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RAPID COMMUNICATION

First record of mites associated with lima bean (*Phaseolus lunatus* L.)

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Abstract

Pest mites of the family Tetranychidae are commonly reported in several legumes. However, reports of their occurrence in lima beans are insipient, especially in Brazil. The objective of this research was to record the occurrence of mites in lima bean plants and to describe their damage in this Fabaceae. *Tetranychus neocaledonicus* André and *Mononychellus planki* McGregor were found in lima bean plants, *Phaseolus lunatus* (Fabaceae or Leguminosae). The lima bean plants, when infested by these mites, initially exhibit small whitish spots in the leaflets, which with increasing population density rapidly evolve into chlorotic patches, followed by silvering, and may dry out and fall due to their overfeeding. The extent of the damage caused to lima bean plants and the adaptability of the mite to warm and dry conditions indicate that *T. neocaledonicus* has greater potential as a lima bean pest than *M. planki* in northeastern Brazil. This is the first record of these mites associated with *P. lunatus*.

Keywords: Tetranychidae, pest mites, legumes

Introduction

Lima bean (*Phaseolus lunatus* L.) is the second most important legume of the genus *Phaseolus,* especially because its protein content is used as an alternative source of food and income by the population (Santos *et al.* 2009). This legume is cultivated in almost all Brazilian states with most of the production concentrated in the northeastern region, cultivation is predominantly associated with family farming (Lopes *et al.* 2010). Thus, lima bean have been cultivated as a way of reducing the almost exclusive dependence on common bean.

In spite of the varied aptitudes, the lima bean has received little attention from research and extension institutions. As a result there is limited knowledge about its agronomic characteristics and consequently, inadequate crop management. Other aggravating factors, such as competition with weeds, incidence of pests and diseases have contributed to reduced crop yields.

Among the mites, 14 species of the Tetranychidae family have been reported on lima bean, of which 11 belong to the genus *Tetranychus* (Migeon and Dorkeld 2016). In Brazil, there are few reports of mites associated with lima bean. The following species were reported: *Tetranychus urticae* Koch (Acari: Tetranychidae) and *Eutetranychus banksi* (McGregor) (Acari: Tetranychidae), in the Federal District and Teresina-PI (Mendonça *et al.* 2011; Gomes Neto *et al.* 2017; França *et al.* 2018) and *Tetranychus gloveri* Bank, 1900 and *Tetranychus tumidus* Banks, 1900 on Bahia, *Tetranychus ludeni* Zacher and *Tetranychus mexicanus* (McGregor 1950) in São Paulo (Flechtmann and Moraes 2017).

Although the cultivation of lima bean is important for small producers in the Brazilian northeast, studies on the interaction of this crop with insect pests and phytophagous mites of economic importance are

scarce (Lopes *et al.* 2010). The objective of the present study was to increase the number of records of phytophagous species associated with lima bean plants, by listing two new phytophagous mite species on lima bean plants and describing their damage.

Materials and Methods

Between May and December of 2016, leaves of different lima bean accessions were collected. A total of 200 plants were sampled for the entire study (10 leaves per sample), from experimental plantations (05°05' S, 42°49' W) located in the Department of Plant Sciences, at the Agricultural Sciences Center, Socopo Campus – University Federal of Piauí (UFPI), Teresina, Piauí State.

The plants had small leaves with whitish spots, showing coalescence of spots, and the leaf limb presented a silver coloration. Initially, the injuries appeared in young leaves at the leaflets' extremities (upper third part of the plant). The old leaves were yellowish. In plants with high infestation (an average of 10 to 20 adult mites besides many eggs and immature stages of the species) whitish colored webs were formed. There were also many damaged leaves and several lima bean plants died. Leaves were brought to the laboratory and inspected under a stereomicroscope (SMZ168 Series – Motic). All tetranychid developmental stages and numerous exuviae were observed, and the mites were transferred to tubes containing 70% alcohol. Later, all the mites present were mounted on microscope slides using Hoyer's medium (about 200 slides were mounted with males and females). The slides were observed and a morphological description under phase contrast microscope (Brand Olympus Model BX41), was made by Dr. José Wagner da Silva Melo (Department of Phytotechnology/Entomology of the University Federal of Ceará) and Manoel Guedes Correa Gondim Junior (University Federal Rural of Pernambuco, Department of Agronomy, Brazil) confirmed the species. Taxonomic keys and descriptions by Pritchard and Baker (1955) were used to identify the species.

