



## SHORT NOTE

### First Record of *Myrcia magna* D.Legrand (Myrtaceae) as a Myrmecophyte Host for *Myrcidris epicharis* Ward, 1990 (Formicidae: Pseudomyrmecinae)

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#### Article History

##### Edited by

Jean C. Santos, UFS, Brazil

Received 17 April 2019

Initial acceptance 04 July 2019

Final acceptance 23 August 2019

Publication date 30 December 2019

#### Keywords

Amazon rainforest, ant-plant association, Hymenoptera, Myrtales.

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In the Neotropics, mutualistic relationships between plants and ants frequently provide protection against predators to the hosts and housing to the insects (Goitía & Jaffé, 2009). Several independent plant-based myrmecophilous interactions have been registered in nature (Heil & McKey, 2003). This category of mutualism is particularly notable in Amazonian communities, where a large number of species of the Formicidae are found inhabiting domatia of plants (Dáttilo et al., 2013).

The subfamily Pseudomyrmecinae (Formicidae) comprises the genera *Myrcidris* Ward, *Pseudomyrmex* Lund, and *Tetraponera* F.Smith. Many species of these genera are arboreal, and some have association with plants that bear domatia (Ward, 1990; Ward & Downie, 2005; Baccaro et al., 2015). To date, *Myrcidris epicharis* Ward, 1990 is the only species described for this genus of ants (Ward & Downie, 2005) that establishes its colonies in domatia present at the nodes of branches of Amazonian plants of the genus *Myrcia*

#### Abstract

The association of the ant *Myrcidris epicharis* with the plant *Myrcia magna* is reported for the first time. This association was registered in two localities along the Negro river basin, in the region of Manaus, Amazonas state, Brazil. The ants inhabit swollen shoots in apical and subjacent nodes of the branches. This record represents the second plant species of Myrtaceae to be associated with *Myrcidris epicharis*.

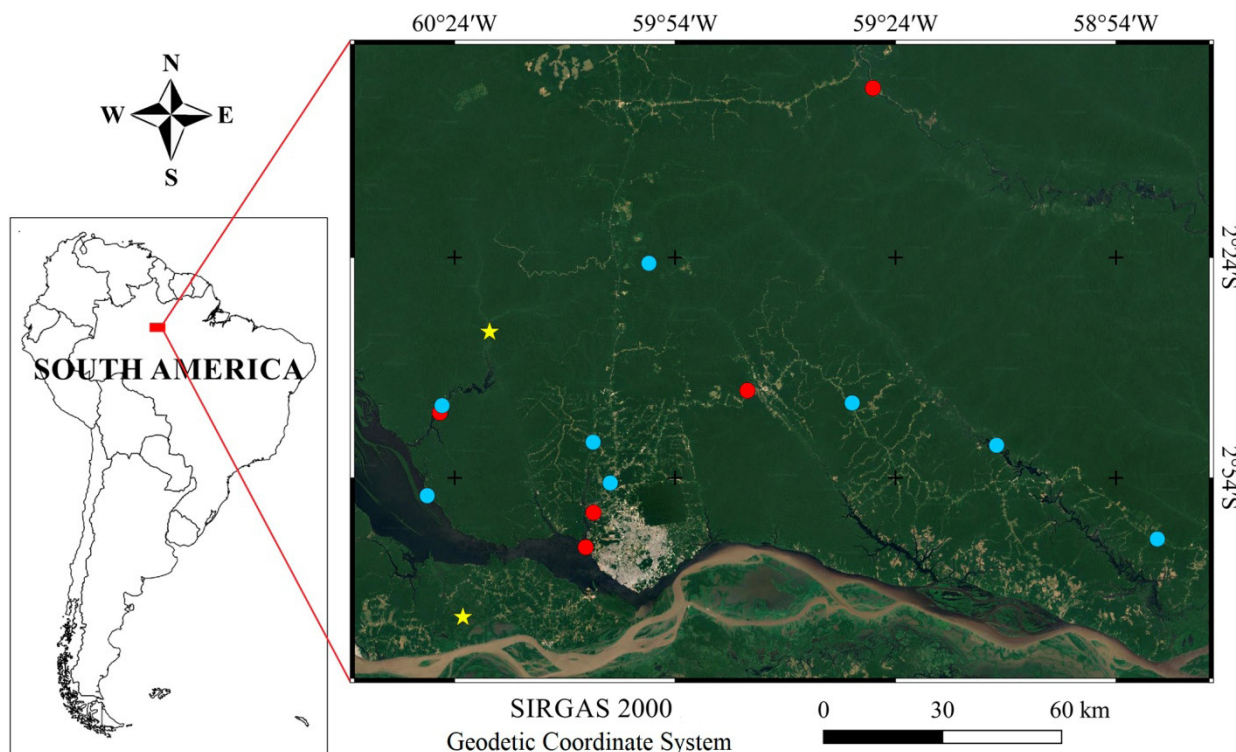
DC. (Myrtaceae) (Passmore et al., 2012; Vicente et al., 2012). This association has been registered only between *Myrcidris epicharis* and *Myrcia madida* McVaugh [for a detailed description of this specialized relationship see Ferreira and Vasconcelos (2010) and Vicente et al. (2012)]. Here we report an interaction between *Myrcidris epicharis* and another species of Myrtaceae, *Myrcia magna* D.Legrand.

