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# A pest out-of-place: two-spotted spider mite, *Tetranychus urticae* (Tetranychidae), on coffee plants

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## Short note

**ABSTRACT**

Brazil is the largest world coffee (*Coffea* spp.) producer. Espírito Santo stands out as the largest Brazilian producing state of *Coffea canephora*, which is commonly intercropped with papaya (*Carica papaya* L.) in the first two years of the establishment of the cultivation. The two-spotted spider mite, *Tetranychus urticae* Koch (Tetranychidae), is considered a pest in papaya, but not in coffee crops. We here report an unusual occurrence of this mite on coffee plants, causing significant damage in fields where they are intercropped with papaya in that state. Mites at different developmental stages were found on the underside of young coffee leaves, producing profuse webbing, causing leaf malformation, necrosis and premature fall. The intercrop of papaya with other crops may lead to the need to adopt measures to control the two-spotted spider mite on the associated crop, even when the latter is known as an unfavorable host to this mite species.

**Keywords** *Coffea*; intercrop; pest mites; papaya

Brazil is the largest world coffee producer. In 2023, around 3.3 million tons of coffee beans were produced in that country in 2.2 million hectares (Conab 2024). About 70% of that total refers to *Coffea arabica* L., and the remainder, to *Coffea canephora* Pierre ex. Froehner. Espírito Santo stands out as the largest Brazilian-producing state of the latter species (Conab 2024), grown mainly in areas of lower altitudes and higher temperatures, averaging in that state between 22 and 26 ºC (Taques and Dadauto 2019).

In northern Espírito Santo, coffee is commonly intercropped with papaya (*Carica papaya* L.) in the first two years of the establishment of the cultivation (Figure 1), at spacings of 3.5 x 1.0 m between coffee and 3.5 x 2.0 m between papaya plants. In that cultivation system, papaya is transplanted first, followed by the transplant of coffee 6 to 12 months later. Espírito Santo is also among the largest papaya producers in the country.

Intercropping has usually been cited as a recommended practice, mainly for shading, plant protection, and increased revenue (Ratnadass *et al.* 2012). However, plant diversification does not always lead to a reduction in the incidence of pests and diseases, as exemplified by reports about the incidence of these problems (Ratnadass *et al.* 2012).

In recent years, the two-spotted spider mite, *Tetranychus urticae* Koch (Tetranychidae), greenish form, has caused significant damage to coffee plants in Espírito Santo, in fields where they are intercropped with papaya. Figures 2A – 2F show the type of damage caused by this mite to leaves of *C. canephora* in the municipality of Boa Esperança, Espirito Santo. Mites at different developmental stages were found on the underside of young leaves (Figure 2A), producing profuse webbing (Figure 2B), causing leaf malformation (Figure 2C and 2D), necrosis (Figure 2E and 2F), and premature fall (see videos in the supplementary material). In one field, approximately 30% of the plants were attacked, but economic loss was not

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**Figure 1** Intercropping of coffee with papaya – Boa Esperança, Espirito Santo, Brazil.

determined. As damage has occurred in the growing season, when plants are most sensitive to injuries, it may be significant if control measures are not adopted.

Worldwide, the two-spotted spider mite has been reported on hundreds of hosts (Migeon and Dorkeld 2024) and it is considered a pest in many agricultural crops, such as papaya (Moraes *et al.* 2024). However, before the present record, this mite had been mentioned on coffee in only one old publication in Hawaii (Marsden 1896) and subsequently mentioned in at least three other publications (Illingworth 1923; Garrett and Haramoto 1967; Lee Goff 1986). In the first two, the mite was reported as "red spider (*Tetranychus telarius*)", while in the last, it was referred to as *Tetranychus cinnabarinus* (Boisduval). Auger *et al.* (2013) considered *T urticae* as a senior synonym of those species. Considering the stage of knowledge of taxonomy at the time of those reports, it is possible that Marsden (1896) was referring to another tetranychid, such as a species of *Oligonychus*, the genus of phytophagous mites most commonly found on coffee plants throughout the world (Migeon and Dorkeld 2024).

Our finding not only shows the colonization of an unusual host by this spider mite, but also a different behavior of this species. Usually, attacks of the two-spotted spider mite initiate on leaves of the median and basal strata, causing no malformation, given that the leaves are fully formed. Attacks on young leaves only happen after the mite population reaches high levels on median and basal leaves.

What are the possible causes of the incidence of this spider mite on young leaves of coffee seedlings in Espirito Santo? Certainly, the incidence on those plants was favored by their proximity to attacked papaya plants, a well-known host of *T. urticae* (Moraes *et al.* 2024). This species has been one of the main phytosanitary problems on papaya in Brazil, because of the difficulties in controlling it, often leading producers to intensify the use of pesticides, often carelessly (Castilho *et al.* 2021; Moraes *et al.* 2024). The injudicious use of chemical products generally causes some problems, such as the evolution of pest resistance and the mortality of natural enemies. This, in turn, can lead to an increased incidence of two-spotted spider mite on papaya and probably on intercropped coffee plants. The placement of the inoculum source (heavily infested papaya leaves) above the coffee seedlings may have promoted the attack of *T. urticae* on the latter. The evolution of spider mite host range was studied by Gould (1979), who demonstrated that this can be a rapid process influenced by the proximity of plant species, including known and potential hosts.

