


Scientific Note

Scale insects (Hemiptera, Coccomorpha: Diaspididae, and Pseudococcidae) found on *Myrciaria dubia* in Pará State, Brazil

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Abstract. The present study aimed to report the occurrence of scale insects, namely *Chrysomphalus aonidum* (Linnaeus, 1758), *Ischnaspis longirostris* (Signoret, 1882), *Pinnaspis aspidistrae* (Signoret, 1869) (Hemiptera: Diaspididae), and *Nipaecoccus filicis* Williams & Granara de Willink, 1992 (Hemiptera: Pseudococcidae) on plants of *Myrciaria dubia* (Kunth) McVaugh (Myrtaceae) in the experimental fields of Embrapa Amazônia Oriental in the municipalities of Belém and Tomé-Açu, Pará State, Brazil. This is the first report of these species on *M. dubia*, as well as of *N. filicis* in Brazil.

Keywords: Camu-camu, Coccoidea, Myrtaceae.

Myrciaria dubia (Kunth) McVaugh (Myrtaceae) is native to the Amazon biome and is mainly found on riverbanks and lakeshores in Brazil, Bolivia, Colombia, Ecuador, Peru, and Venezuela (Acioli et al. 2016; Mendes & Lima Junior 2017). In Brazil, it is found in Acre, Amapá, Amazonas, Maranhão, Pará, Roraima, Rondônia, Tocantins, and in the Cerrado of Mato Grosso (Yuyama et al. 2010; Nascimento & Carvalho 2012; Mendes & Lima Junior 2017). The plant is commonly known as camu-camu in Brazil, Peru, and Colombia. It is also sometimes referred to as: aracá, araçarana, araçazinho, aracá d'água, aracá-de-igapó, azedinha, camocamo, caçari, crista de galo, sarão, and socoró in Brazil and as guayabo and guayabito in Venezuela (Nascimento & Carvalho 2012; Acioli et al. 2016).

The camu-camu fruit is rich in vitamin C, vitamin A, glucose, fructose, starch, pectin, fiber, and minerals, such as K, Ca, Mg, Na, Zn, Fe, Cu, and Al. Moreover, it is high in antioxidants, such as polyphenols and anthocyanins, and has gained the interest of the pharmaceutical industry (Yuyama et al. 2002; 2003; Villanueva-Tiburcio et al. 2010; Freitas et al. 2019).

Under natural conditions, camu-camu trees are rarely attacked by insects. However, with the loss of ecological balance, phytophagous insects capable of causing phytosanitary problems can occur in commercial plantations in dryland areas (Couturier et al. 1999). Among these pests, scale insects (Hemiptera: Coccomorpha) stand out, as 18 species, distributed in four families, have already been previously observed on camu-camu trees (Tab. 1).

From April 2016 to July 2018, camu-camu clones that were introduced into the experimental fields of Embrapa Amazônia Oriental in Belém (01°26'S, 48°26'W) and Tomé-Açu (02°30'S, 48°23'W), Pará were evaluated for the presence of scale insects. The clones were aged five and four years, respectively. The experimental areas were formed by 10 clones, with three plants/clone and four repetitions.

In the field, camu-camu plants were inspected with a magnifying glass (20×) for better visualization of the scale insects. Leaf and stem samples were collected from infested plants, then stored in plastic bags and transported to the laboratory, where they were sorted using a stereomicroscope.

Chrysomphalus aonidum (Linnaeus, 1758), *Ischnaspis longirostris* (Signoret, 1882), *Pinnaspis aspidistrae* (Signoret, 1869) (Hemiptera: Diaspididae), and *Nipaecoccus filicis* Williams & Granara de Willink, 1992 (Hemiptera: Pseudococcidae) were identified (Fig. 1) from samples collected in Belém, while only *I. longirostris* was found in Tomé-Açu samples. Except for *N. filicis*, all species of scale insects identified are polyphagous, and have been recorded on several economically important plants in Brazil (Silva & Ribeiro 2000; Claps et al. 2001; Wolff et al. 2009; García Morales et al. 2016; Almeida et al. 2018; Kondo & Watson 2022a; Martins et al. 2022). The plants examined had no apparent damage.

