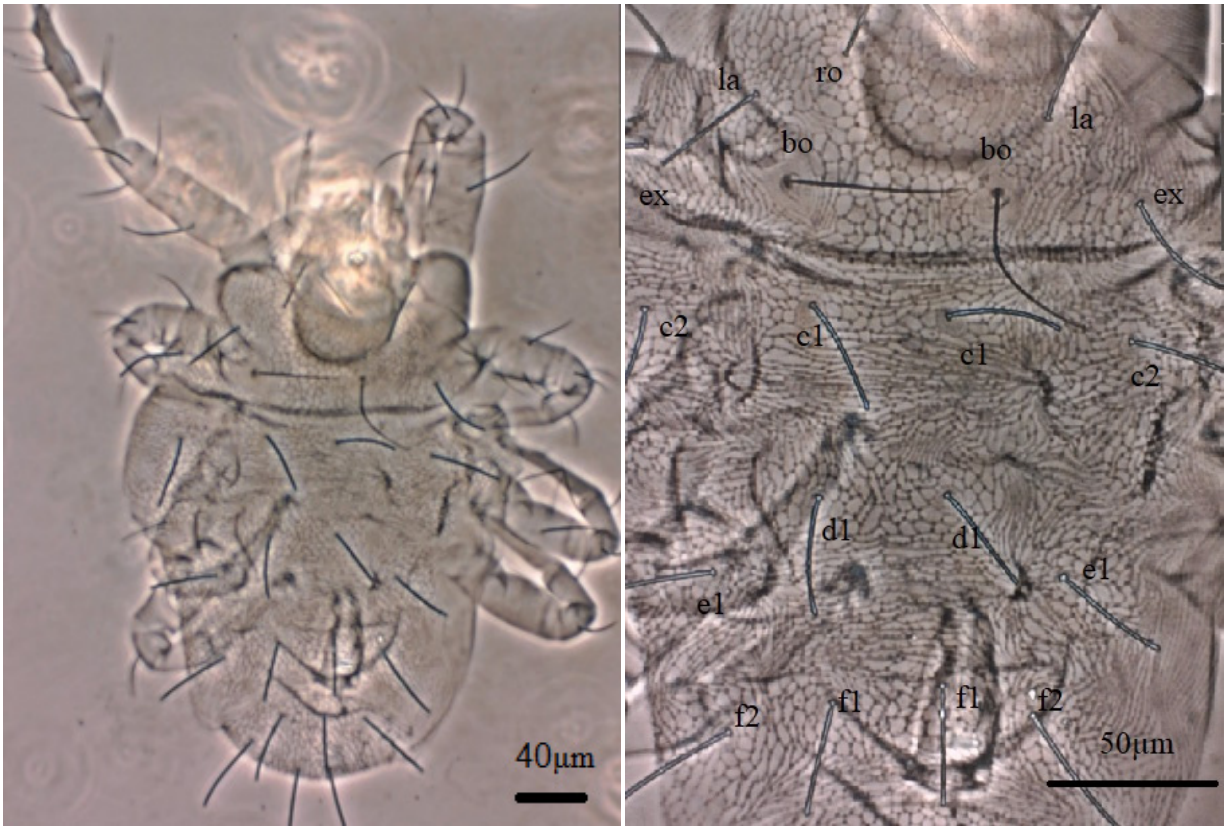

Figure 3. Habitus of *Lorryia reticulata*, dorsal view (left), and dorsal idiosomal reticulations (right).

Lorryia woolleyi (Baker, 1968)

Remarks – This species was first described as a *Paralorryia* by Baker (1968) but was later moved to *Lorryia* by Sadeghi Namaghi (1995) and Kaźmierski (1998). All dorsal body setae are serrate and sharp distally (Fig. 4) and the movable chelae are not longer than the distal segment of the palps. Round, tear-shaped and finely striated areas around setae, type of body striae (Paralorryia s. str.) and longitudinal striae between *c1* and *d1* as shown in figure 4 (right). This is the first record of this species from Mazandaran province.

Examined material – Sari, Paein Houlár, 36° 25′ 41″ N, 53° 08′ 01″ E, H: 185m, soil, 21 August 2019, 1♀.

Family Iolinidae Pritchard, 1956
Subfamily Pronematinae André, 1979 sensu André and Fain, 2000
Genus *Proctotydaeus* Berlese, 1911

Type species: *Proctotydaeus viator* Berlese, 1911
This is the first record of this genus from Mazandaran province.

Subgenus *Proctotydaeus* (*Oriolella*)

Proctotydaeus (*Oriolella*) sp.

