



## *Machima itatiaia* sp. nov.: a new species of lichen-mimic katydid (Orthoptera: Tettigoniidae: Phaneropterinae) from the Brazilian Atlantic Forest

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### Abstract

The Brazilian genus *Machima* Brunner von Wattenwyl, 1878 includes three valid species: *M. paranensis* Rehn, 1950 and *M. scalprum* Rehn, 1950 distributed on Southern and *M. phyllacantha* (Burmeister, 1838) from Northeastern Brazil. Herein we analyzed eleven male specimens of *Machima* from Parque Nacional de Itatiaia and propose a new species. *Machima itatiaia* sp. nov. is characterized by its main lobe of the cercus curving abruptly on apical two-thirds and accessory lobe as long as wide. The new species is the first record of the genus from Southeastern Brazil. Finally, we also present a key to species of *Machima* based on males.

**Key words:** Dysoniini, Southeastern Brazil, key to species, Neotropical

### Introduction

The katydid tribe Dysoniini Rehn, 1950 (Phaneropterinae) contains 87 species divided into 13 genera, which are distributed throughout the Neotropical Region up to southern United States. Representatives of the tribe are characterized by their resemblance to lichens, mosses, and tree trunks, and may have spines and spurs throughout the body (Cadena-Castañeda 2011). In the last decade, a series of new species has been described for the tribe, in addition to genus groups created to organize its classification (Cadena-Castañeda, Braun & Buzzetti 2016; Braun 2011; Cadena-Castañeda 2011; Cadena-Castañeda & Gorochoch 2012, 2013; Cadena-Castañeda, Mendes & Sovano 2015; Gorochoch 2014).

Dysoniines are organized into three genus groups: the **Dysonia Group** with *Dysonia* White, 1862, *Lichenodentix* Cadena-Castañeda, 2011, and *Lichenomorphus* Cadena-Castañeda, 2011; the **Paraphidniae Group** with *Anaphidna* Gorochoch & Cadena-Castañeda, 2012 and *Paraphidnia* Giglio-Tos, 1898; and the **Markia Group** with *Apolinaria* Rehn, 1950, *Lichenodraculus* Braun, 2011, *Machima* Brunner von Wattenwyl, 1878, *Machimoides* Rehn, 1950, and *Markia* White 1892. In addition, three other genera are not placed in any generic group: *Hammatofera* Brunner von Wattenwyl, 1878, *Quiva* Hebard, 1927, and *Yungasacris* Rehn, 1950 (Cadena-Castañeda, Braun & Buzzetti 2016; Braun 2011; Cadena-Castañeda 2011; Cadena-Castañeda & Gorochoch 2012, 2013; Cadena-Castañeda, Mendes Sovano & Gorochoch 2015).

In the Markia Group, Gorochoch (2012) points out that morphological differences among genera are due to specializations related to the lichen camouflage, and that all five genera in the group could be subgenera of *Markia*. However, Cadena-Castañeda (2013) noted some other diagnostic features among genera, such as, the ornamentation of the fastigium and pronotum and male terminalia. *Machima* and *Machimoides* are considered closely related genera, sharing many aspects of the external morphology (Rehn 1950). Nevertheless, Rehn (1950) distinguishes these two genera based on the presence of an elongate spine on anterior genicular lobes of foreleg and midleg, the shape of the fastigium and mainly, the size and morphology of the male cercus.

*Machima* Brunner von Wattenwyl, 1878 currently includes three valid species, *Machima paranensis* Rehn, 1950 and *Machima scalprum* Rehn, 1950 from Southern Brazil and *Machima phyllacantha* Burmeister, 1838 (type-species) from Northeastern Brazil. Although many new species in Dysoniini have been studied and described recently, posterior to Rehn (1950), who described two of the included species, no other distributional records or taxonomic studies involving *Machima* species have been published. Herein, a new species of *Machima* is described from Parque Nacional de Itatiaia, Southeastern Brazil, and a key to species of *Machima* is provided.

## Material and methods

Eleven males of *Machima* **sp. nov.** were studied, all collected at Parque Nacional de Itatiaia, Rio de Janeiro State, Brazil. However, only nine of those were included in the type-series because of their preservation condition. Specimens studied are deposited in Coleção Entomológica Prof. Alfredo Pinheiro Dutra, Departamento de Zoologia, Instituto de Biologia, Universidade Federal do Rio de Janeiro, Rio de Janeiro (DZRJ); Coleção Entomológica do Instituto Oswaldo Cruz, Rio de Janeiro (CEIOC); and Coleção Entomológica, Museu Nacional, Universidade Federal do Rio de Janeiro, Rio de Janeiro (MNRJ).

