



Systematics, Morphology and Biogeography

A new species and new records of *minuta*-group *Gnamptogenys* from Brazil (Hymenoptera: Formicidae)

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ABSTRACT

We report new records of *Gnamptogenys caelata* Kempf (1967) and *Gnamptogenys minuta* (Emery, 1896) from Brazil. We also describe *Gnamptogenys piei* n. sp. from Southeast Brazil. This distinctive new species is known only from a single worker found in leaf litter from montane forests of the Mantiqueira mountains in Itatiaia National Park, Rio de Janeiro State, Brazil. The specimen was collected at 1991 m above sea level, an infrequent altitude for *minuta*-group ants, usually more common at lower altitudes. The new species is imaged, compared with other *minuta*-group species, and an updated identification key for all known species of the *minuta*-group is included.

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Introduction

The genus *Gnamptogenys* Roger is the most diverse of the Ectatomminae subfamily, with more than 130 species found in tropical and subtropical areas of Southeast Asia, Australasia, and the Americas (Lattke, 2004). This group is generally recognizable in the Americas by the usually costulate or striate integument, metacoxa with a dorsal tooth or spine, lack of a protibial apical seta, and the fused promesonotum. In the last twenty-five years, the New and Old World fauna were revised by Lattke (1995, 2004). Synopses, keys and lists of species have been published by Wu and Wang (1995) and Xu and Zhang (1996) for Chinese species, Shattuck (1999) for the Australian fauna, Zhou (2001) for the Chinese Guangxi Province, Lattke et al. (2007) for the New World species, Lattke et al. (2008) for Colombian species, Lattke and Delsinne (2016) for *minuta*-group species, and Chen et al. (2017) for Chinese species.

The *minuta*-group comprises eight species found from Central America to southern Brazil. Some are widespread such as *G. minuta* (Emery, 1896) or *G. caelata* Kempf (1967), but most are known from either scant specimens or relatively restricted geographic distributions, such as *G. falcifera* Kempf (1967) or *G. petiscapa* Lattke (1990). Little is known about their biology but, in contrast with most *Gnamptogenys* that frequently nest in decomposing wood, these species probably nest in the soil. There are records of *Gnamptogenys*

in decomposing wood, but the only *minuta*-group nest record is that of a *G. minuta* nest found in the soil under a stone (Lattke and Delsinne, 2016). The *minuta*-group is easily distinguished by having the frontal lobes completely covering the antennal insertions and the petiolar spiracle ventrally oriented and recessed in a pit (Lattke, 1992). Other *Gnamptogenys* have narrow frontal lobes that in a dorsal cephalic view leave the antennal basal condyle partially exposed and the petiolar spiracle opening is obliquely directed and at the same level as the surrounding cuticular surface (Lattke, 1992). The ever increasing amount of ant diversity studies and widespread adoption of leaf litter sampling has substantially enriched museum holdings of these ants. In this work we expand knowledge about distribution of two species: *G. caelata* and *G. minuta*, and describe *G. piei* n. sp., a very distinct new species of *Gnamptogenys* belonging to the *G. minuta*-group.

Materials and methods

The specimens under study were obtained during maintenance work in the ant collection of DZUP - Coleção Entomológica Padre Jesus Santiago Moure, Universidade Federal do Paraná, Curitiba, PR, Brazil.

The new species is described from a single worker collected during the “Projeto Altitudinal Mata Atlântica” in Itatiaia National Park in Mantiqueira Mountains, Rio de Janeiro, Brazil. During this project ants were collected with “mini-Winkler” extractors (Fisher, 1998) along an altitudinal gradient with eight sampling stations starting at 600 m and ending at 2457 m above sea level. In each station a 200 m transect was established with 10 sampling points separated

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20 m from each other, and 1 m² of leaf litter was sampled from each point (Lasmar, 2016). Despite this sampling effort (80 samples), just a single specimen of *G. piei* n. sp. was found. We compared it with specimens of *G. striolata* (Borgmeier, 1957) and *G. caelata*, which most resemble the new species, from DZUP and with digital images from Antweb.

In distribution list we consider records of municipalities and parks from Brazil. The new records correspond to the individual Brazilian states. The references of distribution were obtained from literature. In examined material we refer to the number of specimens in parentheses (1w = one worker). For all specimens we provided coordinates (in decimal degrees) and altitude (in meters). When these data were not available on the labels, we used Google Earth (2018) to estimate them. The coordinates and altitudes that were not directly obtained from the labels were written in parentheses.

