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First association of scale insects (Hemiptera: Diaspididae) with *Salacia crassifolia* (Mart. Ex Schult.) G. Don. (Celastraceae)

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Abstract. *Salacia crassifolia* (Mart. ex Schult.) G.Don., (Celastraceae) is a native species of shrub/tree highly appreciated in Brazil for its fruits and medicinal properties. Scale insects have never been reported associated with *S. crassifolia*; nevertheless, this paper describes the occurrence of two diaspidids on *S. crassifolia* leaves in Brazil. Three mature trees were inspected in February and March 2018 and scale insect samples were collected and preserved in 70% alcohol, then mounted and identified under an optical microscope. Two species of scale insects were found associated with this plant, *Pseudoparlatoria argentata* Hempel and *Melanaspis aristotelesi* Lepage and Giannotti, both from the family Diaspididae (Hemiptera). The three observed trees were infested by the diaspidids, with some leaves completely colonized by both species. This is the first reported occurrence of *P. argentata* and *M. aristotelesi* in plants of the Celastraceae family. It is also the first report of these insects in the Distrito Federal, Brazil, expanding the distribution and hosts in native plant species of the Cerrado biome.

Key words. Brazilian savanna, forest entomology, pest insects, native scale insects.

Introduction

The Cerrado *sensu lato* is the second largest Brazilian biome in area, second only to the Amazon rainforest (Ribeiro and Walter 2008). A wide diversity of plants, animals, and microorganisms occurs in this biome and several species are considered endemic. Therefore, it is considered a hotspot for the conservation of world biodiversity (Klink and Machado 2005).

The Celastraceae family includes trees, shrubs, subshrubs, and lianas found mainly in tropical regions, including the Brazilian Cerrado (Oliveira et al. 2012; Groppo and Erbert 2015). Molecular studies clustered members of the Hippocrateaceae family within Celastraceae, characterizing them as a paraphyletic group (Simmons and Hedin 1999; Simmons et al. 2000, 2001; Groppo and Erbert 2015) whose species share similar chemical compounds (Oliveira et al. 2012). The genus *Salacia* L. is one of the most represented genera of Celastraceae in the Neotropical region, with over 30 described species (Lombardi and Temponi 2001). *Salacia crassifolia* (Mart. Ex Schult.) G.Don. is one of the most important species for the Cerrado region (Silva Junior 2005).

Salacia crassifolia is a shrub/tree species that grows to six meters high and is widely distributed in the Brazilian Cerrado, especially in the Cerrado *sensu stricto* and Cerradão (Almeida et al. 1998). It has simple, alternating, elliptical or oblong leaves, with acute, obtuse, or retained apices (Silva Júnior 2005). Its fruits are berries with sweet pulp that are frequently eaten by the local fauna and indigenous peoples. In folk medicine, the plant is used as an antibiotic (Silva Júnior 2005) and to treat diseases (Oliveira et al. 2012; Carneiro et al. 2013, 2018). In addition, the leaf extract has antimicrobial properties (Rodrigues et al. 2015).

Studies about insects associated with *S. crassifolia* have concentrated on their fruits, in which several species of fruit flies (Diptera: Tephritidae and Lonchaeidae) have been described, including species new to science (Braga Filho et al. 2001; Bomfim et al. 2014). Scale insects associated with Celastraceae species, including *S. crassifolia*, have never been reported in the Brazilian Cerrado (García Morales et al. 2016). Therefore, this paper is the first record of the occurrence of two diaspidids on *S. crassifolia*.

Materials and Methods

The work was carried out with three adult *S. crassifolia* trees located in Brasilia, Federal District, Brazil (15°56′57.2″ S, 48°10′00.4″ W). The three plants produce flowers and fruits regularly.

Leaf samples of the *S. crassifolia* that contained scale insects were collected in February and March 2018. The collected material was fixed in Falcon tubes containing 70% ethanol and mounted on slides following the methods adapted and described by Wolff et al. (2014) for identification under optical microscope. The specimens were identified according to the morphological characteristics of adult females based on the literature for species determination (Lepage and Giannotti 1944; Wolff 2008). The slides containing the scale insects are deposited at the Ramiro Gomes Costa Entomology Museum (MRGC), State Department of Agriculture, Livestock and Rural Development (DDPA, SEAPDR, RS).

Furthermore, 30 leaves (ten from each tree) were randomly collected from the infested plants and the number of scales was counted with the aid of a magnifying glass with 30× magnification, without species-level identification, in order to verify the average number of individuals found per leaf. All pictures were taken by the first author (M.T.C.) using a digital camera (Sony®).

Results

Two scale insects were found associated with *S. crassifolia*: *Pseudoparlatoria argentata* Hempel (Fig. 1) and *Melanaspis aristotelesi* Lepage and Giannotti (Fig. 2), both from the family Diaspididae (Hemiptera).

The three plants were infested by the diaspidids, with some leaves completely colonized by both species. The insects of this family produce scales that cover their bodies, protecting them, but the scales can easily detach from individuals.

