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Article in *Zootaxa* · April 2017

DOI: 10.11646/zootaxa.4250.4.4

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Description of the male of *Phoebe ornator* (Tippmann, 1960) (Coleoptera: Cerambycidae: Lamiinae: Hemilophini), analysis of the species biogeography, and first observation of chromatic gender dimorphism in Hemilophini

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Abstract

The male of *Phoebe ornator* (Tippmann, 1960) is described. Chromatic gender dimorphism is also reported for the first time in the Hemilophini. In addition, new records are presented for *P. ornator* for the Brazilian states of Amazonas, Mato Grosso, Rondônia and São Paulo, and the Bolivian department of La Paz. The biogeography of *P. ornator* is analyzed.

Kew words: Bolivia, Brazil, longhorned beetle, MaxEnt, Neotropical region, taxonomy

Introduction

The Neotropical longhorned beetle genus *Phoebe* Audinet-Serville, 1835, has been reviewed by Martins & Galileo (2014), and, including two subsequently described taxa (Galileo 2015), currently contains 18 species. Males of several *Phoebe* species justify the name “longhorned beetle” in two ways. Besides having very long antennae, they are also among the few longhorned beetles that bear a pair of cephalic horns. Apart from this exceptional feature, many species of *Phoebe* are dorsally covered, excepting certain restricted black areas, with dense white pubescence and, in our opinion, belong to the most aesthetically beautiful group of the longhorned beetles. Chromatic gender dimorphism, which has been rarely observed in longhorned beetles, has not been described from the Hemilophini. *Phoebe ornator* (Tippmann, 1960) has been found in the Bolivian departments of Tarija (Perger & Guerra 2013), Cochabamba and Santa Cruz, and from the Brazilian state of Goiás (Martins & Galileo 1993). The closest Bolivian (Buena Vista) and Brazilian (Leopoldo Bulhões) records are separated by a distributional gap of over 1,600 km. The biogeographical affinities of this species and the reason for this disconnected distribution have not been analyzed to date.

According to the key to *Phoebe* by Martins & Galileo (1998), *P. ornator* is distinguished from congeners by an elytral apex with spicules at the outer angle and dorsal side of the elytra with white pubescence and black maculae or bands. Martins & Galileo (2014) provided a more detailed description of the distribution of the pubescence and colour of *P. ornator*—pronotum covered with white pubescence and five black rounded maculae, black epipleura, and elytra covered with white pubescence and seven black maculae: (1) at the sides of the scutellum; (2) on the anterior fifth fused with the carina and away from the suture; (3) on the anterior third; (4) on the middle fused with the carina and away from the suture; (5) on the middle, elongated, sutural; (6) on the distal third fused with the carina and away from the suture; and (7) occupying the apices. However, the literature refers exclusively to the description of female specimens. Even the male cited by Martins and Galileo (1993), which is according to the authors deposited in the ACMT, most likely refers to a female as there is no male in this collection (James E. Wappes, personal communication).

In this contribution, the male of *P. ornator* is described for the first time. Furthermore, biogeographic affinities of this species are discussed and chromatic gender dimorphism is reported for the first time in the Hemilophini.

Material and methods

Biogeography. To analyze the biogeography of *P. ornator*, distributional records without coordinates were approximated to locations via the gazetteers GeoLocator (<http://tools.freeseide.sk/geolocator/geolocator.html>) and GeoNames (<http://www.geonames.org/>). The coordinates and a shapefile of the biogeographical regionalization by Olson *et al.* (2001) were visualized using the geographic information system, QGIS (version 2.14.3, <http://www.qgis.org/en/site/>).

