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NOTA CIENTÍFICA

First record of *Pachybrachis* Chevrolat, 1836 (Coleoptera: Chrysomelidae: Cryptocephalinae) on *Spermacoce verticillata* L. (Rubiaceae) and synthesis of its plant associations in Brazil

Primer registro de *Pachybrachis* Chevrolat, 1836 (Coleoptera: Chrysomelidae: Cryptocephalinae) en *Spermacoce verticillata* L. (Rubiaceae) y síntesis de sus asociaciones vegetales en Brasil

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Abstract
This study reports *Pachybrachis* sp. association with a new host, *Spermacoce verticillata* L. (Rubiaceae). It synthesizes Brazil locality records and host plant records from literature. Specimens of adults and larvae were collected on the host in an urban area of Maceió, Alagoas, Brazil. Larvae and adults were reared on the host plant in the laboratory, using fresh plant tissue daily.

Resumen
Este estudio presenta la asociación de *Pachybrachis* sp. con un nuevo huésped, *Spermacoce verticillata* L. (Rubiaceae). En este trabajo se dan a conocer las localidades registradas en Brasil para la especie y los registros de plantas huésped mencionados en la literatura. Se recolectaron especímenes de adultos y larvas sobre el huésped en un área urbana de Maceió, Alagoas, Brasil. Las larvas y los adultos se criaron en la planta huésped en el laboratorio, utilizando tejido vegetal fresco a diario.

Keywords:

Alagoas; Host plant; Immature; Insect-plant interaction; Pachybrachina.

Palabras clave:

Alagoas; Inmaduro; Interacción insecto-planta; Pachybrachina; Planta huésped.

Spermacoce verticillata L. (synonym: *Borreria verticillata* (L.) G. Mey.) (Rubiaceae) conserves important pollinators and natural enemies around it (Dale et al. 2019). Commonly known as "shrubby false buttonweed" (GBIF 2021a), *S. verticillata* is a native herb from tropical America, but it is considered a weed in Brazil probably due to its tolerance to nutrient-poor soils and the easy dispersal of its seeds (Lorenzi 1991). This plant is part of folk medicine due to its antimicrobial (Koné et al. 2004) and anti-inflammatory properties (Lima et al. 2018); it is also a source of raw material for handicraft products (Lima et al. 2013). *Spermacoce verticillata* is also useful in biological control programs as it is the main source of nectar for wasps (Arévalo & Frank 2005, Leppla et al. 2007, Abraham et al. 2010, Portman et al. 2010). In addition, it has larvicidal activity against *Aedes aegypti* (Linnaeus, 1762) (Oliveira et al. 2010).

Chrysomelidae is the fourth largest family of the order Coleoptera. Because it is essentially phytophagous, it plays a big role in insect-plant interactions. Members of the subfamily Cryptocephalinae, represented in Brazil by 723 species in 37 genera (Chamorro et al. 2021), feed on green leaves, decaying plant material, and girdle stems (Chamorro 2014); some are myrmecophilous (Agrain et al. 2015). Members of the Cryptocephalini tribe are flower eaters and pollen eaters (Chamorro 2014). Some groups, as subtribe Pachybrachina, pose a complex identification challenge at genus level even for specialists (Sassi 2018).

Worldwide, two species are associated with Rubiaceae: *Cryptocephalus trizonatus* Suffrian, 1852 on *Coffea* sp. (Maes & Staines 1991) and *Cryptocephalus moraei* (Linnaeus, 1758) on *Gallium* sp. (Biondi & Di Casoli 1996, Maican & Munteanu 2008). None of the reports provide information about the presence of immatures on the plant.

We report a new record of *Pachybrachis* sp. whose adults and immature stages are in association with *S. verticillata* in Brazil. We also summarize the distribution records of this genus and its plant associations in Brazilian territory.

