

# Neotropical Entomology

## SCALE INSECTS (HEMIPTERA: COCCOIDEA) on *Myrciaria dubia* (Kunth) McVaugh (MYRTACEAE) in BRAZIL --Manuscript Draft--

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<b>Corresponding Author:</b>	Vera Wolff, Ph.D. Funadação Estadual de Pesquisa Agropecuária-Fepagro Porto Alegre, Rio Grande do Sul BRAZIL
<b>Corresponding Author Secondary Information:</b>	
<b>Corresponding Author's Institution:</b>	Funadação Estadual de Pesquisa Agropecuária-Fepagro
<b>Corresponding Author's Secondary Institution:</b>	
<b>First Author:</b>	Vera Wolff, Ph.D.
<b>First Author Secondary Information:</b>	
<b>Order of Authors:</b>	Vera Wolff, Ph.D.
	Takumasa Kondo, Ph.D.
	Ana Peronti, Ph.D.
	Aloyséia Noronha, Ph.D.
<b>Order of Authors Secondary Information:</b>	
<b>Funding Information:</b>	
<b>Abstract:</b>	The coccids <i>Ceroplastes jamaicensis</i> White, <i>Parasaissetia nigra</i> (Nietner), <i>Pseudokermes vitreus</i> (Cockerell) (Coccidae) and the diaspidid <i>Pseudaonidia trilobitiformis</i> (Green) were collected on <i>Myrciaria dubia</i> (Kunth) McVaugh (Myrtaceae), in the municipality of Belém and Tomé-Açu, PA, metropolitan and Northeast Pará mesoregions, Brazil. A key to species of Coccoidea recorded on <i>M. dubia</i> , based on adult females is provided. Photographs for all scale insects reported on <i>M. dubia</i> , with the exception of <i>Austrotachardiella sexcordata</i> Matile-Ferrero (Kerriidae) are provided. <i>Ceroplastes jamaicensis</i> is recorded for the first time for Brazil and is herein reported for the first time associated with this host.
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Vera Regina dos Santos Wolff, Laboratório e Museu de Entomologia, Fundação Estadual de  
Pesquisa Agropecuária - Fepagro, Rua Gonçalves Dias, 570, Menino Deus, Porto Alegre, RS,  
Brasil, CEP 90130-060; vera-wolff@fepagro.rs.gov.br; wolffvera@gmail.com

SCALE INSECTS (HEMIPTERA: COCCOIDEA) on *Myrciaria dubia* (Kunth) McVaugh  
(MYRTACEAE) in BRAZIL

V. R. S. WOLFF<sup>1</sup>; T. KONDO<sup>2</sup>; A.L.B.G. PERONTI<sup>3</sup>; A.C.S. NORONHA<sup>4</sup>

<sup>1</sup>Fundação Estadual de Pesquisa Agropecuária - FEPAGRO; <sup>2</sup>Corporación Colombiana de  
Investigación Agropecuaria (Corpoica), Centro de Investigación Palmira; <sup>3</sup>Universidade  
Estadual Paulista Júlio de Mesquita Filho, Faculdade de Ciências Agrárias e Veterinárias de  
Jaboticabal; <sup>4</sup>Empresa Brasileira de Pesquisa Agropecuária (Embrapa Amazônia Oriental)

SCALE INSECTS on *Myrciaria dubia* in BRAZIL

**Abstract** - Commercial cultivation of the fruit tree *Myrciaria dubia* (Kunth) McVaugh

(Myrtaceae) is being developed in Brazil but, in plantations, phytophagous insects, including scale insects (Hemiptera: Coccoidea), can become pests. The coccids *Ceroplastes jamaicensis* White, *Coccus viridis* (Green), *Parasaissetia nigra* (Nietner), *Pseudokermes vitreus* (Cockerell) (Coccidae) and the diaspidid *Pseudaonidia trilobitiformis* (Green) were collected on *M. dubia*, in the municipality of Belém and Tomé-Açu, in the State of Pará (PA), metropolitan and Northeast Pará mesoregions, Brazil. A key to species of Coccoidea recorded on *M. dubia*, based on adult females is provided. Photographs for all scale insects reported on *M. dubia* are provided. *Ceroplastes jamaicensis* is recorded for the first time for Brazil and is herein reported for the first time associated with this host.

