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Neolasioptera pantaneira, a new species of Cecidomyiidae (Diptera) associated with *Aeschynomene denticulata* (Fabaceae) from Brazil

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(With 17 figures)

Abstract

A new species of gall midge that induces stem galls on *Aeschynomene denticulata* (Fabaceae) is described based on material collected in Pantanal (Mato Grosso do Sul, Brazil). This species is unique among the Brazilian congeners in having spatula with three convex teeth, cruciate, with defined anterolateral extensions, four lateral papillae on each side of the spatula, and three pairs of terminal papillae (larva), four-segmented palpi (adult), 17 flagellomeres (female), ovipositor about 11 times length of seventh tergite.

Keywords: gall, interaction insect-plant, Pantanal, taxonomy.

Neolasioptera pantaneira, uma nova espécie de Cecidomyiidae (Diptera) associada com *Aeschynomene denticulata* (Fabaceae) do Brasil

Resumo

Uma nova espécie de Cecidomyiidae que induz galhas caulinares em *Aeschynomene denticulata* (Fabaceae) é descrita com base em material coletado no Pantanal (Mato Grosso do Sul, Brasil). Esta espécie é única entre as congenéricas brasileiras por possuir espátula com três dentes convexos, com extensões anterolaterais cruzadas e bem definidas, quatro papilas laterais de cada lado da espátula e três pares papilas terminais (larva), palpos com quatro segmentos (adulto), 17 flagelômeres (fêmeas), ovipositor cerca de 11 vezes mais longo que o sétimo tergito.

Palavras-chave: galha, interação inseto-planta, Pantanal, taxonomia.

1. Introduction

Aeschynomene denticulata Rudd. (Fabaceae), commonly known as "corticeirinha", "anguicinho", "pinheirinho", "maricazinho", or "paquinha", is a native plant to Brazil. It is an invasive subshrub or herb, occurring mainly in wet places. It blooms from November to January. In Brazil, this plant is wide spread, with records in North (Amazonas and Pará), Northeast (Bahia and Pernambuco), Central-West (Goiás, Mato Grosso do Sul, and Mato Grosso), Southeast (Minas Gerais, Rio de Janeiro, and São Paulo), and South (Paraná, Santa Catarina, and Rio Grande do Sul) regions, occurring in several biomes – Amazonian Forest, Caatinga, Cerrado, Atlantic Forest, Pampa, and Pantanal (Jardim Botânico do Rio de Janeiro, 2015). It is economically important as it invades annual crops, fruit and vegetable growing.

Stem galls were found in *A. denticulata* in Mato Grosso do Sul. The galler was identified as a new species of *Neolasioptera* Felt, 1908 (Diptera, Cecidomyiidae).

Neolasioptera is known from Nearctic and Neotropical regions, and comprises 134 species, which induce mainly stem galls, but also petiole, leaf vein, or flower galls. Most live on Asteraceae, but many other plant families are hosts also. Only 11 species are associated with Fabaceae (Table 1) (Gagné and Jaschhof, 2014).

In Brazil, 07 species are recorded: 1) *N. cerei* Rübsaamen 1905 – host plant: *Hylocereus setaceus* (Salm-Dyck)

Table 1. List of *Neolasioptera* spp. (Diptera, Cecidomyiidae) associated with Fabaceae.

