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The digitalization of Acarologia papers prior to 2000 was supported by Agropolis Fondation under the reference ID 1500-024 through the « Investissements d’avenir » programme (Labex Agro: ANR-10-LABX-0001-01)

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Some *Tydeus* mites (Acariformes: Prostigmata: Tydeidae) of Kermanshah province, western Iran, with remarks on *Tydeus caudatus*

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(Received 02 April 2016; accepted 14 June 2016; published online 21 October 2016)

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**ABSTRACT** — During a survey in Kermanshah province, western Iran, seven species of mites of the genus *Tydeus* (Acari: Prostigmata: Tydeidae) were collected from 2006 to 2013. *Tydeus helenipanoue* Kaźmierski, 1998 is recorded for the first time in Iran. *Tydeus californicus* (Banks, 1904), *T. electus* Kuznetzov 1973, *T. inclutus* Livshitz, 1973, *T. kochi* Oudemans, 1928 and *T. mississippiensis* Baker 1970 are new for the fauna of this province. Previously invalidated *T. caudatus* is herein revalidated. Several new hosts for these species have been recorded, diagnoses for *T. caudatus* and *T. helenipanoue* proposed, and an identification key is provided for all these species. A list of previously recorded mites of genus *Tydeus* from Iran until 2015 is also added.

**KEYWORDS** — Tydeinae; new records; taxonomy; fauna; checklist; key

**INTRODUCTION**

The family Tydeidae (Trombiformes: Prostigmata) is a large and taxonomically complex family with a worldwide distribution (Krantz 1978). These species are fast moving small soft-bodied mites with color ranged from white, yellow, green and orange to black, about 0.25 - 0.5 mm in length. They live in moss, lichen, soil, litter, rotten wood, humus, mushrooms and grass, on straw and hay, on trees, under the bark and on the bark of trees, on plants leaves, in bird nests and in stored products (Khanjani and Ueckermann 2003). Tydeids are reported as plants and fungi feeders, scavengers and predators. *Tydeus californicus* has been reported by Fleschner and Arakawa (1953) and Hernandes et al. (2006) feeding on plants. As fungivorous mites, they might play an important role in decreasing the impact of plant pathogens and as scavengers they are effective in cleaning the leaf surface. As an example, the mite *Orthotydeus lambi* (Baker) reported to decrease the population of the fungus *Uncinula necator* (Schwein) in grapes by feeding on its hyphae (English-Loeb et al. 1999). Several species are found associated with insects (Treat 1970) or harmful to human and domestic animals (Kaźmierski 1998).

Linnaeus (1758) introduced first a tydeid mite in
the "Fauna suecia" as Acarus croceus and then he described the same species in "Systema naturae" as Acarus salicinae rosae (Sepasgosarian 1997). Koch (1835), 77 years later, established the genus Tydeus for two species T. velox and T. croceus. In the following three years, Koch (1838) described 11 additional species. Berlese (1883) described one species, and Cannestrini (1886) described four species (Sepasgosarian 1997). Meanwhile, Ashmead (1879) has described one mite species as Acarus gloveri in the USA, known as T. gloveri today. Moniez (1894) described T. molestus in Belgium and Kramer (1877) created the family Tydeidae.

During the first half of the 20th century, Berlese (1908, 1910) described six genera, Thor (1933) four and Oudemans (1937) one, including several related species. Grandjean (1938) and other scientists described several species too. One of the most known mite specialists, Edward W. Baker, proposed six genera and described many new species from 1943 to 1974. Kuznetzov also described many new species with Livshitz and other authors (André 1980).


The aim of this study was to determine the diversity and habitats of mites of the genus Tydeus in the Kermanshah agricultural ecosystems, located in western Iran and to review their taxonomic status. As some Tydeidae species might be beneficial organisms, it is important to have accurate species descriptions for their correct identification (Darbemamieh et al. 2010).