Keywords: Coccidae, Diaspididae, native fruit tree, camu-camu, Amazon basin.

## Introduction

*Myrciaria dubia* (Kunth) McVaugh (Myrtaceae) is a native fruit tree widely distributed in the Amazon basin (Nascimento & Carvalho 2012). In Brazil, this fruit tree is known as “araçá”, “araçá-d’água”, “araçá-do-lago”, “araçarana”, “araçazinho”, “caçari”, “camu-camu”, “camucamuzeiro”, “crista-de-galo”, “sarão” and “socoró” (Ferreira & Ribeiro 2006).

The importance of *M. dubia* is related mainly to the high content of vitamin C present in its fruits, which also contain vitamin A, glucose, fructose, starch, pectin, polyphenols, anthocyanins, fiber and minerals (nitrogen, phosphorus and potassium) (Andrade *et al.* 1991, Yuyama *et al.* 2002a, 2002b).

Peru is the largest producer and exporter of *M. dubia* fruits. In the Peruvian Amazon, the area occupied by natural populations of this fruit tree is scattered in small areas along river banks and estimated at 1,323 ha (Nascimento & Carvalho 2012). The camu-camu has a potential for commercial exploitation in the Amazon region. However, it is rarely cultivated due to lack of suitable clones for cultivation in dry land conditions (Nascimento & Carvalho 2012).

The “melhorFRUTA” project, which started since 2008, aims to genetically improve the “camu-camu” tree in Brazil for the production of fruits for non-flooding areas at the Active Germoplasm Bank of Embrapa in eastern Amazon (Nascimento *et al.* 2013). The best plant materials have been cloned already and are at the evaluation phase.

The “camu-camu” is rarely infested by phytophagous insects under natural conditions; however, in commercial crops in dryland areas where ecological equilibrium is disturbed, these insects become more abundant causing damage to the host plant. In the State of Pará, Brazil, in experimental plantations in the municipality of Belém and commercial orchards in the municipality of Tomé-Açu (nurseries in land areas and high floodplain), a total of 31 species of phytophagous insects was observed (Couturier *et al.* 1999). Among these insects, the authors listed nine species of scale insects, namely, *Ceroplastes floridensis* Comstock, *Coccus longulus* (Douglas), *Coccus viridis* (Green), *Parasaissetia nigra* (Nietner), *Protopulvinaria pyriformis* (Cockerell), *Pseudokermes vitreus* (Cockerell) (Coccidae), *Lepidosaphes* sp., *Pseudaonidia trilobitiformis* (Green) (Diaspididae) and *Dysmicoccus brevipes* (Cockerell) (Pseudococcidae) (Couturier *et al.* 1999). However, according to Couturier *et al.* (1999), only *D. brevipes* causes injuries to the infested plants, occasionally resulting in the dieback of the plant. Besides these species, other scale insects have been reported in association with *M. dubia* elsewhere, i.e., *Niveaspis lepagei* Giannotti (Diaspididae) in the Amazon and São Paulo, and *Austrotachardiella sexcordata* Matile-Ferrero (Kerriidae) and *Ceroplastes flosculoides* Matile-Ferrero in Peru (Foldi 1988, Matile-Ferrero & Couturier 1993, Kondo & Gullan 2005, Ben-Dov 2015a).

Fruits of camu-camu are harvested as individual fruits either with or without the peduncle. Some scale insect species may be found on the fruit and/or peduncle, thus a risk of being transported to other regions. Considering the increased cultivation of *M. dubia*, especially in the north of Brazil, this study aimed to update the list of scale insect species associated with

1 this host in the municipalities of Tomé-Açu and Belém /PA and produce an identification key  
 2 including all species already reported on this host plant.

