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Scientific Note

Two new occurrences of *Oligonychus* (Acari: Thrombidiformes: Tetranychidae) in *Coffea canephora* Pierre ex. Froehner, with description of damage and record of its natural enemies in the state of Amazonas, Brazil

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Abstract. The objectives of this work were to document two new occurrences of *Oligonychus* (Trombidiformes: Tetranychidae) in coffee plant, present the damage, and report the occurrence of natural enemies. The records were done in three production areas in the counties of Itacoatiara, Silves, and Urucará, state of Amazonas. We verified the occurrence of *Oligonychus mangiferus* (Rahman and Sapra) and *Oligonychus peronis* Pritchard and Baker. In two crops, *O. mangiferus* was observed causing severe damage. For both species, we observed the occurrence of natural enemies such as predatory insects and mites, and acaropathogenic fungus. Based on the results, the occurrence of *O. mangiferus* and *O. peronis* in coffee farming is now known.

Keywords: *coffeae* new species subgroup; Conilon/robusta coffee; Pest management; Spider mites; Tropical agriculture.

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The two largest producers of conilon coffee, *Coffea canephora* Pierre ex. Froehner (Rubiaceae), in Brazil are the states of Espírito Santo (stand of 932,906 plants) and Rondônia (stand of 197,124 plants), respectively located in the Southeast and North regions of the country (CONAB 2021). For the state of Amazonas, also in North region, coffee growing is still an activity that has not yet been explored, with a planted area of 192-ha for conilon coffee, in addition to 23-ha for arabica coffee (*Coffea arabica* L.) (IBGE 2020). The main producer in Amazonas is the municipality of Apuí, with production of 270-t of conilon coffee per year, representing more than 80% of all coffee produced in the state (IBGE 2020).

In 2019, to improve coffee production in the state, competition trials were implemented to evaluate and identify clones of conilon/robusta coffee better adapted to Amazonian edaphoclimatic conditions. For this purpose, experiments were installed in the counties of Humaitá, Itacoatiara, Manaus, Silves, and Urucará, with BRS clones developed by Embrapa-RO, called "Robustas Amazônicos" (Teixeira *et al*. 2020). Encouraged by research actions, public policies to support coffee growers and the interest of investors in the Amazonian coffee production chain, new private production areas have been installed in Amazonas.

Among the various problems that can occur in coffee production areas is the occurrence of pest insects and mites that, depending on climatic conditions, cultivation system or biological imbalance, can cause considerable damage, impairing the development and production of plants (Costa *et al*. 2015). One of the main pests for coffee (*Coffea* spp.) is the mite *Oligonychus ilicis* (McGregor) (Thrombidiformes: Tetranychidae), which has been recorded in several producing regions in Brazil (Reis & Zacarias 2007; Costa *et al*. 2015). The damage caused by *O. ilicis* occurring more frequently in neighboring plants (aggregated), being observed in the older leaves of these plants (Costa *et al*. 2015). The infested leaves initially show chlorotic punctuations, later they lose their natural brightness, and the upper surface has a tanned appearance (Reis & Zacarias *et al*. 2007; Moraes & Flechtmann 2008).

Oligonychus ilicis belongs to the *coffeae* species group and subgroup (Mushtaq *et al*. 2021). Three other species of this subgroup [*Oligonychus coffeae* (Nietner), *Oligonychus punicae* (Hirst) and *Oligonychus yothersi* (McGregor)] also have already been recorded in *Coffea* spp. (Migeon & Dorkeld 2021). *Oligonychus mangiferus* (Rahman and Sapra) and *Oligonychus peronis* Pritchard and Baker are also part in the *coffeae* species subgroup (Mushtaq *et al*. 2021), both with a record of occurrence in the state of Amazonas (Vasconcelos & Silva 2015). *Oligonychus mangiferus* is cosmopolitan and polyphagous, occurring in 54 hosts in 21 families, including one species of Rubiaceae (Migeon & Dorkeld 2021). On the other hand, *O. peronis* occurs, in addition to Brazil, in Costa Rica and Ecuador, having five hosts in three families (Vasconcelos & Silva 2015; Migeon & Dorkeld 2021).

