



Systematics, Morphology and Biogeography

A new species of *Youngomyia* Felt from Brazil and new morphological data on *Youngomyia pouteriae* Maia (Insecta, Diptera, Cecidomyiidae)

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ABSTRACT

Youngomyia matogrossensis Proença & Maia a new species of Cecidomyiidae (Insecta: Diptera) that induces cylindrical hairy galls on leaves of *Pouteria torta* (Mart.) Radlk. (Sapotaceae) is herein described and illustrated (larvae, pupal exuviae, male and female). The galler, gall and host plant were collected at Parque Nacional da Chapada dos Guimarães, in the state of Mato Grosso (Brazil). New morphological data and photographs of pupal exuviae, male and female of *Youngomyia pouteriae* Maia, 2001 are also provided.

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Introduction

Pouteria torta (Mart.) Radlk (Sapotaceae) is a perennial tree, native to Brazil, distributed from Central to South America. In Brazil, it presents a wide distribution being found in North, Northwest, Midwest and Southeast areas, including four phytogeographical domains: Amazon rainforest, Caatinga (dry forest), Cerrado and Atlantic forest (Flora do Brasil, 2018). This plant is commonly called “guapeva”, “curiola”, “acá ferro”, “abiu do cerrado”, and “grão de galo”, and it is used both as food resource and antidiarrheal medicine (Perfeito et al., 2005).

A single insect gall morphotype attacking leaves of *P. torta* has been reported so far. It was record for the first time by Urso-Guimarães and Scareli-Santos (2006) in Pé-de-Gigante Reserve, a Cerrado area in the municipality of Santa Rita do Passa Quatro, in São Paulo State, Brazil. The galler was identified as a probably new species of *Youngomyia* Felt, 1908. Later, Urso-Guimarães et al. (2017) recorded this same gall morphotype in a Cerrado area in Aquidauana, Mato Grosso do Sul, Brazil.

Youngomyia Felt, 1908 have been recorded in the Nearctic, Neotropical and Oriental regions. Only six species are known so far and four of them are from the Neotropics, one from Brazil (*Youngomyia pouteriae* Maia, 2001). The majority of the species are

inquilinous, possibly predaceous, in galls of other cecidomyiids, but some of them induce gall (Gagné and Jaschhof, 2017).

This genus is characterized as follows: incomplete Rs situated before or after the half of the length of R1; long tricircumfilar male flagellomeres; female with numerous connective circumfilar; neck of the flagellomeres covered with setae in both sexes; tarsal claws strongly curved after the basal third; gonocoxite with a setulose mesobasal lobe; long gonostyle; hipoproct with closely appressed spines at the posterior half, and variable aedeagus (Gagné, 1994).

The objectives of this study are to describe a new species of *Youngomyia* that induces galls on leaves of *Pouteria torta* (Mart.) Radlk. (Sapotaceae) and to provide new morphological data on pupal exuviae, male and female of *Youngomyia pouteriae* Maia, 2001.

Material and methods

This study is part of the project “Diptera dos estados do Mato Grosso, Mato Grosso do Sul e Rondônia: diversidade, sistemática e limites distribucionais”. The aim of this project is to inventory the diversity of Diptera from Brazil’s North and Midwest areas.

The species described in the present study was collected on Sep. 2011 at Parque Nacional da Chapada dos Guimarães (National Park of Chapada dos Guimarães) in Mato Grosso (Brazil). The gall (Fig. 1) was photographed using a digital camera and characterized by the plant organ of occurrence, shape, color, presence or absence of trichomes, and number of internal chambers.

