



# New records of pleasing lacewings (Neuroptera, Dilaridae) from São Paulo state, Brazil

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## Abstract

This note extends the geographic range of *Nallachius adamsi* Penny, 1981, *N. dicolor* Adams, 1970 and *N. phantomellus* Adams, 1970 to São Paulo state, Brazil, based on the examination of specimens obtained in an area of riparian forest (21°36'47" S, 047°49'04" W, ca 532 m above sea level) at the Estação Ecológica de Jataí, in the municipality of Luís Antônio.

## Key words

Light trap; *Nallachius adamsi*; *Nallachius dicolor*; *Nallachius phantomellus*; range extensions.

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## Introduction

The Dilaridae (Neuroptera) comprise 2 extinct and 4 extant genera with near 100 species distributed in 3 subfamilies, Berothellinae, Dilarinae and Nallachinae (Aspöck et al. 2015, Zhang et al. 2016, Liu et al. 2017). Due in part to their rarity, the biology of this family is poorly documented (Penny 1981, Bowles et al. 2015, Liu et al. 2017), but the larvae are known live in decayed wood and under barks of dead trees (MacLeod and Spiegler 1961, Penny 1981, Oswald 1998).

The Dilaridae have a disjunct distribution, with occurrence records in North and South America, Europe, Asia and Africa, but they are absent in the Australian region (Oswald 1998, Liu et al. 2017). Of the Nallachinae, *Nallachius* Navás, 1909 occurs in the Nearctic and Neotropical regions while *Neonallachius* Nakahara, 1963 is an African and Asian genus (Liu et al. 2017).

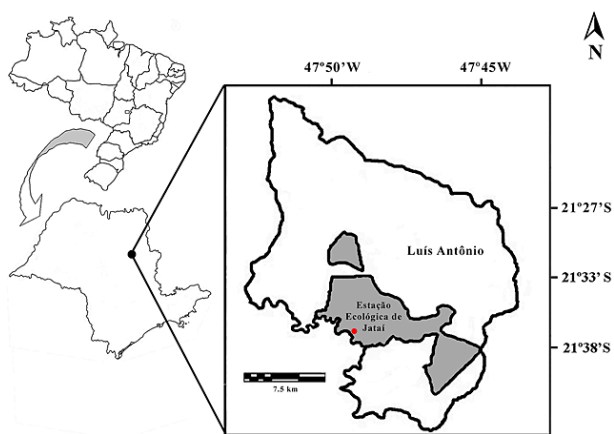
The genus *Nallachius* comprises 20 described spe-

cies, of which 10 are known from 12 states of Brazil (Oswald 1998, Monserrat 2005, Machado and Rafael 2010, Martins and Araújo 2016, Liu et al. 2017). Only *N. limai* Adams, 1970 is recorded from São Paulo state, Brazil (Martins and Amorim 2015). Herein, we reported the first records of *Nallachius adamsi* Penny, 1981, *N. dicolor* Adams, 1970, and *N. phantomellus* Adams, 1970 from São Paulo state.

Little is known about their prey, but there are reports of *Nallachius* larvae feeding upon larvae of *Cucujus clavipes* Fabricius, 1775 (Coleoptera, Curculionidae), *Elaphidion* sp. (Coleoptera, Cerambycidae), and *Camponotus castaneus* (Latreille, 1802) (Hymenoptera, Formicidae) (MacLeod and Spiegler 1961, Kuhar 1995).

