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Presence of a Non-Pest Mite *Tarsonemus confusus* Ewing (Acari: Tarsonemidae), in Florida Strawberry Fields[1]

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Introduction

This publication aims to increase awareness of a commonly found fungus-feeding mite, *Tarsonemus confusus,* in strawberry fields. There are more than 270 species in the mite family Tarsonemidae. In Florida, *Tarsonemus confusus* Ewing (Acari: Tarsonemidae) sometimes appears in strawberry fields late in the season, between January and March. These mites and their eggs may be observed under the calyxes of bronzed and cracked strawberry fruits in fields with prior insect infestation. *Tarsonemus confusus* may be misidentified as a pest mite. In fact, without help from an expert mite taxonomist, incorrect species identification can be a major concern. Although this mite species typically does not achieve pest status on most crops, an incorrect pest identification may lead to unnecessary application of miticides, triggering a secondary pest outbreak. This publication is intended to help growers, crop consultants, crop scouts and Extension agents to distinguish *Tarsonemus confusus* mites from pest mites and thus reduce unnecessary, excessive, and harmful use of insecticides.

Synonymy

Tarsonemus assimillis Banks

Distribution

Tarsonemus confusus has extensive distribution in many parts of the world, including Belarus, Brazil, Canada, China, Egypt, Germany, Hungary, Ireland, Italy, Japan, Korea, Poland, Russia, Turkey, Ukraine, and the United States (Zhang 2003; Ripka et al. 2005; Lofego et al. 2005; Figure 1). In the southeastern United States, *T. confusus* has been found in low numbers in blackberry orchards in Florida and Georgia (Akyazi et al. 2021).

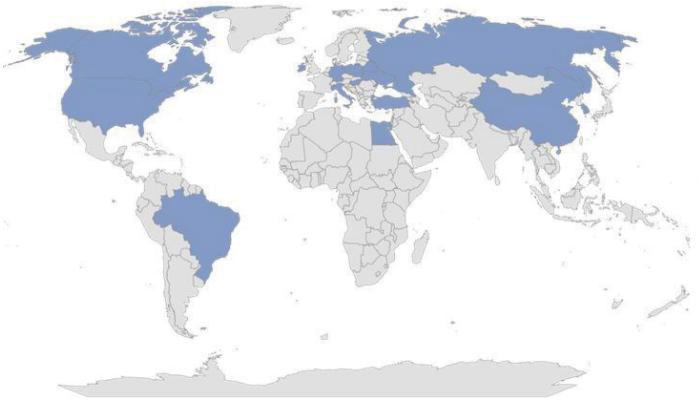

Figure 1. World distribution of *Tarsonemus confusus*.
Credits: Zhang (2003)

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Description

The eggs are oval to oblong and smooth surfaced. Immature stages are white and have three pairs of legs. The larvae can be differentiated from nymphs by their constricted abdomen. Adult females are larger (0.194 mm long and 0.133 mm wide) than males (0.151 mm long and 0.71 mm wide) and are brown and dark brown with four pairs of legs (Spiegelberg 1951). The fourth leg in adults is vital for identification purposes. In males, the coxa of the fourth leg is subtriangular, and the tarsal claw is short, stout, and half as long as the tibiotarsus (Spiegelberg 1951). In females, the femur in the fourth leg is longer than those in the other legs and contains two extended sub-basal and sub-lateral setae (Figure 2). The tibia is short, with very long flagelliform setae (Ewing 1939).

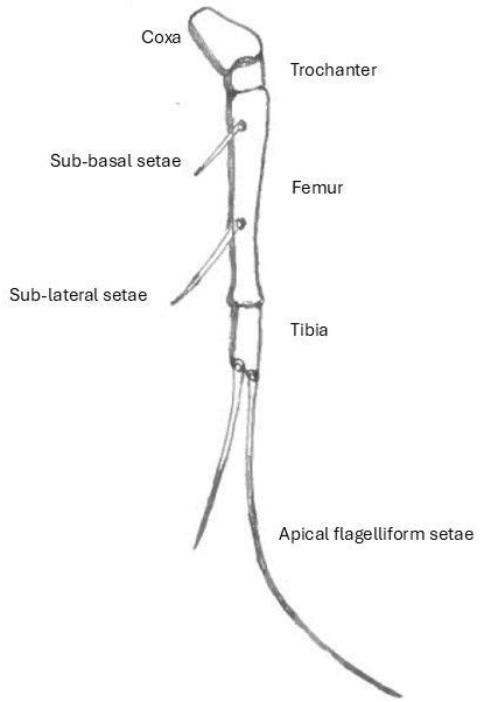

Figure 2. Fourth leg of female *T. confusus*.
Credits: adapted from Ewing 1939 (Re-drawn)