Measurements of the ant were taken using a Leica KL300 LED stereomicroscope with an ocular micrometer (80×). The selection of measures and indices are based on Lattke and Delsinne (2016). All measurements are in millimeters.

HL: Head length: midline length of head proper, measured in full-face (dorsal) view, from the anterior clypeal margin to the midpoint of a line drawn across the vertexal margin.

HW: Head width: maximum width of head measured in full-face view, excluding the eyes.

ED: Eye diameter: measured along its long axis in lateral view.

PL: Petiole length: the maximum length of the petiole measured in lateral view.

SL: Scape length: length of the first antennal segment, excluding the neck and basal condyle.

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

CI: Cephalic index: HW/HL × 100.

OI: Ocular index: ED/HW × 100.

SI: Scape index: SL/HW × 100.

Digital images were obtained with a Leica DFC 500 camera coupled to a Leica MZ16 stereomicroscope and Leica IM 50 software (Image Manager). Images were combined with the focus stacking software Leica Auto-Montage Pro. Additional edits were performed using GIMP 2.10.2.

Results

Gnamptogenys caelata Kempf (1967)

Distribution in Brazil. MARANHÃO: Açailândia (**new record**); MINAS GERAIS: Nova Lima (**new record**); PARÁ: Belém (Kempf and Brown, 1968); PARANÁ: Iguazu (Kempf, 1967); RONDÔNIA: Porto Velho (**new record**). Despite its widespread distribution in South America, the records are few and sparse, and these new records begin to fill in the significant gaps. Most records suggest a preference for lowland sites, although one is from 1400 m.

Examined material. BRAZIL: Maranhão: Açailândia, Horto Fazenda Pompéia, -4.8750, -47.2944 (364 m), 12–22.II.2006, Silva R.R. & Feitosa, R.M. col., Winkler 16 (1w) [DZUP]. Minas Gerais: Nova Lima – Vale S/A, Mina Tamanduá, -20.0881, -43.9408, 1400 m, 12.II.2012, Queiroz et al. col. (2w) [DZUP]. Rondônia: Porto Velho, Área Mutum, -9.5989, -65.0497 (102 m), 17–27.VII.2013, Mazão G.R. & Probst R.S. col., M6P1 (1w) [DZUP]; Porto Velho, Área Mutum, -9.6286, -65.0575 (99 m), 17–27.VII.2013, Mazão G.R. & Probst R.S. col., M8P1 (1w) [DZUP].

Gnamptogenys minuta (Emery, 1896)

Distribution in Brazil. ACRE: Senador Guiomard (**new record**). AMAZONAS: Manaus (Franken et al., 2013; Gomes et al., 2018); Benjamin Constant (Lattke, 1992); Manaquiri (Souza et al., 2016). BAHIA: Ilhéus (Delabie and Fowler, 1995). GOIÁS: Jataí (**new record**). MARANHÃO: Estreito (**new record**). MINAS GERAIS: Viçosa (Sobrinho and Schoereder, 2007); Parque Estadual do Rio Doce (Castro et al., 2011). PARÁ: Iriboca (Kempf and Brown, 1968); Alter do Chão, Santarém (Vasconcelos et al., 2006). RIO DE JANEIRO: Cicuta Forest, Volta Redonda (Montine et al., 2014); Ilha Grande. SANTA CATARINA: Nova Teutônia (Borgmeier, 1957). SÃO PAULO: Biritiba-Mirim (Suguituru et al., 2013). These records fill in some gaps for the few Brazilian states where this species has not been recorded.

Examined material. Brazil: Acre: Senador Guiomard, Fazenda Experimental Catuaba, -10.0778, -67.6264, 214 m, 7.XI.2016, grupo 2 Formigas do Brasil col. (1w) [DZUP]. Goiás: Jataí, S. Granjeiro (-17.8811, -51.7390) (761 m), 12.II.2008, J. Diniz col. (1w) [DZUP]. Maranhão: Estreito, Fazenda Itaueiras, -6.5318, -47.3711 (155 m), 12–22.VI.2006, Silva, R.R. & Feitosa, R.M. col., Winkler 09 (1w) [DZUP]. Rio de Janeiro: Ilha Grande, Trilha Jararaca, -23.1811, -44.3517 (154 m), 1.XII.2009, J.M. Queiroz col. (1w) [DZUP].