Results

The following species were identified: *Tetranychus neocaledonicus* André and *Mononychellus planki* (McGregor) (Acari: Tetranychidae) (Figs. 1J and 1L) in *Phaseolus lunatus.*

Tetranychus neocaledonicus is red and lives on the underside of leaves, where it produces webs when there is high infestation (Fig. 1A). It deposits its eggs on the abaxial surface of the leaves. At first, the attacked plants have small whitish spots, which later evolve into chlorotic patches, followed by silvering, drying and falling of leaves (Fig. 1B). Freshly deposited eggs are spherical. Gradually they become brown with red circular patches on the sides (Fig. 1C). The larvae are a light and bright color at hatching. As they develop, they become green with dark lateral patches (Fig. 1D) and protochrysalis (Fig. 1E). The protonymph is green on the back and the deutonymph is pinkish (Figs. 1F, 1G). The female *T. neocaledonicus* is red with pale white legs, whereas males are greenish yellow (Figs. 1H, 1I). The proximal double arrows of the tarsus I are located distally to the proximal tactile arrows (Ramírez *et al.* 2018). The dorsal-median spur is absent. According to Moraes and Flechtmann (1981) the head of the aedeagus is globular, having the anterior angle greater than the posterior (Fig. 2A).

Mononychellus planki lives on both sides of the leaves. It is visually distinguishable from other tetranychids species due to its intense green coloration (Ramírez *et al.* 2018) and the reticulate pattern on the dorsum of the body, especially surrounding the setal bases (Flechtmann 1996). All active phases are green, with yellow legs (Figs. 1J, 1L). They do not produce webs and deposit their eggs along the vein. The damage caused by *M. planki* is similar to that caused by *T. neocaledonius* and described above, except for the absence of webs. The male has a curved aedeagus to the belly (Fig. 2B).

Discussion

Tetranychus neocaledonicus, collected from cotton plants, was described in 1933 in New Caledonia, Oceania. Currently, this species is widely distributed in tropical and subtropical areas of the world, and has been reported on more than 500 botanical species (Migeon and Dorkeld 2016). In Brazil, *T. neocaledonicus* was first reported in 1970 on peanut plants (*Arachis hypogaea* L.). Notwithstanding, several other botanical species have been cited as hosts, including castor bean (*Ricinus communis* L.), pinion (*Jatropha* sp.), macassar bean (*Vigna* sp.), okra (*Hibiscus esculentus* L.), sponge gourd (*Luffa aegyptiaca* Mill.), banana (*Musa* sp.), coconut (*Cocos nucifera* L.), peach palm (*Bactris gasipaes* Kunth) and mulungu (*Erythrina velutina* Willd), *Phaseolus lunatus*, Fabaceae (Poderoso *et al.* 2010; Mendonça *et al.* 2011; Silva and Gondim Junior 2016; Gomes Neto *et al.* 2017).

