



RESEARCH ARTICLE - ANTS

Pheidole protaxi sp. nov. (Hymenoptera: Formicidae), new species from tabuleiro forests of the Atlantic Forest biome

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Introduction

With more than 1,000 valid species in the world, and many others awaiting description, *Pheidole* Westwood, 1839 (Formicidae: Myrmicinae: Attini) is one of the largest ant genera (Longino, 2009). This genus has a worldwide distribution, and in the New World where more than 600 species were described, it is very abundant in all ecosystem (Wilson, 2003). Its species exhibit a wide range of foraging behaviors, nesting habits, and colony structure (Wilson, 2003). Here we describe a new species of *Pheidole* after the morphology of its minor and major worker from Southern Bahia, Brazil. This was discovered in a remnant fragment of forest belonging to the ecological system known as “Floresta Ombrófila Densa das Terras Baixas” (IBGE, 2012) or “Floresta Pluvial dos Tabuleiros” (Thomas, 2003).

This ecosystem is a variety of the lowland ombrophilous forests from the Central Corridor of Atlantic Forest biome (Thomas, 2003). Locally, it covers large sedimentary plains of the Barreiras formation, being located primarily south of the Rio Jequitinhonha south to the Rio Doce in Espírito

Abstract

Hereafter a new species of *Pheidole* Westwood, 1839 (Hymenoptera: Formicidae) is described from Southern Bahia in Brazil, after the morphology of its minor and major workers. This taxon is easily distinguished from any other congeneric species by a unique combination of characters.

Santo (Thomas, 2003). They are flat formations with deep soils, bearing forests relatively tall (canopy of 40 m), but with some very large trees on flat terrain (Thomas, 2003) and a few vegetal density in undergrowth, facilitating locomotion (IBGE, 2012). The flora is relatively well characterized by ecotypes of the genera *Ficus*, *Alchornea*, *Handroanthus* and ochlospes *Tapirira guianensis* Aubl. (IBGE, 2012), and the Jussara palm *Euterpe edulis* (Thomas, 2003). While the floristical components of the tabuleiro forests are relatively well known, knowledge on the fauna is comparatively very poor, especially about arthropods. Like this, there are still very few published studies on the diversity of ants in these forests. However, several standardized collects made in some remnant fragments in Southern Bahia, revealed a very high taxonomic diversity for the ants of leaf-litter, both at specific and generic level (Lacau *et al.*, in prep.).

In this context, the present description of a new *Pheidole* species contributes to increase the knowledge on the diversity of ants in this ecosystem. This paper is a partial integrative result of the research projects “Contribution to the Study of the Ants Fauna in Lowland Ombrophilous Forests from the



Atlantic Forest Biome” and “Hyperdiversity of the genus *Pheidole* Westwood (Hymenoptera: Formicidae) in Bahia: emphasis on the Atlantic Forest” (MCT/CNPq/DGP/GEBAN), and “*A biossistemática aplicada ao estudo das formigas (Hymenoptera: Formicidae) como instrumento de formação e capacitação em taxonomia integrativa*” (UESC/PPG-ZOO & MCT/CNPq and MEC/CAPES, Edital nº 52/2010 – PROTAX).

Material and Methods

Field work was performed in November 2011, collecting manually the specimens using a pooter, featherweight forceps and a fine brush. All specimens were caught in a single nest.

Morphological examination of specimens was completed at various magnifications using a light stereomicroscope Olympus SZX7.

Morphological data were compared between species by using the bioinformatics software Xper³ ©LIS (<http://www.xper3.fr/>).

Morphometric measures were made with a Carl Zeiss measuring microscope and recorded to the nearest 0.01 mm. All measurements are given in millimeters, using the following definitions and abbreviations:

EL eye length: the maximum diameter of the eye.

GL gaster length: the length of the gaster in lateral view from the anteriormost point of first gastral segment (third abdominal segment) to the posterior most point.

HL head length: maximum distance from the mid-point of the anterior clypeal margin to the mid-point of the posterior margin of the head, measured in full-face view.

HLA1 anterior head length: in full-face view, perpendicular distance between two horizontal lines, one tangent to anteriormost projection of clypeus, one tangent to lowermost margin of compound eye.

HLA2 anterior head length: in full-face view, perpendicular distance between two horizontal lines, one tangent to anteriormost projection of cephalic capsule (excluding the anterior margin of clypeus), one tangent to lowermost margin of compound eye.