Abiotic variables and potential distribution range. In order to estimate the effect of environmental variables on the distribution of *P. ornator*, and to predict the potential geographical range of this species, the known locations of *P. ornator* were related to the environmental characteristics of the reported locations by creating a MaxEnt model. MaxEnt estimates the likelihood of specific environmental conditions being suitable for the target species and has been widely used in ecological and biogeographical studies (Elith *et al.* 2011). A detailed explanation of how the method applies to species distribution modelling is available in Elith *et al.* (2011). MaxEnt version 3.06 (<http://www.cs.princeton.edu/~schapire/maxent/>) was employed with the default parameters of Phillips *et al.* (2006). Nineteen bioclimatic variables at a spatial resolution of 2.5 arcmin (Hijmans *et al.* 2005; available at <http://www.worldclim.org>) were used as predictors. All variables were clipped to include South America at a resolution of approximately 1x1 km² grid cells. The model was not cross-validated because of the small sample size. The area under the curve (AUC) from the receiver operating curve plot was used as a measure of the model's overall performance (see Pearce & Ferrier 2000, but also Lobo *et al.* 2008). The AUC has values usually ranging from 0.5 (random) to 1.0 (perfect discrimination) (Pearce & Ferrier 2000). Model results were processed and visualized with QGIS.

Photographs of pinned specimens were taken with a Canon EOS Rebel T3i DSLR camera, Canon MP-E 65mm f/2.8 1–5X macro lens, controlled by Zerene Stacker AutoMontage software. Measurements were taken in “mm” with a micrometer ocular Hensoldt/Wetzlar - Mess 10 in a Leica MZ6 stereomicroscope, which was also utilized in the study of the specimens.

A photograph of the holotype female of *Phoebe ornator* is available in Lingafelter *et al.* (2016). Full references to *P. ornator* are available in Monné (2016).

The collection acronyms used in this study are as follows:

ACMT	American Coleoptera Museum, San Antonio, Texas, USA.
CBF	Colección Boliviana de Fauna, La Paz, Bolivia.
MNRJ	Museu Nacional, Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil
MZSP	Museu de Zoologia, Universidade de São Paulo, São Paulo, Brazil.

Following museum specimens of *Phoebe ornator* were examined:

BOLIVIA, *Cochabamba*: Yungas del Palmar, 1 ♀, X.1949, H. Zellibor col. (MNRJ); *La Paz*: Caranavi, 1300 m a.s.l., 1 ♀, XII.2007, S. Le Tirant col. (**new department record**). *Tarija*: Salinas valley (21°45'26S / 64°12'49W), 1 ♀, I.2012, R. Perger & F. Guerra col. (CBF); 1 ♂, same data, I.2015 (MZSP). *Santa Cruz*: 1 ♀, La Guardia (17°52'59"S / 63°19'04"W), 480 m a.s.l., Chiquitano forest, 4.XII.2016, beating tray, R. Perger col. (CBF); 1 ♀, Potrerillo del Guenda (ACMT).

BRAZIL, *Amazonas*: Tabatinga, 2 ♀, IX.1984, B. Silva col. (MNRJ) (**new state record**). *Goiás*: Campinas (currently part of Goiânia), 2 ♂, 1 ♀, XII.1935, R. Spitz col. (MZSP); Leopoldo Bulhões, 1 ♂, XII.1933, R. Spitz col. (MZSP); 1 ♂, III.1930, R. Spitz col. (MZSP); 2 ♂, XI.1931, R. Spitz col. (MZSP). *Mato Grosso*: Barra do Bugres, 1 ♀, XI. 1983, Silva, Becker & Roppa col. (MNRJ); Sinop (12°31S / 55°37W), 350 m. a.s.l., 3 ♀, X. 1974, Alvarenga & Roppa col. (MNRJ); Vera (12°16S / 55°36W), 350 m. a.s.l., 1 ♀, X.1973, Alvarenga & Roppa col. (MNRJ) (**new state record**). *Rondonia*: Vilhena, 1 ♀, XI.1973, Alvarenga & Roppa col. (MNRJ); Forte Príncipe da Beira, 1 ♀, 10.XI.1961, F.M. Oliveira col. (MNRJ) (**new state record**). *São Paulo*: Luís Antônio (Estação Ecológica de Jataí; 21°36'47S / 47°43'43W), 1 ♀, XII.2007, Lara & Perioto col. (MZSP); 1 ♀, XII.2008, Lara & Perioto col. (MZSP); 3 ♀, X.2009, Lara & Perioto col. (MZSP).

Results

Taxonomy

Phoebe ornator (Tippmann, 1960)

(Figs. 1–6)

Adesmus ornator Tippmann, 1960: 204.

