



## Two New Records for Spider Mite Fauna of Turkey, *Tetranychus kanzawai* Kishida and *Eotetranychus rubiphilus* Reck (Trombidiformes: Tetranychidae)

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### ABSTRACT

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Two new spider mites, *Tetranychus kanzawai* Kishida and *Eotetranychus rubiphilus* Reck (Trombidiformes: Tetranychidae) were recorded for Turkish phytophagous mite fauna. While *E. rubiphilus* was obtained from *Prunus domestica* L. and *Prunus cerasus* L. (Rosaceae), *T. kanzawai* was found only on *P. domestica* in different municipalities of Ordu province, Turkey.

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### Introduction

Tetranychid mites represent major pests in agriculture. They cause severe symptoms and yield losses by feeding in many crops of economic importance worldwide. To date, 1321 species of tetranychid mites belonging to about 86 genera have been identified all over the world. The genera *Eotetranychus* Oudemans, comprise 200 species and *Tetranychus* Dufour 154 species (Migeon and Dorkeld 2019).

According to Migeon and Dorkeld (2019), five species of *Eotetranychus* are recorded from Turkey. These species are *E. carpini* (Oudemans) (Onucar and Ulu 1988; Uysal et al. 2001), *E. coryli* Reck (Ozman and Cobanoglu 2001), *E. populi* (Koch) (Duzgunes 1965), *E. pruni* (Oudemans) and *E. tiliarium* (Hermann) (Duzgunes 1963).

The genus *Tetranychus* are also represented by 5 species in Turkey (Migeon and Dorkeld 2019). They are as follows; *Tetranychus evansi* Baker & Pritchard (Kazak et al., 2017); *Tetranychus solanacearum* Cobanoglu &

Ueckermann (Cobanoglu et al. 2015); *Tetranychus tumidellus* Pritchard & Baker (Duzgunes 1959); *Tetranychus turkestanii* (Ugarov & Nikolskii) (Duzgunes 1954; Uysal et al. 2001; Ozsisli and Cobanoglu 2011) and *Tetranychus urticae* Koch (Duzgunes 1954; Aydemir and Toros 1992; Altincag and Akten 1993; Uysal et al. 2001; Ozsisli and Cobanoglu 2011; Kasap et al. 2014).

Although, a total of 10 species of *Tetranychus* and *Eotetranychus* are reported from Turkey by Migeon and Dorkeld (2019), *Tetranychus desertorum* Banks (Duzgunes 1962) and *Eotetranychus uncatatus* German (Yanar and Ecevit 2005) were omitted by these authors.

This paper reports two new records of tetranychid mites belonging to the genera *Eotetranychus* and *Tetranychus* for the Turkish mite fauna. Additionally, measurements ( $\mu\text{m}$ ) of the Turkish specimens (only the range), information regarding collection details, habitats, hosts and world distribution are also presented here.

## Materials and Methods

Mite surveys were carried out between May and November in plum (*Prunus domestica* L.) and sour cherry (*Prunus cerasus* L.) (Rosaceae) orchards located in Akkuş, Altınordu, Fatsa, Perşembe, Ünye municipalities of Ordu province of Turkey in 2016-2017. Leaves were taken from different parts of the tree canopy. The samples were put into paper bags placed inside plastic bags, labeled, and transferred to the laboratory. The mites were collected with a 0 or 00 paint brush under a stereomicroscope (Leica S8 APO) directly from the leaves. Mites were cleared in lacto-phenol, mounted in Hoyer's on microscope slides and dried for 5-7 days in an oven at 50°C according to the method of Krantz and Walter (2009).

Tetranychid mites were identified to species level using the relevant identification keys such as Auger et al. (2013), Zhang (2003), Seeman and Beard (2011), Maric et al. (2017) and observing key characters such as shape of aedeagus. Predatory mite species which were together with tetranychid mites on *Prunus* leaves were also collected. The identification of predatory mites was also performed using the available keys such as Cobanoglu (1989a, b, c; 1993a, b, c, d), Faraji et al. (2011), Doker et al. (2016) for phytoseiid mites and Ueckermann (2013), Ripka et al. (2013) for tydeoid mites.

Identifications and illustrations were made with a Leica DM 2500 phase contrast microscope equipped with a drawing tube. Measurements were done using Leica Application Suite (LAS). The identification of tetranychid species at the species level was made by Dr. Philippe Auger (INRA, France). The mite specimens were deposited in the Mite Collection at the Ordu University, Agricultural Faculty, Plant Protection Department, Ordu, Turkey.