Original descriptions (Burmeister 1838; Brunner von Wattenwyl 1878; Tepper 1892; Rehn 1950), species identification key (Rehn 1950), and photographs of holotypes available at the Orthoptera Species File (Cigliano et. al 2019) were used for the construction of the taxonomic key and identification of specimens of *Machima* **sp. nov.** Terminology follows Cadena-Castañeda (2013) for the head, Braun (2011) and Cadena-Castañeda (2013) for the thorax, and Rehn (1950) and Cadena-Castañeda (2013) for the male terminalia. Habitus photographs were made using a Sony Alpha DSLR-A230 camera. Photographs of detailed morphological features were taken using a Leica DFC450 camera attached to a Leica M205C stereomicroscope with the software LAS v4.6.

## Results

### List of species of *Machima*

*Machima itatiaia* **sp. nov.** Brazil: Rio de Janeiro State.

*Machima paranensis* Rehn, 1950: 306. Brazil: Paraná State.

*Machima phyllacantha* Burmeister 1838: 688. Brazil: Bahia State.

*Phaneroptera acanthocephala* Serville 1838: 425. Kirby 1906: 410 [Synonymized]

*Machima scalprum* Rehn, 1950: 301. Brazil: Santa Catarina State.

### Key to valid species of *Machima* (based on male specimens)

1. Main lobe of cercus elongated and curving weakly at apical half (Rehn 1950, Figs. 12, 14); accessory lobe of cercus longer than wide (Rehn 1950, Figs. 12, 14) ..... 2
- Main lobe of cercus elongated and curving abruptly at apical two-thirds (Fig. 2C); accessory lobe of cercus as long as wide (Fig. 2C) ..... *M. itatiaia* **sp. nov.**
- 2(1). Apex of main lobe of cercus weakly curved in dorsal view (Rehn 1950, Fig. 12) ..... 3
- Apex of main lobe of cercus forming a hook and abruptly narrowed in dorsal view (Rehn 1950, Figs. 14–15) ..... *M. paranensis*
- 3(2). Accessory lobe of cercus with acute apex ..... *M. phyllacantha*
- Accessory lobe of cercus with rounded apex (Rehn 1950, Fig. 12) ..... *M. scalprum*