## Methods

The *Nallachius* specimens were collected with 2 light traps built according to Szentkirályi (2002). These



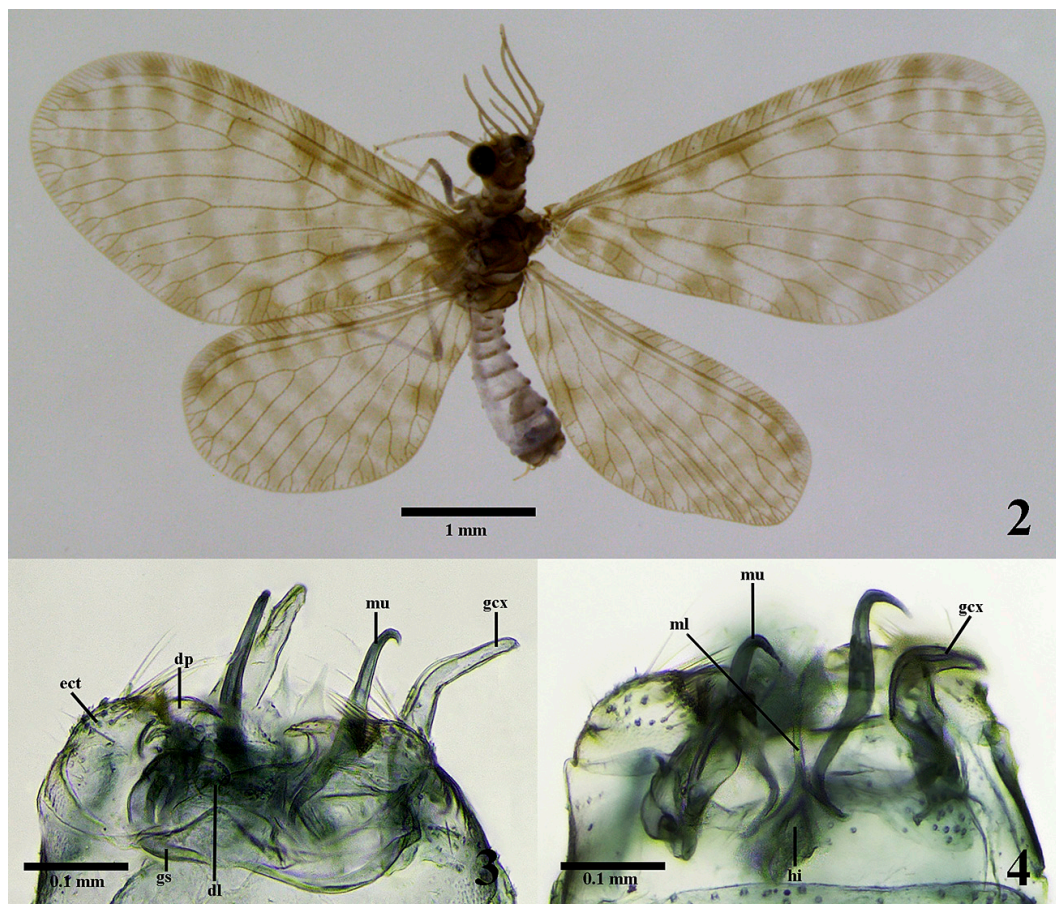
**Figure 1.** Map of Brazil showing state of São Paulo, in detail the municipality of Luís Antônio and in gray the Estação Ecológica de Jataí. The red spot indicates the collection location of the *Nallachius Navás*, 1909 (Neuroptera, Dilaridae) species.

traps were operated in an area of riparian vegetation (21°36'47" S, 047°49'04" W, ca 532 m above sea level) within the Brazilian Savannah domain at the Estação Ecológica de Jataí, in Luís Antônio municipality, São Paulo state, Brazil (Fig. 1). The light traps were separated from each other by 100 m and fixed in trees inside the forest, ca 2 m from the ground. The traps were

equipped with 250 W mercury vapor lamps, and their function was controlled by electronic timer coupled to an electromechanical contactor so that the traps remained active on Mondays, Wednesdays, and Fridays, from dusk to dawn, between November 2007 and November 2009. In the traps, a 5% formalin solution and neutral liquid soap were used as preservative. The captured specimens were sent for identification to the Laboratório de Bioecologia e Taxonomia de Parasitoides e Predadores da APTA Ribeirão Preto, in Ribeirão Preto, São Paulo state, Brazil.