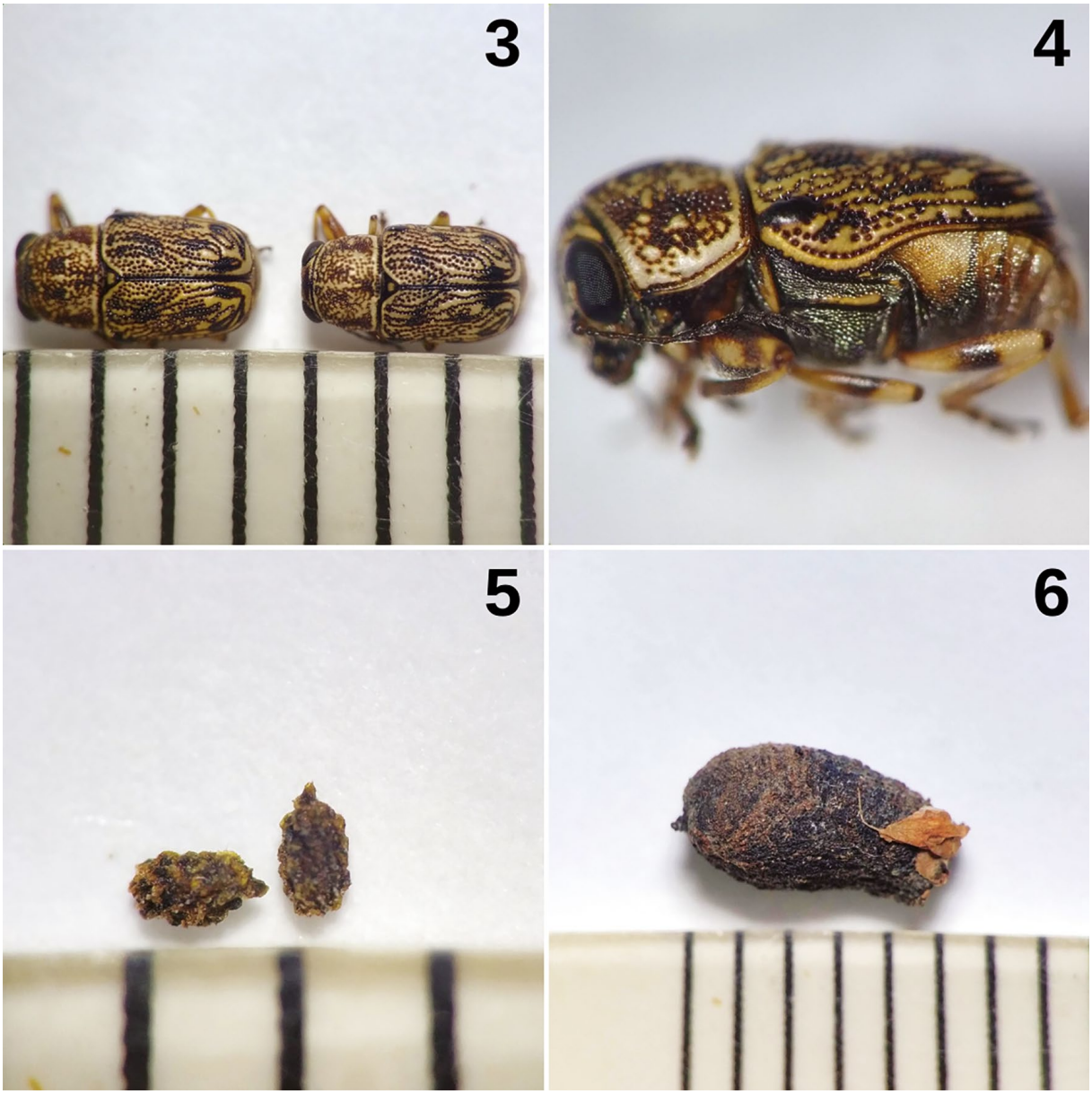
Two adults and two mature larvae specimens were collected in an urban area of Maceió, Alagoas (-9.558304, -35.776127) (Fig. 1), on *S. verticillata* (Fig. 2), near the Catolé e Fernão Velho Environmental Protection Area, fragment of the Atlantic Forest, in September of 2019. The plant was identified by Dra. Letícia Ribes de Lima (Universidade Federal de Alagoas). In the laboratory (24.1 – 26.0 °C, 62 – 77% RH, photoperiod 12:12 h), the larvae and adults were reared with daily addition of fresh parts of the plant, from which pupae and eggs were obtained. Morphometric determinations under stereomicroscope were performed too. Subsequently, a genera key (Chamorro-Lacayo 2013) of the subtribe Pachybrachina was used for identification of the beetles, which was confirmed by Dr. Davide Sassi (Università degli Studi di Milano). The analysis of publications related to the occurrence records made it possible to trace the current state of the genus occurrence and plant association for Brazil. Voucher specimens of the beetles will be deposited in the Padre Jesus Santiago Moure Entomological Collection, Federal University of Paraná, Brazil; plant exsiccates will be deposited in the Institute of the Environment of Alagoas's Herbarium-MAC.