MATERIAL AND METHODS

Sampling was carried out from 2006 to 2013 on farms and in orchards of Kermanshah province, Iran. Mites were collected on leaves by two methods:

(i) placing plant, bark and branch samples into plastic zip-kip bags for stereomicroscopic examination later, or
(ii) beating branches over a white plastic board (with a screen above to prevent unwanted materials and insects), and then transferring mites with a 00 paintbrush into vials containing 75 % ethanol. The soil mites were extracted with a Tullgren funnel and collected under a stereomicroscope. After clarifying in lactic acid, permanent mountings were made using Hoyer’s solution (Walter and Krantz 2009). Specimens were identified under a phase contrast microscope (Olympus BX 51). The nomenclatural-terms and setal notations of the idiosoma and appendages follow that of Kaźmierski (1998). All specimens have been collected by the senior author and are deposited at the Acarological Collection of Agricultural Faculty, Tarbiat Modares University, Tehran, Iran.

RESULTS

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

Collected material from Kermanshah Province:

**Tydeus californicus** (Banks, 1904)
Locality and habitat where specimens have been presently found: Songhor, Cherry leaf, 12 Oct. 2013, 34°45′58″N, 47°34′45″E, Altitude: 1663 m, 1 ♀ & 3 TN (Tritonymph).

**Tydeus caudatus** (Dugès, 1834) sensu Baker, 1970
Locality and habitat where specimens have been presently found:
1) Kermanshah, Sour cherry leaf, 05 Sep. 2007, 34°21′41″N, 47°56′16″E, Altitude: 1298 m, 1 ♀,
2) Rijab, Walnut leaf, 10 Aug. 2011, 34°24'57"N, 46°54'29"E, Altitude: 1531.5 m, 1 TN,
3) Sahne, Apple leaf, 19 Oct. 2010, 34°29'09"N, 47°41'29"E, Altitude: 1376.5 m, 1 TN,
4) Kermanshah, Soil, 30 Apr. 2011, 34°19'28"N, 47°05'56"E, Altitude: 1326 m, 1 DN,
5) Kermanshah, plum leaf, 05 Sep. 2007, 34°20'11"N, 47°05'38"E, Altitude: 1323 m, 1 TN,
6) Songhor, Cherry leaf, 12 Oct. 2013, 34°45'58"N, 47°34'45"E, Altitude: 1663 m, 2 TN.

**Figure 1:** *Tydeus caudatus* collected from Kermanshah orchards.

**Figure 2:** *Tydeus caudatus* female with eggs and prelarva inside. Spatulate setae are visible.

*Tydeus electus* Kuznetzov, 1973

Locality and habitat where specimens have been presently found:
1) Ravansar, Apple leaf, 25 Aug. 2012, 34°42'09"N, 46°39'13"E, Altitude: 1345 m, 1♀ with 4 eggs.,
2) Songhor, Soil, 05 Sep. 2012, 34°44'23"N, 47°36'24"E, Altitude: 1695 m, 1♂,
3) Kermanshah, Soil, 02 Oct. 2011, 34°21'43"N, 47°06'19"E, H: 1299 m, 1♂,
4) Kermanshah, Soil, 26 Jul. 2011, 34°19'35"N, 47°06'43"E, Altitude: 1315 m, 1 TN,
5) Rijab, Apple leaf, 08 Sep. 2011, 34°24'56"N, 46°54'38"E, Altitude: 1540 m, 1♀,

Diagnosis — This species (figure 1) has a short, slender ωl which is not 1/2 as long as tarsus width; the dorsal leg setae are slightly lanceolate and serrate; the dorsal setae of genua III and tibiae III-IV are blunt distally; the coxae may have faint reticulate patterns; there are no empodial claws. Palpi are typically elongate. Dorsal body striae are typical; the ventral hysterosomal striae are longitudinal. The propodosomal trichobotriae are stout, slightly serrate and not much longer than the other dorsal body setae; the dorsal body setae are slightly lanceolate and serrate except η1, η2 and ps1 which are spatulate distally. Gravid female contain many eggs (figure 2). This species is widespread on many plants in the most temperate areas of the world (Baker 1970).
Tydeus helenipanoue Kaźmierski, 1998

Locality and habitat where specimens have been presently found: Kermanshah, Koozaran, soil, 21 Oct. 2011, 34°24'34"N, 46°51'52"E, Altitude: 1325 m, 1 TN.