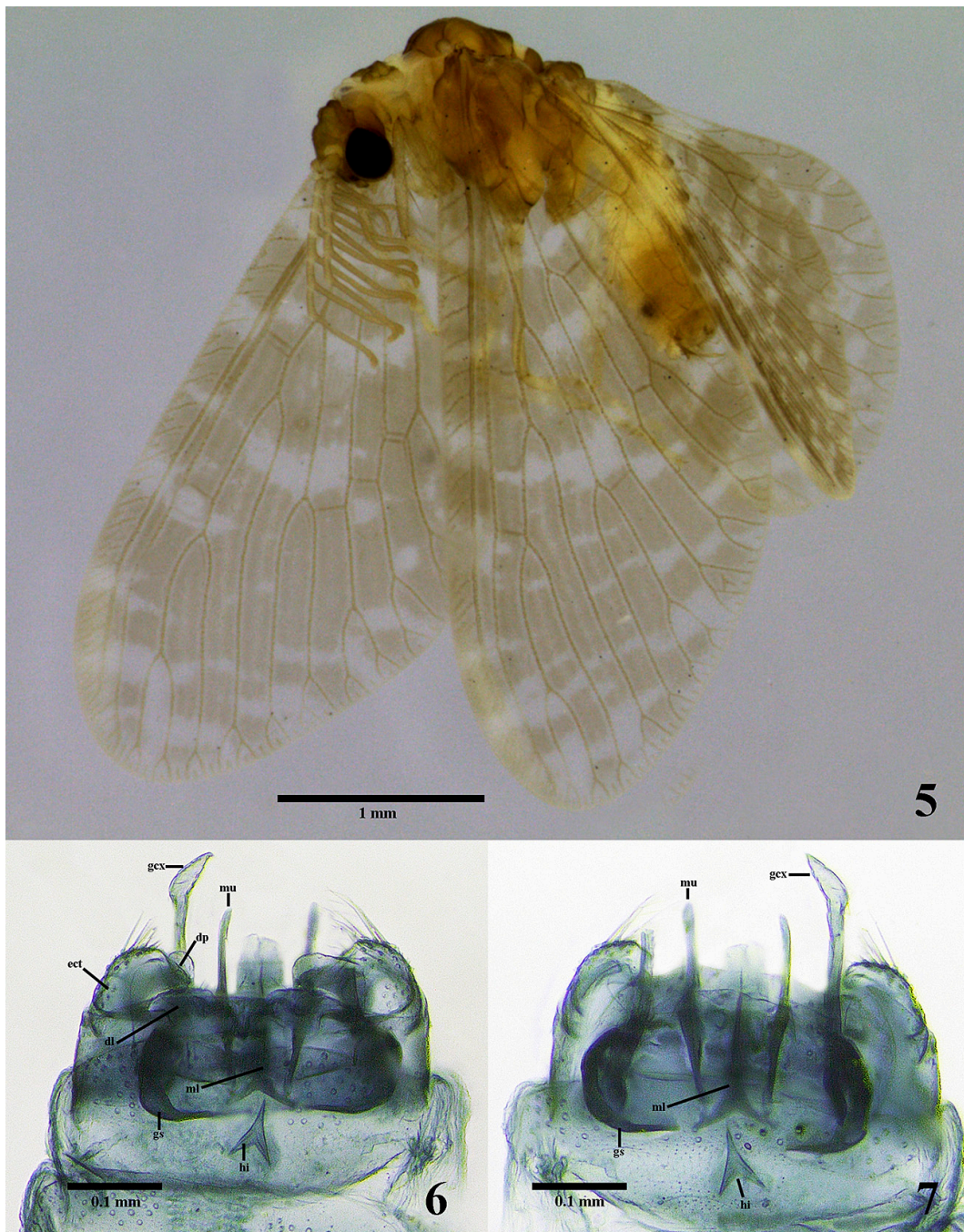
Observations were made under magnification using a stereomicroscope (Leica MZ9.5, Leica Microsystems, Switzerland) and optical microscope (Leica DM500, Leica, China). The color images were obtained with a digital camera (Leica DFC295, Leica, Germany) attached to a stereomicroscope (Leica M205C APO, Leica, Singapore) as well as to a DM500 microscope. Serial images from different layers were combined with Helicon Focus software (v. 5.3) and figures were prepared using Adobe Photoshop software (v. 11.0).