Species	Host plant	Distribution
Neolasioptera aculeatae Gagné 2011	*Parkinsonia aculeata* L.	Argentina, poss. Paraguay.
N. aeschynomensis (Brèthes 1918)	*Aeschynomene montevidensis* Vogel	Argentina
N. brevis Gagné 1984	*Gleditsia triacanthos* L.	USA
N. cassiae (Felt 1909)	*Cassia nictitans* L.	USA
N. crotalariae (Stebbins 1910)	*Crotalaria sagittalis* L.	USA
N. desmodii (Felt 1907)	*Desmodium cuspidatum* (Muhl. ex Willd.) DC. ex D. Don or *D. canadense* L. (DC.); *Desmodium* spp.	USA
N. indigoferae (Möhn 1964)	*Indigofera suffruticosa* Mill.	El Salvador
N. ingae (Möhn 1964)	*Inga spuria* Humb. & Bonpl. ex Willd., *I. leptoloba* Schltdl.	El Salvador
N. lupini (Felt 1908)	*Lupinus arboreus* Sims., *Lupinus* sp.	USA
Neolasioptera phaseoli (Möhn 1975)	*Phaseolus* sp.	El Salvador

R.Bauer (Cactaceae), 2) *N. cupheae* Gagné 1998 – host plant: *Cuphea carthagenensis* (Jacq.) J. Macbr. (Lythraceae), 3) *N. eugeniae* Maia 1993 – host plant: *Eugenia uniflora* L. (Myrtaceae), 4) *N. fariae* (Tavares 1922) – unknown host plant, 5) *N. lantanae* (Tavares 1922) – host plant: *Lantana* sp. (Verbenaceae), 6) *N. ramicola* Maia 2009 – host plant: *Physalis angulate* L. (Solanaceae), and 7) *N. urvilleae* (Tavares 1909) – host plant: *Urvillea uniloba* Radlk. (Sapindaceae) (Gagné and Jaschhof, 2014).

Neolasioptera is a diverse genus. It gathers the species of Alycaulini whose adults have four or three-segmented palpi and fully fused, unlobed female cerci, pupae with a non-brittle exoskeleton, and larva with the spatula usually well-developed, three or four lateral papillae on each side of the spatula and usually 6 or 8 terminal papillae, and convex and unlobed terminal segment (Gagné, 1994).

2. Material and Methods

Studied area. Pantanal, with diverse landscapes units differentiated by the intensity and regularity of the flood pulse, has an area of approximately 140,000 km^2, of which more than half is covered by water at the time of the flooded (Pott and Pott, 1994) and holds 38.21% of the Upper Paraguay Basin (Silva and Abdon, 1998). The climate is sub-humid tropical - Aw (Koeppen, 1931), with dry winters and rainy summers. The average annual rainfall varies between 1,000 and 1,400 mm, concentrating between November and April (Soriano et al., 2001). The vegetation of the sedimentary foodplain is a mosaic of aquatics, foodable grasslands, riparian forests, savannas (cerrados), cerrado woodlands, dry forests, and a large area of mono-dominant savannas, and pioneer woodlands (Pott et al., 2011) and aquatic environments such as freshwater or brackish lagoons, rivers, fooding runoff ("vazantes") and anabranch ("corixos"), and the highly sandy soil (Abdon et al., 1998).

In the Pantanal, the ponds are small depressions freshwater, circular or elongated that in full season reach up to a meter deep receiving contribution of surface water, which can be aligned and connect to each other in the form of rosary, that being in drought dry (Bacani and Sakamoto, 2007).

Individuals of *A. denticulata* were found on the edge of a permanent pond surrounded by woody vegetation patches resistant to flooding, known locally as "capões" in the sub-region Abobral, farm São João (19°23'09.01"S, 57°02'57.77"O, 92 m), Municipality of Corumbá, Mato Grosso do Sul, Brazil, in March, April and May 2013, the dry season in the Pantanal. Ungalled branches were pressed and identified by GC and FML. The exsiccate (CGMS 50234) was incorporated in the herbarium CGMS/Universidade Federal de Mato Grosso do Sul.

Galled stems were removed from the plant, placed in plastic bags and taken to the laboratory for observing the emergence of the adults in their own inflated plastic bags, at room temperature. Larvae and pupae exuviae were obtained through dissection of some galls under stereoscopic microscope, all the material was fixed in 70% alcohol.