Gnamptogenys piei n. sp.

(Fig. 1)

Diagnosis. Mesosomal dorsum mostly longitudinally costulate; anterior margin of clypeus with weak median lobe, clypeal lamella absent; metanotal groove absent; propodeum armed with small, distinct tooth; foretarsal base with seta opposite protibial spur; dorsum of petiole with concentric rugulae; meso- and metatibiae with one apical spur each.

Description. Holotype measurements: HL 0.93; HW 0.84; SL 0.75; ED 0.13; WL 1.05; PL 0.43; CI 91; OI 16; SI 89. Head subquadrate in full-face view; posterior cephalic margin mostly straight with slight median concavity, lateral margin broadly convex. Eye convex, placed just anterad of cephalic mid-length; ommatidia relatively large, 7 ommatidia present along greatest diameter. Malar area with arched longitudinal carina extending from anterior clypeal margin to mid-distance between eye. Clypeal disk, frontal lobe, cephalic dorsum, and vertex with slightly sinuous longitudinal costulae; head punctate-rugulose laterally. Frontal lobe in full-face view expanded anterad, completely covering antennal insertion. Mandible triangular and elongate, dorsum longitudinally rugulose-punctate and shining, basal angle shaped as broad, blunt triangle; masticatory margin broadly concave with two preapical blunt teeth, largest situated close to mandibular mid-length and shortest closer to basal angle, some inconspicuous denticles found just apicad of large tooth. Anterior margin of clypeus broadly convex, with weak median lobe, lamella absent; clypeal disk surface relatively flat. Surface level of both clypeal disk and most of frons interrupted by brief, depressed area between frontal lobes. Posterior clypeal margin at mid-length of frontal lobes shaped as obtuse angle posteriorly bordered by narrow parallel strip that slopes ventrally, defining anterior margin of depressed area. This area gradually slopes dorsad until reaching predominant dorsal frons surface level just posterior to frontal lobes. Antennal scape surpasses posterior cephalic margin by less than one-fifth its length, shining, densely punctulate and densely covered by suberect whitish hairs. Cephalic ventrum with longitudinal to oblique rugulose costulae that diverge posteriorly. Palps not visible.

Mesosomal dorsal margin in profile forming single broad convexity; promesonotal suture and metanotal sulcus not impressed, mesosomal dorsum longitudinally costulate medi-

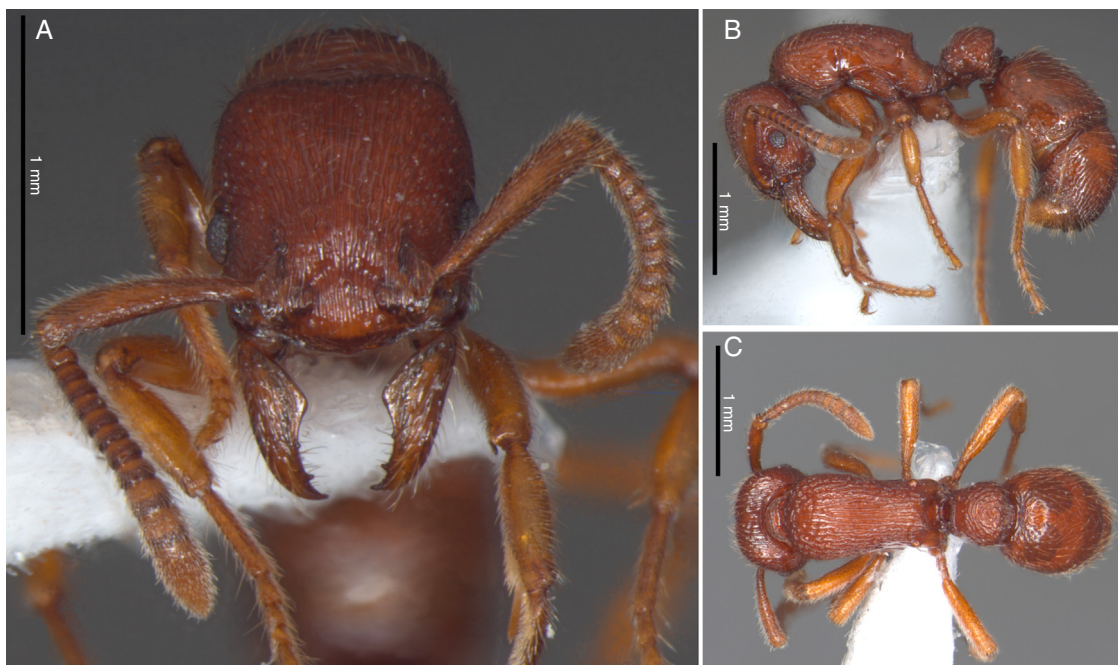


Fig. 1. *Gnamptogenys piei* n. sp. Holotype. (A) Dorsal view of head; (B) lateral view of body; (C) dorsal view of body.