Chrysomphalus aonidum grows on leaves and fruits of many plants. This species is distributed in 120 countries (Berry & Watson 2022), with records in 189 host plant genera, including eight genera of Myrtaceae (*Decaspermum*, *Eucalyptus*, *Eugenia*, *Gossia*, *Melaleuca*, *Myrtus*, *Psidium*, and *Syzygium*) (García Morales et al. 2016). In Brazil, *C. aonidum* is found in Acre, Amapá, Amazonas, Bahia, Espírito Santo, Goiás, Maranhão, Mato Grosso, Minas Gerais, Pará, Paraíba, Paraná, Pernambuco, Rio de Janeiro, Rio Grande do Norte, Rio Grande do Sul, Santa Catarina, and São Paulo (Claps et al. 2001; Almeida et al. 2018; Berry & Watson 2022; Martins et al. 2022).

Ischnaspis longirostris has been recorded in 99 countries (Kondo & Watson 2022b), on 161 host plant genera, including three genera of Myrtaceae (*Eucalyptus*, *Eugenia*, and *Psidium*) (García Morales et al. 2016). In Brazil, it is found in Bahia, Espírito Santo, Minas Gerais, Pará, Pernambuco, Rio de Janeiro, Rio Grande do Sul, Santa Catarina, and São Paulo (Claps et al. 2001; Kondo & Watson 2022b; Martins et al. 2022).

Pinnaspis aspidistrae has been recorded in 109 countries (Watson 2022) in 140 genera of host plants, including one genus of Myrtaceae (*Psidium*) (García Morales et al. 2016). In Brazil, it has been found in Amapá, Amazonas, Bahia, Distrito Federal, Espírito Santo, Goiás, Maranhão, Minas Gerais, Pará, Paraíba, Paraná, Rio de Janeiro, Rio Grande do Sul, Santa Catarina, and São Paulo (Claps et al. 2001; Almeida et al. 2018; Martins et al. 2022; Watson 2022).

Table 1. Species of scale insects (Hemiptera: Coccoomorpha) reported in *Myrciaria dubia*.

Species	References
Coccidae	
<i>Ceroplastes floridensis</i> Comstock, 1881	Brazil [Pará] Couturier et al. 1999
<i>Ceroplastes flosculoides</i> Matile-Ferrero, 1993	Peru [Jenaro Herrera, Iquitos] Matile-Ferrero & Couturier 1993
<i>Ceroplastes jamaicensis</i> White, 1846	Brazil [Pará] Wolff et al. 2016
<i>Coccus hesperidum</i> Linnaeus, 1758	Peru [Jenaro Herrera, Iquitos] Couturier et al. 1992
<i>Coccus longulus</i> (Douglas, 1887)	Brazil [Pará] Couturier et al. 1999
<i>Coccus viridis</i> (Green, 1889)	Brazil [Pará] Couturier et al. 1999; Wolff et al. 2016
<i>Parasaissetia nigra</i> (Nietner, 1861)	Brazil [Pará], Peru [Jenaro Herrera, Iquitos] Couturier et al. 1992; Couturier et al. 1999; Wolff et al. 2016
<i>Protopulvinaria pyriformis</i> (Cockerell, 1894)	Brazil [Pará], Peru [Jenaro Herrera, Iquitos] Couturier et al. 1992; Couturier et al. 1999
<i>Pseudokermes vitreus</i> (Cockerell, 1894)	Brazil [Pará] Couturier et al. 1999; Wolff et al. 2016
Diaspididae	
<i>Hemiberlesia lataniae</i> (Signoret, 1869)	Peru [Jenaro Herrera] Couturier et al. 1992
<i>Howardia biclavis</i> (Comstock, 1883)	Peru [Iquitos] Couturier et al. 1992
<i>Lepidosaphes</i> sp.	Brazil [Pará] Couturier et al. 1999
<i>Pseudoanidia trilobitiformis</i> (Green, 1896)	Brazil [Pará], Peru [Jenaro Herrera] Couturier et al. 1992; Couturier et al. 1999; Wolff et al. 2016
<i>Niveaspis lepagei</i> Giannotti, 1942	Brazil [Amazonas] Foldi 1988
Kerriidae	
<i>Austrotachardiella sexcordata</i> Matile-Ferrero, 1993	Peru [Jenaro Herrera, Iquitos] Matile-Ferrero & Couturier 1993
Pseudococcidae	
<i>Dysmicoccus brevipes</i> (Cockerell, 1893)	Brazil [Pará], Peru [Jenaro Herrera] Couturier et al. 1992; Couturier et al. 1999
<i>Ferrisia virgata</i> (Cockerell, 1893)	Peru [Jenaro Herrera] Couturier et al. 1992
<i>Nipaecoccus nipae</i> (Maskell, 1893)	Peru [Jenaro Herrera] Couturier et al. 1992

[State in Brazil or city/district in Peru].


