



SCIENTIFIC NOTE

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First record of the occurrence and description of damage caused by *Tetranychus mexicanus* in guarana plants

*Primeiro registro de ocorrência e descrição dos danos de *Tetranychus mexicanus* em guaranazeiro*

ABSTRACT: Guarana (*Paullinia cupana* Kunth, Sapindaceae) is a cultivated plant typical of the Amazonian biota. Among the pests that attack the crop, mite has not been recorded. Thus, recording the first occurrence of *Tetranychus mexicanus* (McGregor, 1950) (Acari: Tetranychidae) in guarana trees and characterize the damage is paramount. The specimens were collected from plants of BRS-Maués variety kept in a greenhouse in Manaus, Amazonas. The mites, in the field (*in vivo*) and in the laboratory (mounted on a microscope slide), and the damage were characterized and recorded on images. The recorded characterizations were compared with those in the literature for *T. mexicanus*. Mites were infesting more than 90% of the plants and causing severe damage. Thus, guarana is included in the list of host plants of *T. mexicanus*, which may cause damage to plants kept in a protected environment.

RESUMO: O guaraná (*Paullinia cupana* Kunth, Sapindaceae) é uma planta cultivada típica da biota amazônica. Entre as pragas que atacam a cultura ainda não há registro de ácaros. Assim, registrar-se a primeira ocorrência de *Tetranychus mexicanus* (McGregor, 1950) (Acari: Tetranychidae) em guaranazeiros e caracteriza-se os danos. Os espécimes foram coletados de plantas da variedade BRS-Maués mantidos em casa de vegetação em Manaus, Amazonas. Os ácaros, em campo (*in vivo*) e em laboratório (montados em lâmina para microscopia), e os danos foram caracterizados e registrados em imagens. As caracterizações registradas foram confrontadas com as existentes na literatura para *T. mexicanus*. Os ácaros estavam infestando mais de 90% das plantas e causando severos danos. Assim, o guaraná passa a compor a lista de plantas hospedeiras de *T. mexicanus*, podendo causar danos em plantas mantidas em ambiente protegido.

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1 Introduction

Guarana (*Paullinia cupana* Kunth, Sapindaceae) is a cultivated plant typical of the Amazonian biota. Its seeds are used mainly in the soft drink industry and in the form of stick, syrup, powder, or extract (Poltronieri *et al.*, 1995). The three leading Brazilian producers are Bahia, Amazonas and Mato Grosso, which together represent over 95% of production (Instituto Brasileiro de Geografia e Estatística, 2018).

The main pest of the guarana plant in Amazonas is the thrips *Pseudophlothrips adisi* (zur Strassen, 1978) (Thysanoptera: Phlaeothripidae) (Tavares *et al.*, 2007). Among the phytophagous mites, so far, there has been no record of the species causing damage to the guarana plant.

The first step in integrated pest management is to identify the unwanted organisms and their damage (Stein, 2006). Based on these identifications, it is possible to gather the information necessary for their correct management. Currently, in relation to pests, guarana is considered a rustic crop, with little occurrence of these organisms, however, with the expansion of areas cultivated with guarana in Brazil, it is possible that new records of pests for the crop will occur. Thus, the objective of this work was to record the first occurrence of *Tetranychus mexicanus* (McGregor, 1950) (Acari: Tetranychidae) in guarana trees and to characterize the damage of the spider mite in the culture.

2 Material and methods

The records were made in Manaus, Amazonas, on November 20, 2019, on 250 guarana trees of the BRS-Maués variety, at around 1.5 years old. The plants were used in a fertilization experiment and were kept in a greenhouse (3° 06' 03" S and 59° 58' 36" W), laterally protected by galvanized wire mesh with a 50-mm hole and covered by transparent plastic. Until the date of occurrence of the spider mite, no phytosanitary treatment was carried out to control pests or diseases.

The site was inspected for photographic record and collection of infested leaves. During the inspection, the distribution of the most infested plants in the stand was observed, as well as plants with different infestation intensities to characterize the damage. Samples were collected from 20 plants, represented by two median leaves of each plant. In the laboratory, leaves were observed under a stereomicroscope to collect adult males and females of the spider mite, with the aid of a fine-bristled brush.

Adult specimens were collected and directly mounted on microscopic slide preparations in Hoyer's medium (Moraes & Flechtman, 2008). Males were mounted individually, in the lateral position. Females were mounted in sets of three females per slide, at the dorsoventral position. Then the slides were dried in an oven at 45 °C for 72 hours.

Afterward, of the spider mite were identified and photographic under a microscope with phase contrast.

For identification, a specialized identification key and the description and redescrptions of the specie were used (McGregor, 1950; Pritchard & Baker, 1955; Vacante, 2010; Seeman & Beard, 2011).