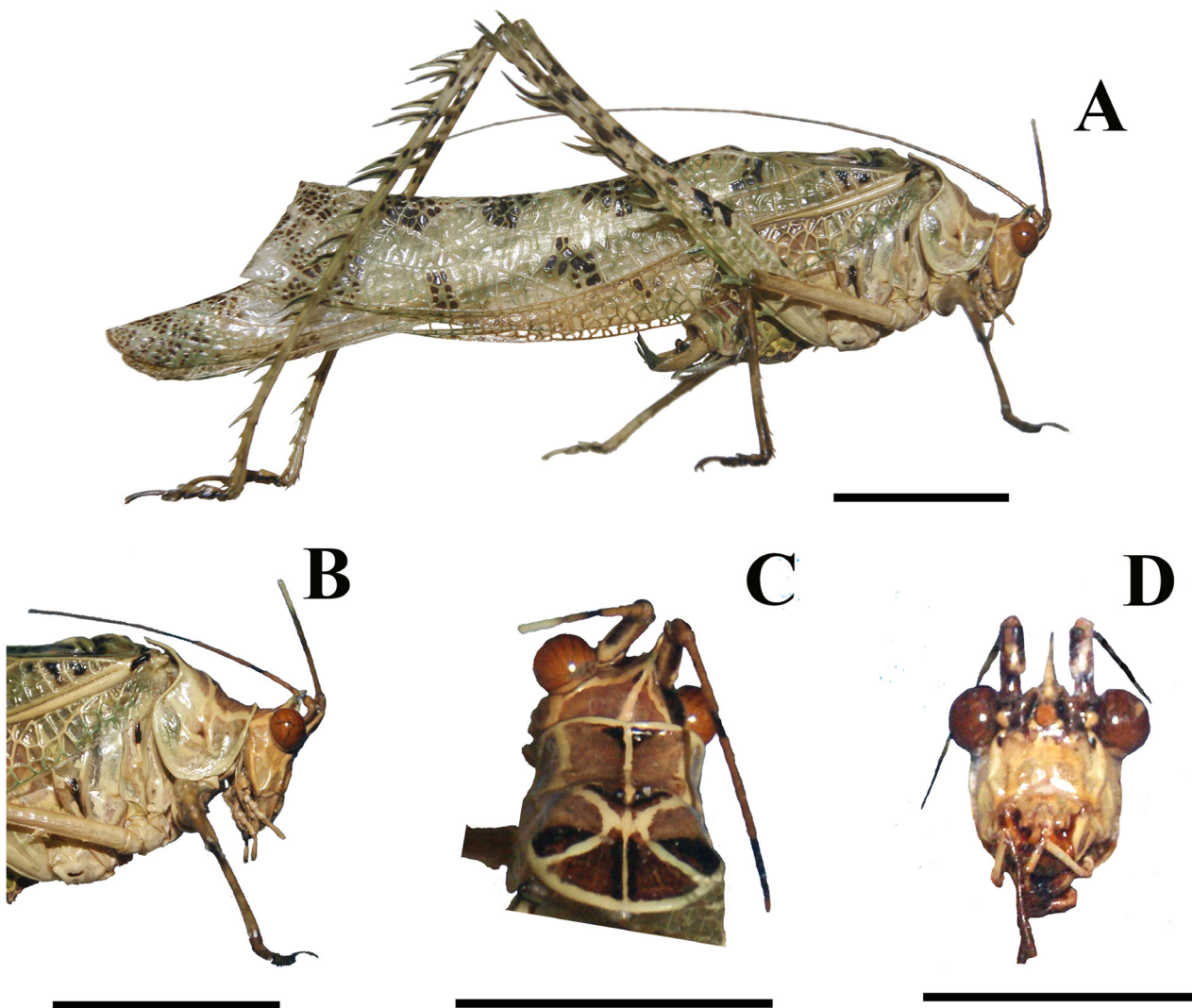
### *Machima itatiaia* Antunes & Takiya **sp. nov.**

(Figs. 1–2)

**Diagnosis.** Main lobe of male cercus strongly curved after 2/3 of length and abruptly narrowed preapically (Fig. 2C); accessory lobe of cercus of directed dorsally and with rounded apex (Fig. 2C).

**Description.** *Head.* Head (Figs. 1C, D) weakly conical in frontal view; fastigium (Fig. 1D) as long as escape and pedicel length combined. *Thorax.* Pronotum (Figs. 1B, C) smooth with posterior margin weakly projected and lateral margins very pronounced; prosternum unarmed. *Wings.* Wings (Fig. 1A) developed, hind wing surpassing tegmen; stridulatory files of left and right tegmina (Figs. 2A, B) with 46 and 37 teeth, respectively. *Legs.* Legs (Fig. 1A) armed; foreleg femur with anterior genicular lobe with elongate spine, posterior genicular lobe with short spine, and ventral margin with two spines, tibia with four ventral spines and a single dorsal near tympanum; tympanum covered by cuticle; midleg (Fig. 1A) with femur with anterior genicular lobe with elongate spine, posterior genicular lobe with short spine, and ventral margin with two spines, tibia with four small spines, being two ventral smaller near apical portion and two larger near proximal portion; hindleg (Fig. 1A) with femur with five pairs of ventral spines weakly curved and two apical spines, tibia with seven pairs of spines weakly curved. *Male abdomen.* Cercus (Figs. 2C, D) developed, main lobe expanded at basal two-thirds; in dorsal view, with distinct accessory lobe in between basal and medial third directed dorsally with rounded apex; apical third abruptly narrowed and acute, directed inwardly; in lateral view, apex hook-shaped; subgenital plate (Fig. 2E) with broad base, posterior margin with V-shaped emargination and two developed styles.

**Coloration.** Head (Figs. 1A–D) mostly light green. Pronotum (Figs. 1A–C) light green with black lines. Tegmen (Fig. 1A) green with small black spots. Hind wing (Fig. 1A) transparent with apex similar to tegmen. Legs (Fig. 1A) green with mostly black thorns. Cercus (Figs. 2C, D) and subgenital plate (Fig. 2E) brownish-yellow with apical parts black and brownish-yellow.



**FIGURE 1.** *Machima itatiaia* sp. nov. male. (A) lateral habitus; (B) details of head and thorax, in lateral view; (C) head and thorax, in dorsal view; (D) head, in frontal view. Scale: 10 mm.