The collected material was labeled and transported to the Laboratório de Diptera (Museu Nacional/UFRJ, Rio de Janeiro). Samples

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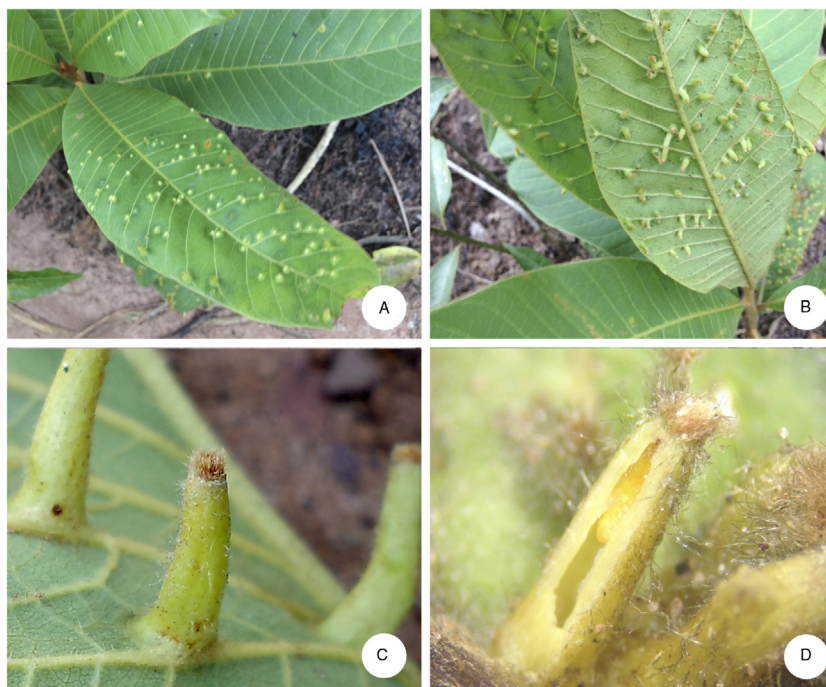


Fig. 1. Cylindrical gall, green, one-chambered, with brownish trichomes on leaves of *Pouteria torta* (Mart.) Radlk. (Sapotaceae). (A) View of the galls on the leaf's adaxial side; (B) galls on leaves' abaxial side; (C) detail of the gall; (D) opened gall, showing the inner chamber and a young pupa of *Youngomyia matogrossensis* Proença & Maia.

of the gall were placed in plastic pots at room temperature to rear adults. Other samples were dissected to obtain larvae and pupae of the inducer. The specimens were prepared and mounted on slides following the methods outlined in Gagné (1994).

The gall midge genus was identified using Gagné's (1994) key to Neotropical genera and the species was determined to be new to science after comparison with the original descriptions and illustrations of the known species, and with specimens from the Cecidomyiidae collection of the Museu Nacional (MNRJ). The diagnostic characters were illustrated with an optical microscope. Photographs were taken by a NIKON eclipse e200 camera coupled to an optical microscope. All drawings were scanned and processed in Adobe Illustrator CC 2015® and both draw's plates and photographs were processed in Photoshop CS6®.

We designated a male as holotype and also males, females, pupal exuviae and larvae as paratypes. All material, including the types, is deposited in the Cecidomyiidae collection of Museu Nacional, Rio de Janeiro (MNRJ). Morphological terminology follows Gagné (1994). The field work was done by Maia, V.C. and Ascendino, S., and the description of the new species by Proença, B. and Maia, V.C.

The host plant was identified by Dr. Gracialda Ferreira and Manuel Cordeiro (Universidade Federal Rural da Amazônia), and the exsiccate was deposited in the herbarium of that institution.

