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Original Article

Occurrence of *Pinnaspis strachani* (Cooley, 1899) (Hemiptera: Diaspididae) on *Murraya paniculata* (L.) Jack (Rutaceae) in the Midwest of Brazil, with a taxonomic key to common *Pinnaspis* species

Ocorrência de *Pinnaspis strachani* (Cooley, 1899) (Hemiptera: Diaspididae) em *Murraya paniculata* (L.) Jack (Rutaceae) no Centro-Oeste do Brasil, com uma chave taxonômica para espécies comuns de *Pinnaspis*

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Abstract

Pinnaspis strachani (Cooley, 1899) (Hemiptera: Diaspididae) is a polyphagous scale insect that has a wide range of hosts worldwide, with records of occurrence in more than 79 families and 265 plant genera. In Brazil, *P. strachani* has been recorded in nine states, distributed in the Southeast (4 spp.), Northeast (2 spp.), North (2 spp.), and South (1 sp.). Until now, there was no record of this armored scale insect in Central Brazil. This work reports the occurrence of *P. strachani* for the first time in the Midwest Region, with infestations on *Murraya paniculata* (L.) Jack (Rutaceae) plants. The collections were carried out in Alto Paraíso de Goiás, State of Goiás, Brazil. Morphological and ecological aspects, and geographic distribution of the occurrence of this diaspidid in Brazil are presented in this work, in addition to an identification key to most common *Pinnaspis* species recorded in the country.

Keywords: biodiversity, Coccomorpha, entomology, scale insect, taxonomy.

Resumo

Pinnaspis strachani (Cooley, 1899) (Hemiptera: Diaspididae) é uma cochonilha polífaga que possui uma grande diversidade de hospedeiras distribuídas ao redor do mundo, com ocorrência em mais de 79 famílias e 256 gêneros botânicos. No Brasil, *P. strachani* foi registrada em nove Estados, distribuídos no Sudeste (4 spp.), Nordeste (2 spp.), Norte (2 spp.) e no Sul (1 sp.). Até o momento, não há registro de ocorrência dessa cochonilha no Brasil Central. Esse trabalho registra a ocorrência de *P. strachani* pela primeira vez na Região Centro-Oeste, com infestações em plantas de *Murraya paniculata* (L.) Jack (Rutaceae). Aspectos morfológicos e ecológicos, e a distribuição geográfica desse diaspidídeo no Brasil são apresentadas neste trabalho, além de uma chave de identificação para as espécies de *Pinnaspis* mais comuns reportadas no país.

Palavras-chave: biodiversidade, Coccomorpha, entomologia, cochonilha, taxonomia.

1. Introduction

Scale insects (Hemiptera: Coccomorpha) are phytophagous insects that live in association with different families of plants and can cause great damage and economic losses (Grazia et al., 2024). The family Diaspididae, commonly known as "armored scale insects" or "diaspidids", is the most numerous within the superfamily Coccoidea, with 419 genera and 2,714 species described in more than 180 families and 1,830 plant genera (Miller and Davidson, 2005; García-Morales et al., 2016).

Murraya paniculata (L.) Jack (Rutaceae), popularly known as "murta" in Brazil, is an exotic species originated in Asia that was widely planted in Brazil for landscaping, ornamental purposes, and as hedges, and can be found from the North to South of the country (Pirani and Groppo, 2025). It is a shrub that can reach up to seven meters in height, with evergreen leaves and terminal inflorescences with fragrant white flowers (Dosoky et al., 2016). The leaves are widely used in folk medicine due to their pharmacological properties and several studies have been conducted on their compounds and possible uses (Olawore et al., 2005; Ng et al., 2012; Dosoky et al., 2016).

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Among the insects that attack *M. paniculata*, one of the main species is *Diaphorina citri* Kuwayama (Hemiptera: Liviidae), a psyllid that transmits a bacterium that causes Huanglongbing (HLB), currently the main disease of *Citrus* spp. (Parra et al., 2010). In addition to *D. citri*, thirty scale insect species have been described in association with this plant to date around the world, including 20 species of the family Diaspididae (García-Morales et al., 2016).