Figure 1. Scale insects in camu-camu trees: *Chrysomphalus aonidum* (A); *Nipaecoccus filicis* (B); *Ischnaspis longirostris* (C); *Pinnaspis aspidistrae* (D). (Photos: Aloyséia C. S. Noronha).

The only record of *N. filicis* so far was near Teziutlan, Puebla, Mexico, on ferns (Polypodiopsida) (Williams & Granara de Willink 1992; Miller 1996; García Morales et al. 2016). Among the phytophagous insect species reported by Couturier et al. (1992) on *M. dubia*, we only observed *Nipaecoccus nipae* (Maskell) in the experimental plantations in Jenaro Herrera, Requena province, and *Nipaecoccus* sp. in Jenaro Herrera and Iquitos, Peru.

Ceroplastes jamaicensis White, 1846, *Coccus viridis* (Green, 1889), *Parasaissetia nigra* (Nietner, 1861) and *Pseudokermes vitreus* (Cockerell, 1894) (Hemiptera: Coccidae), and *Pseudoanidia trilobitiformis* (Green, 1896) (Hemiptera: Diaspididae) were observed on different camu-camu clones by Wolff et al. (2016). In the present study, most of these species were found in a small number of plants. However, *P. nigra* was found in 54% of the plants evaluated in Belém in the 2016/2017 biennium and was present in all clones evaluated in May and June 2018, without causing plant death. Moreover, ants were observed in all plants infected with *P. nigra*, thus hindering the collection of plant materials (Fig. 2). In plants with a higher incidence of this scale insect, the occurrence of sooty mold (*Capnodium* sp.) was also noted.



Figure 2. *Parasaissetia nigra* in association with ants on a camu-camu tree. Belém, Pará, Brazil. (Photo: Aloyséia C. S. Noronha).

Parasaissetia nigra is a polyphagous species that has been recorded on 292 genera and 101 families of plants worldwide. Among these are ornamentals and plants of agricultural importance, such as cotton, coffee, citrus, and mango (García Morales et al. 2016; Kondo & Lin 2022). With regard to the Coccidae species found on *M. dubia* in the Loreto region of Peru, *P. nigra* was the only harmful species for causing intense proliferation of sooty mold (Couturier et al. 1992).

The present study represents the first record of the scale insect species *C. aonidum*, *I. longirostris*, *P. aspidistrae*, and *N. filicis* on *M. dubia*, as well as the first report of *N. filicis* in Brazil.

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Authors' Contributions

WMON and FLG were responsible for setting up and maintaining the experimental areas. ACSN and RHSS conducted field and laboratory activities. VRSW, VCPS, and MBK identified the species of the scale insects. ACSN and VRSW wrote the manuscript. All authors discussed and revised the manuscript.

Conflict of Interest Statement

The authors declare that there is no conflict of interest.