All measurements are given in micrometers (µm) with the mean followed by minimum and maximum values in parentheses. The setal nomenclature used in this study follows Lindquist (1985).

## Results

### Family Tetranychidae Donnadieu

Genus *Tetranychus* Dufour

*Tetranychus kanzawai* Kishida: 105

Synonyms (Migeon and Dorkeld 2019):

*Tetranychus hydrangeae* Pritchard & Baker

*Tetranychus japonicus* Hotta

**Examined material:** Two males were obtained from plum leaves in Ordu province of Turkey; Akkuş, 40°48'4.12" N, 36°56'22.18" E, 1103m, 05.08.2016, 1♂ (*P. domestica*); Akkuş, 40°46'4.59" N, 36°56'31.07" E, 1224m, 05.08.2016, 1♂ (*P. domestica*).

#### Description

**Male** (n: 2) (Figure 1)

**Body:** Body length 313-320 excluding and 369-389 including gnathosoma. Dorsal setae measurements as follows:  $v_2$  51-52,  $sc_1$  60-83,  $sc_2$  54-57,  $c_1$  71-75,  $c_2$  68-74,  $c_3$  60-61,  $d_1$  75-77,  $d_2$  70-73,  $e_1$  69-72,  $e_2$  68-70,  $f_1$  56-57,  $f_2$  48-51,  $h_1$  17-19.

**Gnathosoma:** Spinneret length on palp tarsus 5.5. Peritreme curled distally (Figure 1c).

**Legs:** Length of legs (excluding coxae) and leg setal count as follows (solenidion provided in parentheses):

Leg I; 218-232, 2 - 1 - 10 - 5 - 9 + (4) - 13 + (3) + 2 duplexes;

Leg II; 181-183, 2 - 1 - 6 - 5 - 7 - 13 + (1) + 1 duplex;

Leg III; 176-177, 1 - 1 - 4 - 4 - 6 - 9 + (1);

Leg IV; 206-210, 1 - 1 - 4 - 4 - 7 - 10 + (1).

Empodia I uncinata (claw-like) with dorsal spur, II-IV with proximoventral hairs (Figure 1a).

**Aedeagus:** Knob of aedeagus rounded anteriorly and pointed posteriorly (Figure 1b). Knob twice width of neck (5.6/2.2 µm; knob/neck). Dorsal surface of knob slightly convex.

#### Remarks:

*T. kanzawai* is known as kanzawa spider mite or tea red spider mite. Females are carmine red in summer and striae form a diamond-shaped pattern between setae  $e_2$  and  $f_1$  (Ehara, 1956; Seeman and Beard, 2011).

Females oviposit 40-50 eggs during their life-span on the undersurface of leaves. The optimum temperature range of this species is between 20°C and 25°C. At 16°C, females enter diapause (Zhang 2003) and overwinter as such (Osakabe 1967).

This species occurs in the Palearctic, Oriental, Neotropical, Nearctic, Australasian and Afrotropical regions on 190 hosts especially on *Morus* genus. It is present in neighbor countries of Turkey such as Greece and Iran (Migeon and Dorkeld, 2019).

*T. kanzawai* resembles red form of *T. urticae* but differs in shape of male aedeagus with *T. kanzawai* having a much large knob (Ehara, 1956; Zhang, 2003).

*T. kanzawai* and *T. urticae* are polyphagous spider mites. They often co-occur on the same plant specimen. However, *T. urticae* in Japan is observed only in agroecosystems where predators are less abundant, whereas *T. kanzawai* lives on wild plants where predators are abundant. Because, it is known that *T. kanzawai* potentially encounters predators more frequently than *T. urticae* does (Murase et al., 2018).

In Asia and especially in Japan, this spider mite is one of the most serious pests (Nishimura et al., 2007). *Phytoseiulus persimilis* (Anthias-Henriot) (Mesostigmata; Phytoseiidae) controls *T. kanzawai* in vineyards. *Neoseiulus fallacis* (Garman) (Mesostigmata; Phytoseiidae) is effective on tea (Zhang 2003). It is also associated with *Neoseiulus longispinosus* (Evans) (Zhang 2003) and *Neoseiulus womersleyi* (Schicha) (Mesostigmata; Phytoseiidae) (Murase and Fujita 2018). Besides predator mites, *T. kanzawai* can also be controlled by predatory insects. *Oligota flavicornis* (Boisduval & Lacordaire) (Coleoptera; Staphylinidae), *Scolothrips indicus* Priesner (Thysanoptera; Thripidae), *Mallada basalis* (Walker) (Neuroptera; Chrysopidae) and some species of *Orius* (Heteroptera; Anthocoridae) are most effective predators against this spider mite (Zhang, 2003).