ally and rugulose-costulate laterally. Anterior pronotal surface with 6 transverse rugulose costulae; lateral pronotum with low but distinct rugulose costae, progressively becoming smooth posterad; anepisternum smooth and katepisternum smooth with some longitudinal striae; mesometapleural suture well-impressed; metapleuron mostly smooth and shining, with transverse striae close to bulla. Metapleural gland opening forms transverse slit. Propodeal spiracle round, elevated on broadly conical tumulus, surrounded by light brown ring; distance between spiracle and posterior margin of propodeum is approximately 3 spiracular openings. Propodeal denticle low but distinct. Propodeal declivity shining with lateral and dorsal rugosities and median oval smooth area. Coxae with transverse striae, protarsal base opposite spur with prominent seta and row of smaller setae; femora and tibiae punctulate; meso- and metatibiae with one apical spur each and no apical setae. Metacoxal dorsum with low, posterobasal denticle. Claws with preapical tooth.

Petiolar node rugulose-costulate to rugulose-punctate; anterior and dorsal margins in lateral view convex and continuous; posterior margin vertically straight; node with concentric rugulose in dorsal view, subpetiolar process subquadrate, anteriorly rounded, posteriorly shaped as short, blunt tooth. Petiolar spiracle within round depression. Ventral margin of abdominal sternite III in lateral view mostly broadly convex with slight concavity at prora; length of anterior margin of tergite III in lateral view approximately one-third that of dorsal margin, dorsal margin straight to weakly convex. Abdominal segment IV arches posteroventrally with long and convex dorsal margin in lateral view and extremely short ventral margin, apex of segment faces ventrally; rest of abdominal segments mostly recessed. Abdominal tergite III laterally with scattered shallow piligerous punctae, dorsomedially with longitudinal costulae, progressively rugulose to punctate laterally. Abdominal tergite IV mostly longitudinally costulate, sternite roughly rugulose-punctate. Body mostly ferruginous, legs orange, antenna and mandible ferruginous brown; body with abundant white, decumbent hairs.

Type material. Holotype. Brazil: *Rio de Janeiro*: Parque Nacional Itatiaia, –22.4116, –44.6386, 1991 m, 20.I.2015, Lasmar et al. col. One point-mounted worker deposited in DZUP with the unique

identifier DZUP 548816. Collected as part of Projeto Altitudinal Mata Atlântica – Transecto 6A, Winkler extractor, Ponto 1.

Etymology. This species is named in honor of Dr. Marcio Pie, professor of the Universidade Federal do Paraná, PR, Brazil, for his contributions in science, especially in myrmecology.

Discussion

Gnamptogenys piei n. sp. can be easily identified as a member of the *minuta*-group because it presents the petiolar spiracle within a ventral cavity, the antennal insertions completely covered by the frontal lobes, a curved longitudinal carina in the malar area, and a row of setae on the protarsal base opposite the spur. However, the new species differs from other *minuta*-group members by having a prominent seta on the protarsal base opposite the spur (Lattke, 1992). Another *minuta*-group character, the dorsomedian cephalic carina, is indistinct in this species on account of the costulate frons. *Gnamptogenys simulans* (Emery, 1896), *G. fieldi* Lattke (1990), and *G. falcifera* differ from *G. piei* n. sp. by not having their body covered with longitudinal costulae. In addition, *G. fieldi* and *G. falcifera* have falcate mandibles. *Gnamptogenys piei* n. sp. also may be easily separated from *G. petiscapa* and *G. vriesi* Brandão and Lattke (1990), which have the mesosomal dorsum separated into distinct convexities by a well-developed metanotal groove. *Gnamptogenys simulans*, *G. fieldi*, *G. falcifera*, and *G. petiscapa* have no records for Brazil, while *G. vriesi* has the closest record in Mato Grosso, Brazil, almost 2000 km away from the Itatiaia Mountains (Vicente et al., 2015). *Gnamptogenys piei* n. sp. possibly occurs in sympatry with *G. minuta*, known from the Atlantic Forest (Silva and Brandão, 2014), but the latter has a completely pruinose integument and it is thus not easily confused with *G. piei* n. sp. *Gnamptogenys piei* n. sp. may be confused with *G. caelata* and *G. striolata* on account of the longitudinal sculpturing, but *G. caelata* differs because of its smaller size (total body length less than 3 mm) and absence of meso- and metatibial spurs. *Gnamptogenys striolata* has the anterior margin of the clypeus with a lamella and a conspicuous median tooth, the mandible with at least eight distinct teeth and the dorsum of the petiole and abdominal tergite III is mostly foveolate. The morphological similarities of *Gnamptogenys piei* n. sp. with *G. caelata* and