Phoebe ornator Martins & Galileo 1993: 113 (comb. nov.); Monné, 2016: 773.

Description. Male. Head from brown to dark brown, except for reddish-brown ventral side. Mouthparts yellowish. Scape, pedicel and antennomeres III–IV from orange-brown to reddish brown; antennomeres V–XI dark brown. Prothorax usually dark brown, but sometimes lighter, mainly anteriorly on pronotum and ventrally. Mesosternum dark brown. Mesepimera and mesepisterna from light brown to dark brown. Metepisterna and metasternum from reddish brown to brown. Elytra with dorsal side dark brown, usually darker toward apex, but could be brown at base, gradually darker toward apex; sides mostly from reddish brown to brown. Legs yellowish, with part of tarsal claws brownish. Abdominal ventrites I–II usually brown or dark brown; ventrites III–V usually reddish brown (sometimes yellowish brown).

Head. Frons transverse, slightly oblique, and slightly convex with large horns at sides of lower eye lobes near antennal socket, distinctly concave from horns to just after upper-eye lobes. Frons, vertex, area behind eyes and genae (except for glabrous, narrow, apical region) with dense, white pubescence obscuring integument, except for three maculae of yellowish-brown (sometimes brown) pubescence (occasionally not visible based on position of head, or fused), placed close to prothoracic margin, not obscuring integument: one transverse on each side behind upper-eye lobes; another centrally, elliptical, with long, erect, sparse setae on frons. Cephalic horns narrowed toward acute apex, obliquely directed upward and not divergent toward sides from base to apex with white, dense pubescence on base and gradually becoming less dense toward apex; length variable, from slightly smaller than width of lower-eye lobe to about 1.5 times width of lower-eye lobe. Ventral side of head mostly glabrous, except for short, moderately sparse setae on submentum. Outer side of mandibles with dense, white pubescence interspersed with long, erect, sparse setae. Distance between upper-eye lobes 0.35 times length of scape; distance between lower-eye lobes in frontal view 0.75 times length of scape. Antennae (based on a single male) 2.8 times elytral length, reaching elytral apex at quarter of antennomere VI; antennal formula (ratio) based on antennomere III: scape = 0.59; pedicel = 0.10; IV = 0.76; V = 0.63; VI = 0.65; VII = 0.61; VIII = 0.59; IX = 0.58; X = 0.57; and XI = 0.61.

Thorax. Prothorax cylindrical and slightly wider than long. Pronotum with dense, white pubescence obscuring integument, except for five subrounded maculae with yellowish-brown pubescence not obscuring integument: one at each side of anterior half; one centrally at basal half; on each side of basal half (almost on lateral side of prothorax). Sides of prothorax with dense, white pubescence obscuring integument except for subcircular macula with yellowish-brown pubescence, not obscuring integument, placed close to anterior margin. Prosternum, prosternal process, most mesosternum and mesosternal process possesses yellowish-brown pubescence that does not obscure integument. Mesepimera, mesepisterna, metepisterna and sides of metasternum with dense, white pubescence obscuring integument; remaining surface of metasternum with yellowish pubescence that does not obscure integument.

Elytra. Dorsal side with dense, white pubescence obscuring integument except for following areas that featured yellowish pubescence (sometimes more brownish) that does not obscure integument (frequently these areas almost disappear because of white pubescence): one subcircular macula close to scutellum; one subcircular macula at basal sixth between suture and lateral carina; one subelliptical maculae near beginning of second quarter, close to suture (occasionally circular but not reaching suture); one subelliptical, usually oblique, macula between suture and lateral carina (sometimes more circular) placed slightly before middle; one elongate, close to suture at middle; one subcircular between suture and lateral carina placed proximal to beginning of distal third, frequently fused with transverse macula that reaches carina and, commonly, almost lateral margin; one transverse from suture to lateral margin near apex. Elytral carina with yellowish pubescence that does not obscure integument (sometimes almost glabrous). Vertical sides of elytra mostly with white, dense pubescence obscuring integument at least partially; narrow area close to margin with yellowish pubescence distinctly not obscuring integument from base to roughly distal quarter (this area wider on basal third). Elytral apex truncate, with short spine at outer angle.