In this study, *T. kanzawai* was collected together with *Neoseiulella tiliarum* (Oudemans) and *Typhlodromus rhenanus* (Oudemans) (Mesostigmata; Phytoseiidae) species on *P. domestica*. These predatory species might be potential control agents of *T. kanzawai*. Therefore, studies to evaluate their effectiveness to suppress *T. kanzawai* population are recommended.

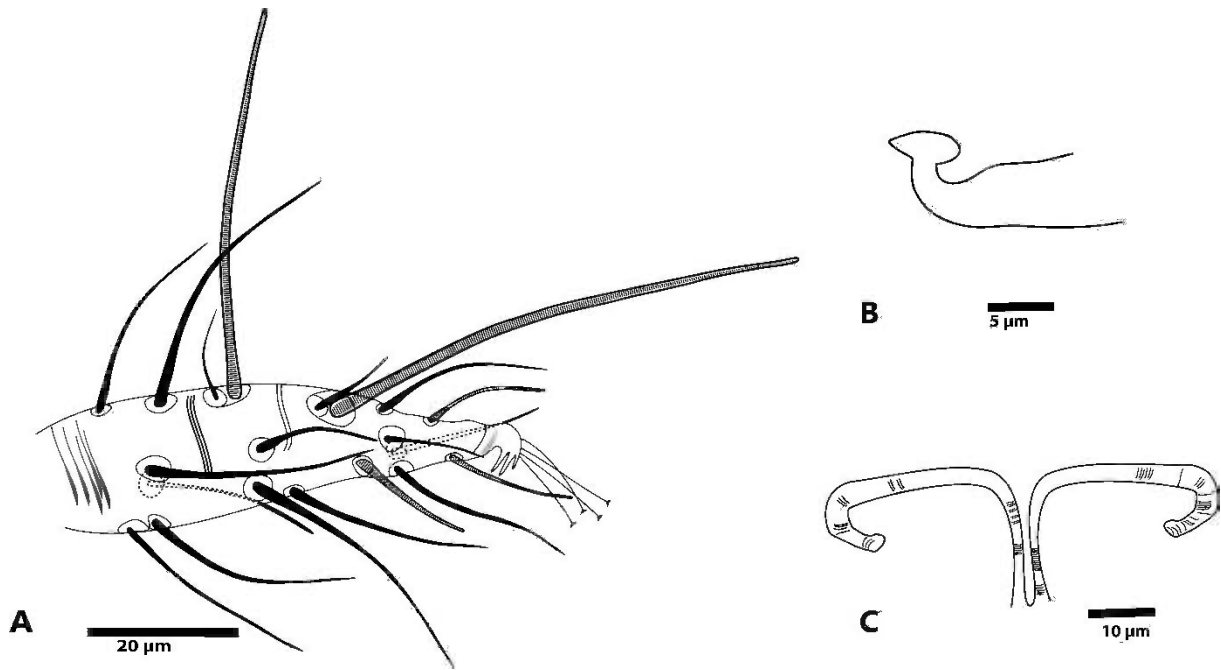


Figure 1. *Tetranychus kanzawai* male; tarsus I (A), aedeagus (B), peritreme (C)