### 4 **Material and methods**

5 Scale insects were collected on leaves and branches of *M. dubia*, during a survey of  
 6 arthropods in experimental areas of “camu-camu” clones at Embrapa Amazônia Oriental,  
 7 municipality of Belém (01°26'09.15"S, 48°26'28.62"W) and Tomé-Açu (02°30'18.8"S,  
 8 48°23'22.6"W), PA, metropolitan and Northeast Pará mesoregions. In each location (Belém  
 9 and Tomé-Açu) 120 plants were surveyed, consisting of 10 clones, 3 plants/experiment lot,  
 10 with 4 repetitions, for a total of 240 plants surveyed. In Belém, the survey was made between  
 11 2012–2014, on two-years old plants at the beginning of the study, and in Tomé-Açu, one  
 12 assessment was made in October 2013 and another in September 2014, on plants that were  
 13 about one year old. The presence of scale insects was observed on all clones in the  
 14 experimental area in Belém.

15 Samples of leaves and branches infested with scale insects were examined at the Entomology  
 16 Laboratory of Embrapa Amazônia Oriental, in Belém, PA. The scale insects were placed in  
 17 70% ethanol and sent to the Entomology Laboratory of Fepagro (Fundação Estadual de  
 18 Pesquisa Agropecuária), in Porto Alegre, Rio Grande do Sul.

19 Initially, the scale insects were sorted and separated into families by the first author (VRSW)  
 20 who determined the specimens of the family Diaspididae to the species level. Duplicates of  
 21 samples of Coccidae were sent to the second author (TK) and third author (ALBGP) for  
 22 identification.

23 The scale insects were slide-mounted following the techniques adapted by Wolff (2001) for  
 24 diaspidids and by Granara de Willink (1990) for coccids and were identified according  
 25 morphological characteristics of the adult female as described by Claps & Wolff (2003) for

diaspidids; and White (1846), Hamon & Williams (1984), Williams & Watson (1990), Hodgson (1994), Kondo & Hardy (2008) for coccids.

The specimens were examined by optical microscopy to determine the species, and were cataloged and deposited in the Museum Ramiro Gomes da Costa (MRGC) in Porto Alegre, o Rio Grande do Sul, Brazil. For photomicrographs, a digital camera attached to a stereo- and optical microscope was used. Samples were also deposited in the Entomological Collections of Embrapa Amazônia Oriental, in Belém, PA.

## Results and Discussion

The scale insects collected on *M. dubia* in the municipality of Tomé-Açu and Belém /PA, Brazil were identified as *C. jamaicensis*, *P. nigra*, *P. vitreus* (Coccidae) and *P. trilobitiformis* (Diaspididae). *Ceroplastes jamaicensis* is recorded for the first time for Brazil and is herein reported for the first time associated with “camu-camu”. These scale insects were collected on the leaves and twigs. *Pseudaonidia trilobitiformis* was also found on the fruits and *C. viridis* was observed on the peduncle, thus increasing their risk of being transported to other regions.

## Taxonomy

### Key to adult females of Coccoidea species recorded on *Myrciaria dubia* in Brazil.

1. Dorsum with a pair of anal plates placed anteriorly to anal cleft.....2 (Coccidae)
- Dorsum without a pair of anal plates placed anteriorly to anal cleft..... 9

- 2 (1) Legs reduced to one very small segment or often absent; antennae 1 segmented;  
 stigmatic setae either not differentiated from marginal setae, or with 1 long seta in each  
 spiracular cleft ..... *Pseudokermes vitreus* (Cockerell) (Fig 1)  
 -. Legs and antennae well-developed; stigmatic setae differentiated from marginal setae, shape  
 and length variable, totaling 3 or more per stigmatic cleft..... 3
- 3 (2). Body covered by a thick waxy test; anal plates surrounded by a heavily sclerotized  
 caudal or anal process; stigmatic setae usually abundant, more than 4 in each stigmatic cleft;  
 dorsum with specialized uni-, bi-, or trilocular pores of the *Ceroplastes*-type.....  
 ..... 4 (*Ceroplastes*)  
 - Body covered by thin wax, sometimes becoming highly convex when mature; anal plates  
 not surrounded by a caudal process; stigmatic setae typically 3 in each cleft; dorsal pores  
 variable, but not of the *Ceroplastes*-type .....6
- 4 (3). Stigmatic setae lanceolate, with pointed apices, not restricted to within each stigmatic  
 cleft, extending out from each cleft along margin; tubular ducts with expanded inner ductule  
 (i.e. broader than outer ductule), present in a submarginal band from near eye to slightly  
 anterior of anal cleft, absent from cephalic and vulvar areas; anal process short.....  
 ..... *Ceroplastes floridensis* Comstock (Fig 2)  
 - Stigmatic setae not lanceolate, restricted to a compact group within each stigmatic cleft, not  
 extending out from each cleft along margin; tubular ducts with slim inner ductule (i.e.  
 narrower than outer ductule), present only in genital and cephalic region; anal process either  
 short or well developed .....5