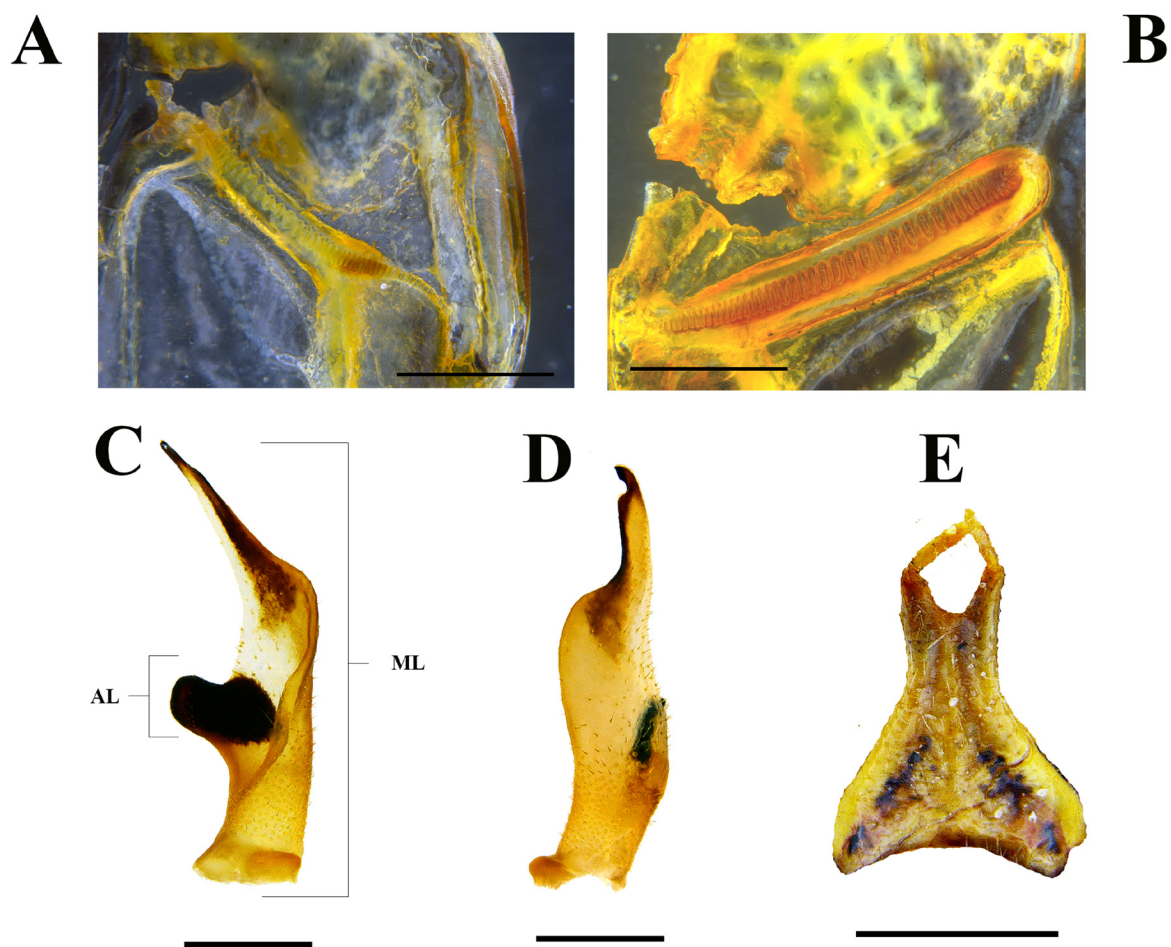
**Measurements (mm).** Nine males (holotype): Total length 22–24 (22); Pronotum length: 6–6 (6); Tegmen: 34–37 (34); Foreleg: 17–19 (19); Hind leg: 54–61 (60).

**Taxonomic notes.** As mentioned by Rehn (1950), specific diagnostic characteristics among *Machima* species are found only in the male genitalia. *Machima itatiaia* sp. nov. stands out from all other species in the curvature of the main lobe of cercus. However, it seems to be more similar to *M. scalprum* in the shape of the apex of the accessory lobe.

Unfortunately, no females are known for this species. The most recent specimens studied were collected attracted to lights between 2012 and 2018, and collecting efforts since then included several trips to the same place where these specimens were collected, especially during 2018 and 2019, but no additional specimens were collected.