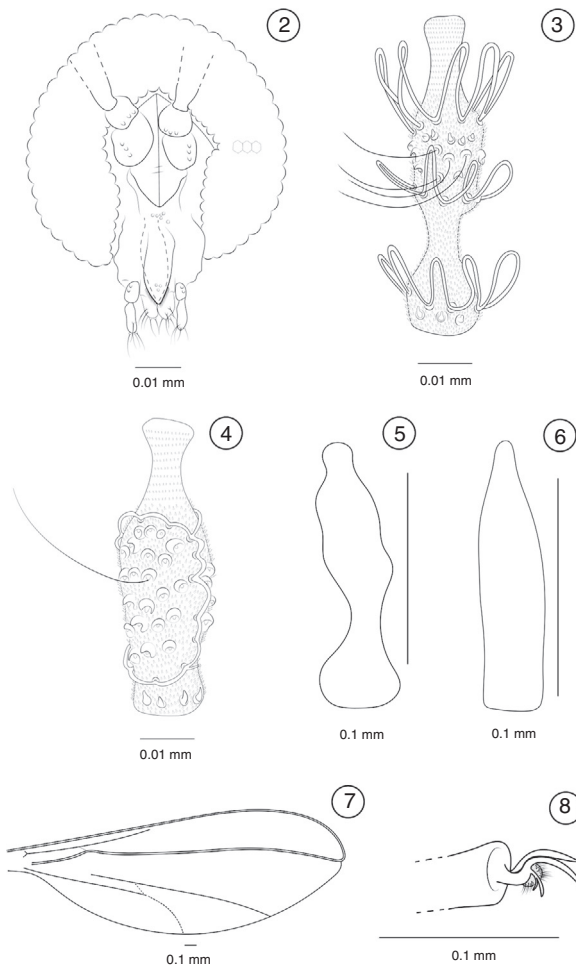
Type-material of *Y. pouteriae* deposited in the Cecidomyiidae collection of the Museu Nacional (MNRJ) was examined in the present study.

Results

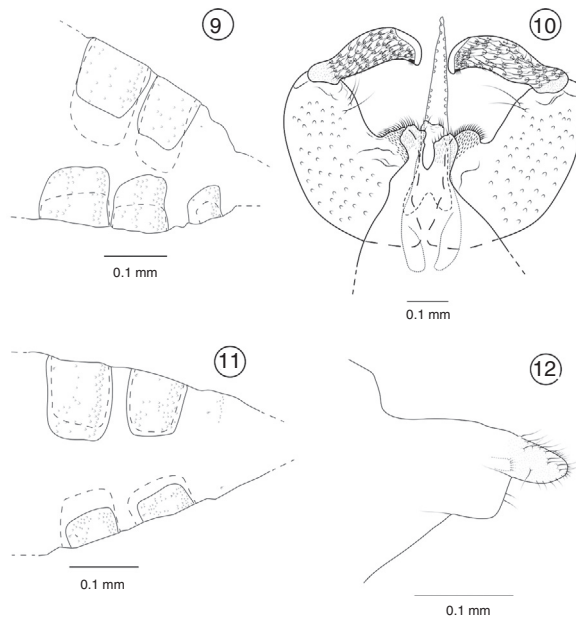
Youngomyia matogrossensis sp. nov. (Figs. 2–18)

Diagnosis. Adult: claws two-toothed; empodia short, not reaching bend in claws; claviform gonostylus; setulose and oval cerci; hypoproct slightly longer than cerci; aedeagus long and triangular. Ovipositor short, slightly protrusible, with 1.6 times the length of sternite 7; oval and separated cerci. Pupal exuviae: antennal bases short and triangular; prothoracic spiracle long; abdominal

segments 2–8 with serrated dorsal spines. Larvae: two-toothed spatula with tapered end; three pairs of setulose terminal papillae. **Description.** Adult. Body length: 2.9–3.4 mm in males ($n=4$), 3.9–4.6 mm in females ($n=3$). Head (Figs. 2–6): Frontoclypeus with 5–9 setae ($n=5$); labrum long-attenuated with 2 pairs of ventral sensory setae close to the apex ($n=3$), hypopharynx apically setulose, slightly longer than labrum ($n=3$), labellae long, convex, setulose, with two pairs of setae ($n=3$); palpus two-segmented, cylindrical, the second two times longer than the first one. Occipital process absent. Eyes facets hexagonal, closely approximated. Antenna 2 + 12: scape obconical with 2–3 setae ($n=4$), pedicel globose with 2–5 setae ($n=4$) (Fig. 2). Male flagellomeres: distal circumfilum with loops longer than those of the others and middle circumfilum with loops shorter than those of the basal one (Fig. 3). Female flagellomere 1 slightly longer than the others; circumfila in two rings slightly sinuous, one ring distal and the other subbasal, interconnected by a longitudinal slightly sinuous strand (Fig. 4). Antennae with long and setulose necks and flagellomere 12 with apical process in both sexes (Figs. 5 and 6). Apical process 7.0 times shorter than flagellomere 12 in males ($n=1$) and 6.5 times in females ($n=1$). Thorax (Figs. 7 and 8): Male wings with 2.3–2.5 mm in length ($n=4$), female wings 2.9–3.0 mm in length ($n=4$). Rs evanescent, reaching R1 before the midlength; the other veins as in the generic characterization (Fig. 7). Anepimeron with 7–10 setae. Scutum with lateral and dorsal setae, scutellum with few subapical setae. Tarsal claws robust, strongly sclerotized, bend at the basal third, two-toothed, the superior tooth conspicuously longer than the inferior one; setulose empodia, not reaching the bend in claws (Fig. 8). Male abdomen (Fig. 9): tergites 1–7 sclerotized, rectangular, with one anterior pair of trichoid sensilla. Tergites 1–6 with single row of posterior setae; some sparse setae irregularly distributed and scales elsewhere. Tergite 7 evenly sclerotized, with setae irregularly distributed. Tergite 8 not sclerotized with only one anterior pair of trichoid sensilla as vestiture. Sternites 2–8 sclerotized, rectangular, with one pair of trichoid sensilla, scales elsewhere. Sternites 2–4 with a simple row of posterior setae and scattered mesal setae; sternites 5–7 with more than two posterior