The samples of *Myrcidris epicharis* and *Myrcia magna* were collected during field expeditions to the Rio Negro Sustainable Development Reserve (RDS Rio Negro, 03°02'56''S, 60°06'11''W) and to the Alto Cuieras river base of the National Institute for Amazonian Research (Cuieras, 02°34'07''S, 60°19'15''W) in January 2018 and July 2018 respectively (Fig 1). The plants were identified based on specimens deposited at INPA herbarium (from National Institute for Amazonian Research, Manaus, Amazonas, Brazil) and on the information of the literature about the systematics



of *Myrcia* (Lucas et al., 2016; 2018). The ants were identified following Baccaro et al. (2015). Pictures in the field were taken with a Nikon D3300 camera and laboratory pictures were taken with a Leica M205C stereomicroscope. Voucher material of the plants was deposited at SORO herbarium (from Federal University São Carlos, Sorocaba, São Paulo, Brazil) and the ants were deposited at Zoological Collection Paulo Bührnheim (from Federal University of Amazonas, Manaus, Amazonas, Brazil). Additional material of *Myrcia*

*magna* was selected by examining the specimens deposited in herbaria in order to hypothesize the actual range of occurrence of this interaction. The specimens of *Myrcia magna* deposited at INPA were analyzed directly, and the presence of domatia in materials from other plant collections was checked from online high-resolution images. The geographical coordinates were extracted from the specimens' labels when available and estimated when missing. A map of plant species distribution was made using QGIS version 2.18.20 (QGIS Development



**Fig 1.** Distribution of *Myrcia magna*: our records of plants associated with *Myrcidris epicharis* (yellow stars), and records of plant material deposited in herbaria that bear domatia (blue circles) and without domatia (red circles).