The Cecidomyiidae was mounted on microscope slides, following the method outline by Gagné (1994). The gall midge was identified to genus level based on the key in Gagné (1994). Then, we used the key to Neotropical species of *Neolasioptera* in Gagné et al. (2011). The species was compared to the descriptions and illustrations of the Brazilian species as well as to Neotropical species associated with Fabaceae. The most important morphological characters were illustrated, using light microscope with camera lucida. Measurements were made using a microscope slide with scale. The terminology of Gagné (1994) was adopted. Type-material is deposited in the Diptera Collection of the Museu Nacional (MNRJ)/Universidade Federal do Rio de Janeiro. The field and laboratory works were done by G.C. and F.M.L., while the description of the new species was done by V.C.M.

Neolasioptera pantaneira Maia, sp. n. (Figures 1-11)

Diagnosis. Adults with four-segmented palpi, female with 17 flagellomeres and ovipositor about 11 times length of seventh tergite. Larva with spatula with three convex teeth, cruciate, with defined anterolateral extensions, four lateral papillae on each side of the spatula, and three pairs of terminal papillae.

Male adult. Body length: 1.70-1.85 mm (n=3). Head (Figure 1): eye facets circular; vertex with facets. Antenna: scape obconic, as long as large, with few setae and scales ventrally, bare dorsally; pedicel globose 1.2 times as wide as long, with several setae and densely covered with scales ventrally, with several setae dorsally, wider than flagellum; flagellomeres barrel-shaped, longer than wide, each with 2 horizontal circumfila and 2 vertical connectives, completely setulose, with a few scales proximad of basal circumfilum, setae between the horizontal circumfila and short neck (Figure 2), flagellomeres 8 + ?, 1st and 2nd flagellomeres 2 connate. Frons thickly covered with setae and scales. Labrum long-attenuate with two pairs of ventral setae; labella hemispherical, each with some lateral setae and two pairs of short setae; palpus with four segments: 1st segment shortest, globose as long as wide, 2nd-4th segments cylindrical, 2nd segment widest, 1.5 as long as wide; 3rd segment 3 times as long as wide, 4th segment longest, 3.5 times as long as wide, all with widely scattered setae and scales. Thorax: scutum with setae of the 2 central rows in sparse files, lateral rows present in 2-3 files and continuous along most of scutal length, scutum otherwise nearly entirely covered with scales except for midline posteriorly and 2 narrow mediolateral lines; scutellum with single irregular horizontal row of setae, otherwise covered with scales;, anepimeron with 07-09 setae, pleura otherwise without vestiture; wing: length (from arculus to apex): 1.0-1.1 mm (n=9); tarsal claws bowed beyond midlength, and toothed; empodium reaching bend in claws (Figure 3).

Abdomen (Figure 4): first through sixth tergites with anterior pair of trichoid sensilla, single posterior row of sparse setae, some lateral setae, and otherwise covered with scales; seventh tergite on anterior half unpigmented and without vestiture, pigmented posteriorly with single row of posterior setae and elsewhere covered with scales; eighth tergite apparent only from anterior pair of trichoid sensilla, 8th tergite elliptical with setae and two anterior trichoid sensilla; second through sixth sternites rectangular with a single posterior row of setae, few lateral setae, elsewhere covered with scales, and with pair of closely set anterior trichoid sensilla; seventh sternite similarly shaped with anterior pair of trichoid sensilla and double row of posterior setae, elsewhere covered with scales; eighth sternite without trichoid sensilla and apparent only posteriorly around double row of setae. Terminalia (Figure 5): gonocoxite not splayed, about 2.7-3.0 times as long as wide, about 1.9-2.0 times as long as gonostylus and setose; gonostylus claviform, tapering from base to apex, setulose on basal third, glabrous and ridged beyond to apical tooth; posterior margins of cerci and hypoproct evenly convex posteriorly, all 3 subequal in shape, the cerci with several setae ventrolaterally and apically, hypoproct with 3 setae along posterior margin about as long as cerci; parameres longer than hypoproct, covered with elongate, recurved setulae, bilobed, the dorsal lobe short, convex, the ventral lobe longer, larger, projecting dorsally in lateral view; aedeagus glabrous, longer than mediobasal lobe, tapering gradually to apex, the apex convex in dorsoventral view.