References

- Acioli, A. N. S.; Barbosa, M. L. L.; Noronha, A. C. S.; Lemos, W. P. (2016) Camu-camu. In: Silva, N. M.; Adaime, R.; Zucchi, R. A. (Eds.), *Pragas agrícolas e florestais na Amazônia*, pp. 94-105. Brasília: Embrapa.
- Almeida, L. F. V.; Peronti, A. L. B. G.; Martinelli, N. M.; Wolff, V. R. S. (2018) A Survey of Scale Insects (Hemiptera: Coccoidea) in Citrus Orchards in São Paulo, Brazil. *Florida Entomologist*, 101(3): 353-363. doi: [10.1653/024.101.0324](https://doi.org/10.1653/024.101.0324)
- Berry, J. A.; Watson, G. W. (2022) *Chrysomphalus* spp. (Hemiptera: Coccoidea: Diaspididae). In: Kondo, T. & Watson, G. W. (Eds.), *Encyclopedia of Scale Insect Pests*, pp. 457-462. Wallingford: CABI.
- Claps, L. E.; Wolff, V. R. S.; Gonzalez, R. H. (2001) Catálogo de las Diaspididae (Hemiptera: Coccoidea) exóticas de la Argentina, Brasil y Chile. *Revista de la Sociedad Entomológica Argentina*, 60(1-4): 9-34. <https://www.biotaxa.org/RSEA/article/view/31987>
- Couturier, G.; Sánchez, H. I.; Flores, E. T. (1992) Insectos fitófagos que viven en *Myrciaria dubia* (Myrtaceae) frutal amazónico en la región de Loreto-Peru. *Folia Amazonica*, 4(1): 19-29. doi: [10.24841/fa.v4i1.168](https://doi.org/10.24841/fa.v4i1.168)
- Couturier, G.; Silva, J. F.; Silva, A. B.; Maués, M. M. (1999) Insetos que atacam o camu-camuzeiro (*Myrciaria dubia* H.B.K.) Mc Vaugh Myrtaceae) em cultivos paraenses. Belém: Embrapa. (Comunicado Técnico, 3). <https://ainfo.cnptia.embrapa.br/digital/bitstream/item/39517/1/Com-Tec-3-Am-Oriental.pdf>
- Foldi, I. (1998) Nouvelle contribution a l'étude des cochenilles de l'Amazonie Brésilienne (Homoptera: Coccoidea). *Annales de la Société entomologique de France*, 24: 77-87.
- Freitas, C. A. B.; Müller, R. C. S.; Nascimento, W. M. O.; Lima, M. O.; Faial, K. C. F.; Lopes, S. A. (2019) Análise Multivariada da Composição Mineral de Frutos de Camu-camu (*Myrciaria dubia*). *Revista Virtual de Química*, 11(3): 741-753. doi: [10.21577/1984-6835.20190054](https://doi.org/10.21577/1984-6835.20190054)
- García Morales, M.; Denno, B. D.; Miller, D. R.; Miller, G. L.; Ben-Dov, Y.; Hardy, N. B. (2016) ScaleNet: A literature-based model of scale insect biology and systematics. *Database*, 2016: bav118. doi: [10.1093/database/bav118](https://doi.org/10.1093/database/bav118).
- Kondo, T.; Lin, Y. P. (2022) Nigra scale *Parasaissetia nigra* (Nietner, 1861) (Hemiptera: Coccoidea: Coccidae). In: Kondo, T.; Watson, G. W. (Eds.), *Encyclopedia of Scale Insect Pests*, pp. 286-289. Wallingford: CABI.
- Kondo, T.; Watson, G. W. (2022a) *Encyclopedia of Scale Insect Pests*. Wallingford: CABI.
- Kondo, T.; Watson, G. W. (2022b) Black thread scale *Ischnaspis longirostris* (Signoret, 1882) (Hemiptera: Coccoidea: Diaspididae). In: Kondo, T. & Watson, G. W. (Eds.), *Encyclopedia of Scale Insect Pests*, pp. 491-493. Wallingford: CABI.
- Martins, D. S.; Wolff, V. R. S.; Culik, M. P.; Santos, B. C.; Fornazier, M. J.; Ventura, J. A. (2022) Diversity, distribution and host plants of armored scale insects (Hemiptera: Diaspididae) in Espírito Santo, Brazil. *Biota Neotropica*, 22(2): e20211248. doi: [10.1590/1676-0611-BN-2021-1248](https://doi.org/10.1590/1676-0611-BN-2021-1248)
- Matile-Ferrero, D.; Couturier, G. (1993) Les cochenilles des Myrtaceae en Amazonie péruvienne. I. Description de deux nouveaux ravageurs de *Myrciaria dubia* (Homoptera, Coccidae et Kerriidae). *Bulletin de la Société entomologique de France*, 98(5): 441-448. doi: [10.3406/bsef.1993.17920](https://doi.org/10.3406/bsef.1993.17920)
- Mendes, M. A. S.; Lima Junior, M. J. V. (2017) Camu-camu *Myrciaria dubia* (Kunth) McVaugh. Comitê Técnico de Sementes Florestais (CTSF)/Associação Brasileira de Tecnologia em Sementes (ABRATES). (Nota Técnica, 4). <http://www.abrates.org.br/nota-tecnica/122/conteudobiblioteca012notatecnica031625028457pdf>
- Miller, D. R. (1996) Checklist of the scales insects (Coccoidea: Homoptera) of Mexico. *Proceedings of the Entomological Society of Washington*, 98(1): 68-86.
- Nascimento, W. M. O.; Carvalho, J. E. U. (2012) A cultura do camu-camu. Brasília: Embrapa. (Coleção Plantar, 71). <https://ainfo.cnptia.embrapa.br/digital/bitstream/item/175155/1/COLECAO-PLANTAR-A-cultura-do-camu-camu-2012.pdf>

