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SHORT NOTE

A note on the karyotype and morphology of the ant *Platythyrea sinuata* (Roger, 1860) (Formicidae, Ponerinae, Platythyreini)

PNC Silva-Rocha[1], JPSO Correia[1], CSF Mariano[1,2], JHC Delabie[2], MA Costa[1]

1- Universidade Estadual de Santa Cruz (UESC), Ilhéus-BA, Brazil

2- Laboratório de Mirmecologia, Centro de Pesquisas do Cacau (CEPEC/CEPLAC), Itabuna-BA, Brazil

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Corresponding author
Patricia Nayara Caldas Silva Rocha
Departamento de Ciências Biológicas
Universidade Estadual de Santa Cruz
Km 16 Rodovia Ilhéus-Itabuna
CEP 45650-000, Ilhéus-BA, Brasil.
E-Mail: patinay9@gmail.com

Abstract

Taxonomy of the genus *Platythyrea* is confusing because of high phenotypic plasticity, possible synonymies and morphological proximity to other species of this genus. The correct identification of *Platythyrea sinuata* can be achieved using integrative taxonomy including both morphological and genetic components. Here we describe the karyotype of *P. sinuata*, which has 2k=24M+20A with CMA_3^+/$DAPI^-$ on a single chromosome of the haploid set. These data will help to clarify the taxonomic status of this species.

The Platythyreini Emery, 1901 includes the genus *Platythyrea* Roger, 1863. This Pantropical genus is composed of 38 species, 13 of which are Neotropical, including four fossil species (Bolton, 2017). Identifying species and characterizing the diversity of *Platythyrea* is not a simple task, because it is a genus with homogeneous morphological characters and it has a relatively high phenotypic plasticity (Brown, 1975). Despite the revision of Brown (1975), there is still much to be clarified about this genus.

Platythyrea sinuata (Roger, 1860) has Suriname as type-locality, and is found in with a wide geographic distribution in forests of South America. According to Brown (1975), *P. sinuata* has two synonyms, *Platythyrea meinerti* Forel, 1905 and *Platythyrea meinerti boliviana* Santschi, 1921, due to its phenotypic variation. However, the taxonomic description of *P. sinuata* still leaves doubts and needs more information. The precise identification of this and other species of this genus would be facilitated by integrative studies combining morphology, molecular and cytogenetic data, given the limitations of classical taxonomic characters (Schlick-Steiner et al., 2010).

Karyotype characters are useful for taxonomic and evolutionary studies. To date, more than 125 morphospecies of Ponerinae ants had their karyotype data studied, with chromosome numbers varying from 2n = 8 to 120 (Lorite & Palomeque, 2010; Mariano et al., 2015; Correia et al., 2016). However, cytogenetic studies with *Platythyrea* are restricted and only four species had their chromosomal numbers identified: *Platythyrea quadridenta* Donisthorpe, 1941, 2n (n) = 18 (9) and *Platythyrea tricuspidata* Emery, 1900, 2n = 92-96 (Imai et al., 1983; 1990) from Malaysia, *Platythyrea pilosula* (Smith, 1858), 2n = 40 (Mariano et al., 2015) from French Guiana and *Platythyrea punctata* (Smith, 1858), 2n = 84 from Central America (Schilder, 1999).

In this context we present a cytogenetic description and notes on the morphology of *P. sinuata* carried out in samples of a colony found in the Brazilian Atlantic Forest. It is noteworthy that this relatively common species in the Amazon region is surprisingly very rare in the Atlantic Forest, as well as two other species of this genus (Delabie, 2001). Our data will be useful for understanding the taxonomic status and evolution of this species in further integrative studies on *Platythyrea*.

The *P. sinuata* colony was collected in cabruca area (name given to cocoa plantation in native forest understory), between rotted trunk and soil in Ilhéus, Bahia State, Brazil (14°47'51"S, 39°02'13"W). Adult workers were identified following Brown (1975). Vouchers were deposited in the Collection of the Laboratory of Mirmecology, at the Centro de Pesquisa do Cacau, CEPEC-CEPLAC, in Ilhéus, Bahia, Brazil.

Specimens were photographed under a Leica M165C stereomicroscope. Morphometric measurements were performed to an accuracy of 0.01 mm following the terminology of Brown (1975).

The colony was maintained in a B.O.D. incubator at 28°C to obtain larvae for cytogenetic analysis. Metaphases were prepared from prepupae cerebral ganglion, following Imai et al. (1988), after 40 minutes treatment in colchicine (0.005%). The slides were then stained with 3% Giemsa solution and analyzed under an Olympus CX41 equipped with a digital camera. A minimum of 10 metaphases was analyzed for each specimen. Chromosomes were classified following Levan et al. (1964) and the karyograms were organized using Adobe Photoshop® 7.

Chromomycin A_3 (CMA_3) and 4'6-diamidino-2-phenylindole (DAPI) staining for the characterization of chromosomal segments rich in CG and AT base pairs, respectively, followed Guerra and Souza (2002). Metaphases images were captured with software Image Pro Plus ® version 4.1 (Media Cybernetics) in an Olympus BX51 microscope.

The specimens had predominantly brown opaque coloration (Fig 1A-F); moderately large eyes 0.31-0.34 (0.33 mm) (Fig 1A, C-D); in lateral view, a curved groove (directed from the dorsal to lateral margin) not developed, present at the base of the mandible (Fig 1D); in side view, long mesosome with Weber length 2.89-3.01 (2.99 mm); in side view, a slope of propodeum with a tooth on the front side; in dorsal view relatively long and narrow petiole, forming a tooth in the postero-medial region; femur of the first leg about twice as wide as the femur of the 2nd leg 0.43-0.46 (0.45 mm) (Fig 1A).