Female adult. As in male, except for: body length: 2.40-3.55 mm (from head until posterior margin of 8th tergites (n=8). Head: antennae 1.5-1.6 times as long as head, with 17 flagellomeres (Figures 6, 7), 17th flagellomere globose; palpus: 4th segment 5.0-6.0 times as long as wide. Wing: length (from arculus to apex): 1.0-1.4 (n=8). Female abdomen (Figures 8, 9): Vestiture of first through sixth segments generally as for male. Seventh tergite rectangular, much smaller than sixth, with pair of trichoid sensilla anteriorly, single row of setae along posterior margin, elsewhere covered with scales. Eighth tergite modified into a pair of elongate sclerites much longer than preceding tergite, only vestiture on each sclerite a single trichoid sensilla anteriorly and a row of setae posteriorly; 2nd to 6th sternites rectangular, narrower than tergites, with a double posterior row of setae, lateral setae, elsewhere covered with scales, except near anterior margin, with pair of closely set anterior trichoid sensilla; seventh sternite similarly shaped with anterior pair of trichoid sensilla, single row of posterior

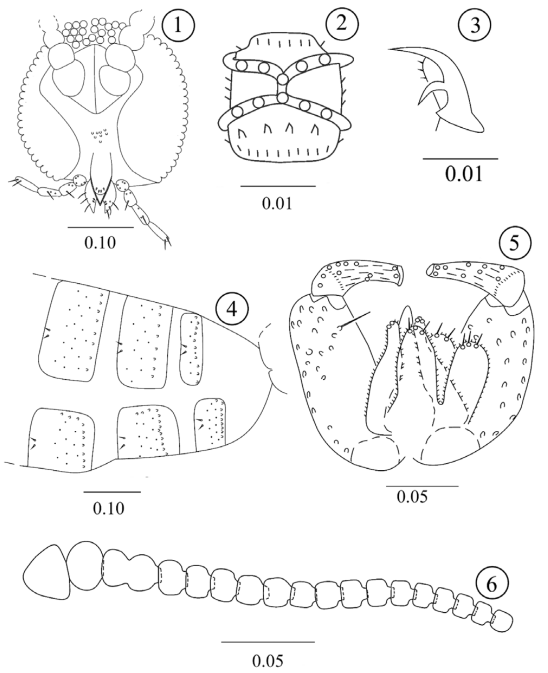

Figure 1-6. *Neolasioptera pantaneira*, sp. n.: 1-5. Male. (1) head, frontal view; (2) 5th flagellomere; (3) tarsal claw and empodium, foreleg; (4) 6th-8th abdominal segments, lateral view; (5) terminalia, dorsal view; (6) female antenna. Scales in mm.