The species *P. argentata* was most abundant on the underside of the leaf, whereas *M. aristotelesi* was more abundant on the upper surface. Due to the high infestation, these insects could impair the photosynthesis process of the plant, as the leaf surfaces were almost completely covered by scale insects, especially *M. aristotelesi*. An average of 328 individual diaspidids was observed on the leaves of the *S. crassifolia* evaluated, with a minimum of 36 and a maximum of 842 individuals. All thirty leaves collected for analysis had diaspidids and the most infested leaves exhibited symptoms of chlorosis on both surfaces.

Discussion

The genus *Pseudoparlatoria* Cockerell is native to the Neotropical region (Malumphy and Redstone 2012) and has been extensively reviewed by Wolff (2001, 2008). It currently has over 40 described species, of which 19 species occur in Brazil (Wolff 2001, 2008; García Morales et al. 2016). This species is a polyphagous scale insect and can be found in the Central-West, Southeast, and Southern regions of Brazil, as well as some provinces of Argentina. It is associated with nine botanical genera, each in a different family, and so far, it is not known to be phytophagous in Celastraceae (Wolff 2008; García

Morales et al. 2016).

The scale that covers *P. argentata* in the prepupal and male pupal stages is elongated and less than 1 mm long. The scale of the adult female is circular or subcircular, about 1.2 mm in diameter, rough, convex, dark brown to black, and with flat margins that are lighter and transparent. The adult female body is subcircular, about 0.6 mm in diameter, similar to *Pseudoparlatoria constricta* Fonseca in that it has a few marginal macroducts, submarginal macroducts much smaller than at the margins from the first abdominal segments, and several microducts in the pre-pygidium abdominal lobes and scattered throughout the pygidium. It differs from *P. constricta* due to the lack of constriction in the margin of the apical cephalothorax (Wolff 2008).

Melanaspis Cockerell has 65 species, 28 of which are Neotropical, and 12 of which occur in Brazil. Most species of *Melanaspis* are monophagous (García Morales et al. 2016). Several species that had been described in *Melanaspis* have been transferred to the genus *Acutaspis* Ferris, based mainly on the shape of the pygidium and the size and location of the anal opening (García Morales et al. 2016).

The scale of *M. aristotelesi* adult female is more or less circular, measuring about 1.4 mm in diameter; the scale of the male is not known. The body of the adult female of *M. aristotelesi* is about 1 mm in diameter (Lepage and Giannotti 1944).

Among the *Melanaspis* species that occur in Brazil, *Melanaspis bondari* Lepage and Giannotti most closely resembles *M. aristotelesi*; both have five pairs of paraphyses with similar shape and distribution in the pygidium. However, *M. aristotelesi* does not possess two slightly sclerotized tubercles on the point of the posterior spiracles, as found in *M. bondari*. Furthermore, the shape of the pygidial lobes is different, and after the third pair of lobes, *M. aristotelesi* has only a small protrusion representing the fourth lobe. *Melanaspis bondari* has a series of 3–4 protrusions on the pigment margin (Lepage and Giannotti 1943, 1944).

Melanaspis aristotelesi was described in 1944 by Lepage and Giannotti, associated with cashew tree (*Anacardium occidentale* L., Anacardiaceae) in the state of Alagoas, Brazil; this is the only host plant record (Claps et al. 1999; García Morales et al. 2016). The association of this diaspidid with a plant from the Brazilian Cerrado increases the possibility of the species being polyphagous.

In the present study, we report the expanding distribution and hosts of *P. argentata* and *M. aristotelesi*, in native plant species of the Cerrado biome, in the Distrito Federal, Brazil. Both diaspidid species were found on *S. crassifolia*, with some leaves completely infested with both species.

