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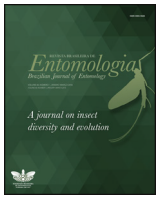

A new species of *Asphondylia* Loew, 1850 (Diptera, Cecidomyiidae) on *Hancornia speciosa* (Apocynaceae), a native plant to Brazil

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ABSTRACT

Asphondylia hancorniae, sp. n. (Diptera, Cecidomyiidae) is described and illustrated. This species was collected in Atlantic Forest and Caatinga domains in Bahia State (Northeastern Brazil). It induces galls on fruits of *Hancornia speciosa* Gomes (Apocynaceae), a plant native to Brazil. *Asphondylia hancorniae* is compared to other congeneric species which induce galls on Apocynaceae.

Introduction

Asphondylia Loew, 1850 (Diptera, Cecidomyiidae) is a wide spread and diverse genus of gall midges, with 308 described species (Gagné and Jaschhof, 2021), characterized by a needlelike ovipositor, two-toothed gonostylus, three-segmented palpi and presence of upper and lower horns on the pupal frons (Gagné, 1994). Among the previously known species, only three induce galls on Apocynaceae: *Asphondylia tabernaemontanae* Möhn, 1959 on *Tabernaemontana amygdalifolia* Jacq. and *T. citrifolia* L., *A. thevetiae* Möhn ,1959, on *Thevetia plumeriaefolia* Benth., and *A. peploniae* Maia, 2001 on *Peplonia asteria* (Vell.) Fontella & E.A.Schwarz. The first two species were described from El Salvador and the third from Brazil (Gagné and Jaschhof, 2021).

In this paper, a new congeneric species is proposed. It induces fruit galls on *Hancornia speciosa* Gomes (Apocynaceae), popularly known as "mangabeira". This plant, native to Brazil, Paraguay, Bolivia, and Peru, has edible fruits with a high percentage of pulp and high content of vitamins and minerals, in addition to antioxidant action and low caloric value (Lederman et al., 2000; Pereira et al., 2016; Silva Júnior et al., 2018). In Brazil, *H. speciosa* shows wide distribution, occurring in savanna formations associated with coastal restinga, coastal plains, and Cerrado, always on sandy soils, poor in nutrients and very well drained (Flora e Funga do Brasil, 2023). It is a pioneer and heliophyte tree or shrub, with semideciduous behavior and abundant latex (Silva et al., 2016).

Materials and methods

VAMP and LSF collected fruit galls on *Hancornia speciosa* in three municipalities of Bahia State (Northeastern Brazil): Mata de São João, Salvador and Lençóis, the first two within the Atlantic Forest domain in Restinga vegetation, and the third within Caatinga domain, in Chapada Diamantina, in Capitinga vegetation, in different dates (see "Material Examined"). Six populations of the host plant were investigated. Their geographic coordinates are presented in Table 1. Specimens of the gall-inducer were reared in laboratory, preserved in 70% ethanol and sent to VCM for identification.

All material was prepared and mounted on microscope slides following the methods outlined in Gagné (1994). The genus was identified using the key of Gagné (1994), and the new species were proposed after comparison with

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literature data (host plants, gall morphology and cecidomyiid descriptions). All types were deposited in the Entomological Collection of the Museu Nacional/Universidade Federal do Rio de Janeiro (MNRJ).

Morphological studies and drawings were made with the aid of an optical microscope with coupled photographic camera and drawing tube. Measurements were done as indicated in Maia and Oliveira (2021). All drawings were edited using Corel DRAW®. Adult morphological terminology follows Gagné (2018) and larval and pupal stages follows Gagné (1989).

The new species is compared to other congeneric species on the same host plant family based on literature data.

Results and discussion

For the first time, galls on *Hancornia speciosa* are reported. This plant has edible fruits, which are used mainly in the production of juice. As the new species described here induces galls on its fruits, it is a potencial pest of *H. speciosa*.

***Asphondylia hancorniae* Maia, sp. nov. (Figs. 1-6)**
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Diagnosis. Male hypoproct sligthly bilobed, male 8th tergite dumbbell shaped; male 2nd-5th sternites with concave anterior margin; female 2nd-4th sternites with concave anterior margin; ovipositor with needle

Table 1
Geographic coordinators and region characterization.