The development of effective management strategies for scale insects necessitates a thorough understanding of their biology and ecology, which can be achieved through comprehensive host cataloging and distribution studies. Therefore, this work reports the occurrence of *Pinnaspis strachani* (Cooley, 1899) (Hemiptera: Diaspididae) for the first time in Central Brazil, causing infestations on *M. paniculata* plants, and provides an identification key to most common *Pinnaspis* Cockerell, 1892 species that occur in Brazil.

2. Material and Methods

Armored scale insects associated with four *M. paniculata* plants were collected in October 2019 in Alto Paraíso de Goiás, Goiás State, Brazil (14°08'02.1"S; 47°31'03.2"W) at an urban area in the Cerrado biome. The plants were identified using the key elaborated by Mou et al. (2021) and the species description by Lorenzi et al. (2018). Cerrado is a biome that has two well-defined seasons, and the regional climate is classified as AW (i.e., a tropical climate with rain in summer and drought in winter), in which the rainy season runs from October to April and the drought from May to September (Köppen and Geiger, 1928).

Leaves, branches, and stems of *M. paniculata* were inspected for the occurrence of scale insects. Plants samples containing diaspidids were stored in a Falcon tube containing 70% alcohol until identification. Specimens were slide-mounted for subsequent analysis under an optical microscope, according to the methodology described by Wolff et al. (2014). Specimens were identified using the key to genus and species descriptions provide by Claps and Wolff (2003). A dichotomous species identification key using the descriptions of adult females for most common *Pinnaspis* species reported in Brazil was elaborated, however, not all species recorded in Brazil were included in the key due to the lack of information and bibliography available in the literature (Leonardi, 1906; Ferris, 1937, 1942; Ferris and Rao, 1947; Arruda, 1972; Claps and Wolff, 2003; Watson, 2022).

The studied material of diaspidids is deposited on the "Coleção Entomológica do Museu Ramiro Gomes Costa (MRGC)". Material was collected under the Brazilian government official authorization conceded by Chico Mendes Institute for Biodiversity Conservation (ICMBio), Ministry of Environment (MMA) (collection permit No. 57418-4).

3. Results

3.1. Identification of the armored scale insect

The scale insect observed on *M. paniculata* was identified as *P. strachani* (Figure 1). The infested plants contained hundreds of individuals of the species (Figure 1A), especially on the leaf surfaces (Figure 1B) and on the stems (Figure 1C). The trunk and adjacent branches were whitish due to high diaspidid infestation (Figure 1C).

Figure 1. *Pinnaspis strachani* on *Murraya paniculata* plants in Goiás, Brazil. (A) *M. paniculata* plant with a large number of individuals of *P. strachani*; (B) Detail of diaspidids on the upper surface of the leaves; (C) Detail of the scale insects on the stem, leaving it with a whitish appearance.

3.2. Macroscopic characteristics of P. strachani

Adult females of *P. strachani* have a body covered by a slightly convex, fragile, translucent scale, grayish-white in color and pear-shaped, narrower at the apical part where the yellowish exuviae are found, and widened at the terminal portion. However, macroscopic characteristics of species from the family Diaspididae are not sufficient to determine the species, making it necessary to observe the microscopic morphological characters of the specimens.

3.3. Microscopic characteristics of P. strachani (diagnosis adapted from Ferris, 1942; Ferris and Rao, 1947; Claps and Wolff, 2003; Watson, 2022)

The body of adult females of *P. strachani* is elongated, less than 1 mm long, about 0.5 mm wide, with a membranous, white or pinkish derm with a yellow pygidium. On the margin of the pygidium, the median lobes (L1) are very close to each other with a fine groove from the median part to the apex; the second pair of lobes (L2) are bilobed and poorly developed; and the third pair of lobes (L3) are formed by only one tip. On the ventral surface there are five groups of perivulvar pores. On the dorsal surface, in the position that corresponds to the space between the median and anterior groups of perivulvar pores, there is a sclerotized spot.

3.4. Hosts and distribution of P. strachani in Brazil

In Brazil, *P. strachani* has been recorded in nine states, distributed in the Southeast (4 spp.), Northeast (2 spp.), North (2 spp.), and South (1 sp.) (Figure 2). Until now, there was no record of this armored scale insect in the central region (Midwest) (Peronti et al., 2025). Furthermore, it has been reported in association with 13 families, 16 genera, and 18 plant species (Table 1).