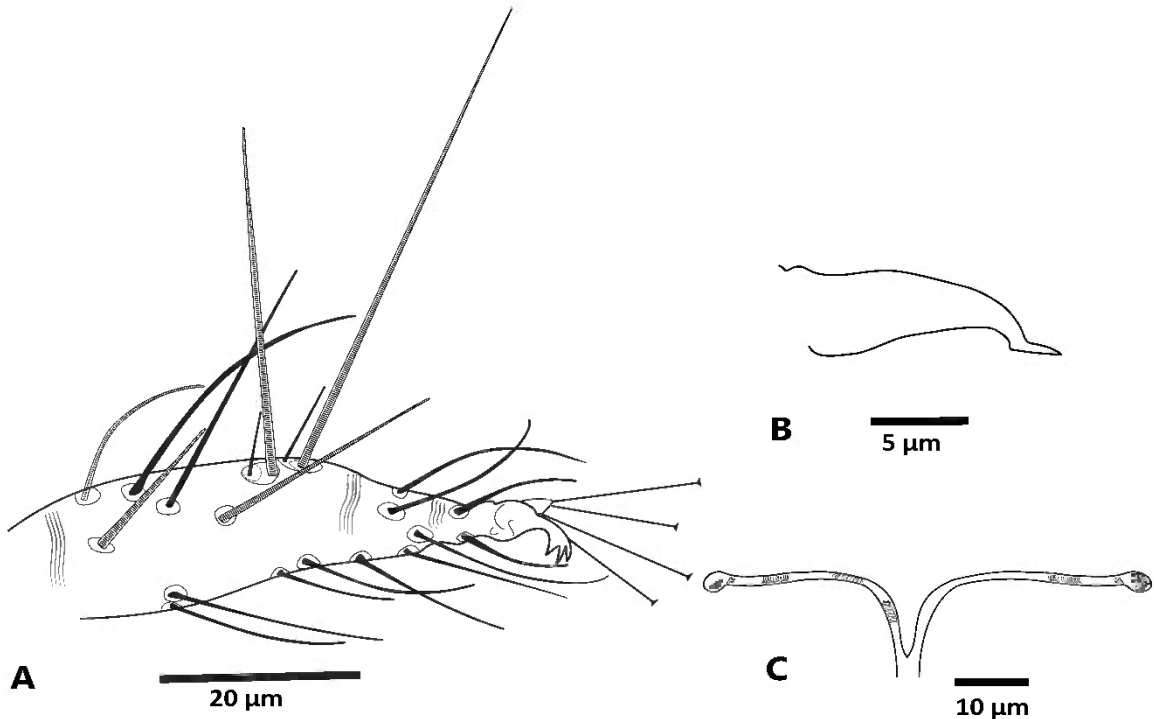


Figure 2. *Eotetranychus rubiphilus* male; tarsus I (A), aedeagus (B), peritreme (C)

**Genus *Eotetranychus* Oudemans**

*Eotetranychus rubiphilus* Reck; 447

Synonym (Migeon and Dorkeld 2019):

*Schizotetranychus (Eotetranychus) bakurianensis* Reck

*Schizotetranychus (Eotetranychus) luteolus* Livshits and Mitrofanov

*Schizotetranychus (Eotetranychus) rubiphilus* Reck

**Examined material:** 22 males were obtained from plum and sour cherry leaves in Ordu province of Turkey; Fatsa, 40°56'39.72" N, 37°35'19.86" E, 453m, 14.06.2016, 1♂ (*P. domestica*); Fatsa, 40°59'59.92" N, 37°30'37.72" E, 22m, 29.06.2017, 3♂ (*P. domestica*); Altınordu, 40°58'1.48" N, 37°45'44.25" E, 302m, 29.06.2016, 1♂ (*P. domestica*); Altınordu, 40°56'7.59" N,

38° 0'14.81" E, 387m, 29.06.2016, 2♂ (*P. domestica*); Perşembe, 41°5'9.65" N, 37°38'12.30" E, 5m, 21.06.2016, 1♂ (*P. domestica*); Perşembe, 41°4'46.89" N, 37°39'27.18" E, 224m, 21.06.2016, 1♂ (*P. domestica*); Perşembe, 40°59'40.20" N, 37°46'8.25" E, 293m, 21.06.2016, 1♂ (*P. cerasus*); Ünye, 41°1'57.01" N, 37°19'29.87" E, 436m, 22.06.2016, 2♂ (*P. domestica*); Ünye, 41° 2'2.24" N, 37°21'25.20" E, 420m, 22.06.2016, 1♂ (*P. domestica*); Ünye, 41°3'6.14" N, 37°20'10.75" E, 353m, 22.06.2016, 1♂ (*P. domestica*); Ünye, 41°4'50.46" N, 37°19'41.76" E, 120m, 22.06.2016, 2♂ (*P. domestica*); Ünye, 41°0'21.67" N, 37°11'12.55" E, 431m, 22.06.2016, 1♂ (*P. domestica*); Ünye, 41°3'36.97" N, 37°22'14.49" E, 259m, 22.06.2016, 1♂ (*P. domestica*); Ünye, 41°5'10.11"

N, 37°12'32.99" E, 239m, 22.06.2016, 1♂ (*P. domestica*); Ünye, 41° 2'33.79" N, 37°12'13.62" E, 453m, 22.06.2016, 1♂ (*P. domestica*); Ünye, 41°1'54.48 N, 37°20'31.29" E, 484m, 22.06.2016, 1♂ (*P. domestica*); Ünye, 41°3'41.23" N, 37°19'12.69" E, 49m, 21.07.2017, 1♂ (*P. domestica*).