Municipality	Region	Population	Physiognomy	Latitude	Longitude
Salvador	Coastal	1	Restinga	-12.924294°	-38.345788°
Mata de São João	Coastal	2	Restinga	-12.435781	-37.945015
Mata de São João	Coastal	3	Restinga	-12.438346°	-37.964066°
Lençóis	Chapada Diamantina	4	Capitinga	-12.350871°	-41.252855°
Lençóis	Chapada Diamantina	5	Capitinga	-12.463392°	-41.350049°
Lençóis	Chapada Diamantina	6	Capitinga	-12.543988°	-41.363839°

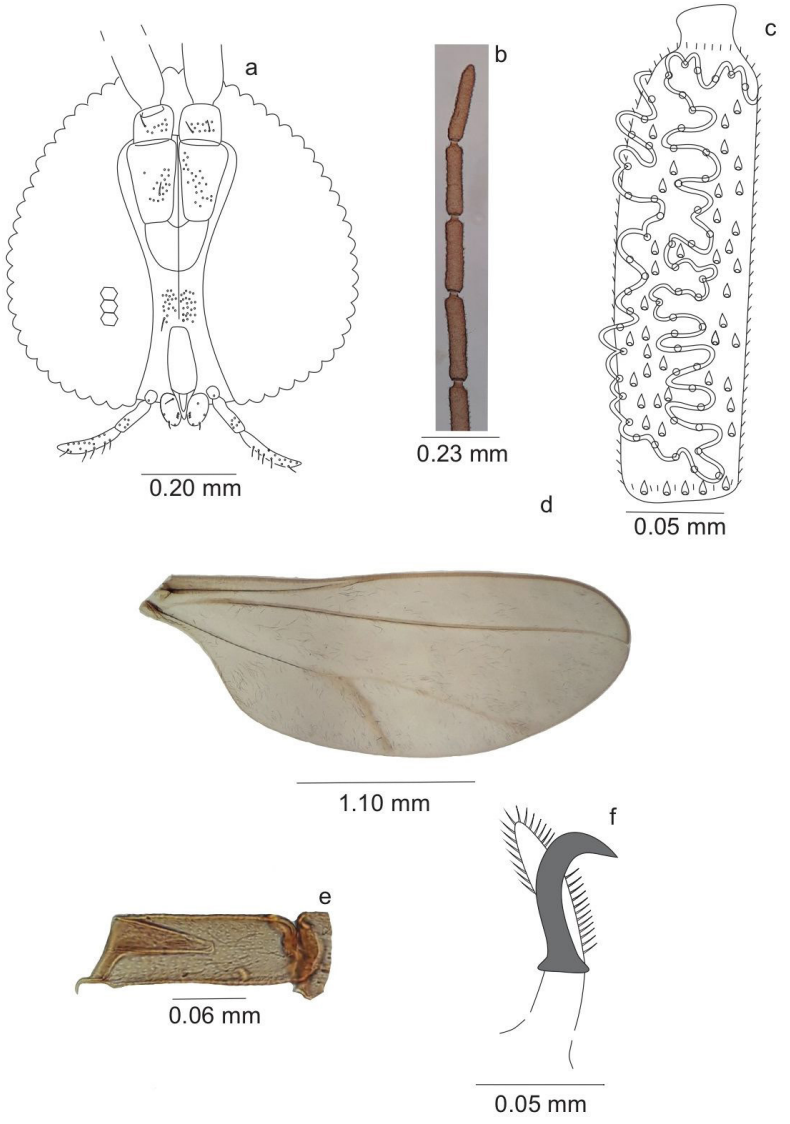

Figure 1 *Asphondylia hancorniae*, sp. n., male: a) Head, frontal view, b) 9th-12th flagellomeres, c) 5rd flagellomere, d) Wing, e) Foreleg, first tarsomere, lateral view, f) Foreleg, tarsal claw and empodium, lateral view).