The correct identification of the pest is the first step towards proper decision making for management. From the identification, it is possible to catalog all the existing information, from sampling methodology to the most efficient control methods. In places where new crops are being implemented, this diagnosis becomes even more necessary for regional pests. Thus, the present work aimed to document two new occurrences of *Oligonychus* for *C. canephora*, describing their damage on plants. Moreover, we reported the occurrence of potential natural enemies.

Sampling was carried out in three conilon/robusta coffee agroecosystems in the state of Amazonas. One of them, located in the company Mil Madeiras Preciosas, in the county Silves, with a 2,40-ha experimental planting area, with 6,154 plants of approximately one year and seven months, and had not undergone any phytosanitary treatment before the sampling recorded in 2021/09/08. Another agroecosystem is located on the Jota Pê Farm, in the county Itacoatiara, with a 0.13-ha crop, with 448 plants of approximately two years and six months, where Neem Oil®, Klorpan 480EC®, and Boveria-Turbo SC® had been applied for the control of *Hypothenemus hampei* (Ferrari) (Coleoptera: Scolytidae) before the sampling of the mite, registered on 2021/09/11. The third agroecosystem, located in Jardim Norte Farm, in the county Urucará, with a 0,10-ha crop, with 308 plants of approximately four months, and had not undergone any phytosanitary treatment before the sampling, recorded on 2021/09/18.

The crops were 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 five plants, represented by 10 median leaves of each plant. In the laboratory, leaves were observed under a stereomicroscope for the counting of post-embryonic stages (mean±standard error). Adult specimens were collected and directly mounted on microscopic slide preparations in Hoyer's medium. Identification was made under a microscope, with phase contrast, based on Rahman & Sapra (1940); Pritchard & Baker (1955); Gupta & Gupta (1994); Khanjani *et al*. (2018); Mushtaq *et al*. (2021). When present, predators were also collected and mounted in slide preparations in Hoyer's or Canada Balsam medium, respectively for mites and insects. Spider mite with symptoms of pathogen infection (mummified) were also collected and mounted in slide preparations in Hoyer's medium + Aman blue (1:1). The identifications of predators and pathogens were based on Gordon & Chapin (1983); Gagne (1995); Alves *et al.* (1998); Lofego (1998); Thyssen (2009); Mirab-Balou *et al.* (2013).

After the observations, the species were identified as *O. mangiferus* and *O. peronis*. Viewed under a microscope (Figure 1A), the females of the two species are indistinct, but differ from *O. ilicis* by having four tactile setae proximal to the pair of proximal duplex setae of tarsus I. Males of *O. mangiferus* (Figure 1B) and *O. peronis* also have indistinct idiosome and legs I. In both species, the aedeagus, from a lateral view, presents the posterior portion ventrally curved. In *O. mangiferus*, the curved portion is short, tapering triangularly and forming an acute angle with the anterior portion (Figure 1C). In *O. peronis*, on the other hand, the curved portion is narrow and truncated, in the shape of a finger, with a distinct bulbous enlargement above this portion (Figure 1D).

In the field, colonies of *O. mangiferus* and *O. peronis* were found on the adaxial surface of leaves, especially near the veins (Figure 1E). It was not observed the occurrence of the two species in the same plantation (cross infestation). By observing them, it was possible to detect the mites moving and the presence of whitish exuviae. In addition, the leaves presented a small amount of web, not always visible, to which debris and dust may have adhered, leaving the leaf with a dirty appearance. The eggs were detected (Figure 1F), with a flattened shape and adhered to the leaf surface, which, depending on their age, can be yellowish to intense and bright red. The larvae have three pairs of legs (and presented greenish color with some reddish spots Figure 1G). The nymphs (proto and deutonymphs) have four pairs of legs and presented pinkish color in the anterior region and purplish or reddish in the posterior region (Figures 1H and I). Adult females are larger than males (Figure 1J), being globose and similar in color to nymphs, with a lighter median band in the posterior region. Males have a posteriorly tapered body and the same coloration as females.