Life Cycle

The life cycle of *Tarsonemus confusus* consists of four stages: egg, larvae, quiescent nymph, and adult (Spiegelberg 1951). *Tarsonemus confusus* has a haplodiploid sex-determination system in which females develop from fertilized eggs, and males develop from unfertilized eggs. The adult female lays eggs after 36 hours of emergence from the nymph stage. Eggs hatch after 54–56 hours. The young larva feeds for 24 hours and develops into a nymph. Nymphs are immobile and develop into adults within 20–32 hours. The life cycle (egg to egg) takes almost six days to complete at a temperature of 29°C (Spiegelberg 1951). Their development and reproduction are temperature dependent (Li et al. 2022). The developmental rate from eggs to adults increases with the increase in temperature from 15°C to 30°C. Temperature significantly influences oviposition, sex allocation, population growth, and survival of these mites (Li et al. 2022).

Host Range

Tarsonemus confusus is found on corn (Poaceae: *Zea mays*), wheat (Poaceae: *Triticum aestivum*), grasses (Poaceae: *Poa* spp.), tomato (Solanaceae: *Solanum lycopersicum*), apple (Rosaceae: *Malus domestica*) (Spiegelberg 1951), and blackberry (Rosaceae: *Rubus* spp.) (Akyazi et al 2021). It is also found in ornamentals such as azalea (Ericaceae: *Rhododendron* spp.), African violet (Gesneriaceae: *Saintpaulia ionantha*), cyclamen (Primulaceae: *Cyclamen persicum*), ivy (Araliaceae: *Hedera helix*), and pilea (Urticaceae: *Pilea peperomioides*) (Zhang 2003). Typically, this mite is found on the part of the plant where fungi are present, probably because this mite feeds on the simple sugars produced when the fungi process plant carbohydrates (Spiegelberg 1951).

Because of its fungivorous nature, this mite species is sometimes responsible for spreading fungal spores. A study found that *T. confusus* was accountable for spreading black dot symptoms in apples in China (Hao et al. 2010). Several pathogenic fungi, namely, *Trichothecium roseum* (Pers.) Link, *Acremonimum stritum* Gams, and several *Alternaria* spp. were found in the infected apple fruit. The presence of *T. confusus* was responsible for the occurrence of the organisms that caused black dot disease (Hao et al. 2010).

Tarsonemus confusus was also found to be associated with dry core rot disease of apples caused by *Coniothyrium* spp. (Michailides et al. 1994). In that study, disease incidences were higher when the mites were present along with the causal fungal agent. Michailides et al. (1994) suspected that *T. confusus* might have carried the fungal spores to the apple core or caused the small wound that allowed the pathogen to enter the fruit. In laboratory cultures, *Tarsonemus confusus* was found to feed on a diverse group of fungi, including *Trichoderma, Geomyces, Cladosporium, Hormiactis, Stachybotris, Botrosporium, Cladobotryium, Beauveria,* and *Unoclodium* (Lindquist 1986). When offered both, *T. confusus* preferred *Alternaria* spp. as a food source over *Cladosporium* spp. from apple foliage. When separate groups of mites were offered only one of the two species of fungi, *Cladosporium* was fed upon as frequently as or more frequently than *Alternaria* (Beleczewski and Harmsen 1994). Again, it is important to stress that most records of *T. confusus* occurring on these plants are not associated

with direct feeding upon the plant tissues but rather upon byproducts produced by the fungus developing on these plants. For example, Li et al. (2022) used *Fusarium* spp. as a food source of *T. confusus* to study the effect of the temperature on the developmental time of the mites.

Differences between *Tarsonemus confusus* and *Phytonemus pallidus*

Tarsonemus confusus is often misidentified as the cyclamen mite *Phytonemus pallidus* (Banks) (Acari: Tasonemidae; Figures 3–5) in strawberries (Zalom et al. 2008). However, there are detectable differences between the morphological characters of the two species that allow them to be distinguished with careful observation (Table 1). *Tarsonemus confusus* has never been reported to be the causative agent of any damage to strawberries stemming from the mite's direct feeding on plant tissue or sap. Proper identification is essential before applying acaricides in the field because unnecessary pesticide application can harm beneficial insects and other non-target organisms.