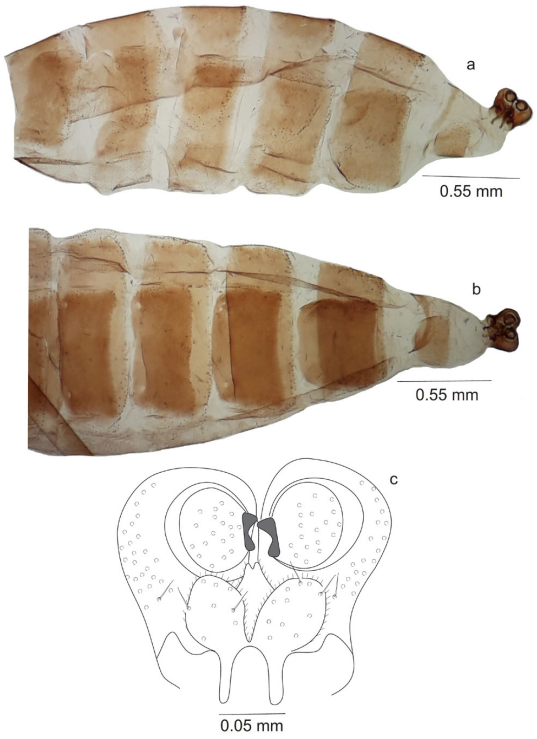

Figure 2 *Asphondylia hancorniae*, sp. n., male: a) 3th abdominal segments to terminalia, lateral view, b) 4th abdominal segments to terminalia, ventral view, c) Terminalia, dorsal view.

part 1.75-1.80 X length 7th sternite; pupa: antennal horn with apical part 1.5 X length of basal part, upper frontal horn simple, lower frontal horn tridentate, 8th abdominal segment with 6-9 dorsal spines in the posterior row; larva with spatula four-toothed and three setose lateral papillae of each side of spatula.

Male: Body: 4.35-5.80 mm long (n=6). Head (Fig. 1a): globoid, 0.65-0.75 mm long, 0.70-0.75mm wide (n=5), eye facets hexagonal, closely appressed; antennae: flagellomeres 1 and 2 not fused, scape truncated conical, setose, 0.16-0.19 mm long, 0.08 mm wide (n=6), pedicel globose, setose, 0.06-0.08 mm long, 0.08 mm wide (n=7), 1st-11th flagellomeres cylindrical, 12th conical (Fig. 1b), circumfila longitudinally wavy (Fig. 1c), 1st flagellomere 0.33-0.40 mm long, 0.05-0.06 mm wide (n=4), 2nd flagellomere 0.27-0.33 mm long, 0.05-0.06 mm wide (n=5), 3rd flagellomere 0.27-0.29 mm long, 0.05-0.06 mm wide (n=5), 4th flagellomere 0.25 mm long, 0.05 mm wide (n=3), 5th flagellomere 0.23-0.25 mm long, 0.05 mm wide (n=3), 6th flagellomere 0.23 mm long, 0.05 mm wide (n=3), 7th flagellomere 0.20 mm long, 0.05 mm wide (n=3), 8th flagellomeres 0.18 mm long, 0.05 mm wide (n=3), 9th flagellomere 0.20-0.26 mm long, 0.05 mm wide (n=5), 10th flagellomere 0.21-0.24 mm long, 0.05 mm wide (n=5), 11th flagellomere 0.20-0.23 mm long, 0.05 mm wide (n=5), 12th flagellomeres 0.20-0.23 mm long, 0.05 mm wide (n=5), proportion flagellomere neck-node: 1:14; frons with 29-41 (n=3); mouth parts: labrum long-attenuate, 0.10-0.14 mm long, 0.05-0.06 mm wide (n=5); hypopharynx of the same shape of labrum, with long lateral setulae, anteriorly directed, 0.18-0.20 mm long, 0.05-0.06 mm wide (n=5); labella elongate and convex, 0.07-0.08 mm long, 0.04 mm wide (n=5), with lateral and mesal setae; palpus 0.21-0.27 mm long (n=6):