Figs. 2–8. *Youngomyia matogrossensis* Proença & Maia. (2) Male head (frontal view); (3) male flagellomere; (4) female flagellomere; (5) male flagellomere 12; (6) female flagellomere 12; (7) male wing; (8) female mid leg: claws and empodium (lateral view).



Figs. 9–12. *Youngomyia matogrossensis* Proença & Maia. (9) Male abdomen, segments 6–8 (lateral view); (10) male terminalia (dorsal view); (11) female abdomen, segments 6–8 (lateral view); (12) ovipositor (lateral view).

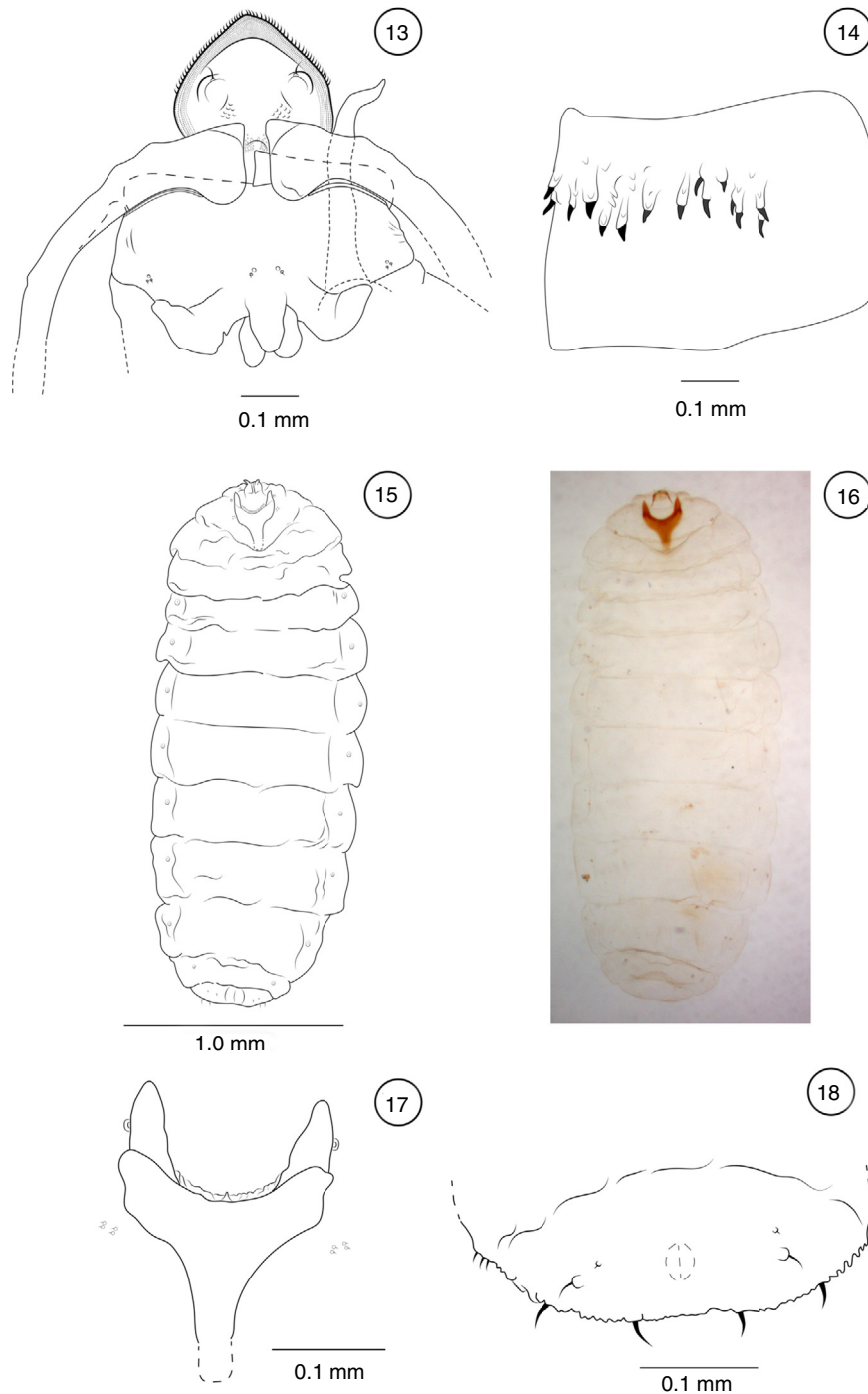
rows of setae and scattered setae on the rest of the sternites. Sternite 8 reduced, about 0.10–0.12 mm in length ($n=7$), with scattered setae on posterior margin, more concentrated from distal half to posterior margin. Sternite 8 about 0.45–0.65 mm as long as sternite 7. Male terminalia (Fig. 10): gonocoxite oval, not splayed, covered with setae, with spiny and rounded mesobasal lobes, slightly shorter than the hypoproct; gonostylus claviform, 1.5–1.6 times shorter than gonocoxite ($n=2$), with strongly pronounced striae at all extension, delimiting elongated cells, each one with a seta at the apex; setulose at basal 1/5. Cerci oval, setulose, with apical setae; hypoproct slightly bilobated, setulose, and slightly longer than cercus; aedeagus very long, triangular, strongly sharp at the apex, with lateral pitted sensorial from the apex to middle length. Female (Fig. 11): tergites 1–7 and sternites 2–7 sclerotized, with scattered scales and anterior pair of trichoid sensilla. Tergites 1–6 rectangular, with rounded margins, single row posterior setae and scattered mesal setae. Tergite 7 with setae more concentrated at the posterior margin. Tergite 8 not sclerotized, with only one anterior pair of trichoid sensilla as vestiture. Sternites 2–5 with row of posterior setae and lateral setae. Sternite 6 with a double row of posterior setae, row of lateral setae and mesal setae. Sternite 7 with setae concentrated posteriorly, laterally and mesally. Sternite 8 not sclerotized, with only one anterior pair of trichoid sensilla as vestiture. Ovipositor (Fig. 12): short, slightly protrusible, about 1.6 times as long as sternite 7; cerci oval, setulose, with dorsal setae longer than the ventral setae; hypoproct tiny, glossiform and setulose. Segment 9 with scattered setae quite varied in size, more abundant ventrally.