The genitalia were hot-macerated in a 10% KOH solution for about 15 min and subsequently immersed, for 1 h, in a 10% C<sub>2</sub>H<sub>4</sub>O<sub>2</sub> solution for neutralization. The structures of genitalia were stored in glycerin in glass microvials



**Figures 2–4.** Male of *Nallachius adamsi* Penny, 1981 (Neuroptera, Dilaridae). **2.** Habitus, dorsal view. **3.** Abdominal apex, dorsal view. **4.** Abdominal apex, ventral view. Abbreviations: dl = dorsal lobe of ectoproct; dp = digitiform process of ectoproct; ect = ectoproct; gs = gonarcus; gcx = gonocoxite; hi = hypandrium internum; ml = median lobe; mu = mediuncus.





**Figures 5–7.** *Nallachius dicolor* Adams, 1970 (Neuroptera, Dilaridae). **5.** Habitus, lateral view, **6.** Abdominal apex, dorsal view. **7.** Abdominal apex, ventral view. Abbreviations: dl = dorsal lobe of ectoproct; dp = digitiform process of ectoproct; ect = ectoproct; gs = gonarcus; gcx = gonocoxite; hi = hypandrium internum; ml = median lobe; mu = mediuncus.

attached in the same pin of the respective specimens.

The voucher specimens, 1 male of *N. adamsi*, 2 males of *N. dicolor*, and 1 male of *N. phantomellus* (LRRP #862-865) examined in this study were deposited in the Entomological Collection of the Laboratório de Sistemática e Bioecologia de Parasitoides e Predadores (LRRP), of the APTA Centro Leste (Ribeirão Preto, SP, Brazil). The collections were done under SISBIO license 16473-1.

The identifications of the *Nallachius* species were made using the keys of Adams (1970) and Machado and Rafael (2010).