Mononychellus planki was described in 1950 in Puerto Rico, Central America, from specimens collected from Erythrina plants (*Erythrina berteroana*

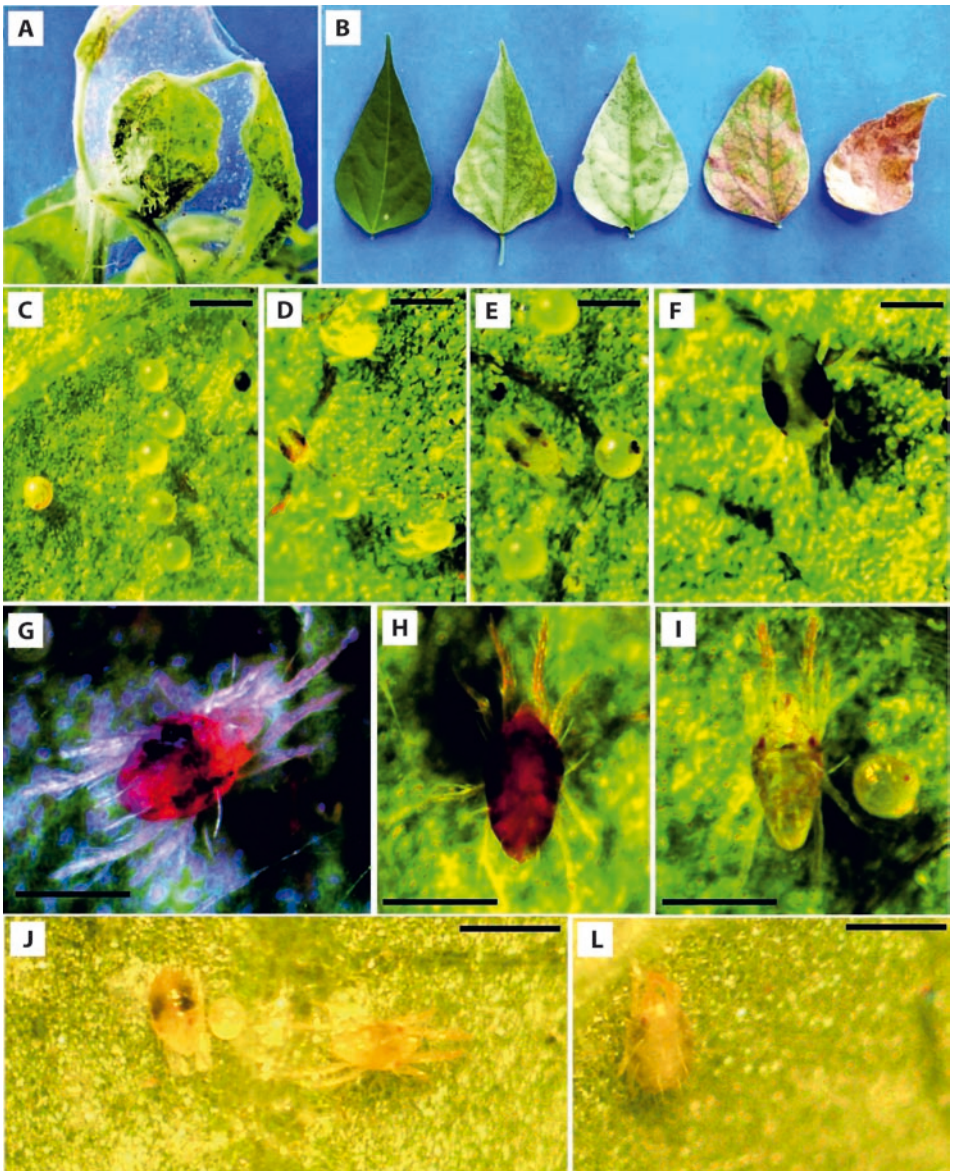

Fig. 1. *Tetranychus neocaledonicus*: A – webs adhered to leaves, B – progression of injuries, C – eggs (Bar 4 µm), D – larvae at different instars (Bar 4 µm), E – protochrysalis (Bar 4 µm), F – protonymph (Bar 4 µm), G – deutonymph (Bar 10 µm), H – female (Bar 10 µm), I – male of *T. neocaledonicus* (Bar 10 µm). *Mononychellus planki*: J – protochrysalis, egg and male (Bar 10 µm), L – Female (Bar 10 µm)