**Etymology.** The species epithet is a reference to the type-locality, Parque Nacional do Itatiaia in Southeastern Brazil. It is treated as a noun in apposition.

**Material examined. Holotype:** ♂, Brasil, RJ, Itatiaia, Parque Nacional de Itatiaia, Casa do Pesquisador, Light, 7.XII.2018, Antunes, A, Ferreira, A.L.D. & Silva, V.C.L. leg. (MNRJ). **Paratypes:** ♂, Brasil, RJ, Itatiaia, Parque Nacional de Itatiaia, Quiosque do Poço Azul, 22° 27' 07" S 44° 36' 45" W, Light, 17–18.XI.2012, Takiya, D.M. & Santos, A.P.M. leg. (MNRJ); ♂, Brasil, RJ, Itatiaia, Parque Nacional de Itatiaia, Quiosque do Poço Azul, 22° 27' 07" S 44° 36' 45" W, Light, 18.XI.2012, Takiya, D.M. & Santos, A.P.M. leg. (MNRJ); ♂, Parque Nacional de Itatiaia, Casa do Pesquisador, 22° 27' 15.2" S 44° 36' 35" W, Light, 17–18.XI.2012, Takiya, D.M. & Santos, A.P.M. leg. (DZRJ ORT0010); ♂, Itatiaia, Estrada do Rio, 1300 m, 10–12.X.1950, Travassos, Albuquerque & Pearson leg. (CEIOC); ♂, Itatiaia, Estrada do Rio, 1300m, 10–12.X.1950, Travassos, Albuquerque & Pearson leg. (CEIOC); ♂, Itatiaia, 12.XI.1993, W. Macchon Silva leg. (CEIOC); ♂, Itatiaia, Estrada do Rio, 1300 m, 10–12.X.1950, Travassos, Albuquerque & Pearson leg. (CEIOC); ♂, Itatiaia, Estrada do Rio, 15.XI.1935, J.F. Zikán leg. (CEIOC). **Additional material:** ♂, Itatiaia, XI/78, Dimitri leg. (MNRJ); ♂, Itatiaia, Estrada do Rio, 830m, 1.X.1954, Leonor Zikán leg. (MNRJ).



**FIGURE 2.** *Machima itatiaia* sp. nov. (A-B) stridulatory files of tegmina; (A) right tegmen; (B) left tegmen. (C-E) male terminalia. (C) left cercus, in dorsal view; (D) left cercus, in lateral view; (E) subgenital plate, in ventral view. Scale: 1 mm.

## Discussion

Of the three valid *Machima* species, currently only *M. phyllacantha* has a synonym associated. *Phaneroptera acanthocephala* Serville, 1838 was synonymized by Kirby (1906) under *M. phyllacantha* without any justification. However, based on the description and collecting locality listed in Serville's (1838) monograph, it is very likely that the synonymy is correct. Serville (1838) describes in detail the dorsal ornamentation of the posterior region of the pronotum that is found in *Machima* species, with three elevated yellow lines, that form a "X" pattern (the Brazilian *Machimoides* has the yellow elevated lines, but they do not form an "X"). Considering that only, *M. phyllacantha* has been recorded from Northeastern Brazil (type locality of *P. acanthocephala*) so far, the synonymy is very likely. Unfortunately, photographs of the actual type specimen of *P. acanthocephala* are not available. The specimen (MNHN-EO-ENSIF915) labeled as "TYPE" photographed and made available at the Muséum national d'Histoire naturelle (Paris) database is unlikely to be a type specimen or conspecific to it (it is most likely a *Dysonia* species). Besides not having the distinctive pronotum ornamentation mentioned above and being collected in Mexico, it also has a hindleg, while Serville's description states that the male specimen he examined lacks the "four posterior legs and antennae".

*Machima itatiaia* **sp. nov.** has all generic diagnostic characteristics listed for *Machima* in the work of Rehn (1950), such as, pronotum not armed; fastigium of vertex conical and as long as escape and pedicel length combined; anterior genicular lobes of foreleg and midleg each with elongate spines, unequal to short spine of posterior lobes; and cercus longer than subgenital plate. However, *M. itatiaia* **sp. nov.** could not be associated to any of the valid species due to the male terminalia morphology. In addition, currently, *M. itatiaia* **sp. nov.** is the only *Machima* species reported from Southeastern Brazil.

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