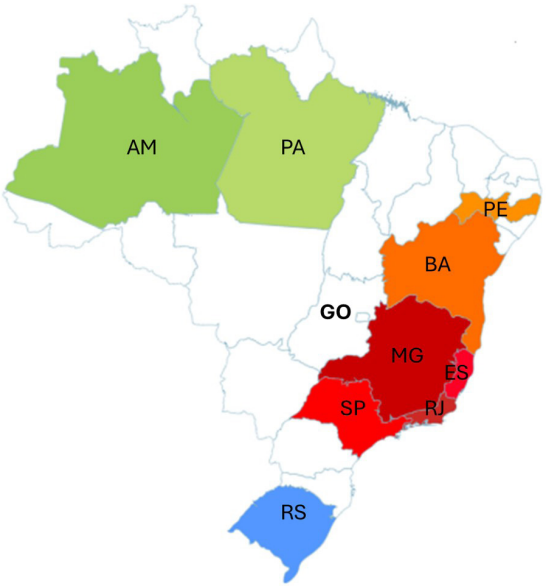

Figure 2. Geographic distribution of *Pinnaspis strachani* in Brazil. North: Amazonas (AM) and Pará (PA); North East: Bahia (BA) and Pernambuco (PE); Southeast: Minas Gerais (MG), Espírito Santo (ES), Rio de Janeiro (RJ), and São Paulo (SP); South: Rio Grande do Sul (RS); and now in Midwest: Goiás (GO). Extracted and adapted from Peronti et al. (2025).

Table 1. Hosts and distribution of *Pinnaspis strachani* in Brazil (García-Morales et al., 2016; Peronti et al., 2025).

Host species	Family	State of Brazil	Reference(s)
Artocarpus heterophyllus Lam., *Chamaedorea seifrizii* Burret, *Citrus aurantium* L., *Hibiscus mutabilis* L., *Hibiscus rosa-sinensis* L., *Mangifera indica* Bl.	Anacardiaceae, Arecaceae, Malvaceae, Moraceae, Poaceae, and Rutaceae	Espírito Santo	Culik et al. (2008), Martins et al. (2022)
Asparagus densiflorus (Kunth.) Jess. var. *sprengeri* Hort., *Bauhinia variegata* L., *Hibiscus rosa-sinensis*, *Melia azedarach* L., *Murraya paniculata* (L.) Jack *Nephrolepis cordifolia* (L.) C.Presl, *Nephrolepis exaltata* Schot var. *florida-ruffle*, *Rhapis excelsa* Henry ex Rehd.	Arecaceae, Asparagaceae, Fabaceae, Malvaceae, Meliaceae, Nephrolepidaceae, and Rutaceae	São Paulo	Hempel (1900), Imenes et al. (2000), Peronti et al. (2001), Martins et al. (2022)
Schizolobium parahyba var. *amazonicum* (Huber x Ducke) Barneby	Fabaceae	Pará	Peronti et al. (2015)
Hibiscus sabdariffa L.	Malvaceae	Amazonas	Foldi (1988)
Azadirachta indica A. Juss	Meliaceae	Bahia	Castro et al. (2020)
Olea europaea L.	Oleaceae	Rio Grande do Sul	Wolff (2014), Wolff et al. (2018)
Niphidium crassifolium (L.) Lellinger	Polypodiaceae	Rio de Janeiro	Silva d'Araujo et al. (1968), Santos and Wolff (2015)
Murraya paniculata	Rutaceae	Goiás	Present study
Unknown	Unknown	Minas Gerais	Watson (2022)
Unknown	Unknown	Pernambuco	Carvalho and Carvalho (1939)

3.5. Pinnaspis species most frequently in Brazil

There are three species of *Pinnaspis* commonly known to occur in Brazil: *Pinnaspis aspidistrae* (Signoret, 1869), *Pinnaspis buxi* (Bouché, 1851) and *P. strachani*. To distinguish these species the following key was developed.

Key to the three most common *Pinnaspis* species that occur in Brazil, based on the adult female (Ferris, 1937, 1942; Ferris and Rao, 1947; Arruda, 1972; Miller and Davidson, 2005; Watson, 2022).