3 Results and Discussion

Colonies of *T. mexicanus*, at all growth stages and webs, were located on the abaxial surface of the fully developed leaves of the guarana plant. The young forms, the newly emerged females (Figures 1A and B), and the males are yellowish-green in color. Subsequently, the females start to display a light red color, with black spots on the sides and the dorsocentral region of the idiosome (Figure 1B).

The coloration of young and adult forms is in accordance with the pattern described in the literature. The young forms of *T. mexicanus* have a greenish color with dark spots (Gondim Júnior & Oliveira, 2001; Pena *et al.*, 2015). Males of this species can be yellowish-green to red (Feres, 2000). The color of females can vary depending on the host, from intense orange-red to brownish-green with black dots (Gondim Júnior & Oliveira, 2001; Moraes & Flechtman, 2008).

Under the microscope, the females showed the distally split empodium, with three pairs of hairs and a well-developed dorsomedial spur (Figures 2A and B). On the tarsus of leg I, the two pairs of duplex-setae are well separated, with the proximal pair placed distally to the four proximal tactile setae (Figures 2C to E) and in line with the solenidium (Figure 2E). The dorsocentral striation pattern of the hysterosome is "diamond-shaped", where the striations between the bases of the e1-e1 and f1-f1 setae are arranged longitudinally and between the bases of e1-f1 are transversally arranged (Figure 2F). Ventrally, the pregenital striation between the ag-g1 bases is weak, with the striae in the medial region being longitudinal and discontinuous (Figure 2G).

In males (five assessed specimens), the empodium also has an evident dorsomedial spur (Figures 2H and I), especially on legs I and II. The aedeagus has the axis of the shaft parallel to the axis of the knob (Figure 2J). In knob, the dorsal margin is convex and with angular projections, being the anterior projection short and the posterior long, slightly curved downwards.

The morphological pattern observed for males and females is compatible with that described for *T. mexicanus* (McGregor, 1950; Pritchard & Baker, 1955; Vacante, 2010; Seeman & Beard, 2011). This pattern is typical of *Tetranychus* species group 8, which harbors *T. mexicanus* and 21 other species (Flechtman & Knihnicki, 2002). In this group, *T. mexicanus* and *T. gloveri* are the most economically important (Flechtman & Knihnicki, 2002).

The *T. mexicanus* population was disseminated in more than 90% of the guarana plants in the greenhouse. The damage was initially characterized by small chlorotic lesions on the abaxial surface of the leaf. As the mites fed, the lesions coalesced resulting in the formation of large chlorotic patches on the two surfaces of the leaves (Figure 1C). Over time, the affected area has dried, starting to

present necrotic spots.

Tetranychus mexicanus has been recorded in 110 hosts, in the Nearctic and Neotropical regions, and also in China (Cheng, 1994; Migeon & Dorkeld, 2021). The

damage observed in the guarana plant has the same pattern as that observed in other hosts (Moraes & Flechtmann, 2008).

Figure 1. Photograph of damages caused by *Tetranychus mexicanus* in guarana. A – Detail of the damage, with the presence of a newly emerged female, on the abaxial surface of the leaf. B – Detail of the damage, with the presence of a female, a deutochrysalis (quiescent protonymph), and a larva, on the abaxial surface of the leaf. C – Overview of damage to the adaxial surface of leaves.

Figura 1. Fotografia dos danos de *Tetranychus mexicanus* em guaraná. A – Detalhe dos danos, com a presença de uma fêmea recém emergida, na superfície abaxial da folha. B – Detalhe dos danos, com a presença de uma fêmea, uma deutocrisálida (protoninfa quiescente) e uma larva, na superfície abaxial da folha. C – Visão geral dos danos na superfície adaxial das folhas.