#### Description

**Male** (n=6) (Figure 2)

**Body:** Body length 261 (246-280) excluding and 321 (307-342) including gnathosoma. Dorsal setae measurements as follows:  $v_2$  44 (42-46),  $sc_1$  73 (71-85),  $sc_2$  45 (42-48),  $c_1$  67 (62-73),  $c_2$  67 (60-71),  $c_3$  51 (45-62),  $d_1$  66 (60-69),  $d_2$  70 (66-75),  $e_1$  60 (54-65),  $e_2$  66 (60-71),  $f_1$  44 (40-46),  $f_2$  24 (20-25),  $h_1$  22 (18-26).

**Gnathosoma:** Peritreme terminates in a simple bulb (Figure 2c).

**Legs:** Length of legs (excluding coxae) and leg setal count as follows (solenidion provided in parentheses):

Leg I; 186 (174-194), 2 - 1 - 10 - 5 - 13 - 13 + (3) + 2 duplexes;

Leg II; 147 (141-153), 2 - 1 - 7 - 5 - 8 - 16;

Leg III; 155 (142-164), 1 - 1 - 4 - 4 - 6 - 11;

Leg IV; 184 (174-197), 1 - 1 - 4 - 4 - 7 - 10.

Duplex setae are adjacent on tarsi I (Figure 2a). On leg I of the male, only empodium I is claw like. However, in this genus the empodium is not claw-like and split distally in 3 pairs of hairs. In the male, only empodium I (or both empodia I and II) can be claw-like.

**Aedeagus:** Aedeagus short, knob extended distally (2.2µm). Anterior and posterior projections angulate, posterior projection sharply pointed, knob directed dorsally with a slight angle to shaft (Figure 2b).

#### Remarks:

Females of *E. rubiphilus* are greenish yellow. Dorsal setae are longer than between their bases. Dark feeding spots are present on both sides of hysterosoma. Webs seen rarely. In fact webbing is difficult to see but present between the main vein and the leaf surface. It constitutes a sort of roof. Males are light yellow. The eggs have a small apical tip (Gutierrez and Helle, 1983).

This species is distributed in the Palearctic region and present in Georgia, Armenia and Syria neighbors of Turkey (Migeon and Dorkeld, 2019).

To date, it was reported from host plants belonging to Compositae, Rosaceae and Vitaceae (Migeon and Dorkeld 2019). Which are as follows; *Alchemilla erythropoda* Juz. (Reck, 1948), *Potentilla fragarioides* L. (Lee, 1989), *Prunus spinosa* L. (Migeon, et al., 2007), *Rubus caesius* L., *Rubus fruticosus* L. (Migeon, et al., 2007; Migeon, 2015; Zriki et al., 2015); *Rubus ulmifolius* L. (Ferragut and Escudero, 1996; Migeon, 2015) (Rosaceae), *Vitis* sp. (Migeon et al., 2004), *Vitis vinifera* L. (Migeon et al., 2007) (Vitaceae).

In this study, *E. rubiphilus* was collected together with the following predators: *Phytoseius finitimus* Ribaga, *Euseius finlandicus* (Oudemans), *Typhlodromus tiliae* Oudemans (Mesostigmata; Phytoseiidae), *Cunaxoides lootsi* Den Heyer & Castro (Trombidiformes; Cunaxidae), *Tydeus californicus* (Banks), *T. goetzi* Schruft (Trombidiformes; Tydeidae) and *Homeopronematus* sp. (Trombidiformes; Iolinidae) from *P. domestica*.

According to the references, obtained tydeoid mites, *T. californicus*, *T. goetzi* (Baker and Wharton, 1952; Gerson et al., 2003; Walter and Proctor, 2013) and

*Homeopronematus* sp. (Zhang, 2003; Hoy, 2011) were accepted as predator.

These species may be potential predators of the *E. rubiphilus*. The predation capability of these species should be studied. Nothing is also known about biology of *E. rubiphilus* and this issue should also be addressed in future studies.

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