1 - The scale covering the body of the adult female is distinctly white or slightly gray; dorsal preanal sclerosis on each side of pygidium present or just represented by a scar; bilobed second lobes poorly developed, with their apices not projecting as far posteriorly as those of median lobes ……..... *Pinnaspis strachani* (Figure 3A, 3B)

- The scale covering the body of the adult female is brown; without a dorsal pre-anal sclerosis on each side of the pygidium 2

2 (1') - Scale covering of the adult female, approximately 2 to 3 mm long. In the dorsal region of the pygidium, there are two or more duct pores in the submarginal abdominal series; strong sclerosis that forms a yoke between the median lobes at their base ……..... *Pinnaspis aspidistrae* (Figure 3C)

- Scale covering of the adult female, approximately 1 mm long. In the dorsal region of the pygidium, few or even absent duct pores in the submarginal abdominal series; the sclerosis that forms a yoke between the median lobes at their base is less strongly sclerotized..... *Pinnaspis buxi* (Figure 3D)

4. Discussion

The genus *Pinnapsis* Cockerell, 1892 has 43 described species occurring in all regions of the world, with nine in the Neotropical region (García-Morales et al., 2016). The body of adult females of *Pinnaspis* species is elongated, with strongly lobed free abdominal segments; their most distinctive characteristic is the pair of median lobes (Lm) closely adpressed, their bases yoked together by a sclerosis, with the internal edges being parallel and very close at the apex, appearing to be fused (Watson, 2022).

Pinnaspis aspidistrae, *P. buxi,* and *P. strachani* are the most common species in Brazil, with wide geographic distribution and occurrence in several families and plant genera (Martins et al., 2022; Peronti et al., 2025). Species of *Pinnaspis* often infest the entire aerial part of host plants, with the characteristic of leaving them with a whitish appearance (Castro et al., 2020; Noronha et al., 2023), giving the appearance as if had been cover in white paint, as observed on the plants of this study. This happens because the white waxy test of the immature males covers the entire part of the plant (for example, stems or leaves), forming conspicuous white groups on the host (Watson, 2022).

In 1900, *P. strachani* was wrongly identified by Hempel as *Hemichionaspis minor* (Maskell, 1885) (syn. *Pinnaspis minor* (Maskell, 1885), now *Serenaspis minima* (Maskell, 1884), an armored scale insect that doesn't occur in Brazil and was not included in the proposed *Pinnaspis* key of this work.

According to Garcia Morales et al. (2016), there are three more *Pinnaspis* species occurring in Brazil: *Pinnaspis mussaendae* (Green, 1896), *Pinnaspis orlandi* (Leonardi, 1906) and *Pinnaspis fonsecai* Arruda, 1972. However,

