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Strawberry mite (*Phytonemus pallidus fragariae*), a new record of tarsonemid mites (Acari: Tarsonemidae) in Iran

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Invasive alien pest species can have economic impact on the ecosystem and target crops, and sometimes lead to change a cropping system (Pena 2013). Kurdistan is the most important province of strawberry production in Iran. Paros, Queen Elisa, Camarosa, Selva, Ventana, Aromas and local variety named Kurdistan are the main strawberry varieties that are cultivated for fruit or plantlet production. The plantlet production is a big business for local nurseries, and propagated plantlets are distributed over the country (Iran). New diseases and pests have been emerging since new cultivars have been introduced in strawberry fields of the region.

Phytonemus pallidus (Banks) (family Tarsonemidae) is a very important pest on greenhouse plants but also causes serious losses in outdoor cultivations including strawberry farms worldwide. They feed and lay egg on new folded leaves and subsequently move to younger ones, as leaves get older and expand. Infested plants bear sterile blooms and become stunted or may even die (Mass 1987).

Tarsonemid mites make one of the smallest mite groups (regarding dimensions), and are scarcely visible by naked eye. Some few feed on green plants as important pests (cyclamen and strawberry mite and broad mite, *Polyphagotarsonemus latus*), while many others subsist on fungi; they are generally free-living or associated with arthropods. However, the biology of a majority of these species remains unknown (Gerson *et al.* 2003).

Phytonemus pallidus (Banks) occurs on crops and garden plants grown in widespread areas of the world and probably has been spread by agriculture and commerce (Lindquist 1986). Twenty nine species in seven genera and three subfamilies of the family Tarsonemidae have been reported from Iran (Sadeghi Nameghi 2013), but *Ph. pallidus* has not been recorded in Iran so far. However, in some neighboring countries like Turkey they are present in limited areas (Yeşilayer and Çobanoğlu 2010). A detailed account of systematics of the genus *Phytonemus* and particularly *Ph. pallidus* sensu lato is given by Lindquist (1986).

Abnormal strawberry plants cv. Paros from a farm (2 ha) in Kurdistan- western Iran (Sanandaj, 35° 16' N, 46° 85' E and 1454.8 m a.s.l.), were delivered to the lab by a local farmer during May 2015. Strawberry plants with distortion, dwarfed appearance, irregular folded leaves, thickened and brittle leaves, shortening of petioles and pedicels symptoms were subjected to stereomicroscopic examination and a dense population of mites was detected. Mites were picked up from young folded infected leaves and were cleared and fixed in Nesbitt's solution and Hoyer's medium, respectively. The slides were put in an oven at 50 °C for one week and coverslips sealed with clear nail varnish. Permanent preparations were subjected to morphometric measurements using a light microscope (Olympus BX50) and photographed with digital camera (Olympus E5, Olympus Optical Co., Ltd. Japan).

Morphometric criteria applied to examine mite samples have been derived from Suski (1970) and Karl (1965) that are considered absolute in contrast to those by Eyndhoven and Groenewold (1959). Measurements are expressed in micrometers (μm). Abbreviations used in text: TbT- tibiotarsus, FeGe - femorogenu, Ge – genu, IV – structures pertaining to leg IV.

Small mites with yellowish brown adult female (Fig. 1a), that are 250–260 μm long, with hind legs reduced to slender threadlike structures and adult males (Fig. 1b) with the modified fourth pair of legs, approximately 75% of the size of the female, were provisionally identified as belonging to the species of a family Tarsonemidae, namely *Phytonemus pallidus* (Banks, 1904). Morphological description of this genus (being monotypic, thus involving also its sole species) can be found in Lindquist (1986).