Figure 3. Pale pink and translucent cyclamen mite adults found feeding underneath strawberry fruit calyx.
Credits: Sriyanka Lahiri, UF/IFAS GCREC

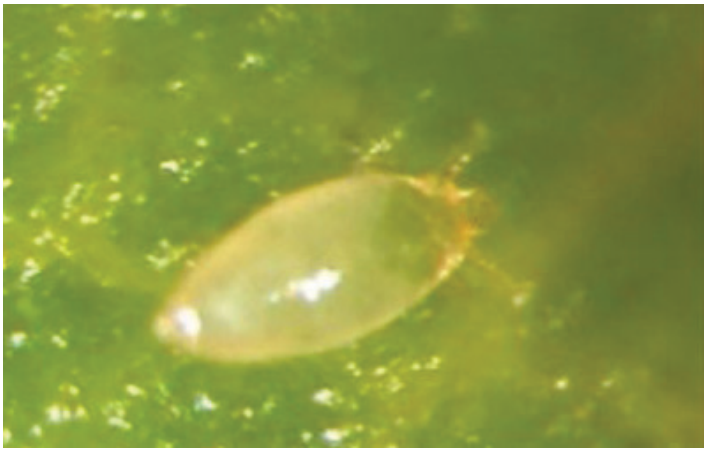

Figure 4. Close up of cyclamen mite adult.
Credits: Justin Renkema, Agriculture and Agri-Food Canada

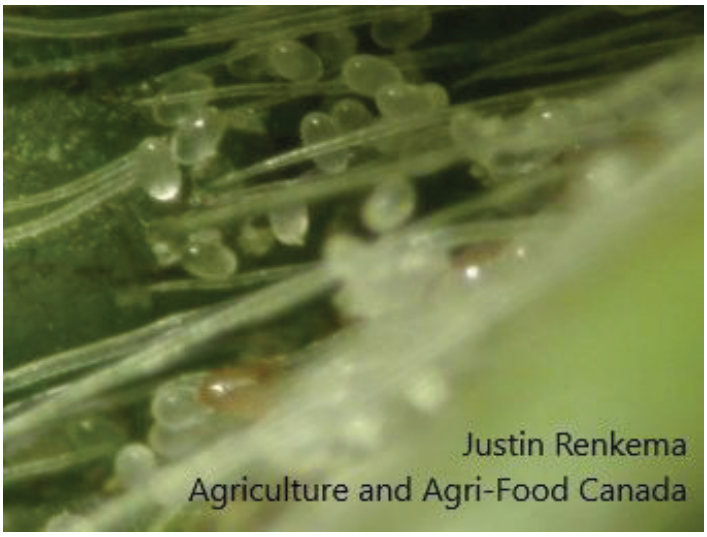

Figure 5. Translucent eggs of cyclamen mites attached to leaf trichomes.
Credits: Justin Renkema, Agriculture and Agri-Food Canada

Economic Importance

Tarsonemus confusus is not presently considered a pest of strawberry in Florida. These mites have been found under the calyx of bronzed and cracked fruits (Figure 6).

Figure 6. Bronzed and cracked strawberry fruit attacked by thrips.
Credits: Sriyanka Lahiri, UF/IFAS GCREC

Management

As mentioned earlier, *T. confusus* is often misidentified as *P. pallidus*. However, the presence of *P. pallidus* in the field can be confirmed by the damage symptoms on the infected plants (Figure 7). The correct identification of specimens must be done to rule out the presence of economically important pests. There is no report of *T. confusus* feeding directly on the strawberry plant tissue. No management is currently needed for *T. confusus* because they are not reported as an economic pest of strawberry.

Figure 7. A stunted strawberry plant infested by cyclamen mites. Note crinkled and compacted leaves at the center.
Credits: Sriyanka Lahiri, UF/IFAS GCREC

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Table 1. Morphological differences between *Phytonemus pallidus* and *Tarsonemus confusus*.

Characteristics	*Phytonemus pallidus*	*Tarsonemus confusus*
Color	Orange or pink, pale yellow, or translucent white (Zalom et al. 2018)	Brown or dark brown (Ewing 1939)
Adult body shape	Elliptical (Zhang 2003)	Oval (Ewing 1939)
Adult legs in female	Hind pair of legs are threadlike (Zalom et al. 2018)	Hind pair of legs are shorter than the margin of the body (Ewing 1939)
Body size of adult female	0.25 mm (Zalom et al. 2018)	0.194 mm (Zhang 2003)
Male legs	The fourth legs with a pair of flanges modified to carry pupae or adult female (Zalom et al. 2018)	Posterior legs do not have any apparatus to carry females (Zalom et al. 2018)