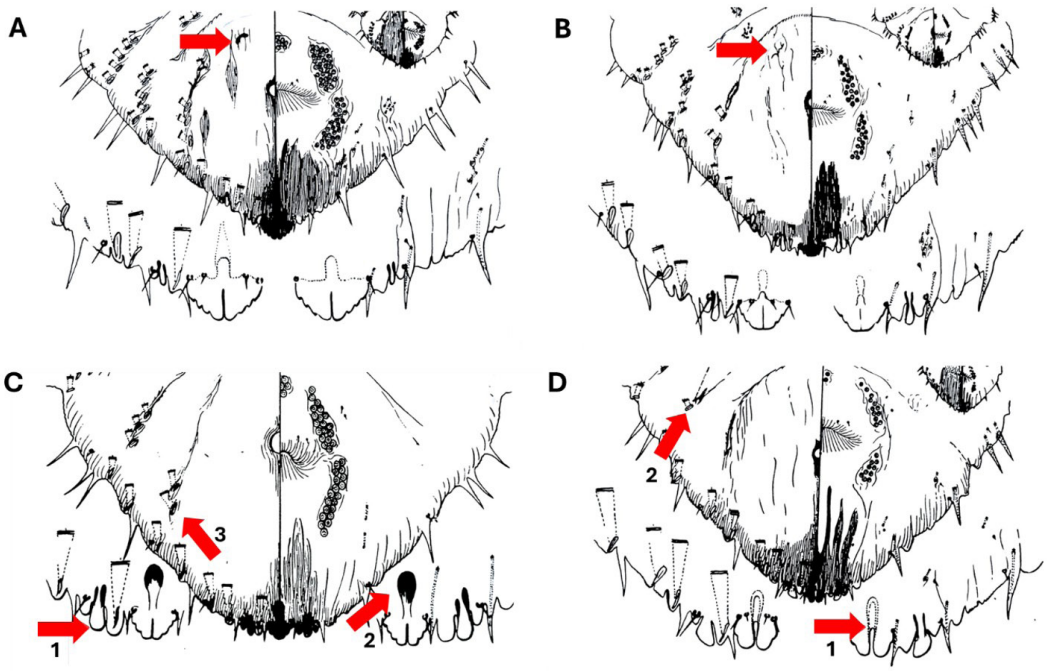

Figure 3. Microscopic characteristics of adult females of *Pinnaspis* spp. (based on Ferris and Rao, 1947): (A) *P. strachani* (arrow indicates sclerotized spot); (B) *P. strachani* (arrow indicates scar); (C) *P. aspidistrae* (arrow 1 indicates developed L2, arrow 2 indicates a yoke between the median lobes and arrow 3 indicates duct pores in the submarginal abdominal); (D) *P. buxi* (arrow 1 indicates separated Lm and arrow 2 indicates few duct pores in the submarginal abdominal).

confirmation is necessary because there are doubts due to the difficulty of identification, as well as there are no new records in the country.

About *P. mussaendae* Green (1937, p. 321-322) wrote "Doubtfully recorded in Australia and Brazil". In the Natural History Museum in London there are 26 slides of *P. mussaendae,* only one of them refers to Brazil, with the following information on the label: *Chionaspis mussaendae* Green/ var ?/ From Malvaceae/ Campinas, Brazil (GBIF, 2025a, b). There are no other records of this species in Brazil.

Another species whose occurrence in Brazil is also doubtful is *P. orlandi*. Ferris and Rao (1947, p. 37) mentioned that "There is nothing in the description of this species that allows its definitive identification". In addition to there being no other record of its occurrence in Brazil. The same occurs with *P. fonsecai*, the description of this species does not allow its definitive identification, and like the previous ones, there is no other record of its occurrence in Brazil. A review of *Pinnaspis* species is important for the accurate identification of the specimens, work that is not the objective of the present study.

Pinnaspis strachani, an exotic armored scale from Asia and commonly known as the lesser snow scale (Watson, 2022), is a polyphagous insect with records of occurrence in more than 79 families and 265 plant genera distributed throughout the world, with exception of the Antarctic region (García-Morales et al., 2016). In the family Rutaceae, 13 genera were described as hosts of *P. strachani*, including important crops, including *Citrus* spp. and olive tree (*O. europea*) (Miller and Davidson, 2005; García-Morales et al., 2016). It has already been reported on *M. paniculata* (or *Murraya exotica* L., heterotypic synonymous of *M. paniculata*) in India (Maxwell-Lefroy, 1902), in Cuba (Soto, 1976), and in Brazil, at São Carlos, São Paulo state (Peronti et al., 2001).

This works marks the first occurrence of *P. strachani* in Goiás, in the Brazilian Midwest region, but it is possible that *P. strachani* occurs in all Brazilian states due to its highly polyphagous habit (Table 1), cosmopolitan distribution, and wide geographic distribution in Brazil (Figure 2) (Watson, 2022; Peronti et al., 2025). Inconsistent taxonomy, erroneous identification, and few collections in other Brazilian states probably underestimate the real distribution and potential hosts of this scale insect.

5. Conclusions

This work reports for the first time the occurrence of *P. strachani* in the Brazilian Midwest, found on *M. paniculata* plants, and expands the distribution of this diaspidid to Central Brazil, highlighting the polyphagous habit of the species and its great dispersal capacity. Studies about scale insects in the Midwest region, including conserved areas of the Cerrado biome, should be stimulated to catalogue and expand the knowledge about the scale insect entomofauna.

Furthermore, the correct identification of *Pinnapsis* species is essential, and a taxonomic revision of the genus in Brazil is necessary. For this, studies on *P. fonsecai*, *P. mussaendae* and *P. orlandi* types are important to clarify the real identity of these species.

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