## Results

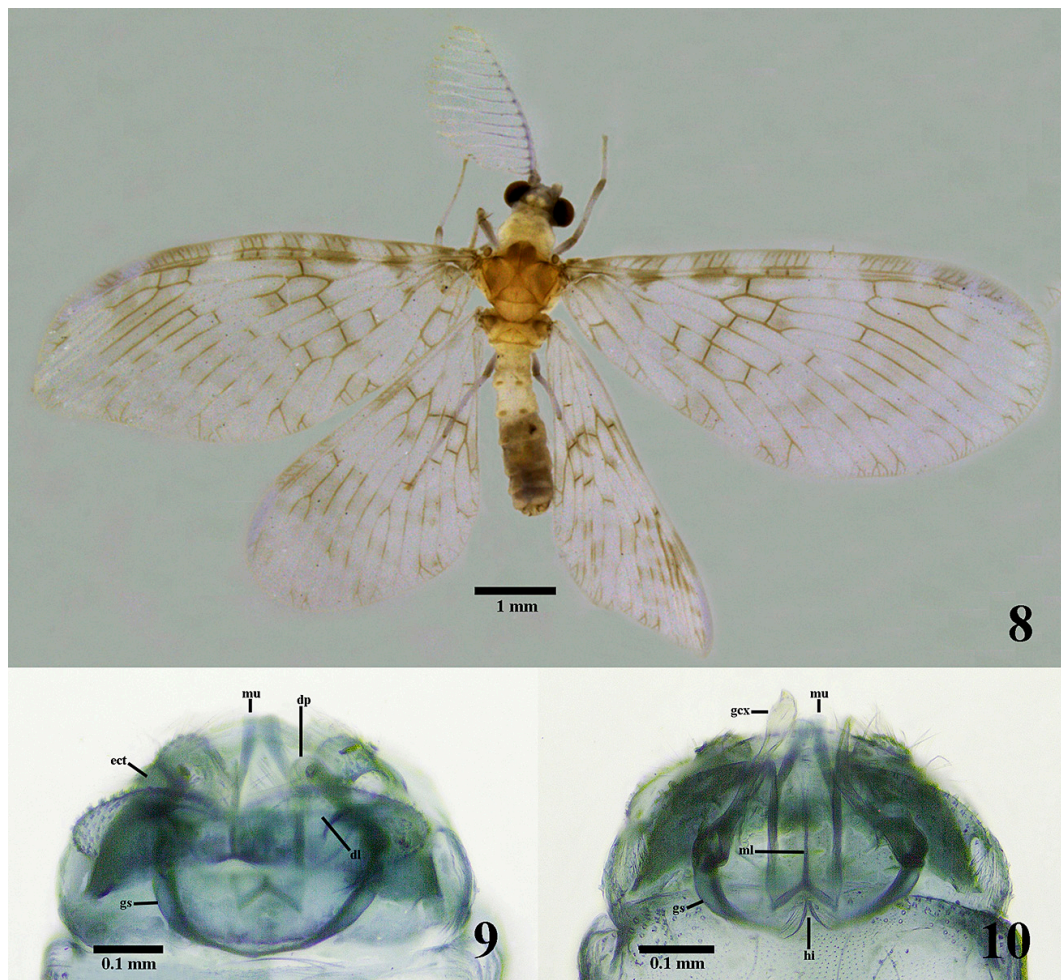
### *Nallachius adamsi* Penny, 1981

Figures 2–4, 11

**Material examined.** 1 male, Brasil, SP, Luís Antônio, Estação Ecológica de Jataí, 21°36'47" S, 047°49'04" W, mata ciliar, ligh trap, 30/IX/2009, RIR Lara and team, legs., LRRP #862.

The specimen of *N. adamsi* was recognized by the combination of the following morphological characteristics: forewing with RS vein 4 branched, most of costal cross-





**Figures 8–10.** *Nallachius phantomellus* Adams, 1970 (Neuroptera, Dilaridae). **8.** Habitus, dorsal view. **9.** Abdominal apex, dorsal view. **10.** Abdominal apex, ventral view. Abbreviations: dl = dorsal lobe of ectoproct; dp = digitiform process of ectoproct; ect = ectoproct; gs = gonarcus; gcx = gonocoxite; hi = hypandrium internum; ml = median lobe; mu = mediuncus.

veins unforked and, MP2 and CuA veins fused; ectoproct with dorsal lobes long, narrow, with rounded tip and digitiform process well developed, tapering to acute point; gonocoxites long, stoutly pointed with longitudinal groove and subapical notch; mediuncus lobes basally complexly curved, closely approximated and acutely pointed (Penny 1981, Machado and Rafael 2010).

*Nallachius dicolor* Adams, 1970

Figures 5–7, 11

**Material examined.** 1 male, Brasil, SP, Luís Antônio, Estação Ecológica de Jataí, 21°36'47" S, 047°49'04" W, mata ciliar, lighth trap, 3/IX/2008, RIR Lara and team, legs., LRRP #863; 1 male, same data except 11/XI/2009, LRRP #864.

Specimens of *N. dicolor* were recognized by the pale labrum; forewing with RS vein 4 branched, most of costal crossveins unforked and, MP2 and CuA veins not fused; ectoproct with dorsal lobes approximated on midline, digitiform lobe with stout hook protruding near apex; gonocoxites lancet-shaped, curved outward; mediuncus lobes slender-ligulate apically and, median lobe wide

basally, apex simple, only membrane bilobed, projecting beyond lateral processes of mediuncus lobes (Adams 1970, Penny 1981, Machado and Rafael 2010).

*Nallachius phantomellus* Adams, 1970

Figures 8–11

**Material examined.** 1 male, Brasil, SP, Luís Antônio, Estação Ecológica de Jataí, 21°36'47" S, 047°49'04" W, mata ciliar, lighth trap, 19/VIII/2009, RIR Lara and team, legs., LRRP #865.