Examined material – Soleiman-Abad, Tonekabon, 36° 48′ 13″ N, 36° 25′ 24″ E, H: 30 m a.s.l.

walnut, 3 July 2013, 3♀♀.
Remarks – femur IV not divided, but tarsus I setae was broken and thus species identification was impossible.

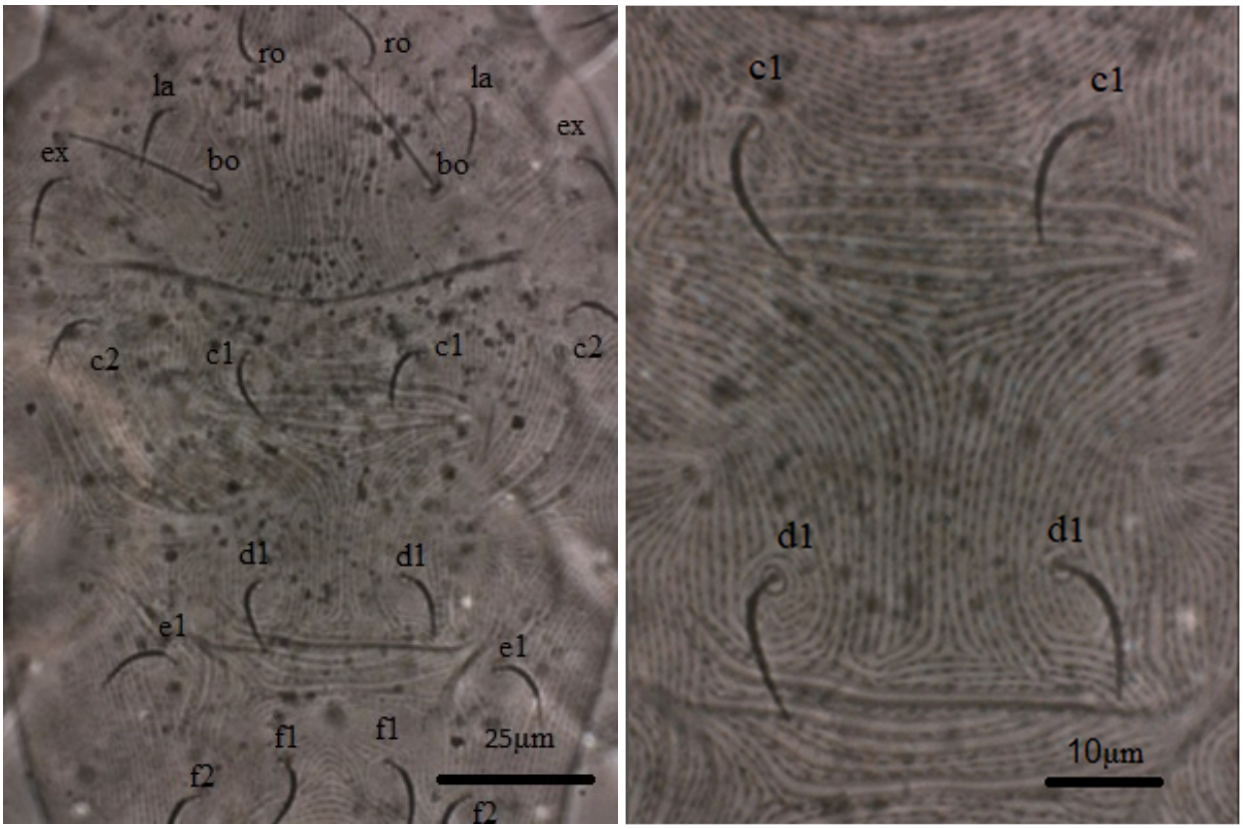

Figure 4. *Lorryia woolleyi*, dorsal idiosoma (left), and striae around setae and between *c1* and *d1* (right).

Proctotydaeus (*Proctotydulus*) *oblongus* (Kuznetzov, 1973)

This is the first record of this species from Mazandaran province.
Examined material – Soleiman-Abad, Tonekabon, 36° 48′ 13″ N, 36° 25′ 24″ E, H: 30 m a.s.l., walnut, 3 July 2013, 1♀.

Genus *Neopronematus* Panou, Emmanouel and Kaźmierski, 2000

This is the first record of this genus from Mazandaran province.
Type species: *Neopronematus aegeae* Panou, Emmanouel & Kaźmierski, 2000

Neopronematus neglectus (Kuznetzov, 1972)

This is the first record of this species from Mazandaran province.
Examined material – Mahmood-Abad, 36° 36′ 58″ N, 52° 11′ 24″ E, H: −24 m b.s.l., apple leaf, 20 August 2019, 3♀♀, Babol, 36° 32′ 58″ N, 52° 39′ 30″ E, H: −6 m b.s.l., pear leaf, 20 August 2019, 2♀♀.