HLP depth concavity vertexal median: in full-face view, perpendicular distance between two horizontal lines, one tangent to dorsalmost of vertexal lobes projection, and other passing by line from vertexal to bottom of groove.

HW head width: the maximum width of the head in full face view.

HWT width of head in height of torulus: measured in full-face view, the distance between the side edges of the head, the height of an imaginary line that passes through the torulus.

MDL mandible length: length of a mandible measured in ventral view from its basal articulation to its apex.

MFL metafemur length: maximum length of metafemur, measured from the junction with the trochanter to the junction with the tibia.

PPH postpetiole height: maximum height of postpetiole, measured in lateral view.

PPL postpetiole length: the maximum length of postpetiole, in lateral view.

PPW postpetiole width: maximum width of postpetiole, measured in dorsal view.

PSL propodeal spine length: maximum length of propodeal spines, measured in lateral view of the same

PTH petiolar node height: maximum height of petiolar node measured in lateral view.

PTL petiole length: the maximum length of the petiole in lateral view.

PTW petiolar node width: maximum petiolar node width, measured in dorsal view.

PW pronotal width: maximum width of pronotum measured in dorsal view.

SL scape length: maximum scape length, excluding basal condyle and neck.

SPL propodeal spiracle width: measured from the outer edge of ring that surrounds orifice.

WH mesosoma height: Distance between the inner base pro-thigh and the top edge of the dorsal prothorax.

WL weber's length: diagonal length, measured in lateral view, from the anterior margin of the pronotum (excluding the collar) to the posterior extremity of the metapleural lobe.

The data for holotype are given in [brackets]; for the paratypes, the means with standard deviations are given in (parenthesis) and the maximum range observed are in { }.

When available, direct comparisons with the morphology of other *Pheidole* species were made through study of high-resolution microphotographs of type and non-type specimens in the following Websites: Ants of Costa Rica (<http://academic.evergreen.edu/projects/ants/genera/PHEIDOLE/Specieslist.html>), AntWeb <http://www.antweb.org/description.do?name=pheidole&rank=genus>), MCZ (<http://140.247.119.225/mcz/recordlist.php>), Smithsonian (<http://ripley.si.edu/ent/nmnhtypedb/public/search.cfm>).

Standard microphotographs were made using the following sequential process: the specimen was first filmed using a video camera (Sony FullHD1080 AVCHD, 10.2Mp) mounted on a light microscope (Zeiss Jena), while the resolution was continuously scanned from the top to the bottom of the holotype specimen; the videos (in format “.mts”) were processed using the free software ImageGrab 5.0 (available at <http://paul.glagla.free.fr/imagegrab.htm>) in order to extract the sharpest images referable to differing focal points, and composite pictures were then assembled using the free software Combine ZM (available at <http://www.hadleyweb.pwp.blueyonder.co.uk/index.htm>). Finally, each optimum microphotograph was improved using Adobe Element Photoshop software (version 6.0).

Depending of the morphological structure considered, morphological concepts and terminology in this paper follow Richards (1956), Eady (1968), Harris (1979), Gauld and Bolton (1988), Goulet and Huber (1993), Kugler (1994), Bolton (1994), Eguchi (2008), Wilson (2003) and Keller (2011).

Taxonomical nomenclature follows Bolton et al. (2014). Because of the messy state of the internal taxonomy for

the Neotropical species of *Pheidole* after that Moreau et al. (2008) showed that nine of the 19 species groups suggested by Wilson (2003) are not monophyletic, no attempt will be done in this paper for classifying the new species here described in any species-group.

Taxonomic information and specimens were managed by using the bioinformatics software Mantis® Version 2.0 (<http://140.247.119.138/mantis/>) (Naskrecki, 2008). Holotype and all paratypes associated with the new species described here have unique specimen-level identifiers affixed to each pin, being written in the text as: “[LBSA_SA_specimen codes]”.

Depository collections are referred to by the following acronyms: **CPDC**, Centro de Pesquisas do Cacau, Comissão Executiva do Plano de Lavoura Cacaueira (CEPLAC), Itabuna-BA, Brazil; **INPA**, Instituto Nacional de Pesquisas da Amazonia, Manaus-AM, Brazil; **MCZ**, Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, USA; **MNHN**, Muséum National d’Histoire Naturelle, Paris, France; **MPEG**, Museu Paraense Emilio Goeldi, Belém, Pará, Brazil; **MZSP**, Museu de Zoologia da Universidade de São Paulo, Brazil.