Abdomen. Sides of ventrites I–IV featured white, dense pubescence obscuring integument (sometimes present only on ventrites I–II or ventrites III–IV on distal half or close to apex); remaining surface with yellowish pubescence distinctly not obscuring integument with long, erect, sparse setae.

Dimensions (mm), male. Total length (from apex of cephalic horn to elytral apex), 8.50–10.75; prothoracic length, 1.40–1.95; anterior prothoracic width, 1.60–2.05; basal prothoracic width, 1.50–1.95; humeral width, 2.10–2.70; elytral length, 5.85–7.20.



FIGURES 1–3 *Phoebe ornator* (Tippmann, 1960), dorsal (a) and lateral (b) habitus of males. **4–6**, idem, females; 1, Brazil, Goiás, Campinas (MZSP); 2, Goiás, Vianópolis (MZSP); 3, Salinas, Tarija department, Bolivia (MZSP); 4, Goiás, Campinas (MZSP); 5, Caranavi, La Paz department, Bolivia (MZSP); 6, Potrerillo del Guenda, Santa Cruz department, Bolivia (ACMT).

Intraspecific variability. Regarding females, the pubescence on the head and vertical sides of the elytra was completely brownish black (Figs 4, 5) or, at most, had white pubescence only on the vertex, behind the eyes and on a small area at the distal quarter of the elytra (Fig. 6) (male frons and vertical sides of the elytra always had white setae; Figs 1–3). The colour variability did not demonstrate any geographical pattern, and though there were no females with white pubescence on their head known from Brazil, females with a completely black head were also found in Bolivia (Fig. 5). In terms of males, extension of the elytral maculation varied by a factor of two, and the apical macula was well separated from the elytral borders (Figs. 1a, 3a) or reached the outer elytral border (Fig. 2a).

Chromatic gender dimorphism. All males examined differed from females as commonly observed in Lamiinae via longer antennae and narrower bodies. Nevertheless, the following differences were noted: white pubescence on the male head and vertical sides of the elytra; the maculae with brownish-black setae on the elytra

were smaller than that in females (maculae on pronotum were usually smaller but could have a similar size seen in females). However, the position of the pronotal and elytral maculae were similar in all examined males and females from Bolivia and Brazil (including sympatric males and females from Goiás in Brazil and Tarija in Bolivia), which led us to the conclusion that the examined males and females were con-specific. Despite the gender colour dimorphism, the key to species of *Phoebe* from Martins & Galileo (2014) permitted recognizing *P. ornator* and was determined not needing modification.

Biogeography. Records for seventeen locations could be obtained from the literature and collections (Fig. 7). All records excepting one (Tabatinga, Amazonas state, Brazil) were situated within a hypothetical rectangle of 1200 km in height (between 11.84°S and 22.9°S) and 2200 km in width (between 67.56°W and 47.06°W). Tabatinga is located another 1100 km north of the next northern most location.

According to the biogeographic regionalization of Olson *et al.* (2001), *P. ornator* has been observed in eight ecoregions. Five records of *P. ornator* are situated in the Bolivian Yungas (the forests in Villa Tunari, Buena Vista and Potrerillo del Guenda are considered as sub-Andean Amazon rainforest by Navarro & Ferreira 2011), four in Cerrado, and two in the Mato Grosso seasonal forest and the Chiquitano dry forest, respectively (Table 1, Fig. 7). Single records were obtained for southwest Amazon rainforest (Tabatinga), Madeira-Tapajos forest (Forte Principe da Beira), Alto Parana Atlantic forest (Campinas) and southern Andean Yungas (Salinas) (this forest is considered Bolivian Tucuman forest by Navarro & Ferreira 2011).