*Nallachius phantomellus* was recognized by the pale labrum; forewing with RS vein 5 branched, most of costal crossveins unforked and, MP2 and CuA veins not fused; ectoproct with dorsal lobes approximated on midline, digitiform process cylindrical, bearing a slender hook on medial surface; gonocoxites shorter than in *N. dicolor*, lateral edge angulate so that shape resembles a scimitar, with tip bent dorsally; mediuncus lobes short, spatulate, hardly bent ventrad, lateral projections rounded and median lobe ends at level of these lateral projections (Adams 1970, Machado and Rafael 2010).



**Figure 11.** Map of South America showing the previously known records (black) and the new records (red) of *Nallachius adamsi* Penny, 1981, *Nallachius dicolor* Adams, 1970 and *Nallachius phantomellus* Adams, 1970 (Neuroptera, Dilaridae).

Discussion

In this paper, we document a new distributional record, which extends the geographic range of *N. adamsi* to São Paulo state, about 2400 km southeast from the type locality at Manaus, Amazonas state, Brazil (Penny 1981; Table 1).

The geographic range of *N. dicolor* is likewise extended to São Paulo state. From the other previously known occurrences, all in Brazil, the new record is about 800 km northeast from the type locality at Nova Teutonia, Santa Catarina state, about 1800 km southwest from Jatobá, Pernambuco state, about 900 km southwest from Berizal, Minas Gerais state, and about 400 km southeast from Caldas Novas, Goiás state (Adams 1970, Penny 1981, Machado and Rafael 2010, Martins and Araújo 2016; Table 1).

*Nallachius phantomellus* was known only from the type locality at the Rio Caragualá (probably a misinterpretation of Rio Caraguatá, Bataguassu municipality), Mato Grosso do Sul state, and Orellana province, Ecuador (Adams 1970, Bowles et al. 2015). We extend to São

Paulo state the geographical range of this species with our new record, which is about 400 km southeast from the type locality and 4000 km southeast from Orellana province (Table 1).

The emergence of the Dilaridae seems to be during the summer, and in the southern hemisphere, the all records were made between October and January except for one each in September and March (Adams 1970; Table 1).

During our 2 years of sampling in the study area only 4 specimens of the 3 species were collected with light traps. Although we sampled at the same time with 2 Malaise traps and collected other families of neuropterans, no Dilaridae were collected. This corroborates the statements of Oswald (1998) and Monserrat (2014) that Dilaridae are typically nocturnal, rarely seen in the field, and thus underrepresented in collections.

This note reveals the incipient nature of the knowledge about the Dilaridae and demonstrates the need of further collection effort to get a better representation of this family in Brazil.

Acknowledgements

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Authors’ Contributions

RIRL collected the examined exemplars and identified the specimens. Both NWP and RIRL wrote the text.

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**Table 1.** Species of *Nallachius* Navás, 1909 (Neuroptera, Dilaridae) obtained at the Estação Ecológica de Jataí, in Luís Antônio, São Paulo state, Brazil and known geographic distribution in the Americas and months of collection.

<i>Nallachius</i> species	Type locality	Distribution	Months of collection	References
<i>N. adamsi</i> Penny, 1981	Brazil, AM, Reserva Duke	Brazil (AM, SP*)	May, July, Sept.*, Dec.	Penny 1981, Machado and Rafael 2010, this study
<i>N. dicolor</i> Adams, 1970	Brazil, SC, Nova Teutônia	Brazil (PE, GO, MG, SP*, SC)	March, Sept.* to Jan., Nov.*	Adams 1970, Machado and Rafael 2010, Martins and Araújo 2016, this study
<i>N. phantomellus</i> Adams, 1970	Brazil, MS, Rio Caraguatá	Ecuador; Brazil (MS, SP*)	March, July, Aug.*	Adams 1970, Bowles et al. 2015, this study

\* New records; AM = Amazonas, GO = Goiás, MG = Minas Gerais, MS = Mato Grosso do Sul, PE = Pernambuco; SC = Santa Catarina, SP = São Paulo.

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