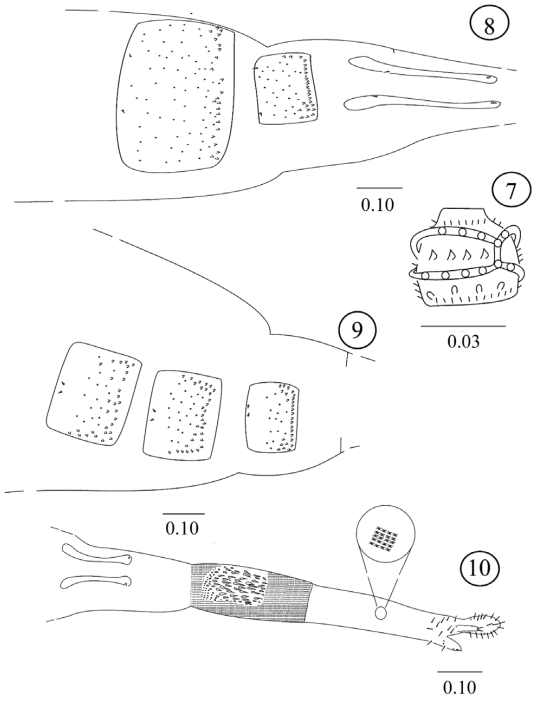

Figure 7-10. Female of *Neolasioptera pantaneira*, sp. n.: (7) 5th flagellomere; (8) 6th-8th abdominal segments, dorsal view; (9) 6th-8th abdominal segments, ventral view; (10) ovipositor, dorso-lateral view. Scales in mm.

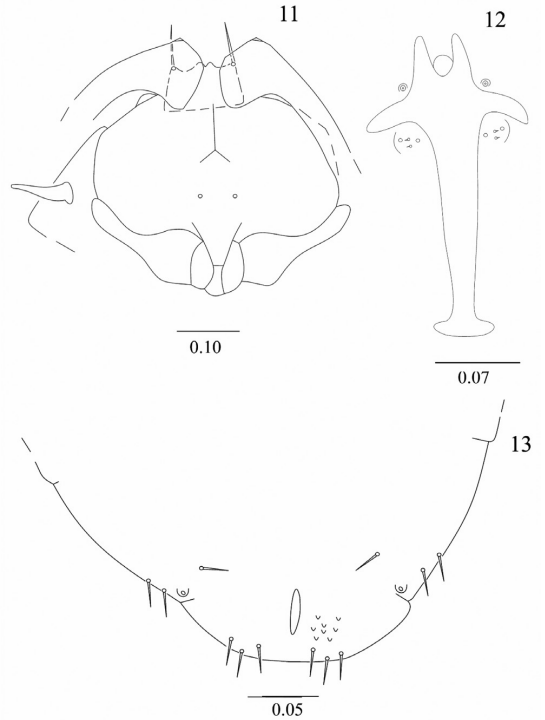

Figure 11-13. Immature phases of *Neolasioptera pantaneira*, sp. n.: (11) Pupa: head and prothoracic spiracle, frontal view; (12) larva: spatula, sternal and lateral papillae, ventral view; (13) larva: last two segments. Scales in mm.

setae, lateral setae, elsewhere covered with scales, except at basal third; eighth sternite unsclerotized. Ovipositor (Figure 10) elongate, protrusible, about 11 times length of seventh tergite (ovipositor measured from anterior margin of 8th tergite to end); cerci fused, elongate-ovoid, about 2.5-3.0 times as long as wide, setose.

Pupa. Length: 2.20-2.70 mm (n=3). Body elongate-cylindrical. Head (Figure 11): antennal bases separate, with acute apical margin Cephalic setae 0.06-0.07mm long (n=3), perpassing antennal sheath. Upper cephalic margin thickened laterally. Frons with a pair of asetose papillae, lateral papillae absent. Prothoracic spiracle digitiform and short, 0.06-0.08 mm long (Figure 11). Abdominal first tergum without spicules, second to eighth terga and all sterna and pleura mostly densely covered with tiny spicules, terminal segment rounded.

Third instar larva. Length: 2.60 mm (n=3). Body spindleform, posterior end convex. Integument entirely and evenly verrucose. Spatula (Figure 12) 0.23-0.25 mm in length (n=3), strongly sclerotized, brown, shaft widest anteriorly, tridentate, middle tooth convex, appreciably shorter than lateral teeth; 4 lateral papillae on each side of spatula, 2 with setae, the other 2 asetose; three pairs of setose terminal papillae, all similar in length (Figure 13).

Gall (Figure 14). Stem gall, fusiform, green, with micropubescence, one-chambered.

Etymology. The name "*pantaneira"* refers to the biome where the species was collected – Pantanal.