TABLE 1. Known records of *Phoebe ornator*, coordinates (decimal degrees), (E) elevation (m a.s.l.), ecoregion and (P) mean annual precipitation; *new ecoregion records; Southern Andean Yungas (Olson *et al.* 2001) are considered Bolivian Tucuman forest by Navarro & Ferreira (2011); the forests in Villa Tunari, Buena Vista and Potrerillo del Guenda are considered as sub-Andean Amazon rainforest by Navarro & Ferreira (2011). ¹Lavado *et al.* 2012; ²Vourlitis *et al.* 2002; ³no data available, data for Sinop (Vourlitis *et al.* 2002), close to Vera; ⁴no data available, data for Costa Marques (Franca 2015), close to Forte Principe da Beira; ⁵SUDAM 1984; ⁶no data available, data for Goiânia (Sousa *et al.* 2010), close to Leopoldo Bulhões; ⁷Landers 2007; ⁸Santos *et al.* 2001; ⁹Martins *et al.* 2011; ¹⁰Gonfiantini *et al.* 2001; ¹¹Abrahamczyk *et al.* 2013; ¹²no data available, because abiotic conditions in mountainous areas often shift rapidly over short distances, no data for close locations is provided; ¹³SENAMHI 2007; ¹⁴CEPAGRI 2010.

Location	Latitude	Longitude	E	Ecoregion	P (mm/yr)
Tabatinga	-4.231	-69.938	77	southwest Amazon rainforest*	1900 ¹
Sinop	-11.864	-55.502	350	Mato Grosso seasonal forest*	2000 ²
Vera	-12.466	-55.348	350	Mato Grosso seasonal forest*	2000 ³
Forte Principe da Beira	-12.428	-64.422	139	Madeira-Tapajos moist*	1300 ⁴
Vilhena	-12.694	-60.098	599	Cerrado	2090 ⁵
Leopoldo Bulhões	-16.581	-48.905	891	Cerrado	1576 ⁶
Vianópolis	-16.852	-48.456	1002	Cerrado	1638 ⁷
Luís Antônio	-21.613	-47.61	705	Cerrado	1536 ⁸
Barra do Bugres	-15.072	-57.181	187	Chiquitano dry forest*	1209 ⁹
Caranavi	-15.836	-67.568	601	Bolivian Yungas	1563 ¹⁰
Villa Tunari	-16.999	-65.413	373	Bolivian Yungas	3710 ¹¹
Yungas de Palmar	-17.133	-65.5	1061	Bolivian Yungas	n.a. ¹²
Buena Vista	-17.457	-63.684	345	Bolivian Yungas	2101 ¹¹
Potreriillo del Guenda	-17.671	-63.457	400	Bolivian Yungas	n.a. ¹²
La Guardia	-17.883	-63.317	480	Chiquitano dry forest*	1085 ¹¹
Salinas	-21.752	-64.212	1208	southern Andean Yungas	1334 ¹³
Campinas	-22.905	-47.060	677	Alto Parana Atlantic forest	1425 ¹⁴