Pupal exuviae (Figs. 13 and 14): Length: 3.2–3.9 mm ($n=5$). Cephalic region (Fig. 13): cephalic seta short with 0.03–0.05 mm in length ($n=9$); apical plate with rough integument in all extension except apically; anterior margin with abundant short spines. Antennal bases sclerotized, triangular, smooth and short, with 0.03–0.05 mm long ($n=8$). Upper and lateral cephalic margin thickened. Two pairs of lower facial papillae, one setose and one aseptose; two groups of three lateral facial papillae: one pair bigger and aseptose, and two setose. Thorax: prothoracic spiracle long, strongly sclerotized, triangular, bent at the 5th distal portion and slightly bent sub apically, 0.32–0.49 mm long ($n=7$); outer margin serrated from the distal half. Foreleg sheath reaching the anterior margin of abdominal segment 5; midleg sheath reaching the middle of abdominal segment 5; hindleg sheath reaching the distal margin of abdominal segment 5. Abdomen (Fig. 14): spiny integument. Segment 1 covered with small spines. Anterior margin of abdominal segment 2–8 with a row of irregular serrated spines of different sizes. Segments 2–8 sclerotized from the anterior margin until the end of the spiny area.

Larvae (Figs. 15–18): Length: 1.1–2.7 mm ($n=13$). Fusiform body, white coloration. Integument dorsal and ventrally rough. (Figs. 15 and 16). Spatula strongly sclerotized, with 0.2–0.3 mm in length ($n=13$), with two well developed teeth, parallel, well separated from each other, apical margin serrated between the teeth. Spatula shaft reduced in length, with about 1/4 of the spatula total length and weakly sclerotized at the end. One aseptose pair of sternal papillae; two pairs of setose lateral papillae on each side of the spatula (Fig. 17); four pairs of setose terminal papillae: two pairs smaller than the others (Fig. 18).

Etymology. The specific name *matogrossensis* refers to Mato Grosso, the Brazilian state where this species was collected.

Material examined. Holotype. BRAZIL: ♂ (slide), Midwest Brazil, Mato Grosso, Parque Nacional da Chapada dos Guimarães, Caminho Vêu da Noiva trail, 15°24'20"S; 55°49'47"W, 5 Sep. 2011, Maia, V.C. and Ascendino, S. col., *Pouteria torta* (Mart.) Radlk. (Sapotaceae), (MNRJ).



Figs. 13–18. *Youngomyia matogrossensis* Proença & Maia. (13) Pupa: cephalic region and prothoracic spiracle (frontal view); (14) pupa: abdominal segment 5 (dorsal/lateral view); (15) larva, general aspect (ventral view); (16) larva, general aspect photomicrograph (ventral view); (17) larval spatula (ventral view); (18) larva: terminal segment (ventral view).

Paratypes. BRAZIL: Midwest Brazil, 12 ♂♂, 10 ♀♀, 5 pupal exuviae and 9 larvae in permanent slides, same data as holotype (MNRJ).

Additional Figs. 19, 20, 21, 22 and 23 showing respectively, one adult female, one larva, one young pupa, one mature pupa of *Youngomyia matogrossensis* and one microhymenoptera pupa (parasitoid).

Gall. The galls of *Youngomyia matogrossensis* are initially green, brownish when mature, and brownish-red when senescent. Brown trichomes are observed throughout the galls, being more abundant

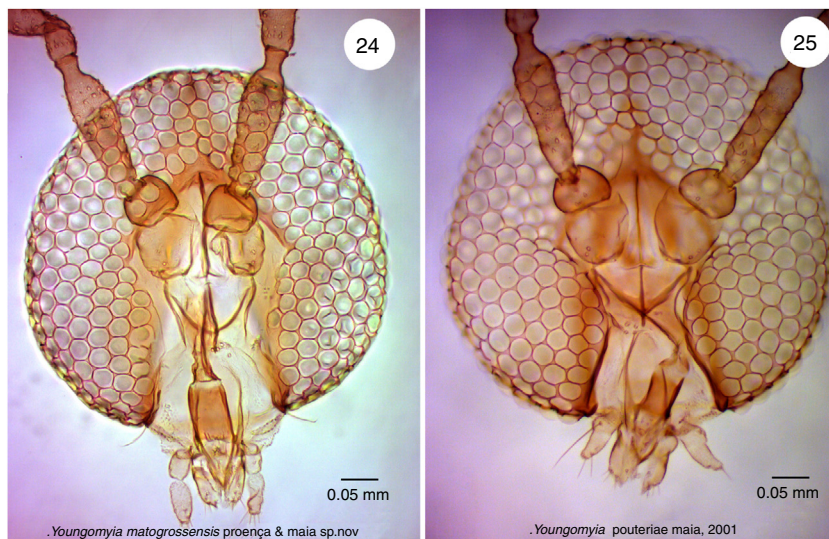
at the apex. The galls are found on young or mature leaves, on both adaxial and abaxial surfaces, being more abundant on the abaxial surface.