The morphological patterns, as well as the shapes and coloring patterns observed in the field, were in accordance with those mentioned for *O. mangiferus* and *O. peronis* (Rahman & Sapra 1940; Pritchard & Baker 1955). The characteristics observed in the field for the two species are similar to those mentioned for *O. ilicis* (Reis & Zacarias *et al*. 2007; Moraes & Flechtmann 2008). Among species recorded, only *O. mangiferus* was previously reported as pest in some agricultural crops (Vacante 2015).

The crop in Mil Madeiras Preciosas and Jardim Norte were infested with a high population of *O. mangiferus* and, consequently, with more damaged plants. The Jota Pê crop was infested with *O. peronis*. The infestations of *O. mangiferus* and *O. peronis* were 98±30, 105±27 and 26±13 mites/leaf, respectively for Mil Madeiras Preciosas, Jardim Norte and Jota Pê. In the three sites, the most infested plants were aggregated, with the colonies distributed in the oldest leaves. Initial damage was bronze spots, mostly near the veins. More damaged leaves lost their natural shine and showed large bronze spots (Figures 1K and L).

The lower infestation in Jota Pê may be related to the application of insecticides and/or to a lower aggressiveness of *O. peronis*. All damages observed were similar to those already reported for *O. ilicis* in coffee crops (Reis & Zacarias *et al*. 2007; Moraes & Flechtmann 2008; Costa *et al*. 2015). Therefore, caution is recommended when identifying and recording *Oligonychus* in coffee plants, as occurrences of O*. mangiferus* and *O. peronis* may go unnoticed and be erroneously attributed to *O. ilicis*.

Some predators were found associated with *O. mangiferus* and *O. peronis*, among which the mites Phytoseiidae (Mesostigmata) *Euseius concordis* (Chant), in the three collection sites, and *Neoseiulus anonymus* (Chant and Baker) in Jardim Norte (Figure 2A). The thrips, *Scolothrips* sp. (Thysanoptera: Thripidae), and the micro ladybug, *Stethorus* sp. (Coleoptera: Coccinellidae), were observed in Jota Pê and Jardim Norte (Figures 2B to D). Larvae of the fly *Feltiella* sp. (Diptera: Cecidomyiidae), were observed in Jardim Norte (Figure 2E). The lacewing larvae, whose identification was only at the order level (Neuroptera), were observed in Mil Madeiras Preciosas. In addition to predators, the acaropathogenic fungus *Hirsutella* sp. (Hypocreales: Ophiocordycipitaceae) was recorded in Jardim Norte (Figures 2F and G).

In coffee plants, there are several biological control agents reported as natural enemies for *O. ilicis*, considered the best-known species for the culture. Vacante (2015) listed several works that mention the phytoseiids *Amblyseius compositus* Denmark and Muma, *Amblyseius herbicolus* (Chant), *Euseius alatus* DeLeon, *Euseius citrifolius* Denmark and Muma, *E. concordis*, and *Iphiseiodes zuluagai* Denmark and Muma as predators of *O. ilicis* in coffee. All of these species already were recorded in agroecosystems for the state of Amazonas

(Vasconcelos & Silva 2015; Cruz *et al*. 2019). Among insects, Vacante (2015) mentioned *Stethorus* spp., *Scolothrips latipennis* Priesner, *Chrysopa* spp. and *Chrysoperla externa* (Hagen) (Neuroptera: Chrysopidae). The author also mentioned the mite pathogen *Hirsutella thompsonii* (Fischer).

With the recent stimulus to coffee production in the state of Amazonas, the cultivated area tends to increase in the coming years. In this scenario, it is necessary to identify which pests can damage the crop in order to plan their management. Thus, considering the damage reported in this work, Amazonian coffee growers should monitor the occurrence of *O. mangiferus* and *O. peronis*. The record of the natural occurrence of various biological control agents is important information that can be used in conservation biological control strategies.