G. striolata mostly agree with the characters used by Lattke (1992: 125) to consider *G. caelata* and *G. striolata* as forming a small sub-group within the *minuta*-group.

Natural history

The specimen of *Gnamptogenys piei* n. sp. was collected in an area of Atlantic Forest in Itatiaia National Park, located in the Mantiqueira mountains, Rio de Janeiro, Brazil. The collection area is within the *Alto-Montana* forest formation, with trees smaller than those of lower altitudes and the soil is humid with large volumes of accumulated organic matter (Koehler et al., 2002). This formation generally has as a lower altitudinal limit 1500 m and the collection site is close to the transition with open meadow-type vegetation. This formation, according to the Koeppen classification scheme, has a Subtropical highland (cwb) climate, in which the temperatures of the coldest month varies between -3°C and 18°C and the average temperature of the hottest month does not exceed 22°C (Alvares et al., 2014). The ant was taken from a leaf litter sample processed with a Winkler extractor. The Type-locality altitude is at the upper limit for *minuta*-group species. Specimen records in Antweb, including abundant Central American records from the LLAMAS project, for species such as *Gnamptogenys simulans* (Antweb, 2018a) and *G. minuta* (Antweb, 2018b) show that they may occasionally be collected at this altitude, or close to it, but they are generally more common at lower altitudes. It remains to be seen if this ant is a specialist restricted to upper altitude, cooler forests or if it also inhabits lower altitude forests. Hopefully additional specimens of this apparently rare species may be retrieved in the future.

Identification key for workers and gynes of the *Gnamptogenys minuta*-group

The new species *G. piei* is included in the identification key modified from Lattke and Delsine (2016):

1. Propodeum with a pair of denticles 7
 - Propodeum continuous, denticles absent 2
2. Integument mostly opaque, sculpturing predominantly granulose with variable degrees of areolae/foveolae 3
 - Integument mostly shiny or silky, sculpturing can be finely striolate or smooth with variable degrees of areolae/foveolae ... 5
3. Mandible falcate, masticatory margin edentate and concave (north-central Venezuela) *G. fieldi*
 - Mandible triangular, masticatory margin fairly straight and denticulate or crenulate 4
4. Metanotal groove well-impressed; spiracles of abdominal segments I and II shining and conspicuous (northwestern Venezuela) *G. petiscapa*
 - Metanotal groove absent; spiracles of abdominal segments I and II opaque and not conspicuous (southern Mexico - Brazil) *G. minuta*
5. Mandible falcate (northern South America) *G. falcifera*
 - Mandible triangular 6
6. Eye not prominent, broadly convex; anterior clypeal margin broadly convex; occipital lobe rounded (southern Mexico - Costa Rica) *G. simulans*
 - Eye prominent, semispherical; anterior clypeal margin medially concave; occipital lobe subangular (eastern Ecuador - central Brazil) *G. vriesi*
7. Meso- and metatibial spurs absent (Colombia - southern Brazil) *G. caelata*
 - Meso- and metatibial spurs present 8

8. Clypeal lamella present; clypeus with a median tooth, postpetiolar tergite mostly with arched punctate-rugulae (southwestern Brazil) *G. striolata*
 - Clypeal lamella absent; clypeus with a median lobe; postpetiolar tergite with rough longitudinal costulae medianly (southeast Brazil) *G. piei* n. sp.

Conflicts of interest

The authors declare no conflicts of interest.

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