- 5 (4) Anal process short; antennae normally 7-segmented; sclerotized area between stigmatic furrows forming a band..... *Ceroplastes flosculoides* Matile-Ferrero (Fig 3)
- Anal process protruding and well developed; antennae normally 6-segmented; sclerotized area between the stigmatic furrows absent..... *Ceroplastes jamaicensis* White (Fig 4)
- 6 (3) Body pyriform, anal plates together pyriform, anterior margin of each plate several times longer than posterior margin; anal plates located towards center of dorsum.....
- ..... *Protopulvinaria pyriformis* (Cockerell) (Fig 5)
- Body oval or elongate oval; anal plates together quadrate; posterior margin of each plate subequal in length to anterior margin or longer; anal plates not located towards center of dorsum.....7
- 7 (6) Dorsum with numerous polygonal areas, except near margins; ventral tubular ducts numerous, present in an obvious submarginal area..... *Parasaissetia nigra* (Nietner) (Fig 6)
- Dorsum without numerous polygonal areas; ventral tubular ducts few or absent, not present in an obvious submarginal area.....8
- 8 (7) Dorsal setae distinctly flagellate and curved; ventral tubular ducts absent.....
- ..... *Coccus longulus* (Douglas) (Fig 7)
- Dorsal setae cylindrical and slightly clavate; ventral tubular ducts present on thoracic region and near mouthparts..... *Coccus viridis* (Green) (Fig 8)
- 9 (1). Antennae 8 segmented; legs well-developed. Body covered by a thin layer of white mealy wax and with 17 pairs of conspicuous lateral wax filaments; number of cerarii

- 1 corresponding to number of lateral filaments, each cerarius with 2–4 enlarged conical  
2 setae.....*Dysmicoccus brevipes* (Cockerell) (Pseudococcidae) (Fig 11)  
3  
4 3 -. Antennae greatly reduced, either with poorly defined two-segmented antennae with a pair of  
5  
6  
7 4 apical setae at apex of terminal segment or represented by an unsegmented projection bearing  
8  
9  
10 5 one or more setae; legs lacking or vestigial. Body covered either by a waxy test cover that is  
11  
12 6 separated from the insect body or by a thick layer of resinous wax; without cerarii ..... 10  
13  
14 7  
15  
16  
17 8 10 (1). Antennae two-segmented. Legs vestigial, each of a form of a pointed tubercle and  
18  
19 9 some setae. Dorsal spine, anal tubercle with an anal fringe and brachial plates present on  
20  
21  
22 10 dorsum. Anterior spiracles located on dorsum, each 2.5 times or more width of posterior  
23  
24 11 spiracles on venter; last abdominal segments not forming a pygidium; test thick and resinous,  
25  
26 12 of sticky texture ..... *Austrotachardiella sexcordata* Matile-Ferrero (Kerriidae) (Fig 12)  
27  
28  
29 13 -. Antennae represented by an unsegmented projection; legs completely absent; dorsal spine,  
30  
31 14 anal tubercle with an anal fringe and brachial plates absent from dorsum; anterior and  
32  
33  
34 15 posterior spiracles located on venter, subequal in length; reduction and fusion of the last  
35  
36 16 abdominal segments into a pygidium; body covered by a waxy test that incorporates the  
37  
38  
39 17 exuviae and waxy cover of previous instars..... 11 (Diaspididae)  
40  
41 18  
42  
43  
44 19 11 (10). Narrow and long shield covering body; pygidium with 2 pairs of developed lobes;  
45  
46 20 dorsal area with 7 pairs of large two-barred macroducts on margin and 2 in middle region near  
47  
48  
49 21 anal opening ..... *Niveaspis lepagei* Giannotti (Fig 9)  
50  
51 22 -. Body covered by an oval shield; pygidium with 4 pairs of developed lobes; dorsal area with  
52  
53  
54 23 many long and narrow one-barred macroducts and with a reticulated area in middle of  
55  
56 24 pygidium ..... *Pseudaonidia trilobitiformis* (Green) (Fig 10)  
57  
58 25  
59  
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61  
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64  
65