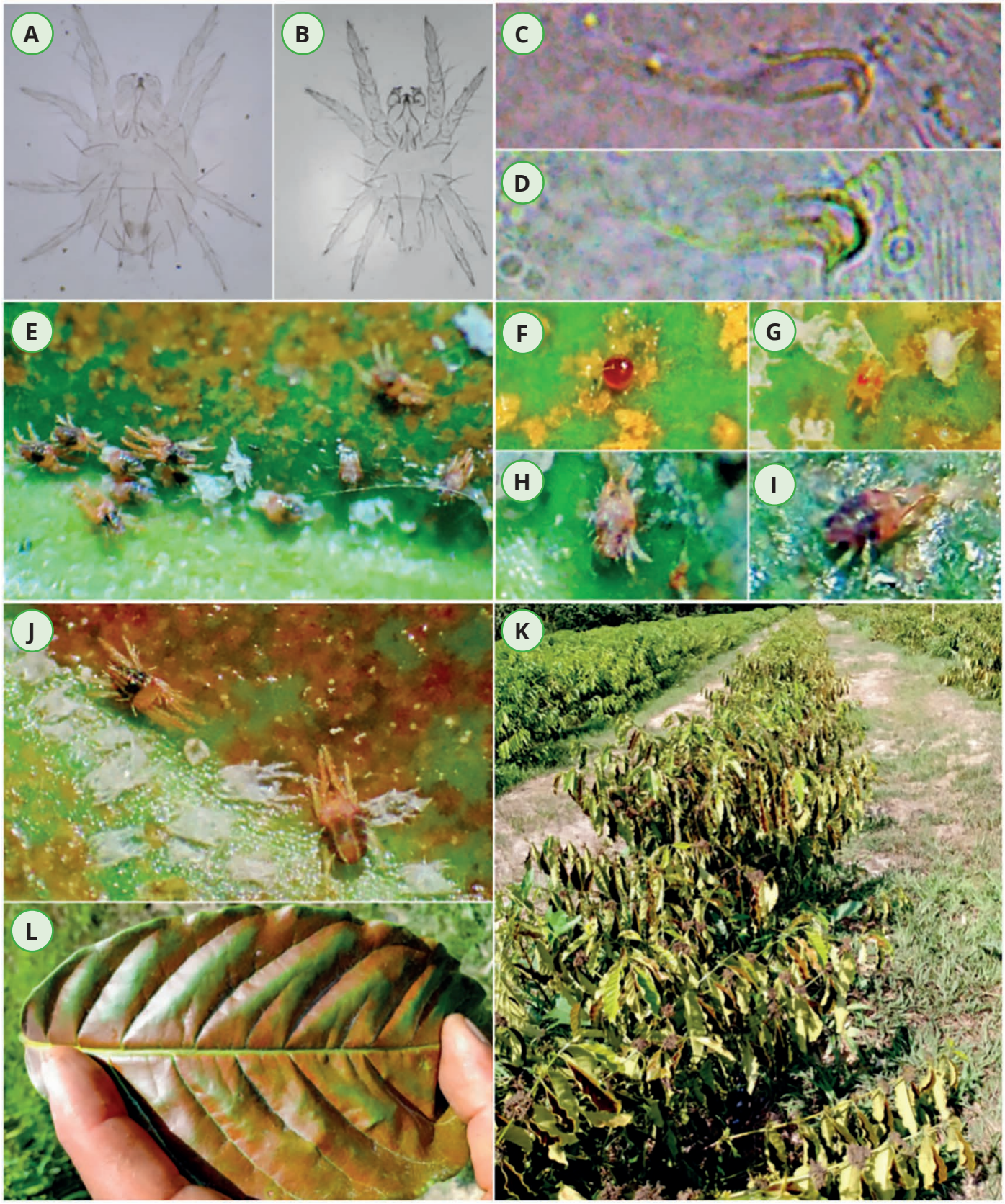

Figure 1. *Oligonychus* in conilon/robusta coffee in the state of Amazonas. A and B – Microscopic overview of female and male of *O. mangiferus*, respectively; C and D – Side view of the aedeagus of *O. mangiferus* and *O. peronis*, respectively; E – Overview of an *O. mangiferus* colony; F to I – Eggs, larva, protonymph, and deutonymph of *O. mangiferus*, respectively; J – Male and female of *O. mangiferus*; K and L – Damage caused by *O. mangiferus*.