Figures 1-2. Habitat of ***Pachybrachis*** sp. 1: Location where the specimens were found. 2: Host plant ***Spermacoce verticillata*** with a late instar larva of ***Pachybrachis*** sp. feeding on its inflorescence (white circle).

The beetles were identified as *Pachybrachis* Chevrolat, 1836 (Chrysomelidae: Cryptocephalinae: Cryptocephalini) (Figs. 3, 4), with female, ≈ 3.2 mm long (n = 1), being larger and more robust than the male, ≈ 3.0 mm long (n = 1). The following characters were confirmed by the key to identify specimens as in the genus *Pachybrachis* and differentiating it from similar genera such as *Metallactus* Suffrian, 1866 and *Griburius* Haldeman, 1849: (a) intercoxal process of the proesternum do not go further the posterior margin of the protrax; (b) broad and evident punctuations in the head, prothorax and elytra; (c) baseline of the elytra is wider than prothorax posterior line; and (d) dorsally flat prothorax, not domed. The egg fecal capsule is ≈ 0.7 mm long (n = 6) (Fig. 5) and the pupa fecal case is ≈ 5.1 mm long (n = 2) (Fig. 6).

Pachybrachis sp. adults feed on leaves of *S. verticillata*, while late instar larvae feed on inflorescences. Mature larvae seem to seek a position under the inflorescences, where they feed until pupation. Females lay their eggs on the inflorescences, but eggs were also found on substrate.

The genus *Pachybrachis* (220 species) is poorly studied in Brazil, with scarce and incomplete records. There is not a single record registered for Brazil in the GBIF (GBIF 2021b), the largest biodiversity data network. Ten studies have information about the genus *Pachybrachis* in Brazil (Table 1). The characteristics of the exact locations of occurrence are barely presented. Most (Baly 1877, Bowditch 1913, Albertoni 2008, Dias 2016, Guedes et al. 2019, Rafael et al. 2020) do not provide any information about plants. Only one study reports the presence and collection of immatures.



Figures 3-6. Adults and immatures of ***Pachybrachis*** sp. from northeastern Brazil. 3: Female (left) and male (right) in dorsal view. 4: Female in lateral view. 5: Egg fecal capsules. 6: Pupa fecal case.

Four records provide information about the plants on which the specimens were found. The genus was recorded on *Mimosa pigra* L. (Fabaceae) and on *Mimosa pigra* var. *berlandieri* (A.Gray) B.L.Turner (accepted name: *Mimosa pigra* var. *asperata* (L.) Zarucchi, Vincent & Gandhi) (Fabaceae) (Harley et al. 1995); on *Baccharis stylosa* Gardner (Asteraceae) in a high altitude area (above 1600 meters) (Flinte et al. 2009); on *Ipomoea carnea* subsp. *fistulosa* (Mart. ex Choisy) D.F.Austin (Convolvulaceae) in Caatinga (Martins 2015); and on *Chamaecrista cathartica* (Mart.) H.S.Irwin & Barneby (Fabaceae) in urban area (Lopes 2020). However, only *B. stylosa* was confirmed as a host plant as immatures and adults were feeding on it.

In summary, we present as a novelty *Pachybrachis* sp. on *S. verticillata,* the first record of Rubiaceae as a host for this beetle genus. Not least, this is the first report of *Pachybrachis* immatures from Brazil.

Table 1. Occurrences of ***Pachybrachis*** Chevrolat, 1836 and its plant associations in Brazil.