***Ceroplastes jamaicensis* White, 1846 (Fig 4)**

Common name: “Lance-wood wax scale”. This Neotropical species was described originally from specimens collected on *Calophyllum* sp. (Clusiaceae) in Jamaica (Ben-Dov 2015a). Until now *C. jamaicensis* has been known only from Jamaica.

**Field characteristics:** “It is yellowish green colour; the base is almost hexagonal; there are six marginal plates; each of which is slightly notched in the middle below: the upper plate is notched behind and has two prominences in front” (White 1846).

**Material studied.** Brazil, **Pará:** Belém, 6 adult ♀♀, 3 slides, 24.ix.2014, A. Noronha col., A. L. B. G. Peronti det., ex. *Myrciaria dubia* (twigs) (MRGC).

***Coccus viridis* (Green, 1889) (Fig. 8)**

Common name: “Green scale” and “green coffee scale”. This is a cosmopolitan species described based on specimens collected on coffee (Rubiaceae) in Sri Lanka. It is a serious pest of coffee, citrus and other crops in several regions in the tropics (Garcia *et al.* 2015).

**Field characteristics:** The adult female is shiny pale green with conspicuous black internal markings that are visible through the semitransparent chitinous body wall. Body elongate-oval and moderately convex.

**Material studied.** Brazil, **Pará:** Belém, 2 adult ♀♀, 2 slides, 30.x.2015, A. Noronha col., A. L. T. Kondo det., ex. *Myrciaria dubia* (MRGC).

1 ***Parasaissetia nigra* (Nietner, 1861) (Fig 6)**

2 Common name: “Nigra scale”. This is a cosmopolitan species described based on specimens  
 3 collected on coffee (Rubiaceae) in Sri Lanka (Ben-Dov 2015a). It is a species of African or  
 4 Asian origin (Wyckhuys *et al.* 2013) and has been recorded on 400 species of host plants  
 5 distributed in 94 families (Ben-Dov 2015a). In Brazil, it is distributed in the States of São  
 6 Paulo, Pará and Rio Grande do Sul, infesting mainly ornamental trees and shrubs such as  
 7 *Schinus molle* (Anacardiaceae) and *Euphorbia fulgens* (Euphorbiaceae), *Psidium guajava* and  
 8 *M. dubia* (Myrtaceae) (Couturier *et al.* 1999, Peronti *et al.* 2001).

10 **Field characteristics:** Body oval to elongate oval; usually convex in lateral view; body color  
 11 varies with host, often translucent yellow, sometimes with brown or red flecks; body turning  
 12 brown or black with age; without an obvious wax covering; ovisac absent (Miller *et al.* 2015).

14 **Material studied.** Brazil, **Pará:** Belém, 1 adult ♀, 1 slide, 07.viii.2014, A. Noronha col., T.  
 15 Kondo det., ex. *Myrciaria dubia* (twigs) (MRGC 1700).