Results

Class: Insecta

Order: Hymenoptera

Family: Formicidae Latreille, 1809

Subfamily: Myrmicinae Lepeletier de Saint-Fargeau, 1835

Tribe: Attini Smith, 1858

Genus *Pheidole* Westwood, 1839

Pheidole protaxi Oliveira and Lacau, new species (Figs 1-3)

<http://zoobank.org/NomenclaturalActs/72A06898-0CAF-4211-8228-39E918B888CA>

0CAF-4211-8228-39E918B888CA

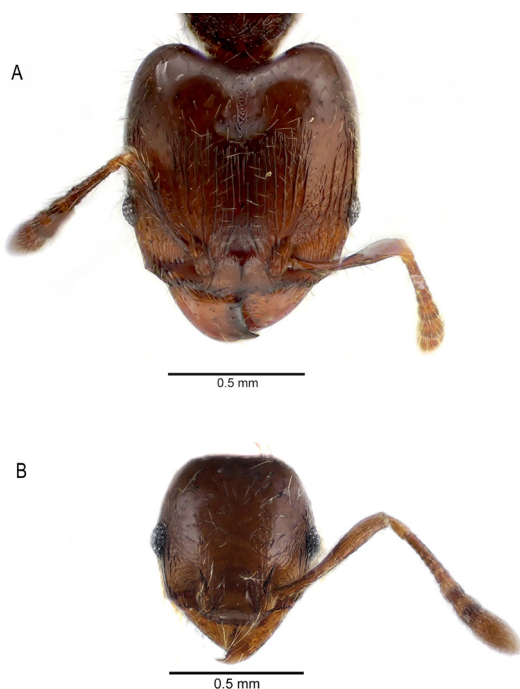


Fig 1. *Pheidole protaxi* sp. nov., head: full-face view. A: holotype major worker, [LBSA_SA_14013667]. B: paratype minor worker, [LBSA_SA_14012040].

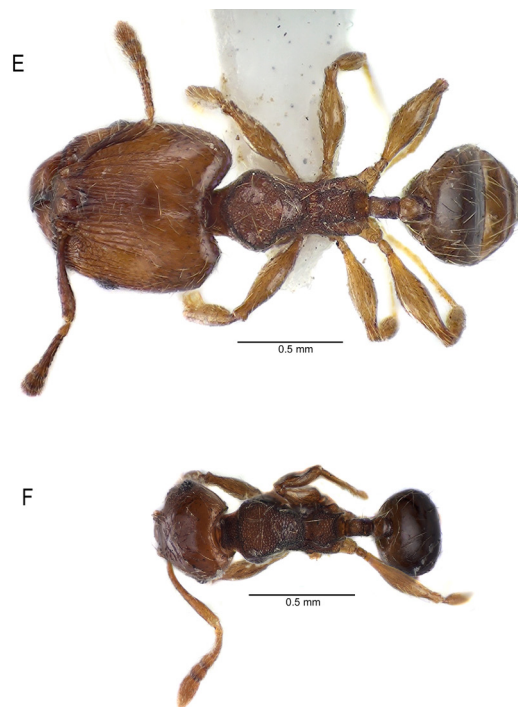


Fig 2. *Pheidole protaxi* sp. nov., habitus: left lateral view. C: holotype major worker, [LBSA_SA_14013667]. D: paratype minor worker, [LBSA_SA_14012040].