Host plant. *Pouteria torta* (Mart.) Radlk (Sapotaceae).

Distribution. So far, *Youngomyia matogrossensis* occurs in three Brazilian states: Mato Grosso, present study, Mato Grosso do Sul, in Aquidauana municipality (Urso-Guimarães et al. (2017)) and São Paulo, in Ecological Station of Jataí (Saito and Urso-Guimarães, 2012) and in Pé-de-Gigante Reserve, Santa Rita do Passa-Quatro (Urso-Guimarães and Scareli-Santos, 2006). All areas in the Cerrado biome.



Figs. 19–23. *Youngomyia matogrossensis* Proença & Maia. (19) Larva inside gall's chamber; (20 and 21) young and mature pupa inside gall's chamber; (22) undetermined hymenoptera parasitoid in the gall; (23) adult female.



Figs. 24 and 25. (24) Palpus two-segmented of *Youngomyia matogrossensis* Proença & Maia (black arrow); (25) palpus one-segmented of *Youngomyia pouteriae* Maia, 2001 (black arrow).

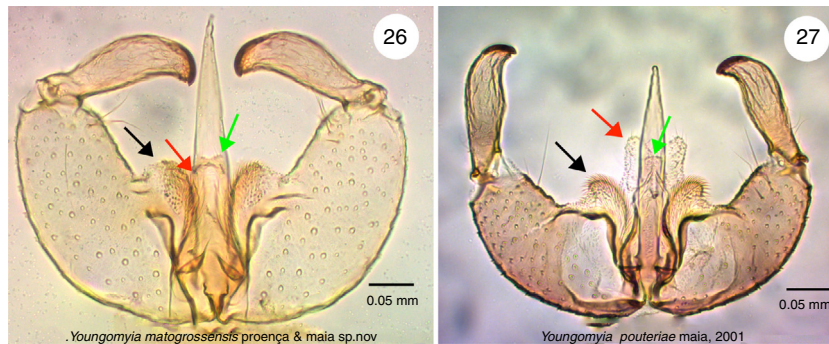
Comments. Urso-Guimarães and Scareli-Santos (2006) recorded leaf galls on *Pouteria torta*, in Minas Gerais State, Brazil, and suggested that they were induced by a new species of *Youngomyia*. Scareli-Santos et al. (2008) described the structure as well as the histochemistry of these galls. Later, the inducer was identified as *Youngomyia pouteriae* Maia, 2001 by Saito and Urso-Guimarães (2012). After comparing the specimens that we have obtained from *Pouteria torta* with the type specimens of *Y. pouteriae*, we realized that the former is a new species of *Youngomyia*. The new species was included in *Youngomyia* based on the following characters: necks of the flagellomeres setulose; gonocoxites with spines on the mesobasal lobes; gonostylus striated; and larvae with two-toothed spatula with tapered end.

Among the previously known species, three have elongated cerci: *Y. pouteriae* Maia, 2001; *Y. podophylla* (Felt, 1907) and *Y. knabi* (Felt, 1912) as well as the new species. However, only in *Y.*

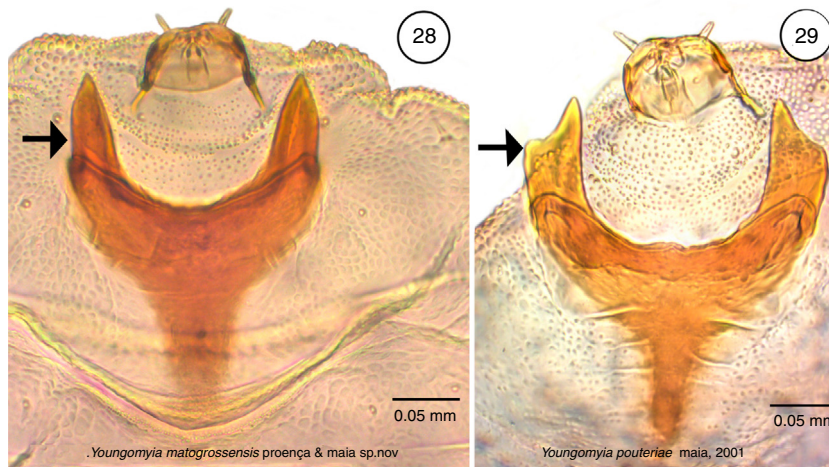
pouteriae and *Y. matogrossensis* the spines on male's hypoproct are absent.