Diagnosis — Dorsal idiosomal setae are equal in shape, narrowly lanceolate and serrate, but unequal in length (caudal ones are slightly longer). Setae \( f_1 \) longer than half distance \( f_1-h_1 \). Setae \( ps_1 \) situated dorsally. Ventral striation between \( mt \) longitudinally. Adults of this species has four pairs of genital setae.

This species is related to \( T. \) munsteri Meyer and Ryke (1959) and \( T. \) quadrisetosus (Schiess 1981) but can be distinguished from the former by narrower and longer dorsal idiosomal setae and from the latter by having serrated setae (Kaźmierski 1998).

Remark — There is a very small \( \omega_1 \) on tarsus I that is much smaller than in the description. This difference is because collected mite was in tritonymph stage where as the description is based on females. This is first record of this mite from Iran.

Tydeus inclutus Livshitz, 1973

Locality and habitat where specimens have been presently found: Songhor, soil under \( Cupressus \) sp., 4 Sep. 2013, 34°46'22"N, 46°35'52"E, Altitude: 1713 m, 1♀.

Tydeus kochi Oudemans, 1928

Locality and habitat where specimens have been presently found: 1) Kandooleh, Grape leaf, 03 oct. 2011, 34°38'59" N, 47°14'20" E, Altitude: 1590 m, 2♀, 2) Kangavar, soil, 29 Apr. 2012, 34°35'22" N, 47°56'46" E, Altitude: 1505 m, 1♀ with two eggs inside.
T. caudatus (Dugès, 1834) sensu Baker, 1970 — Five pairs of caudal dorsal setae spindle and spoon-like and rounded distally, $f1$ not reaches to base of $h1$, $\omega 1$ one third of tarsus width; bothridial setae longer than other dorsal setae; striae between $d1$ setae are obtuse "U" shape ............... T. californicus (Banks, 1904) sensu Baker, 1970

List of reported Tydeus species from Iran until the end of 2015

Tydeus Koch, 1835


4) Tydeus caudatus (Dugès, 1834) Habitats or hosts: sour cherry, grape, plum, walnut, greengage, soil Distribution in Iran: Kermanshah, Shabestar (East Azerbaijan) (Darbemamieh et al. 2010, Akbari et al. 2014)

5) Tydeus darekiwani Sadeghi, Łaniecka and Ka´ zmierski, 2012

Habitat or hosts: Apple, pear Distribution in Iran: Khorasan Razavi (Sadeghi et al. 2012)


7) Tydeus Gloveri (Ashmead, 1879) Habitat or host: Unknown Distribution in Iran: Northern provinces (Khalilmanesh 1979, Modarres Awal 1994, 1997)


9) Tydeus kabutarahangensis Khanjani and Ueckermann, 2003 Habitats or hosts: Soil covered with wheat Distribution in Iran: Hamadan (Khanjani and Ueckermann 2003)


11) Tydeus longisetosus (El Bagoury and Momen, 1988) Habitat or hosts: Apple, bean Distribution in Iran: Maragheh (Khodayari et al. 2010)

12) Tydeus meshkinensis André, Ueckermann and Rahmani, 2010 Habitats or hosts: apple, soil Distribution in Iran: Meshkinshahr (Zanjan), Shabestar (East Azerbaijan) (André et al. 2010, Akbari et al. 2014)

13) Tydeus mississippiensis Baker, 1970 Habitat or hosts: pear, peach, pistachio, plum, walnut, apricot and sour cherry
Distribution in Iran: East Azarbaijan (Daneshvar 1978, Kamali et al. 2001).

14) Tydeus shabestariensis Akbari, Haddad and Ka´zmierski, 2015

Habitat or hosts: soil of apple orchards
Distribution in Iran: East Azarbaijan (Akbari et al. 2015).