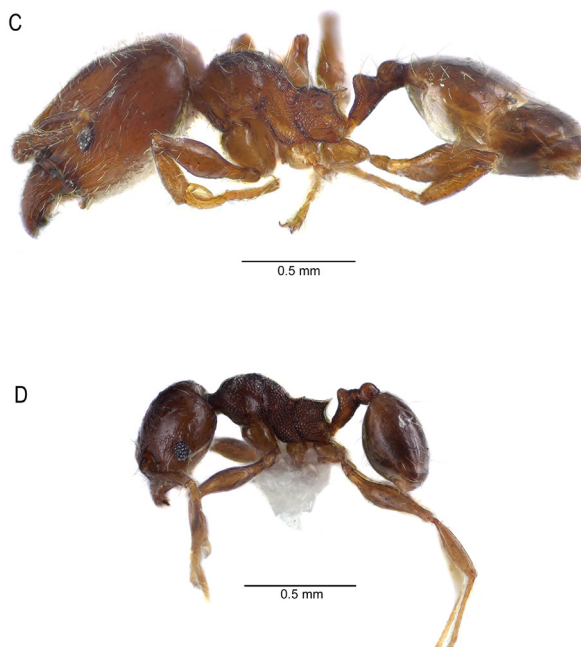


Fig 3. *Pheidole protaxi* sp. nov., habitus: dorsal view. E: holotype major worker, [LBSA_SA_14013667]. F: paratype minor worker, [LBSA_SA_14012040].

Type material: Holotype (Major worker, CPDC: [LBSA_SA_14013667]): Brasil, Bahia, Porto Seguro, CEPLAC/CEPEC/Estação Ecológica do Pau Brasil (ESPAB) (16°23'50''S, 39°10'28''W), elev. 101 m, 5-6.11.2011, col. M.L. Oliveira, Y.A.M. Velasco, & B.J.B. Jahyny. **Paratypes**: 6 major workers and 7 minor workers with the same data as holotype (one major worker and two minor workers deposited in CPDC:

[LBSA_SA_14014469; LBSA_SA_14012040; LBSA_SA_14014463], one major worker and one minor worker in INPA: [LBSA_SA_14014470; LBSA_SA_14014464], MCZ: [LBSA_SA_14014471; LBSA_SA_14014465], MNHN: [LBSA_SA_14014472; LBSA_SA_14014466], MPEG: [LBSA_SA_14014473; LBSA_SA_14014467] and MZSP: [LBSA_SA_14014474; LBSA_SA_14014468].

Etymology. The name of this new taxon, “*protaxi*”, is a latinization of the “PROTAX” name, Brazilian acronym for “Programa de capacitação em taxonomia”, meaning: program of capacitation in taxonomy”.

Diagnosis. The minor and major workers of this new species exhibit all the diagnostic characters of the genus *Pheidole*. It differs from all other known species by the unique following combination of characters. MAJOR WORKER – Head in dorsal view: with a quadrate shape, as long as wide; vertexal margin deeply and widely concave. Frontal carinae short and straight, posteriorly diverging, their tips reaching the imaginary transversal line crossing anterior edge of eyes. Head in ventral view: submedian teeth of hypostomal carina with triangular shape, slightly blunt and strongly divergent. Head in lateral view: median part of vertex with sub-rectilinear outline, slightly convex. Antennae with 12 segments; scape relatively short, its tip not reaching the mid-point between posterior edge of eye and vertexal corner. Mesosoma in dorsal view: with pronotum and mesonotum completely fused, the lateral margins with outline drawing a losange. Mesosoma in lateral view: pronotum and mesonotum completely fused, the dorsal face with outline forming a single convexity. Pronotum in posterior view: dorsal face with outline slightly convex; lateral faces with outline strongly concave. Propodeum in lateral view: spines relatively short, postero-laterally directed. Postpetiole (3rd abdominal segment) in dorsal view: slightly wider than petiole (2nd abdominal segment). First gastral segment (fourth abdominal segment) in dorsal view: anterior margin with outline convex. Vertex almost entirely smooth and shining, except the median longitudinal sulcus with areolate microrugulae (no other sculpturing types). Clypeus with a short longitudinal carina between midpoint of posterior edge and its anterior third; median and lateral parts separated by two symmetrical pairs of straight carinae, diverging anteriorly. Mesosoma almost entirely sculptured with areolate microrugulae, except median part of its dorsal face, posterior part of the lateral faces of pronotum, and median part of katapisternum that are smooth and shining. Antero-dorsal part of pronotum with fine transversal rugulae. Petiole wholly sculptured with areolate microrugulae. Postpetiole nearly all sculptured with areolate microrugulae, except its dorsal face. MINOR WORKER - Head in dorsal view: frontal carinae short and straight, posteriorly diverging, their tips reaching the imaginary transversal line crossing anterior edge of eyes. Head in postero-lateral view: occipital carina present but discrete. Antennae with 12 segments; scape reaching, but not exceeding, posterior margin of head. Mesosoma in dorsal view: pronotal humerus developed

as blunt tubercles. Mesosoma in lateral view: pronotum and mesonotum completely fused, the dorsal face with outline forming a single convexity. Propodeum in lateral view: spines relatively short, postero-laterally directed. Postpetiole (3rd abdominal segment) in dorsal view: same width as petiole (2nd abdominal segment). First gastral segment (fourth abdominal segment) in dorsal view: anterior margin with subrectilinear outline, slightly concave. Head almost entirely smooth and shining, except some rugae and areolate microrugulae on the dorsal part of preocular genae. Mesosoma almost entirely sculptured with areolate microrugulae, except a small circular area smooth and shining on lateral faces of pronotum. Petiole wholly sculptured with areolate microrugulae. Postpetiole entirely smooth and shining.