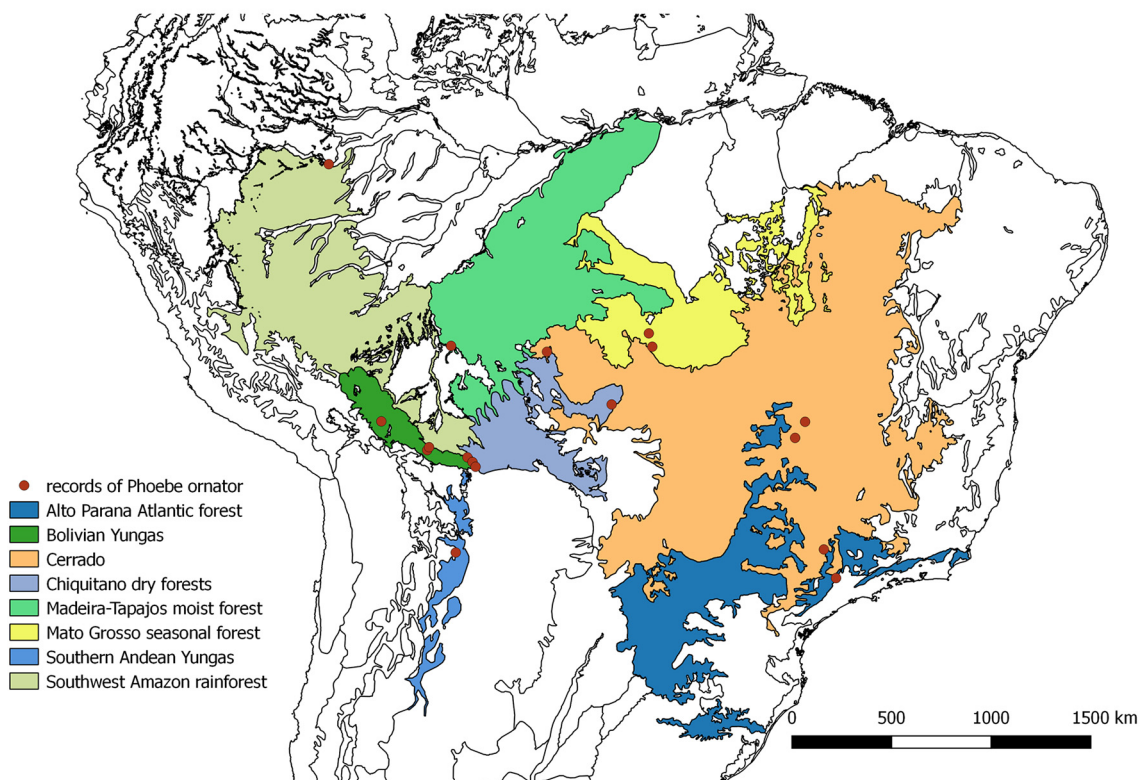


FIGURE 7. Ecoregion distribution of *Phoebe ornator* (Tippmann, 1960) according to the biogeographic regionalization by Olson *et al.* (2001).

The mean annual precipitation of the 15 locations with available data is 1770 mm. The mean annual rainfall of 14 of the 15 locations with available data ranges between 1085 and 2101 mm (Tab. 1); Villa Tunari (Cochabamba department, Bolivia) has a mean annual precipitation of 3710 mm.

Abiotic variables and potential distribution range. According to the MaxEnt model, the most important abiotic variables contributing to the occurrence of the species were the precipitation of the warmest quarter of the year (62%), the temperature annual range (12%) and the isothermality (10%). The AUC (0.930) suggested a high score for model performance.

Areas with actual records and high probability of suitable conditions according to the MaxEnt model were in the ecoregions of the Bolivian Yungas and southwest Amazon rainforest, northwestern Cerrado, Eastern Alto Parana Atlantic forest, Serra do Mar coastal forests and Eastern portions of the Mato Grosso seasonal forest (see Olson *et al.* 2001) (Fig. 8). Conditions typical of those where the species was found were predicted mainly in the southwest Amazon rainforest, Mato Grosso seasonal forest, Cerrado, Alto Parana Atlantic forest, Ucayali moist forest, and, to a certain extent, the Bolivian and Peruvian mountain forests.

Areas without actual records but with suitable conditions for *P. ornator* were predicted in the northwestern Andean montane forests, Western Ecuador forest (both in Ecuador), southern portions of the Peruvian Yungas, and Iquitos varzea/Ucayali moist forest. Low predicted probability of suitable conditions were indicated for Caatinga, Gran Chaco, the northeastern portion of Cerrado, and most of the Amazon rainforests (wide parts of Madeira-Tapajos moist forest, Purus varzea, Tapajos-Xingu moist forest, Xingu-Tocantins-Araguaia moist forest, Tocantins/Pindare moist forest, and forests north of the Amazon River) (Fig. 8).

Discussion

Biogeography. *Phoebe ornator* was previously reported from pre-mountain and mountain forests in Bolivia and Cerrado and the Atlantic forest in Brazil, and is now additionally known from Southwest Amazon rainforest,

Chiquitano, and Mato Grosso seasonal forest (Tab. 1; Fig 7). The MaxEnt model suggests that *P. ornator* has a relatively continuous distribution in the former ecoregions (Fig. 8). *Phoebe ornator* is most likely absent in most Amazon rainforests and drier ecoregions, such as Caatinga, Gran Chaco, the Inter-Andean dry valleys, and Prepuna. The predicted areas with suitable conditions were characterized by a more pronounced dry season with lower temperatures (from July to September) than the Amazon rainforests between $\sim 10^{\circ}\text{N}$ and 10°S , which are distinguished by lower temperature- and precipitation seasonality (see Garcia *et al.* 2010). Nevertheless, the locations in which *P. ornator* has been collected have high rainfall during the peak rainy season from December through February (the warmest quarter of the year) (see Garcia *et al.* 2010), resulting in a higher mean annual precipitation (> 1085 mm, see Tab. 1) than in the Caatinga (500–700mm/yr) and Gran Chaco (400–900 mm/yr).