Material examined. Holotype male. Brazil, Mato Grosso do Suls, Corumbá, Pantanal, 01/III/2013, Catian G. leg, MNRJ. Paratypes: same data as holotype – 2 males, 14 females, 2 pupae, 1 pupal exuviae, and 3 larvae. MNRJ.

Comments. This is the second species of *Neolasioptera* associated with *Aeschynomene* L. The other one, *N. aeschynomensis* (Brèthes 1918) has been recorded only in Argentina, where induces gall on *Aeschynomene montevidensis*. It was described based on female, and Gagné et al., 2011 gave information about larva morphology. Male and pupa are still unknown. The larva is very useful to segregate both species. *N. aeschynomensis* and the new species have three-toothed spatula, cruciate, with defined anterolateral extensions, but they differ in the shape of the teeth, which are pointed in the former (Figure 15) and convex in the latter, as well as in the shape of the basis - more extended laterally in the new species (see Figures 12 and 15 to compare). Although the original female description of *N. aeschynomensis* is very brief, some differences can be pointed: the number of flagellomeres (20 in *N. aeschynomensis* and 17 in the new species), the length of flagellomeres necks (longer in the new species, see Figures 6 and 16 to compare) and the body length (1.50 mm in *N. aeschynomensis* and from 2.40 to 3.55 mm in the new species).

Figure 14. Gall of *Neolasioptera pantaneira*, sp. n. on stems of *Aeschynomene denticulata* Rudd. (Fabaceae).

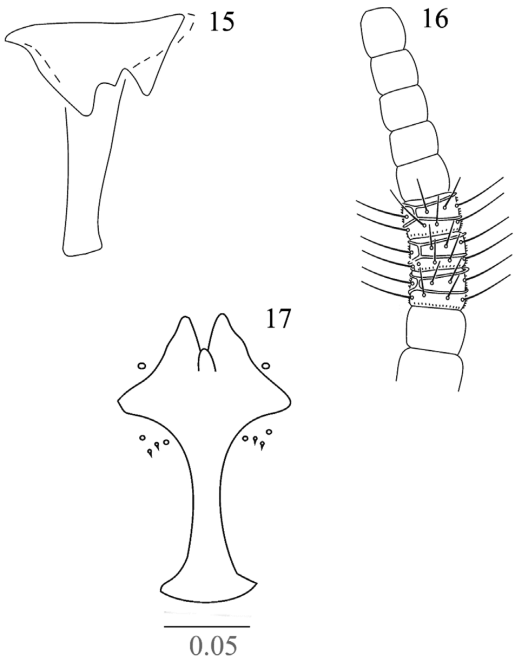

Figure 15-17. *Neolasioptera* spp.: 15-16. *N. aeschynomensis* Brèthes 1918 (original drawings without scales). (15) larval spatula (redrawn from Gagné et al. 1998); (16) female antenna (redrawn from Brèthes, 1918); (17) *N. ramicola* Maia 2009, larval spatula (redrawn from Maia et al., 2009, scale in mm).

The larval morphology also helps to segregate the new species from the other Brazilian congeners: *N. eugeniae* and *N. fariae* are the unique in having two-toothed and four-toothed spatula, respectively. All others have three-toothed spatula. Among these, *N. cerei* is the only one with not cruciate spatula and middle tooth at least as long as the lateral teeth, whereas the reminders have a cruciate spatula. *N. cupheae* has four pairs of terminal papillae, while the new species has three pairs. *N. ramicola* has a relatively shorter spatula shaft and more closely adjacent teeth (see Figures 12 and 17 to compare). In *N. lantanae* the middle tooth is longer than the lateral teeth, differing from the new species where it is appreciably shorter. *Neolasioptera urvilleae* is known only from an inadequate original description of the adults and has not been recorded since. The existence of the types is doubtful (Gagné, 1994). Nothing further can be said about this species until it is found again (Gagné et al., 2011).

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