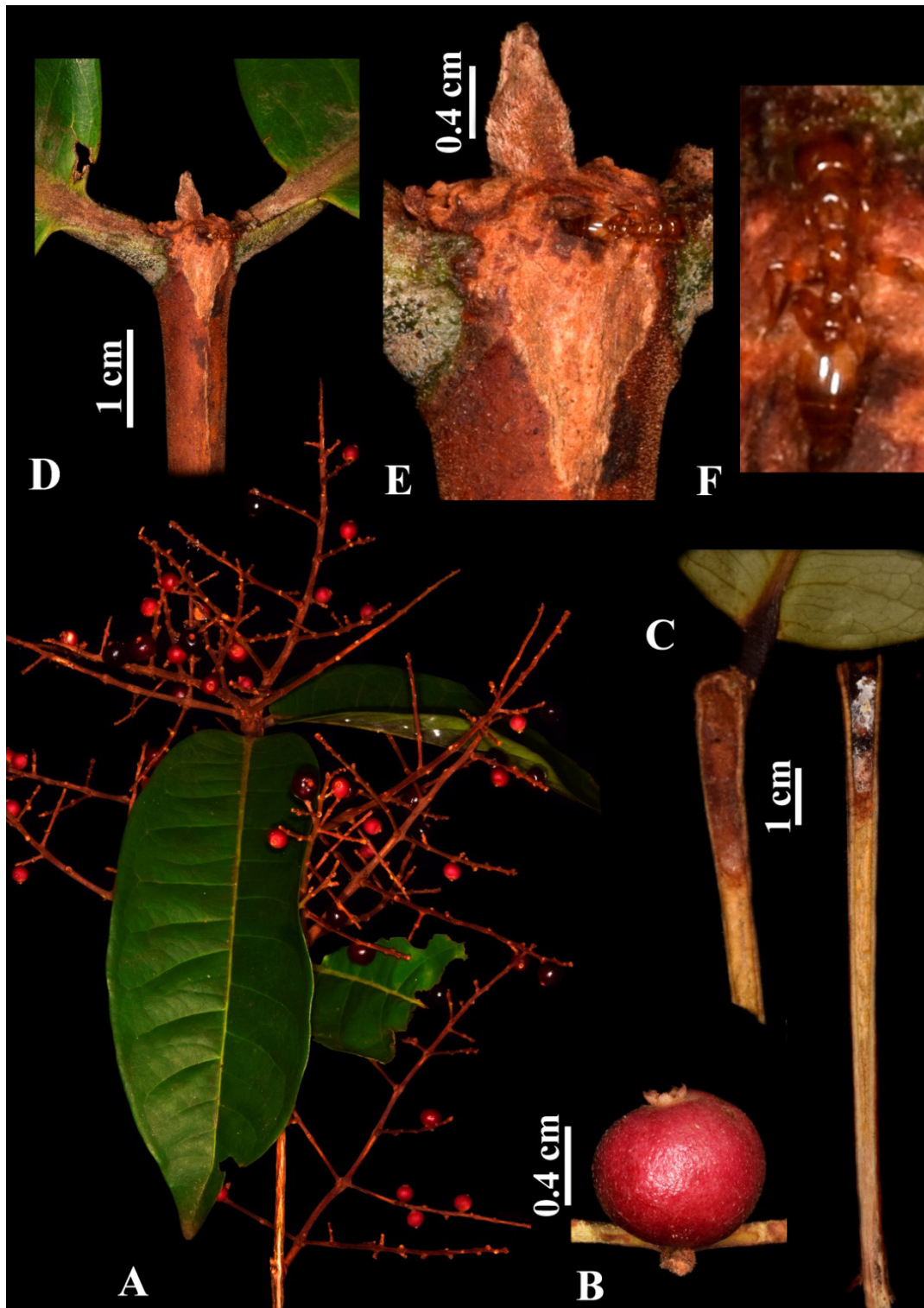
Team, 2019).

Ants inhabiting domatia of *Myrcia magna* were seen and collected from two plants, one in the Cueiras and another in the RDS Rio Negro reserve. The domatia in *Myrcia magna* are presented as hollow cavities in the branches just below each leaf node and also at the base of the petioles, and they are accessed by the ants through circular holes (Fig 2). Workers and queens were observed and collected in both plant individuals (Fig 3). However, differently from *Myrcia madida* in which only one queen of *Myrcidris epicharis* was reported per host plant (Ferreira & Vasconcelos, 2010), in *Myrcia magna* we recorded two queens per plant in RDS Rio Negro and one queen in the Cuieras reserve.

The mutualistic relationship between *Myrcidris epicharis* and *Myrcia madida* was reported to the central (Ferreira & Vasconcelos, 2010; Passmore et al., 2012; Dáttilo et al., 2013) and southern Amazon (Vicente et al., 2012). Other authors also observed a similar phenomenon between *Myrcidris epicharis* and an unidentified species of *Myrcia* in the region

of Manaus (Ward, 1990). *Myrcidris epicharis* was also registered in Colombian Amazon, but with no information about possible interactions with myrmecophytes (Guerrero, 2009). Several studies considered the association between *Myrcidris epicharis* and *Myrcia madida* as highly specialized and mandatory (e.g. Bruna et al., 2005; Dáttilo et al., 2013), but our report involving another species of plant is a first step into the discussion of the specificity of this interaction. Not all herbarium collections of *Myrcia magna* presented domatia (Fig 1), but perhaps they only appear in recently grown branches, unlike those with flowers and fruits frequently preserved.