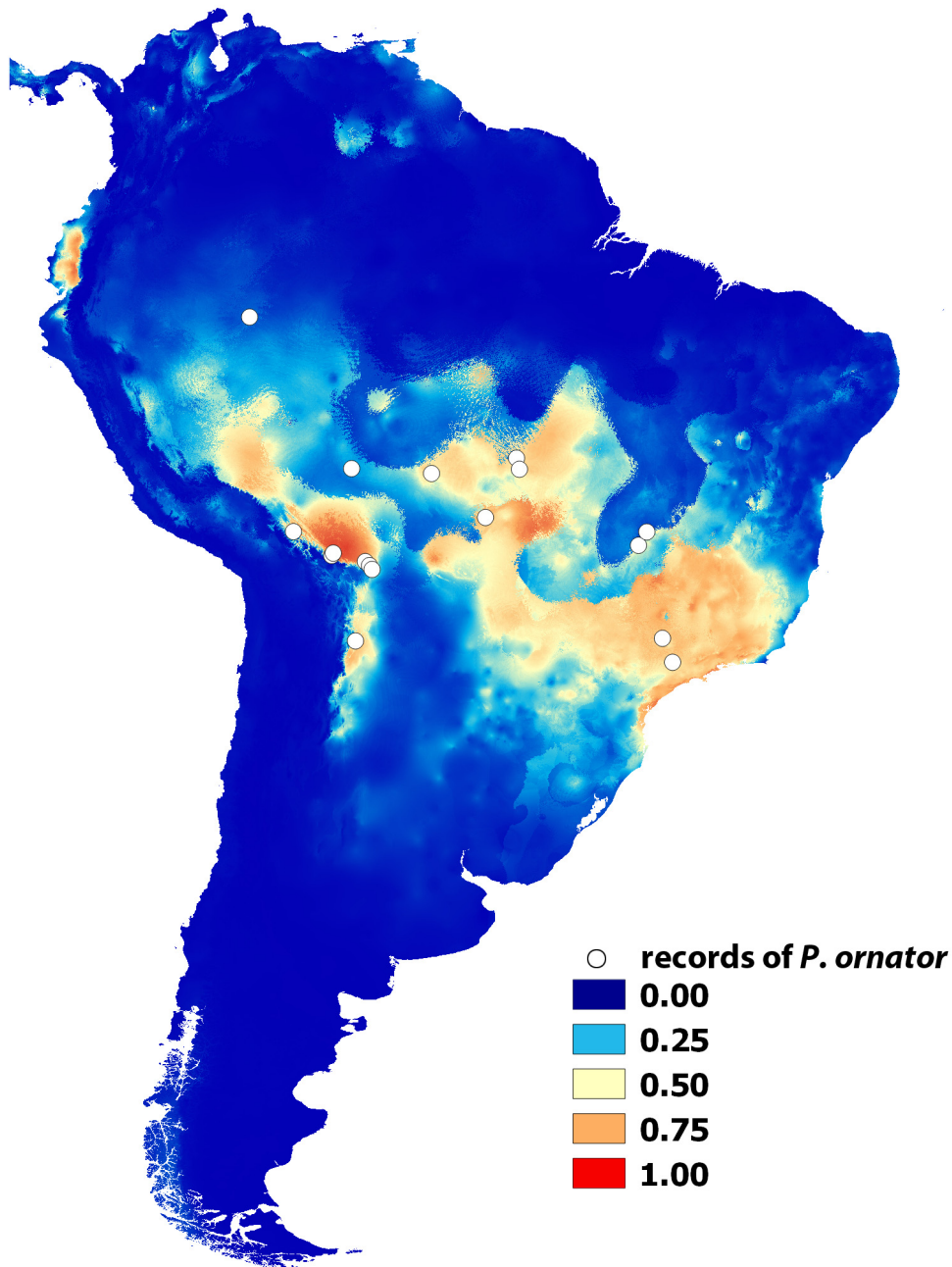


FIGURE 8. Potential distribution of *Phoebe ornator* (Tippmann, 1960) according to MaxEnt. The circles correspond to the totality of the locality data entry used to generate the model. The colour scale indicates the similarity between known and predicted habitats, red and orange represents areas with the highest probability of habitat suitability, beige typical conditions, and blue tones show low probabilities of habitat suitability.