***Pachybrachis* (name as reported)**	**State**	**Municipality or Distrite**	**Location**	**Phytophysiognomy**	**Plant (name as reported)**	**Notes on plant association**	**Literature**
Pachybrachys contortus	Pará	Santarém	Banks of the Amazon	—	—	—	Baly 1877
Pachybrachys contortus	Ceará	—	—	—	—	—	Bowditch 1913
Pachybrachys contortus	Ceará	Maranguape	—	—	—	—	Bowditch 1913
Pachybrachys sp. 1	Ceará	Independência	—	—	—	—	Bowditch 1913
Pachybrachys sp. 2	Ceará	Independência	—	—	—	—	Bowditch 1913
Pachybrachys sp. 3	Ceará	Independência	—	—	—	—	Bowditch 1913
Pachybrachys sp. 4	Rio Grande do Norte	Natal	—	—	—	—	Bowditch 1913
Pachybrachis contortus	Minas Gerais	—	—	—	*Mimosa pigra*	The authors just report that adults were found on plant. Nothing about feeding.	Harley et al. 1995
Pachybrachis sp. nr. musiva	Minas Gerais	—	—	—	*Mimosa pigra*	The authors just report that adults were found on plant. Nothing about feeding.	Harley et al. 1995
Pachybrachis sp.	Amazonas, Minas Gerais, Pará, Paraná, São Paulo	—	—	—	*Mimosa pigra*	The authors just report that adults were found on plant. Nothing about feeding.	Harley et al. 1995
Pachybrachis sp.	Amazonas, Minas Gerais, Pará, Paraná, São Paulo	—	—	—	*Mimosa pigra* var. *berlandieri*	The authors just report that adults were found on plant. Nothing about feeding.	Harley et al. 1995
Pachybrachis sp. 1	Santa Catarina	—	—	—	—	—	Albertoni 2008
Pachybrachis sp. 2	Santa Catarina	—	—	—	—	—	Albertoni 2008
Pachybrachis sp.	Rio de Janeiro	—	Serra dos Orgãos National Park	High-montane forest	*Baccharis stylosa*	Plant should be considered a host plant because adults and larvae were found feeding on plant.	Flinte et al. 2009
Pachybrachis sp.	Rio de Janeiro	—	Serra dos Orgãos National Park	High altitude grassland	*Baccharis stylosa*	Plant should be considered a host plant because adults and larvae were found feeding on plant.	Flinte et al. 2009
Pachybrachis sp.	Paraíba	—	Caatinga	—	*Ipomoea carnea* ssp. *fistulosa*	Plant could be considered a food plant because adult was found feeding on plant.	Martins 2015
Pachybrachys sp.	Rio Grande do Sul	Aceguá	Pampa	—	—	—	Dias 2016
Pachybrachys sp. 1	Paraíba	Santa Terezinha	Caatinga	Riparian forest	—	—	Guedes et al. 2019

Table 1. ....

Pachybrachis **(name as reported)**	**State**	**Municipality or Distrite**	**Location**	**Phytophysiognomy**	**Plant (name as reported)**	**Notes on plant association**	**Literature**
Pachybrachys sp. 2	Paraíba	Santa Terezinha	Caatinga	Riparian forest and xerophilous vegetation	—	—	Guedes et al. 2019
Pachybrachys sp. 3	Paraíba	Santa Terezinha	Caatinga	Riparian forest and xerophilous vegetation	—	—	Guedes et al. 2019
Pachybrachys sp. 4	Paraíba	Santa Terezinha	Caatinga	Riparian forest	—	—	Guedes et al. 2019
Pachybrachis sp.	Minas Gerais	Uberlândia	Urban area	(Don't apply)	*Chamaecrista cathartica*	Plant could be considered a food plant because adult rearing on plant was performed.	Lopes 2020
Pachybrachis sp.	Pernambuco	Fernando de Noronha	Fernando de Noronha Marine National Park	—	—	—	Rafael et al. 2020

Literature cited

Abraham CM, Held DW, Wheeler C. 2010. Seasonal and diurnal activity of Larra bicolor (Hymenoptera: Crabronidae) and potential ornamental plants as nectar sources. Applied Turfgrass Science 7(1):1-9. https://doi.org/10.1094/ATS-2010-0312-01-RS

Agrain FA, Buffington ML, Chaboo CS, Chamorro ML, Schöller M. 2015. Leaf beetles are ant-nest beetles: the curious life of the juvenile stages of case-bearers (Coleoptera, Chrysomelidae, Cryptocephalinae). In: Jolivet P, Santiago-Blay J, Schmitt M, editors. Research on Chrysomelidae 5. ZooKeys 547:133-164. https://doi.org/10.3897/zookeys.547.6098

Albertoni FF. 2008. Besouros da restinga do entorno da Lagoa Pequena, Florianópolis, SC: levantamento taxonômico e aspectos ecológicos [bachelor's monograph]. Florianópolis (SC): Universidade Federal de Santa Catarina.