Despite these similarities *Y. pouteriae* and *Y. matogrossensis* differ in the following aspects: adults – two-segmented palpi in the new species (Fig. 24) and one-segmented in *Y. pouteriae* (Fig. 25); male cercus shorter and aedeagus narrower in *Y. matogrossensis* (Fig. 26) than those of *Y. pouteriae* (Fig. 27); male hypoproct slightly bilobated in the new species and simple in *Y. pouteriae*; mesobasal lobes of *Y. pouteriae* more pronounced than those of *Y. matogrossensis*. Pupal exuviae: Lateral facial papillae are present in the new species but absent in *Y. pouteriae*. Larval spatula without indentation at external margin of the lateral side in *Y. matogrossensis* (Fig. 28), but this indentation is present in *Y. pouteriae* (Fig. 29).

This is the second *Youngomyia* species described from Brazil and the first from Cerrado. The previous known species, *Youngomyia*



Figs. 26 and 27. (26) Male terminalia of *Youngomyia matogrossensis* Proença & Maia. (27) Male terminalia of *Youngomyia pouteriae* Maia, 2001. The arrows point out to the following structures: black arrow: mesobasal lobe; red arrow: cerci; green arrow: hypoproct.



Figs. 28 and 29. Larval spatula of (28) *Youngomyia matogrossensis* Proença & Maia; (29) *Youngomyia pouteriae* Maia, 2001. The arrows show the difference between the larval spatula of both species. An indentation at the external margin of the teeth is only observed in *Y. pouteriae*.

pouteriae Maia, 2001, was found in Atlantic forest areas of Rio de Janeiro (Brazil).

Youngomyia pouteriae Maia, 2001 (Figs. 25 and 27)

New morphological data. Adult: Head (Fig. 25). Both sexes with flagellomeres 1–2 connated and neck of the flagellomeres setulose. Male flagellomeres with basal loops longer than the medial and distal loops; flagellomere 12 with apical process. Female flagellomere 1 longer than the others; circumfila in two rings slightly sinuose, one ring distal and the other subbasal, interconnected by a longitudinal slightly sinuose strand. Hypopharynx triangular, longer than labrum and apically setulose. Labella with 2 pairs of ventral sensorial setae. Palpus with apical setae. Thorax: Wing: Rs bent at its juncture with R5. Legs: Tarsal claws well sclerotized and two-toothed. Male terminalia (Fig. 27). Gonostylus smaller than gonocoxite, with strongly pronounced striae, delimiting elongated cells, each one with a bristle at its base; separated cerci, setose in all length, with six pairs of longer setae at the apex; aedeagus elongated and claviform. Ovipositor: female cerci oval. Pupal exuviae. Antennal bases short, triangular; cephalic seta short. Two pairs of lower facial papillae, one setose and one asetose. Prothoracic spiracle long, triangular, strongly sclerotized, and slightly serrated at the margin. Abdominal segments 2–8 sclerotized dorso-anteriorly, sclerotized area contiguous with spines.

Material examined. 3♂♂, 6♀♀, 3 pupal exuviae and 5 full-grown larvae from Restinga da Barra de Maricá e Itaipuaçu in Maricá and Arraial do Cabo municipality, Rio de Janeiro, Brazil, deposited in the Cecidomyiidae collection at MNRJ, Rio de Janeiro, Brazil.

Conflicts of interest

The authors declare no conflicts of interest.

Acknowledgments

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