The presence of the species in the northwestern Andean montane forests and western Ecuador forest (both in Ecuador), as predicted by the model (Fig. 8), was questionable as this area is separated from the actual records of *P. ornator* by the Andes. In Ecuador, west of the Andes, no species of *Phoebe* resembling *P. ornator* has been collected to date (see Martins & Galileo 2014). In most Amazon rainforests that have, according to the model, a low probability of suitable conditions, *P. ornator* is probably replaced by the similar *Phoebe bicornis* (Olivier, 1795) (Santa Cruz department, Bolivia; French Guiana; Brazilian states of Amapá, Amazonas, Pará) and *P. goiana* Lane 1966, which occurs from Leopoldo Bulhões (Goiás state) to Caixas (Maranhão state) (see Martins & Galileo 2014 for distribution). The likelihood of finding *P. ornator* in a wider area in the Madeira-Tapajos (Fig. 8) moist forest is unlikely because there is only one record from the southern limit of this forest type (Forte Príncipe da Beira) and the model predicts a low probability of suitable conditions in the wide parts of this ecoregion.

It has to be taken into account that the model may be influenced by inaccurate data as a consequence of a limited number of field stations (see Soria-Auza *et al.* 2010). Furthermore, it is possible that the model's performance is influenced by low sample size as the variability in predictive accuracy decreases with increasing sample size (see Hernandez *et al.* 2006). Wisz *et al.* (2008) suggested that sample sizes of >30 produce robust models, while Stockwell & Peterson (2002) thought that a sample size of >50 was better. Nevertheless, Pearson *et al.* (2006) and Hernandez *et al.* (2006) produced useful models with as few as 5–10 positive observations.

Further sampling is required in order to garner a better understanding of the biogeographic affinities of *P. ornator*. While the absence of *P. ornator* in several locations in Amazon rainforests is relatively well-established (see Monné & Monné 2016 for sampled locations), the lack of data for *P. ornator* in seasonal ecoregions in south Bolivia may be the result of sampling bias, just as was shown for Cerambycidae (Perger & Guerra 2013) and for other beetle groups, as well (see *e.g.*, Perger & Grossi 2013; Perger & Guerra 2016).

Chromatic gender-dimorphism. To the best of our knowledge, this is the first reported case of chromatic gender dimorphism in the Hemilophini and probably in the Lamiinae. Sexual dimorphism in Cerambycidae is usually reflected in relatively longer antennae of the males and a smaller and narrower body with enlarged mandibles (Švácha & Lawrence 2014). Sexual dichromatism is commonly observed in Anacolini Thomson 1860 (Prioninae) and has also been reported from several species of Cerambycinae (*e.g.*, Švácha & Lawrence 2014; Perger 2013) and Lepturinae Latreille, 1804 (*e.g.*, Linsley & Chemsak 1976). The factors selecting for chromatic gender dimorphism in longhorned beetles have not been investigated to date. In Anacolini, it is assumed that one sex may be mimetic, or each possibly mimics a different model (Švácha & Lawrence 2014). The possibility of chromatic gender dimorphism in other Lamiinae taxa might have serious implications for studies in taxonomy or diversity, *e.g.*, in cases where two species are only known from males and females, respectively, and they are potentially both members of a single population with chromatic gender dimorphism.

Acknowledgments

We express our thanks to Juan Pablo Botero (MNRJ) and James E. Wappes (ACMT) for providing information on specimens from their collections. Many thanks are also extended to Dr. Eugenio (Gino) Nearn (Purdue University, Department of Entomology, West Lafayette, IN, U.S.A.) and anonymous reviewers for providing helpful comments and suggestions on an earlier draft of this manuscript.

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