Neopronematus sepasgosariani Sadeghi, Łaniecka & Kaźmierski, 2012

This is the first record of this species from Mazandaran province.

Examined material – Mahmood-Abad, apple leaf, 36° 37′ 36″ N, 52° 13′ 48″ E, H: −21 m b.s.l., 20 August 2019, 1♀.

Genus *Pronematus* Canestrini, 1886

Type species: *Pronematus bonatii* Canestrini, 1886

Pronematus ubiquitus (McGregor, 1932)

This is the first record of this species from Mazandaran province.
Examined material – Soleyman-Abad village, Tonekabon, apple leaf, 31 October 2013, 36° 38′ 13″ N, 52° 50′ 10.06″ E, H: 30 m a.s.l., 6♀♀.

Pronematus rykei Meyer & Rodrigues, 1966

This is the first record of this species from Mazandaran province.
Examined material – Sari, Paein Hoular, 36° 25′ 41″ N, 53° 08′ 01″ E, H: 185 m a.s.l., orchard leaf, 4♀♀.

Genus *Homeopronematus* André, 1980

This is the first record of this genus from Mazandaran province.

Homeopronematus anconai (Baker, 1943)

Remarks – Dorsal body are approximately long. For example, *e1* (20 µm) longer than *e1-f1* distance. Tectal setae are longer than plurals on tarsus I. This species was first described as a species of *Pronematus* (Baker, 1943) and then moved to *Homeopronematus* by André (1980). This is the first record of this species from Mazandaran province.
Examined material – Sari, Paein Hoular, 36° 25′ 41″ N, 53° 08′ 01″ E, H: 185m, soil, 21 August 2019, 1♀.

DISCUSSION

Knowledge of Tydeoidea in Iran is limited to a few provinces and studies (Khanjani and Ueckermann 2003; Darbemamieh *et al*. 2010; Sadeghi *et al*. 2012; Akbari *et al*. 2015; Darbemamieh *et al*. 2015, 2016a, b). However, the global knowledge of this group is also in an elementary status. Several factors make them unappealing to study: their delicate bodies and small sizes make them difficult to clarify and mount; many old papers are difficult to find and have inadequate illustrations and descriptions for identification; some descriptions have small figures without enough details or photography; there is no complete key for generic and specific identification in some cases. Collection of these mites is also time-consuming and rarely successful if particular species are being targeted. Most specimens are collected occasionally and by specialists of other groups, without appropriate techniques for clarification required to obtain highly clarified slides.

Despite these problems, it was surprising that none of the studied species were new, suggesting that the Iranian knowledge of the group is better than expected. Of the 16 collected species, 12 were new records for the province, bringing the total of known species to 25. *Tydeus* was the most diverse genus with six species in our collections, including *Tydeus lindquisti* which was recorded for the first time from Iran. Although this species was first collected and described from litter under *Pinus* sp. in

Ontario, Canada (Marshall, 1970), it was later reported from bird nests from different parts of Poland (Kaźmierski *et al*. 2018). The two microscopic photographs (Fig.1, right and left) presented in this paper, are the only available photos of this species. The most abundant genera in the province were *Tydeus* with eight species and *Lorryia* with seven species. Future work on tydeoid mites will clarify the true nature of diversity and distribution of these mites: are tydeid mite species widespread, or is there an undetected endemic fauna in Mazandaran?

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گزارش‌ها و نکته‌های جدیدی از کنه‌های بالاخانوادهٔ Tydeoidea (Trombidiformes: Prostigmata) از استان مازندران ایران

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چکیده

در این بررسی، ۱۶ گونه از شش جنس و دو خانواده از بالاخانواده Tydeoidea از استان مازندران معرفی می‌شوند. نمونه‌های مورد مطالعه، از دو کلکسیون متفاوت است، که توسط نویسندهٔ نخست و سوم از استان مازندران جمع‌آوری شده‌اند. گزارشی جدید برای فون کنه‌های ایران، *Tydeus lindquisti* (Marshall, 1970) ، دوازده گزارش جدید از استان مازندران و برخی نکته‌ها، توضیح‌ها و تصویرها در مورد این کنه‌ها آورده شده است.

واژگان کلیدی: *Homeopronematus*؛ Iolinidae؛ *Lorryia*؛ *Neopronematus*؛ *Proctotydaeus*؛ *Pronematus*؛ *Tydeus lindquisti*.

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