Arévalo HA, Frank JH. 2005. Nectar sources for Larra bicolor (Hymenoptera: Sphecidae), a parasitoid of Scapteriscus mole crickets (Orthoptera: Gryllotalpidae), in northern Florida. Florida Entomologist 88(2):146-151. https://doi.org/10.1653/0015-4040(2005)088[0146:NSFLBH]2.0.CO;2

Baly JS. 1877. XVI. Descriptions of new genera and species of Cryptocephalidae. Transactions of the Royal Entomological Society of London 25(3):211-232. https://biostor.org/reference/235678

Biondi M, Di Casoli MT. 1996. Il popolamento a Coleoptera Chrysomelidae del massiccio del Gran Sasso: analisi zoogeografica ed autoecologica (Insecta). In: Cicolani B, editor. Monitoraggio biologico del Gran Sasso. Volume 1. Colledara (TE): Andromeda Editrice. p. 176-198.

Bowditch FC. 1913. The Phytophaga (Except Cassidae and Hispidae) of the Stanford Expedition to Brazil. Psyche: A Journal of Entomology 20(4):125-131. https://doi.org/10.1155/1913/94781

Chamorro-Lacayo ML. 2013. On the identity of Mastacanthus Suffrian, 1852 and Sternoglosus Suffrian, 1866 and key to world genera of Pachybrachina (Chrysomelidae: Cryptocephalinae: Cryptocephalini). Caucasian Entomological Bulletin 9(1):201-206. https://doi.org/10.23885/1814-3326-2013-9-1-201-206

Chamorro ML. 2014. Cryptocephalinae Gyllenhal, 1813. In: Leschen RAB, Beutel RG, volume editors. Coleoptera, Beetles. Volume 3: Morphology and Systematics (Phytophaga). In: Kristensen NP, Beutel RG, editors. Handbook of Zoology Arthropoda: Insecta. Berlin/Boston: De Gruyter. p. 230-236.

Chamorro ML, Sekerka L, Agrain F, Regalin R. 2021. Cryptocephalinae in Catálogo Taxonômico da Fauna do Brasil. PNUD. [accessed 2021 May 18] http://fauna.jbrj.gov.br/fauna/faunadobrasil/118309.

Dale AG, Perry RL, Cope GC, Benda N. 2019. Floral abundance and richness drive beneficial arthropod conservation and biological control on golf courses. Urban Ecosystems 23:55-66. https://doi.org/10.1007/s11252-019-00907-0

Dias AC. 2016. Efeito de diferentes intensidades de pastejo sobre a comunidade de artrópodes nos campos sulinos [master's dissertation]. Porto Alegre (RS): Universidade Federal do Rio Grande do Sul.

Flinte V, Macedo MV, Monteiro RF. 2009. Chrysomelids and their host plants along an altitudinal gradient in an Atlantic rain forest in the State of Rio de Janeiro, Brazil. In: Jolivet P, Santiago-Blay J, Schmitt M, editors. Research on Chrysomelidae. Volume 2. Morphology and systematics (Phytophaga). Leiden: Brill. p. 31-56.

GBIF (Global Biodiversity Information Facility). 2021a. Spermacoce verticillata L. [accessed 2021 May 17] https://www.gbif.org/species/2918574.

GBIF (Global Biodiversity Information Facility). 2021b. Pachybrachis Chevrolat, 1836. [accessed 2021 Mar 26] https://www.gbif.org/species/1047958.