**DISCUSSION**

The species *T. electus* and *T. caudatus* were the most abundant *Tydeus* species collected in the Kermanshah province. *Tydeus caudatus* is the most common tydeid species in Italian vineyards (Castagnoli 1984); it is reported as predator of *Colomerus vitis* in the laboratory (Camporese and Duso 1995). Studies showed that *T. caudatus* populations can persist and increase in vineyards without eriophyids and other potential preys, as a result of non-prey foods in its diet (Duso et al. 2005). Darbemamieh et al. (2010) first recorded *T. caudatus* for Iranian fauna from Kermanshah orchards and discussed some aspects of its biology and foraging behavior. Akbari et al. (2014) reported this species from Shabestar, East Azerbaijan province of Iran again. In this study we collected this mite from most parts of Kermanshah province on many hosts; that show its host diversity and abundance in western part of Iran.

Dugès’ *caudatus* is a mite listed in both Tenuipalpidae and Tydeidae, based on different publications (André 2011, Castro et al. 2016). André (2011) collected mites on laurustinus shrubs (*Viburnum tinus*) around Montpellier (France) to retrieve the species described by the French scientist. He suggested that Dugès’ *caudatus* is probably a Tenuipalpidae not a Tydeidae. Then he re-described *Tenuipalpus caudatus* (Dugès, 1834) from specimens collected in Montpellier and a neotype that is deposited at Paris. Recently, Castro et al. (2016) provided another new description for this tenuipalpid. The most frequent tydeid observed by André on *Viburnum tinus* in Montpellier was *Tydeus goetzi* Schruft, 1972, and therefore he provided a re-description for it (André 2011). Based on this information, he introduced *Tydeus caudatus* as an invalid name according to his findings and mentioned that *T. goetzi* can be the appropriate name that represents *T. caudatus* characters.

The mysterious question is that if Dugès described two species with one description? Or he saw *T. goetzi* and did not understand that was something different with tenuipalpid one in case that they have completely different appearance? The other hypothesis is that, there were two descriptions and one was lost. If we accept the presence of both species in Dugès slides, why he wrote only one note for both? If we consider that he described tenuipalpid mite and did not talk about tydeid one, so why should we consider *T. goetzi* (another species) presenting name for *caudatus* in case that we have older descriptions of it?

Baker (1970) re-described *Tydeus caudatus* and provided figures and measurements for it that followed and supported by Jeppson et al. (1975). This description is older than schruft’s *T. goetzi* and even followed by lots of scientists. Also, we have some older descriptions from Oudemans (1928) and Thor (1933) with measurements and information about *T. caudatus* that prove the presence of this species. On the other hand, there are some differences between these two near species based on their descriptions. In *T. goetzi*, spatulate setae (20 – 25 µm) abruptly broadened in distal 1/3 and rounded distally, nearly spoon like otherwise in *T. caudatus* relatively long (30 – 36 µm) spatulate setae tapered distal and maximally broadened in at most 2/3 of their length (Figures 1 and 2). Even if the Dugès *caudatus* is tenuipalpid mite, because of these old descriptions on *T. caudatus* and its differences with *T. goetzi*, we can’t omit the species name easily.

Lots of ecological changes may cause moving one species from its habitat and sampling is a random process that cannot be representative of all inhabitants of one place in all seasons and all times. We cannot expect to find a species after 180 years in the same place because of ecological and climatic changes as well as usage of pesticides or other treatments. Since *T. caudatus* is older name than *T. goetzi*, reported in many papers, belongs to real characters that observed in lots of places on different plants and reported as an abundant species in different places of the world, it does not seem that lack of
collecting this species after many years in one place can invalidate this old and frequent name. *T. caudatus* and *T. goetzi* are two near species, but if considering descriptions of Schruft (1972), Baker (1970) and André (2005, 2011) they were synonyms, *T. caudatus* is older and valid name based on Baker’s re-description even with omitting Dugès description. Meanwhile, no one has information about the holotype of Dugès species and no one has checked it before crystallization.

**ACKNOWLEDGEMENTS**

The authors want to thank Dr Sabrina Simon, department of Biosystematics, Wageningen University for her nice cooperation during the writing process of this paper in Netherlands.

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