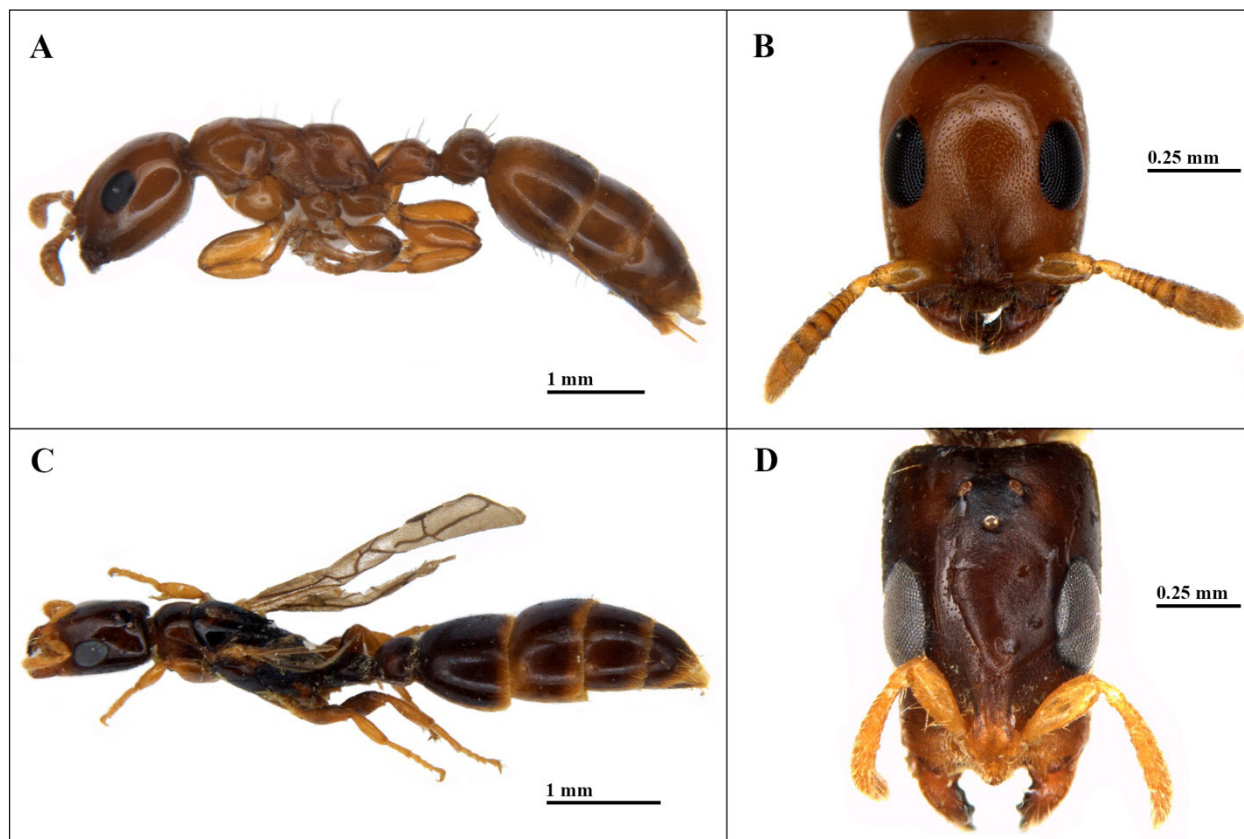
*Myrcia magna* is distinguished from *Myrcia madida* by its inflorescences with opposite to alternate branching, flowers with glabrous floral disc and rounded fruits (vs. inflorescence branching exclusively opposite, floral disc distinctively pilose and ellipsoid fruits in *Myrcia madida*). According to a recently published infrageneric molecular-based classification of the genus *Myrcia*, *Myrcia magna* belongs to *Myrcia* sect. *Aulomyrcia* (O.Berg) Griseb. whilst *Myrcia madida* is



**Fig 2.** Ant-plant association: fertile branch of *Myrcia magna* (Gaem et al. 148)(A), fruit of *Myrcia magna* (B), longitudinal section of a domatium (C), a domatium just below a node (D), an individual of *Myrcidris epicharis* (F. Farroñay, CZPB) getting out of a domatium (E), and detail of an ant (F).

placed within *Myrcia* sect. *Myrcia* (Lucas et al., 2016; 2018). Therefore, these two interactions appear to have originated independently within the genus. Moreover, the domatia present in these two species of *Myrcia* are very similar. It is unclear whether the ants trigger the development of domatia or escape them, and further investigation is required to better understand these associations.