The identification key for *Platythyrea* of the New World by Brown (1975) comprises few diagnostic characters considering the high variation in size, shape and color patterns in the species of this group. *Platythyrea sinuata* exhibits a great morphological similarity with *Platythyrea angusta* Forel, 1901, *P. pilosula* and *P. punctata* making its correct identification difficult (Brown, 1975).

In Formicidae discrete phenotypic variations observed are not always to be considered as useful characteristics for the separation of populations into distinct species, and may be only the reflection of geographic or ecological variations (Lucas et al., 2002; Fedoseeva, 2011).

As *P. sinuata* has a wide geographical distribution and explores different habitats the best way to correctly identify possible cryptic species would be to analyze the greatest amount of data available (Seifert, 2009; Heled & Drummond, 2010), mainly due to its phenotypic plasticity, which hinders classical taxonomic approaches.

Platythyrea sinuata had 2n=44 chromosomes, with karyotypic formula 2k=24M+20A (Fig 2). A length heteromorphism occurs in the first chromosome pair. Imai et al. (1983) reported a large difference in the chromosome number of two Malaysian species *P. quadridenta* and *P. tricuspidata* showed, 2n=18 and 2n=96, respectively. In the Neotropics (French Guiana), Mariano et al. (2015), reported

Fig 1. *Platythyrea sinuata*: (A) side view; (B) dorsal view; (C) head in front view; (D) head in side view; (E) mesosome in lateral view; (F) petiole in lateral view.

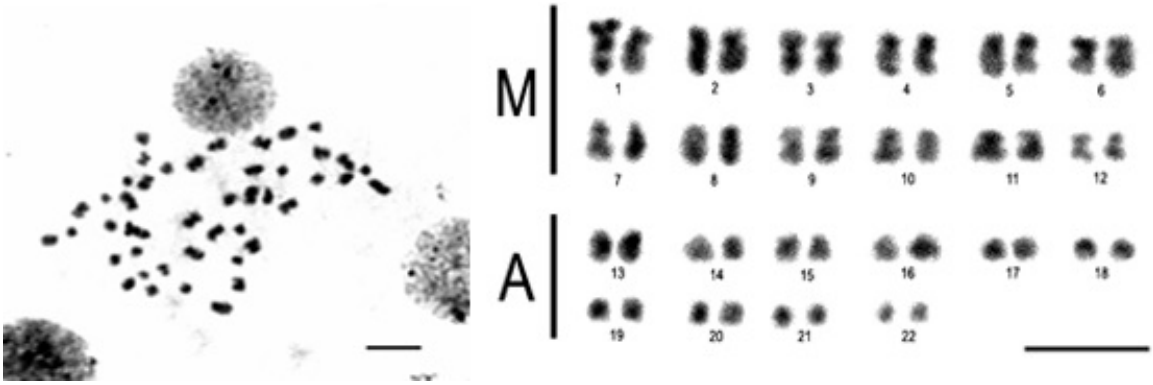

Fig 2. Metaphase and karyotype of *Platythyrea sinuata*. Bar = 10 µM.

the chromosome number 2n=40 for *P. pilosula*, while *P. punctata* of Central America, showed 2n=84 (Schilder, 1999). This variation is significant considering the small number of karyotypes known for *Platythyrea* to date. Although the greatest variation was found among Malaysian species (2n=18, 2n=96) high and intermediate numbers were reported in Central America and South America, respectively.

Platythyreini (*Platythyrea*) comprises a monophyletic group according to Schmidt (2013), with low chromosome numbered *P. quadridenta* positioned basally compared to *P. punctata* (2n = 84). The inclusion of cytogenetic data from more taxa will allow drawing important conclusions about the genus karyotypic evolution.

The fluorochrome staining showed a single marking, CMA_3^+/$DAPI^-$ in a single chromosome of the 1st pair, which coincides with a secondary constriction and length heteromorphism (Fig 3). Secondary constriction and CMA_3^+/$DAPI^-$ markings, consistently coincided with the nucleolar organizer region (NORs) in several other species, and indicates that the heteromorphism of *P. sinuata* is related to the variation in NORS length. Length heteromorphism was observed in other ants such as *Pheidole* Westwood, 1839, and in *Temnothorax rugatulus* (Emery, 1895) (Taber & Cokendolpher, 1988).

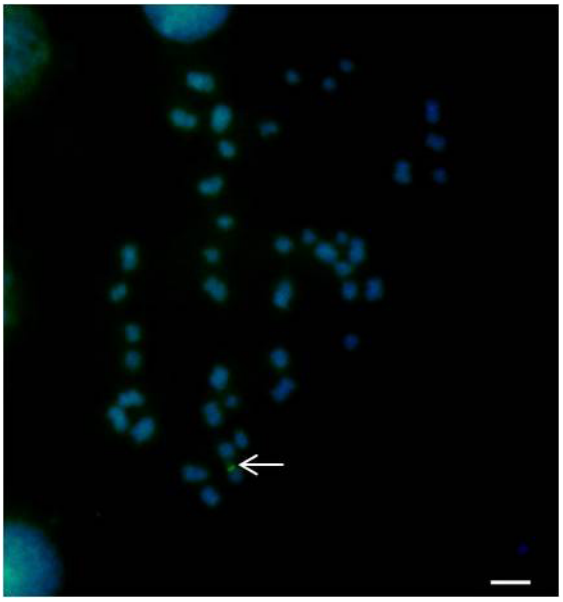

Fig 3. Metaphase of *Platythyrea sinuata* showing CMA_3^+/$DAPI^-$ band indicated by the arrow. Bar = 10 µM.

The morphological and cytogenetic characterization of *Platythyrea sinuata* presented here will be useful for future taxonomic revision of the genus and in evolutionary studies, involving the establishment of phylogenetic relationships among species.

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