17 ***Pseudokermes vitreus* (Cockerell, 1894) (Fig 1)**

18 Commonly known as the “glassy scale”, this Neotropical species was described based on  
 19 specimens collected on *Acacia* sp. (Fabaceae) in Trinidad and Tobago (Kondo & Hardy  
 20 2008). Currently, *P. vitreus* is distributed in the North America (Florida), Central America  
 21 (Barbados, Costa Rica, Cuba, Dominican Republic; Guadeloupe; Guatemala; Jamaica;  
 22 Panama; Puerto Rico, Vieques Island; Trinidad and Tobago) and South America (Argentina,  
 23 Brazil, Colombia, Ecuador [Galapagos Islands] and Venezuela), and has been recorded on the  
 24 following host plants: *Annona cherimola*, *Annona* sp., *Rollinia mucosa* (Annonaceae), *Acacia*  
 25 sp., *Cajanus cajan*, *C. indicus*, *Calliandra purpurea*, *Calliandra* sp., *Inga* sp., *Mimosa* sp.,

*Pithecellobium dulce* (Fabaceae), *Laurus nobilis*, *Persea americana steyermarkii*, *P. borbonia* (Lauraceae), *Myrica cerifera* (Myricaceae), Orchidaceae, Thymelaeaceae, *Vitis vinifera* (Vitaceae) (Kondo & Hardy 2008, Ben-Dov 2015a). In Brazil, this species is distributed in the States of Amazonas, Pará and São Paulo (Foldi 1988, Couturier *et al.* 1999, Kondo & Hardy 2008, Ben-Dov 2015a).

**Field characteristics:** Wax covering glassy and transparent, with a conspicuous longitudinal ridge; in dorsal view the cover is circular, irregular, with a roughened surface containing both radiating and concentric striations; moderately convex in lateral view; body reddish brown; eggs hatch within the body of the female (Miller *et al.* 2015). It occurs on leaves and twigs of the plant host (Kondo & Hardy 2008).

**Material studied.** Brazil, **Pará:** Belém, 14 adult ♀♀, 6 slides, 07.viii.2014, A. Noronha col., T. Kondo det., ex. *Myrciaria dubia* (twigs) (MRGC 1698, 1699, 1701, 1702, 1703, 1705).

# *Pseudaonidia trilobitiformis* (Green, 1896) (Fig 10)

This species was originally described from specimens collected in Sri Lanka, Punduloya, on leaves of an unidentified tree; it is a cosmopolitan species and occurs on 180 plant species in about 40 plant families (Ben-Dov 2015b). In Brazil, it has been recorded on about 40 plant species, including *Myrciaria* sp.; it is found in Pará, Ceará, Rio Grande do Norte, Paraíba, Pernambuco, Bahia, Minas Gerais, Rio de Janeiro, São Paulo and Rio Grande do Sul (Claps *et al.* 2001).

**Field and slide-mounted characteristics:** Scale cover of adult female circular or subcircular about 2.80 mm in diameter, pale brown, with central or sub-central exuviae almost the same

color. Slide-mounted adult females about 0.9 mm in length, slightly longer than wide, pyriform, with a pronounced constriction between the pro- and mesothorax. Pygidium dorsal with a reticulated area in the middle; paraphyses present; perivulvar pores present in four groups; apex of pygidium truncate, with median, second and third lobes almost at the same level.

**Material studied.** Brazil, **Pará:** Belém, 2 adult ♀♀, 1 slide, 19.ii.2013, A. Noronha col., Wolff, V. R, S. det., ex. *Myrciaria dubia* (leaves) (MRGC 1685).

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- Figs 1–12. Adult females of scale insects (Hemiptera: Coccoidea) recorded on *Myrciaria dubia*. 1. *Pseudokermes vitreus*. 2. *Ceroplastes floridensis*. 3. *Ceroplastes flosculoides*. 4. *Ceroplastes jamaicensis*. 5. *Protopulvinaria pyriformis*. 6. *Parasaissetia nigra*. 7. *Coccus longulus*. 8. *Coccus viridis*. 9. *Niveaspis lepagei*, anterior and posterior part of slide-mounted specimen. 10. *Pseudaonidia trilobitiformis* on leaf and a specimen with waxy cover removed (left side corner). 11. *Dysmicoccus brevipes*. 12. *Austrotachardiella sexcordata*. Photos: 1, 7 & 11 by T. Kondo, 2, 3, 5, 6, 8 & 10 by A.L.B.G. Peronti, 4 & 9 by V.R.S. Wolff, 12 used with permission from Société Entomologique de France which has the copyright for this image. A.L.B.G. Peronti and T. Kondo compiled the photographic plate.