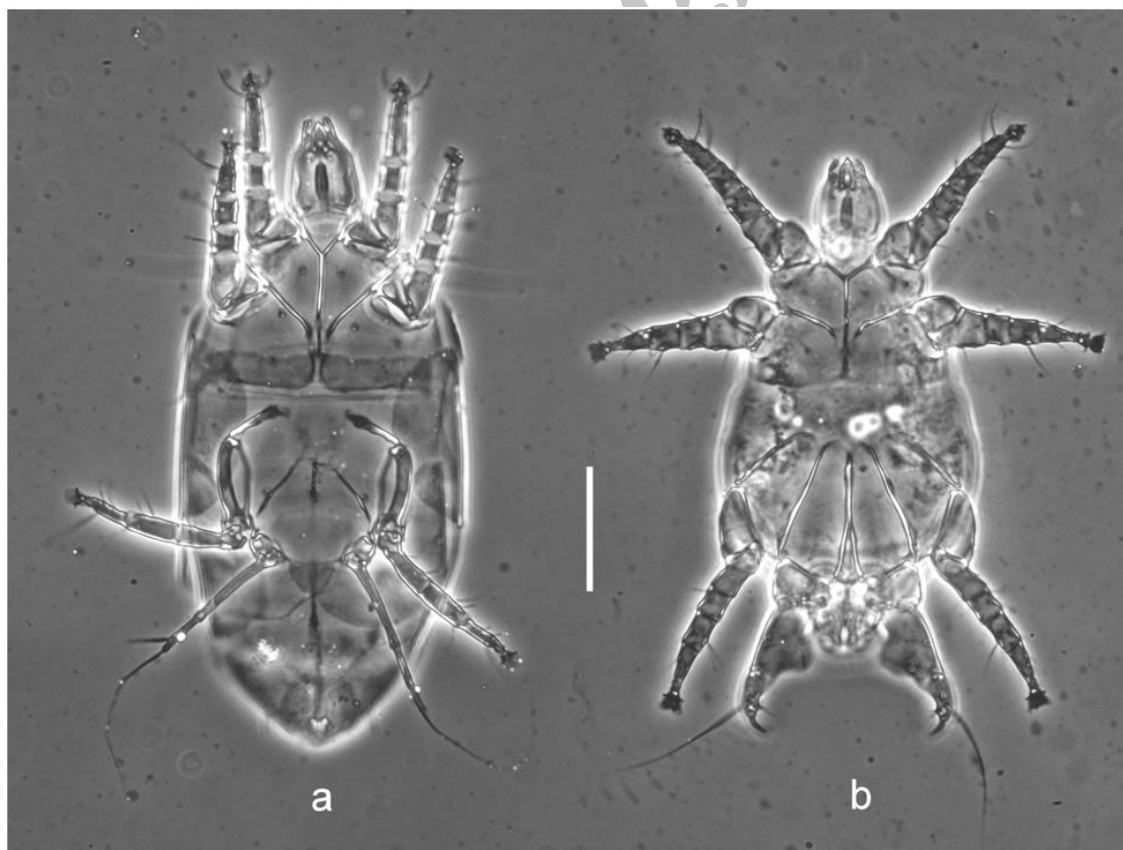


Figure 1. Adult female (a) and male (b) of *Phytonemus pallidus* collected from strawberry farms in Kurdistan, Iran (scale bar 50 μm).

Further examination provided measurable diagnostic characters with the following results [means for three specimens (\pm SD)]:

Females – **v1: 20.67 (0.58)**, **sc2: 79.67 (2.08)**, **c2: 11.00 (1.00)**, **f-f: 30.67 (5.03)**, **FeGe IV: 40.67 (0.58)**, **TbT IV: 18.00 (1.00)**, **FeGe IV/ TbT IV: 0.44 (0.03)**, **v' Ge IV: 12.67 (0.58)**.

Males – **v1: 20.33 (2.31)**, **v2: 10.33 (0.58)**, **sc2: 65.33 (4.51)**, **FeGe IV: 31.00 (1.00)**, **v' Ge IV: 22.33 (1.53)**.

Above presented data when compared with results of biometric analyses by Suski (1970) and especially Karl (1965) indicate that the examined samples belong to *Ph. pallidus fragariae* (Zimmermann, 1905). Characters whose variability falls entirely within the limits as presented by Karl (1965) are marked above with boldface. Remaining ones have their means still fitting within mentioned limits, however extremes may slightly be below or above them.

Today the current systematic status of *Ph. pallidus* is not entirely resolved. According to Karl (1965) and Lindquist (1986) this species should be considered as a complex of three subspecies: *Ph. p. pallidus*, *Ph. p. fragariae* and *Ph. p. asteris*. In reality it cannot be acknowledged if those are indeed subspecies, host races or their complexes, or even genuine species. We thus follow the option of a subspecific status of considered form(s), however future researches may prove otherwise.

Phytonemus pallidus with its subspecies *Ph. p. fragariae* are presented therefore here as a new record for the fauna of Iran, however, the symptoms have been seen during farm inspections already in 2008 by the authors (the first two authors, unpublished data). *Phytonemus pallidus* as an important pest in greenhouses, ornamental plant and numerous crop cultivations in the world, is a potential damaging pest if it distributes over Iran, and therefore it must be limited as soon as possible. Further studies need to be focused on the finding of the origin of spreading populations and the biology of the mite species in the country in order to apply preventive measures.


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Received: 28 August 2016
Accepted: 10 September 2016
Published: 15 October 2016

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