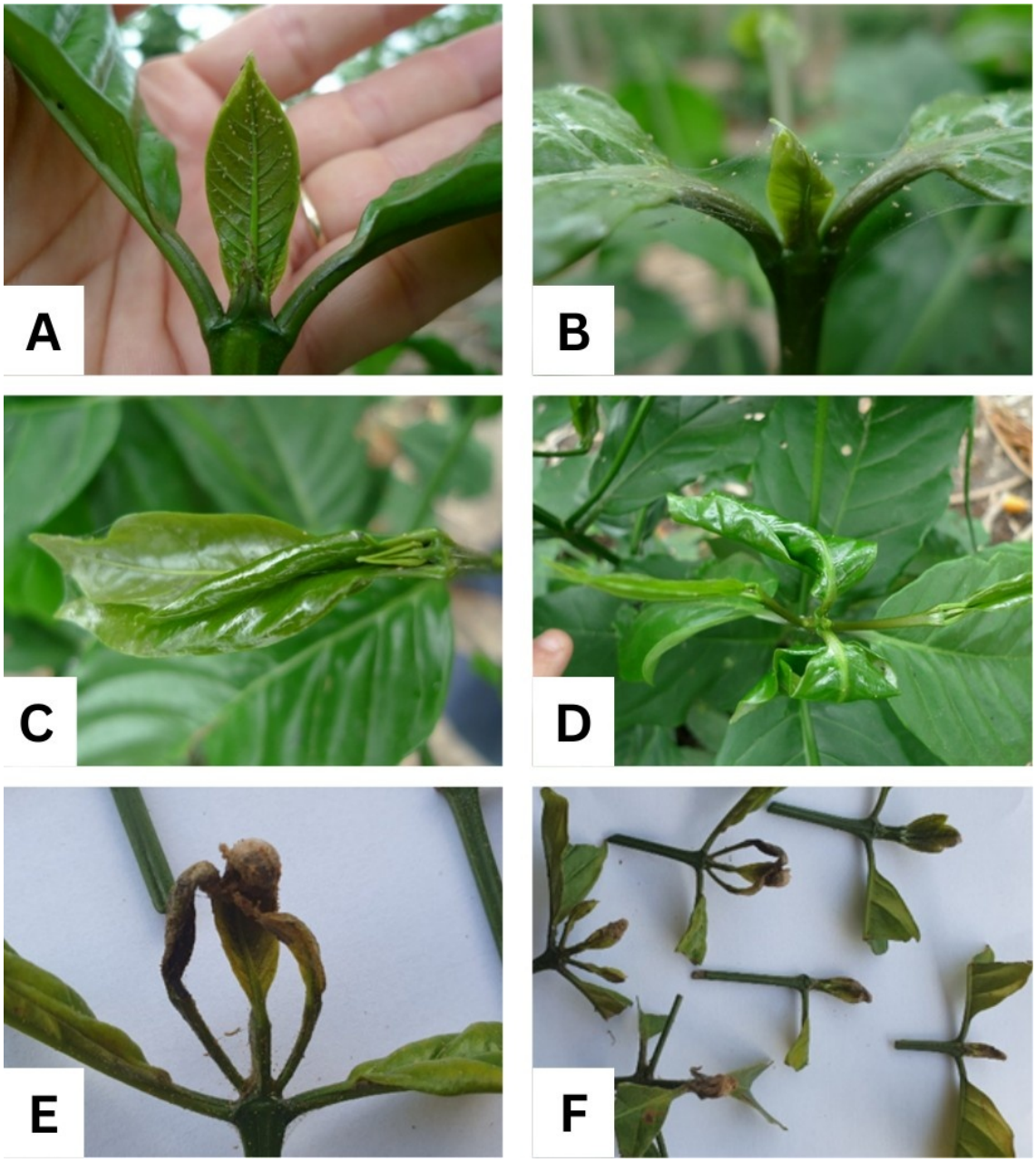


**Figure 2** *Coffea canephora* leaves attacked by *Tetranychus urticae*.

However, our observations in this study should not imply that the association of coffee with another crop usually attacked by *T. urticae* is always non-recommended, as it has been shown that its performance on a potential new host depends upon the host onto which it comes from (Fellous *et al.* 2014). These authors have also shown and discussed the results of different authors on the ability of populations of *T. urticae* to evolve to living on unusual hosts. Most worrying are the results of studies showing the possibility for parallel evolution of the improved performance of *T. urticae* on still other hosts (which could be other crops) not included in a given selection process (Fellous *et al.* 2014).

One of the objectives of intercropping coffee and papaya is to increase revenue, allowing income from the production of papaya while coffee plants grow before initiating commercially

significant yield. Another objective is the partial shading of the first by the latter, to provide protection of coffee plants against ultraviolet light (Bernado *et al.* 2024). On the other hand, there is evidence that the known spider mite's preference for the underside of the leaves is related to avoidance of the effect of ultraviolet sunlight (Ohtsuka and Osakabe 2009; Sakai and Osakabe 2010; Sudo and Osakabe 2011). Hence, this may facilitate the attack of the mite to the coffee plants, breaking its natural resistance of the coffee plant, which may be biochemical or physical, possibly due to the difficulty in penetrating older leaves with its stylets in the feeding process. These aspects require detailed studies to be unveiled.

The incidence of mites on crops not usually damaged by these organisms has been previously reported in intercrops with papaya. Moraes *et al.* (2024) cited the incidence of high populations of *Tetranychus bastosi* Tuttle, Baker & Sales (Tetranychidae) on cowpea, *Vigna unguiculata* (L.), when it was associated with papaya, in Petrolina, Pernambuco state, northeastern Brazil. This mite usually does not cause significant damage to cowpea cultivated in isolation.

In conclusion, the intercrop of papaya with other crops may lead to the need to adopt measures to control the two-spotted spider mite on the associated crop, even when the latter is known as an unfavorable host to this mite species. The evaluation of the long-term consequences of this type of intercrop is warranted.

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