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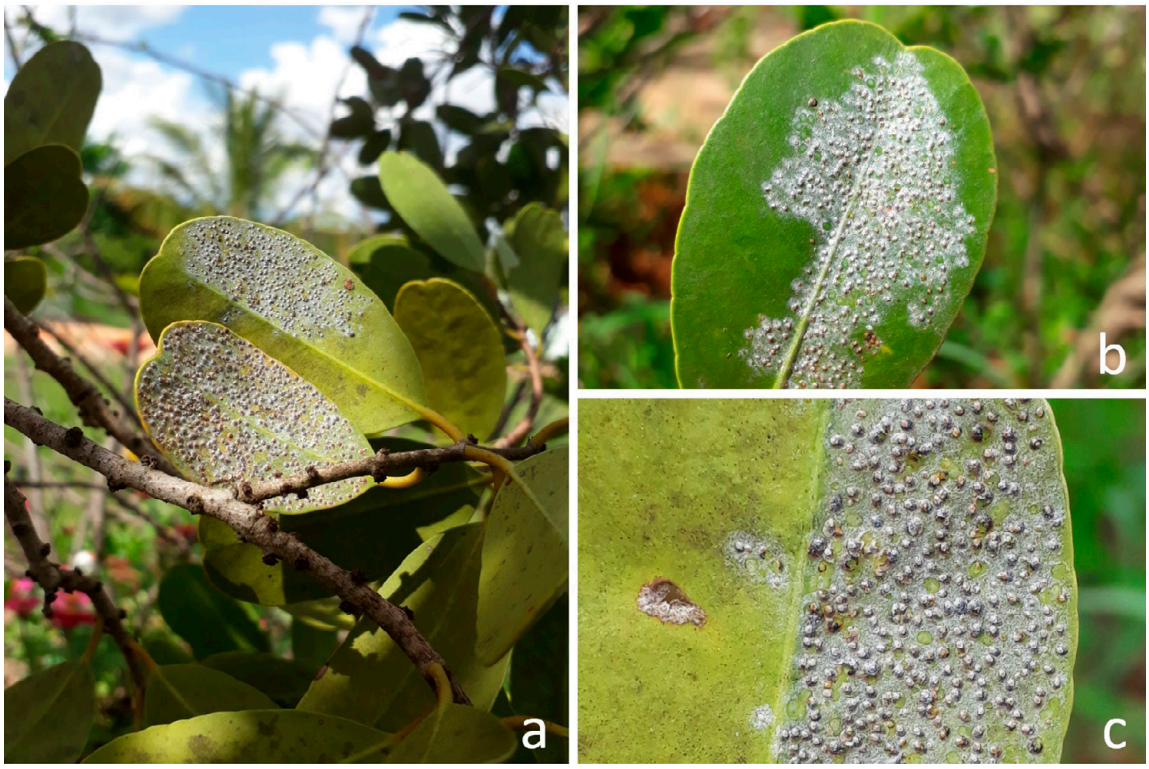

Figure 1. *Pseudoparlatoria argentata* associated with *Salacia crassifolia* in Brasilia, Brazil. **a)** *S. crassifolia* tree infested with diaspidids. **b)** Lower surface of leaf highly infested with diaspidids. **c)** Detail of the *P. argentata* scales.

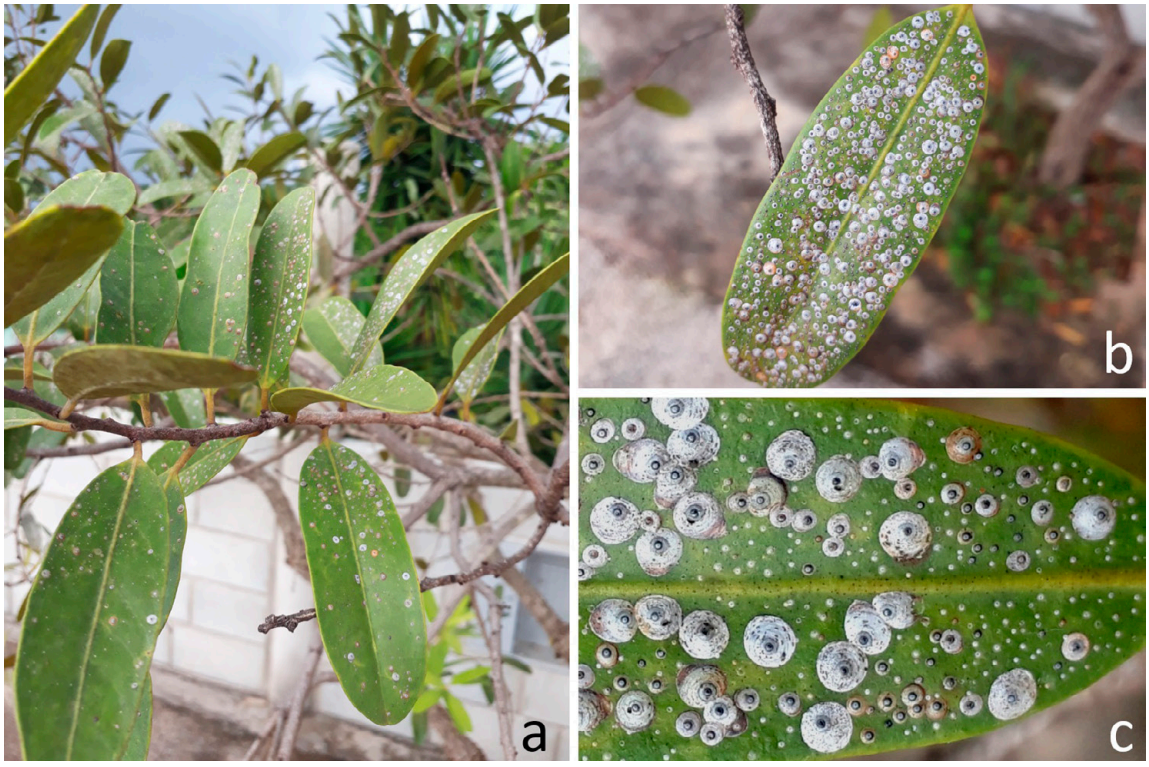

Figure 2. *Melanaspis aristotelesi* associated with *Salacia crassifolia* in Brasilia, Brazil. **a)** *S. crassifolia* tree infested with diaspidids. **b)** Upper surface of leaf highly infested with diaspidids. **c)** Detail of the *M. aristotelesi* scales.