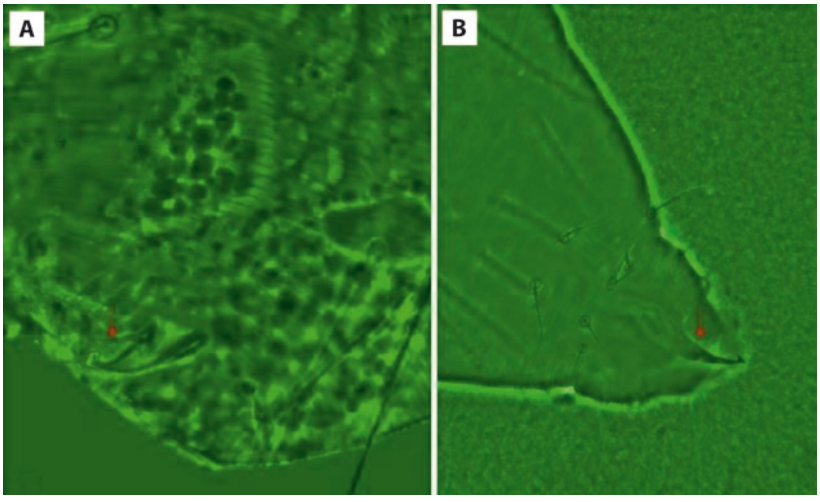

Fig. 2. Aedeagus of the tetranychidae on lima bean: A – *Tetranychus neocaledonicus*, B – *Mononychellus planki*

Urb.). This species has been found in Argentina, Brazil, Colombia, Costa Rica, Cuba, Ecuador, Paraguay, Puerto Rico, Trinidad and Tobago and Venezuela, as well as Mexico and the United States, infesting more than 60 botanical species (Migeon and Dorkeld 2016). In Brazil, *M. planki* has been reported in soybean (*Glycine javanica* L. and *G. max* Merill), annona (*Annona diversifolia* Saff), cotton (*Gossypium hirsutum* L.), bean (*Phaseolus vulgaris* L. and *Vigna ungiculata* L.), wild bean or snout bean (*Rhynchosia minima* L.), okra (*Abelmoschus esculentus* L.) and spontaneous plants (*Desmodium purpureum* Hook. & Arn., *Sida cordifolia* L., *S. santaremensis* Monteiro, *S. rhombifolia*, *S. urens,* Vernonia sp., Asteraceae, *Glycine* sp2, Fabaceae, *Pterodon emarginatus*, Fabaceae, *Curatella americana*, Dilleniaceae) (Moraes and Flechtmann 1981; Guedes *et al.* 2007; Roggia *et al.* 2008; Mendonça *et al.* 2011; Rezende *et al.* 2012; Cruz *et al.* 2012; Reichert *et al.* 2014; Nery *et al.* 2015; Demite *et al.* 2016; Teixeira *et al.* 2017).

Although infrequently, the occurrence of these species on the same lima bean plant, and sometimes on the same leaf, has been verified. The coexistence of tetranychid species is not frequent; it is probable that, in this case, competition occurs not only for space, but also for food (Foot 1963). In Brazil, mixed infestations of *T. neocaledonicus* and *M. planki* were observed on okra plants (Mendonça *et al.* 2011). Nonetheless, this is the first report of mixed infestations on lima bean plants. The occurrence of mixed infestations reinforces the need to know more about the biology and behavior of these species. Furthermore, a greater sampling effort to characterize the acarofauna on lima beans is needed.

This is the first record of the tetranychids *T. neocaledonicus* and *M. planki* on lima bean (*P. lunatus*) in Brazil. The higher population density, in addition to the injuries caused by *T. neocaledonicus* and the adaptability to warm and dry weather conditions indicate that this mite has great potential to become a pest of economic importance for crops in northeastern Brazil.

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