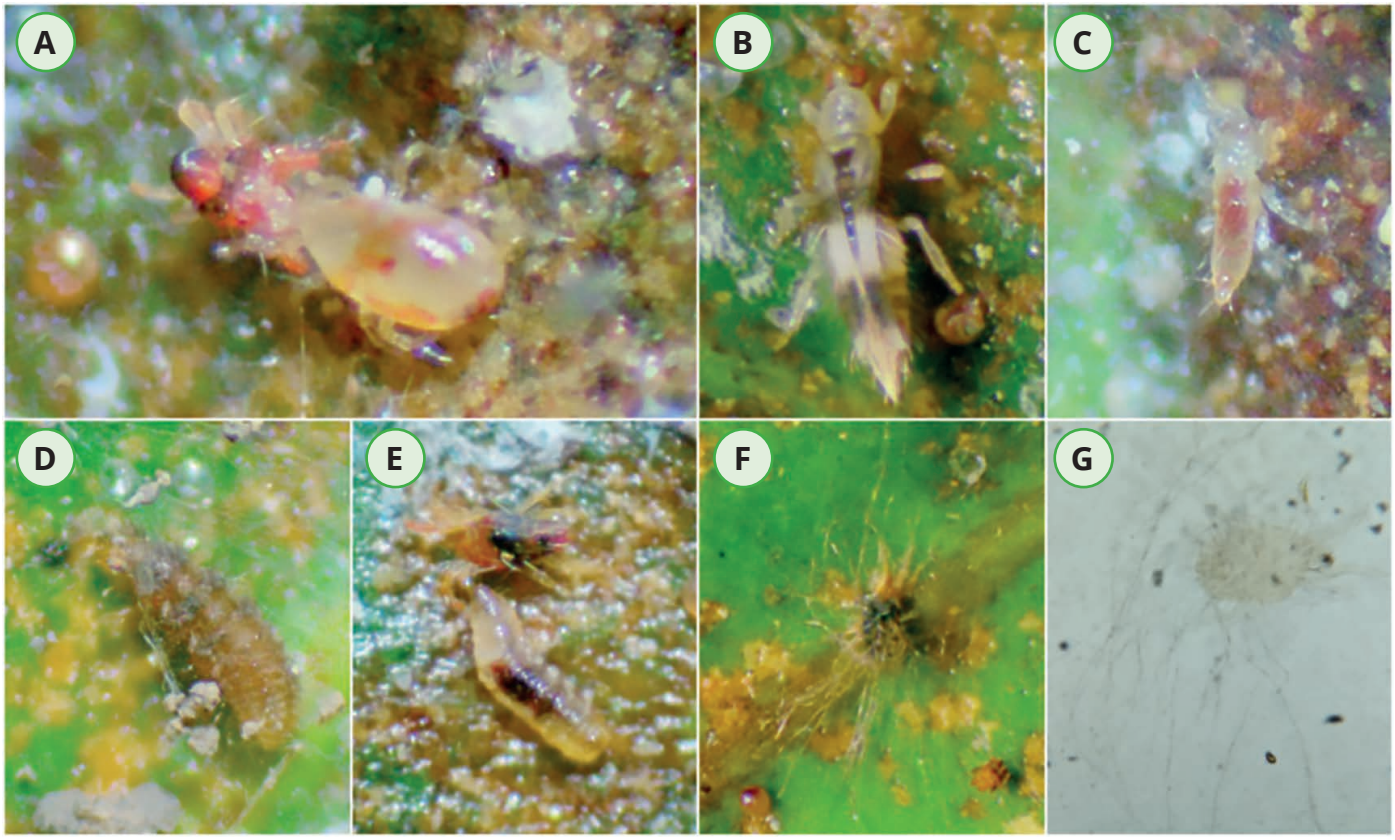

Figure 2. Natural enemies associated with *Oligonychus mangiferus* colonies in conilon/robusta coffee in the state of Amazonas. A – Adult *Neoseiulus anonymus* preying on adult male; B and C – Adult and nymph, respectively, of *Scolothrips* sp. preying on eggs; D – *Stethorus* sp. larva preying on eggs; E – *Feltiella* sp. larva preying on adult male; F and G – Mummified adult female, after infection by *Hirsutella* sp., observed under a stereomicroscope and under a microscope, respectively.

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