Measurements. MAJOR WORKERS (n= 7): **EL:** [0,11] (0,12±0,01) {0,11-0,14}, **GL:** [0,78] (0,78±0,13) {0,54-0,92}, **HL:** [0,80] (0,88±0,04) {0,8-0,93}, **HLA1:** [0,22] (0,25±0,02) {0,22-0,28} **HLA2:** [0,16] (0,18±0,02) {0,15-0,21}, **HLP:** [0,07] (0,10±0,02) {0,07-0,12}, **HW:** [0,79] (0,85±0,03) {0,79-0,90}, **HWT:** [0,64] (0,69±0,03) {0,64-0,72}, **MDL:** [0,38] (0,39±0,02) {0,35-0,41}, **MFL:** [0,54] (0,55±0,02) {0,52-0,58}, **PPH:** [0,13] (0,15±0,01) {0,13-0,17}, **PPL:** [0,13] (0,13±0,01) {0,11-0,15}, **PPW:** [0,13] (0,14±0,01) {0,13-0,15}, **PSL:** [0,08] (0,09±0,02) {0,06-0,10}, **PTH:** [0,17] (0,18±0,01) {0,17-0,20}, **PTL:** [0,22] (0,23±0,01) {0,21-0,25}, **PTW:** [0,10] (0,11±0,01) {0,09-0,12}, **PW:** [0,37] (0,40±0,02) {0,37-0,43}, **SL:** [0,42] (0,43±0,03) {0,38-0,47}, **SPL:** [0,05] (0,04±0,01) {0,03-0,05}, **WH:** [0,36] (0,39±0,03) {0,36-0,44}, **WL:** [0,73] (0,73±0,02) {0,70-0,77}. MINOR WORKERS (n= 7): **EL:** (0,09±0,01) {0,09-0,10}, **GL:** (0,48±0,06) {0,40-0,58}, **HL:** (0,48±0,02) {0,44-0,50}, **HLA1:** (0,18±0,01) {0,16-0,19} **HLA2:** (0,11±0,02) {0,08-0,13}, **HW:** (0,46±0,02) {0,44-0,48}, **HWT:** (0,40±0,02) {0,37-0,43}, **MDL:** (0,28±0,01) {0,26-0,30}, **MFL:** (0,43±0,02) {0,40-0,45}, **PPH:** (0,10±0,01) {0,08-0,12}, **PPL:** (0,09±0,01) {0,08-0,10}, **PPW:** (0,10±0,01) {0,09-0,11}, **PSL:** (0,07±0,01) {0,05-0,08}, **PTH:** (0,14±0,01) {0,12-0,15}, **PTL:** (0,19±0,02) {0,16-0,20}, **PTW:** (0,07±0,01) {0,06-0,08}, **PW:** (0,30±0,01) {0,30-0,31}, **SL:** (0,39±0,02) {0,35-0,42}, **SPL:** (0,03±0,00) {0,03-0,04}, **WH:** (0,31±0,02) {0,28-0,34}, **WL:** (0,59±0,02) {0,56-0,62}.

Geographic range. Brazil: Southern Bahia state.

Biology. This species is only known from the type series which specimens were collected in a leaf litter sample of a great primary remnant fragment of tabuleiro forest (more than 7.000 ha). The colony was nesting between leaves, under a small rotten wood.

Discussion

The recent revisionary works of Wilson (2003) and Longino (2009), and the availability on-line of a large number of microphotographs of the type-material for nearly all valid Neotropical *Pheidole* species, have turned easier their identification. Thus, based on all available morphological

information, a comparative study with others congeneric species showed that *Pheidole protaxi* sp. nov. is unique by the whole combination of characters offered in its diagnosis, and, for this, cannot be confused with any other species of the genus.

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