- Silva, P. H. S.; Ribeiro, J. L. (2000) Ataque da cochonilha “escama farinha” *Pinnaspis aspidistrae* (Signoret, 1869) (Hemiptera: Diaspididae) em cajueiro anão precoce irrigado. Teresina: Embrapa Meio-Norte. (Comunicado Técnico, 113). <https://ainfo.cnptia.embrapa.br/digital/bitstream/item/83379/1/CT1130001.pdf>
- Villanueva-Tiburcio, J. E.; Condezo-Hoyos, L. A.; Asquiere, E. R. (2010) Antocianinas, ácido ascórbico, polifenolestotales y actividad antioxidante, em la cáscara de camu-camu (*Myrciaria dubia* (H.BK) MC Vaugh). *Ciência e Tecnologia de Alimentos*, 30: 151-160. doi: [10.1590/S0101-20612010000500023](https://doi.org/10.1590/S0101-20612010000500023)
- Watson, G. W. (2022) *Pinnaspis* spp. (Hemiptera: Coccomorpha: Diaspididae). In: Kondo, T. & Watson, G. W. (Eds.), *Encyclopedia of Scale Insect Pests*, pp. 520-525. Wallingford: CABI.
- Williams, D. J.; Granara de Willink, M. C. (1992) *Mealybugs of Central and South America*. Wallingford: CAB International.
- Wolff, V. R. S.; Kondo, T.; Peronti, A. L. B. G.; Noronha, A. C. S. (2016) Scale insects (Hemiptera: Coccoidea) on *Myrciaria dubia* (Myrtaceae) in Brazil. *Neotropical Entomology*, 45 (3): 274-279. doi: [10.1007/s13744-016-0365-2](https://doi.org/10.1007/s13744-016-0365-2)
- Wolff, V. R. S.; Ramos, R. L. D.; Medeiros, S. M. M. (2009) Cochonilhas (Hemiptera, Sternorrhyncha, Coccoidea) associadas a plantas medicinais e aromáticas. *Pesquisa Agropecuária Gaúcha*, 15: 65-68. <http://revistapag.agricultura.rs.gov.br/ojs/index.php/revistapag/article/view/206>
- Yuyama, L. K. O.; Barros, S. E.; Aguiar, J. P. L.; Yuyama, K.; Silva-Filho, D. F. (2002) Quantificação de fibra alimentar em algumas populações de cubiu (*Solanum sessiliflorum* Dunal), camu-camu (*Myrciaria dubia* (H.B.K.) Mc Vaugh) e açaí (*Euterpe oleracea* Mart). *Acta Amazonica*, 32(3): 491-497. doi: [10.1590/1809-43922002323467](https://doi.org/10.1590/1809-43922002323467)
- Yuyama, L. K. O.; Aguiar, J. P. L.; Yuyama, K.; Lopes, T. M.; Favaro, D. I. T.; Bergl, P. C. P.; Vasconcellos, M. B. A. (2003) Teores de elementos minerais em algumas populações de camu-camu. *Acta Amazonica*, 33(4): 549-554. doi: [10.1590/S0044-59672003000400002](https://doi.org/10.1590/S0044-59672003000400002)
- Yuyama, K.; Yuyama, L. K. O.; Valente, J. P.; Silva, A. C.; Aguiar, J. P. L.; Flores, W. B. C.; Lima, C. G. B. (2010) *Camu-camu*. Jaboticabal: FUNEP. (Série Frutas Nativas, 2).