Zoological material examined: BRAZIL. Amazonas: Iranduba, RDS do Rio Negro, galho de *Myrcia* sp., 03°02'56"S, 60°06'11"W, 27 January 2018, coleta manual, col.: F. Farroñay (CZPB-HY000006–7); Manaus, Base Alto Rio Cuieras, 02°34'07"S, 60°19'15"W, 09 July 2018, coleta manual, col.: F. Santana. (CZPB-HY000003–5).



**Fig 3.** *Myrcidris epicharis* (F. Santana, CZPB). A worker in lateral view (A) and full-face view (B). Queen in lateral view (C) and full-face view (D).

Plant material examined: BRAZIL. Amazonas: Iranduba, RDS do Rio Negro, mata de terra firme, 03°02'56"S, 60°06'11"W, 27 January 2018 (fr.), P.H. Gaem *et al.* 148 (SORO 6575); Manaus, Proximidades da Base Alto Cuieras do INPA, 02°34'07"S, 60°19'15"W, 09 July 2018, N.B. Cabello 102 (SORO 6574).

Additional plant material considered. INPA: D.F. Coêlho *s.n.* (INPA 2247); D.F. Coêlho *et al.* 59 (INPA 98378); A.H. Gentry 12863 (INPA 128044); W.A. Rodrigues 4004 (INPA 10569); W.A. Rodrigues 4361 (INPA 10927). NY: D.F. Coêlho *et al.* 59 (barcode: 01461064); C.A. Cid Ferreira *et al.* 6770 (barcode: 01461065) M.J.R. Pereira *et al.* 3304.4967 (barcode: 01551639); G.T. Prance *et al.* 3758 (barcode: 01461068); G.T. Prance *et al.* 3714 (barcode: 01461067); W.A. Rodrigues and J. Lima 4119 (barcode: 01461066); M.G. da Silva 919 (barcode: 01461063). SPF: S.G. Egler 1101 (barcode: 00131778).

### Acknowledgements

We thank the anonymous reviewers for the precious observations. We are also indebted to the Myrtaceae specialist Marcos Sobral, who kindly helped us to identify *Myrcia magna*. Moreover, we thank the CENBAM-PPBio group: Armando dos Santos, Lúcia Pinto, William Magnusson, Albertina Lima, Iderland Viana, Emilio Higashigawa, Ramiro

Melsinki, Andresa Viana, and the field assistants from the Ramal Uga-Uga village. The collection at the RDS Rio Negro reserve was made during inventory conducted by FF as part of his studies at the Master Program in Botany at National Institute of Amazonian Research (INPA) and as part of the CNPq Research Group Ecology and Evolution of Amazonian Plants of INPA. The collection at the Cuieras reserve was obtained in July 2018 during the "I Natural History Course at the Cuieras Reserve" organized by the Museu na Floresta Project (INPA-JICA). We thank National Council for Scientific and Technological Development (CNPq) for research funding, grant 302309/2018-7. This study was financed in part by Coordination for the Improvement of Higher Education Personnel (CAPES) - Finance Code 001. Finally, this paper is part of the results of a project supported by São Paulo Research Foundation (FAPESP), grant 2018/13985-9.

### Authors' Contributions

PHG, FF, NBC & AV collected the plants and ants during the field expeditions cited. PHG, FF & TFS investigated the taxonomy of the organisms involved in the interaction. PHG & FF made the literature review and verified the novelty of the interaction. All authors wrote the manuscript. PHG, FF & TFS prepared the figures. Finally, FFM & AV advised this work as a whole.

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