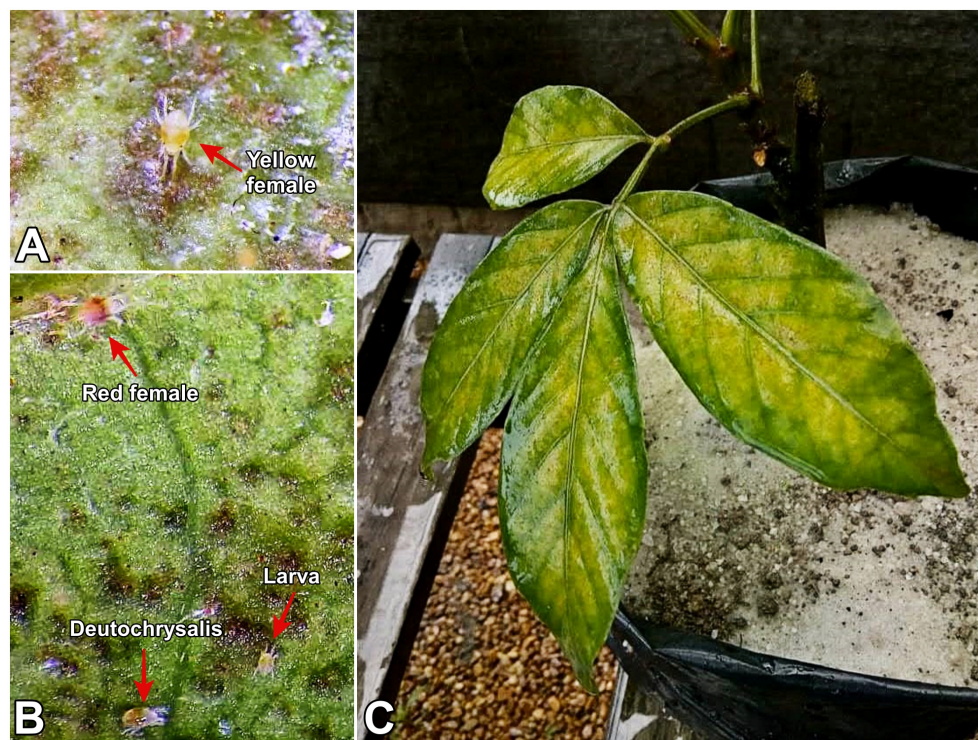
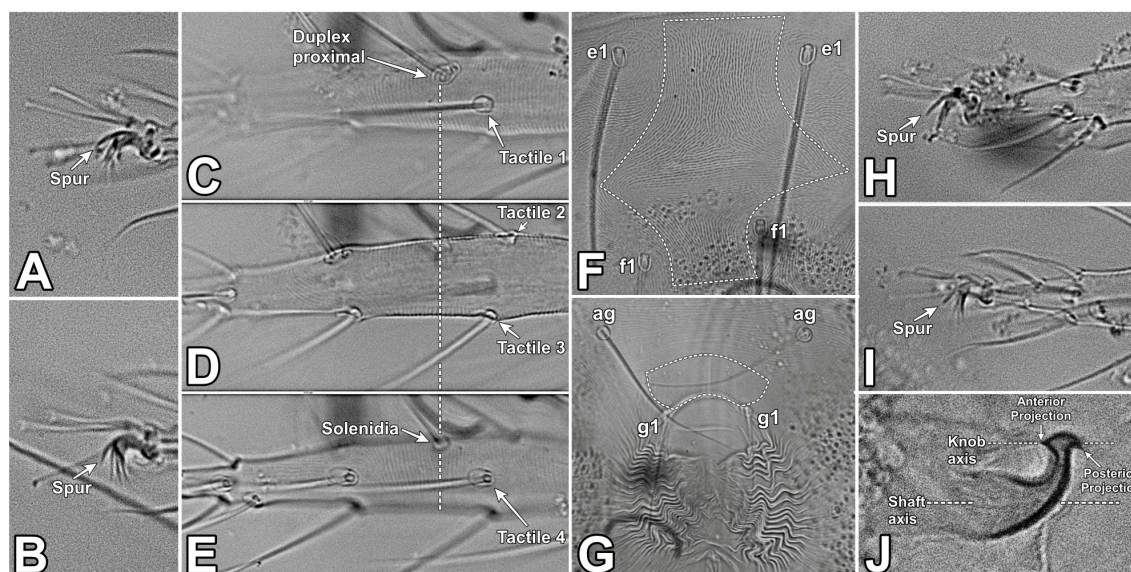


Figure 2. Microscopic photograph of *Tetranychus mexicanus*. Female: A – empodium I, B – empodium II, C to E – tarsus I, F – dorsocentral striation of the hysterosome, and G – pregenital striation. Male: H – empodium I, I – empodium II and J – aedeagus.

Figura 2. Fotografia microscópica de *Tetranychus mexicanus*. Fêmea: A – empódio I, B – empódio II, C a E – tarso I, F – estriação dorsocentral do histerossoma e G – estriação pré-genital. Macho: H – empódio I, I – empódio II e J – edeago.



In protected environments (greenhouses), spider mites are among the main pests for many cultivated plants. In this environment, plants are often grown in monoculture, facilitating the dispersal and rapid development of mites (Zhang, 2003). Severe damage caused by *T. mexicanus* in plants kept in a protected environment was also reported by Pena *et al.* (2015).

4 Conclusion

Based on the results, the guarana tree become part of the list of host plants for *T. mexicanus*. The damage to the guarana leaf is small yellow lesions that coalesce to form large chlorotic patches, causing the leaf to dry out prematurely. This mite can cause severe damage to guarana trees kept in a protected environment.

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