Guedes RS, Zanella FCV, Grossi PC. 2019. Composição e riqueza de espécies de uma comunidade de Coleoptera (Insecta) na Caatinga. Iheringia, Série Zoologia 109:e2019012. https://doi.org/10.1590/1678-4766e2019012

Harley K, Gillett J, Winder J, Forno W, Segura R, Miranda H, Kassulke R. 1995. Natural Enemies of Mimosa pigra and M. berlandieri (Mimosaceae) and prospects for biological control of M. pigra. Environmental Entomology 24(6):1664-1678. https://doi.org/10.1093/ee/24.6.1664

Leppla NC, Frank JH, Adjei MB, Vicente NE. 2007. Management of pest mole crickets in Florida and Puerto Rico with a nematode and parasitic wasp. Florida Entomologist 90(1):229-233. https://doi.org/10.1653/0015-4040(2007)90[229:MOPMCI]2.0.CO;2

Lima IC, Castro RN, Chaves DSA, Ferreira RT, Carvalho MF, Malvar DC, Vanderlinde FA. 2018. The folk medicine as tool for discovery of new anti-inflammatory drugs: the example of Spermacoce verticillata. Acta Horticulturae 1198:67-74. https://doi.org/10.17660/ActaHortic.2018.1198.13

Lima VHM, Gomes Neto JP, Cavalcanti MS. 2013. Recursos vegetais utilizados pela comunidade de Vila Velha, Ilha de Itamaracá, Pernambuco, Brasil. Revista Ouricuri 3(1):29-42. https://www.revistas.uneb.br/index.php/ouricuri/article/view/6431

Lopes BS. 2020. Ecologia das interações e diversidade de insetos em espécies de Fabaceae no Cerrado [doctoral's thesis]. Ribeirão Preto (SP): Universidade de São Paulo.

Lorenzi H. 1991. Plantas daninhas do Brasil: terrestres, aquáticas, parasitas, tóxicas e medicinais. 3ª ed. Nova Odessa (SP): Plantarum.

Koné W, Atindehou KK, Terreaux C, Hostettmann K, Traoré D, Dosso M. 2004. Traditional medicine in North Côte-d'Ivoire: screening of 50 medicinal plants for antibacterial activity. Journal of Ethnopharmacology 93(1):43-49. https://doi.org/10.1016/j.jep.2004.03.006

Maes JM, Staines CL. 1991. Catálogo de los Chrysomelidae Coleoptera de Nicaragua. Revista Nicaraguense de Entomologia 18:1-53. http://www.bio-nica.info/RevNicaEntomo/RevNicaEntomo.htm

Maican S, Munteanu C. 2008. The diversity of urban coleopterans. In: Onete M, editor. Species monitoring in the central parks of Bucharest. Bucharest: Ars Docendi. p. 106-112.

Martins JKSS. 2015. Interações ecológicas associadas a Ipomoea Carnea subs. fistulosa (Martius e Choise) (Convolvulaceae) em uma área de Caatinga no Nordeste do Brasil [master's dissertation]. Recife (PE): Universidade Federal Rural de Pernambuco.

Oliveira PV, Ferreira JC, Moura FS, Lima GS, de Oliveira FM, Oliveira PES, Conserva LM, Giulietti AM, Lemos RPL. 2010. Larvicidal activity of 94 extracts from ten plant species of northeastern of Brazil against Aedes aegypti L. (Diptera: Culicidae). Parasitology Research 107:403-407. https://doi.org/10.1007/s00436-010-1880-4

Portman SL, Frank JH, McSorley R, Leppla NC. 2010. Nectar-seeking and host-seeking by Larra bicolor (Hymenoptera: Crabronidae), a parasitoid of Scapteriscus mole crickets (Orthoptera: Gryllotalpidae). Environmental Entomology 39(3):939-943. https://doi.org/10.1603/en09268

Rafael JA, Limeira-de-Oliveira F, Hutchings RW, Miranda GFG, Silva Neto AM, Somavilla A, Camargo A, Asenjo A, Pinto ÂP, Bello AM, et al. 2020. Insect (Hexapoda) diversity in the oceanic archipelago of Fernando de Noronha, Brazil: updated taxonomic checklist and new records. Revista Brasileira de Entomologia 64(3):e20200052. https://doi.org/10.1590/1806-9665-rbent-2020-0052

Sassi D. 2018. Revision of the Metallactus kollari species-group with a new diagnosis of the genus (Coleoptera: Chrysomelidae: Cryptocephalinae). Zootaxa 4413(1):57-110. https://doi.org/10.11646/zootaxa.4413.1.2

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