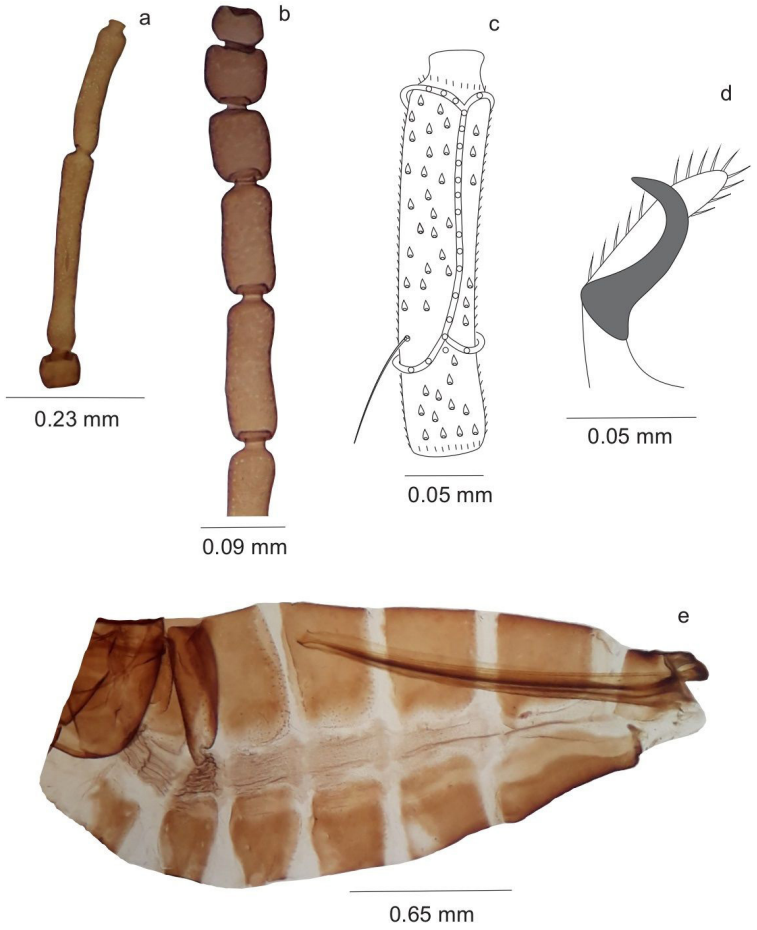

Figure 3 *Asphondylia hancorniae*, sp. n., female: a) Pedicel, 1st and 2nd flagellomeres, b) 8th -12th flagellomeres, c) 5th flagellomere, d) Foreleg, tarsal claw and empodium, lateral view, e) Abdomen, lateral view.

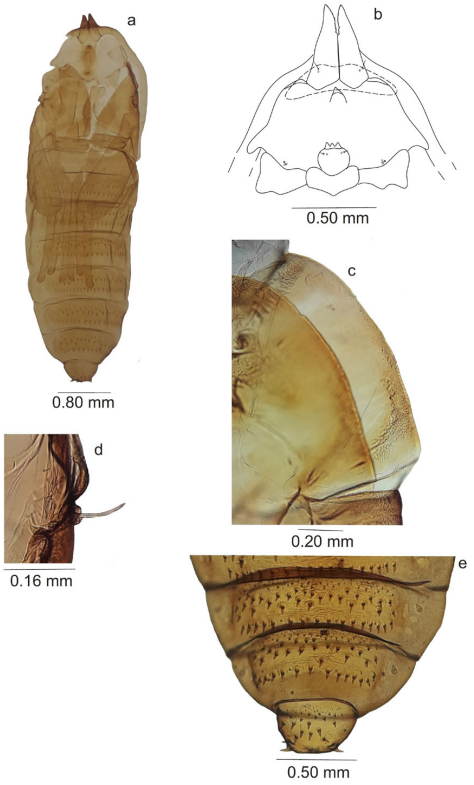

Figure 4 *Asphondylia hancorniae*, sp. n., pupa: a) General aspect, ventral view, b) Head, ventral view, c) Thoracic integument, lateral view, d) Prothoracic spiracle, e) 5th-8th abdominal segments, dorsal view.

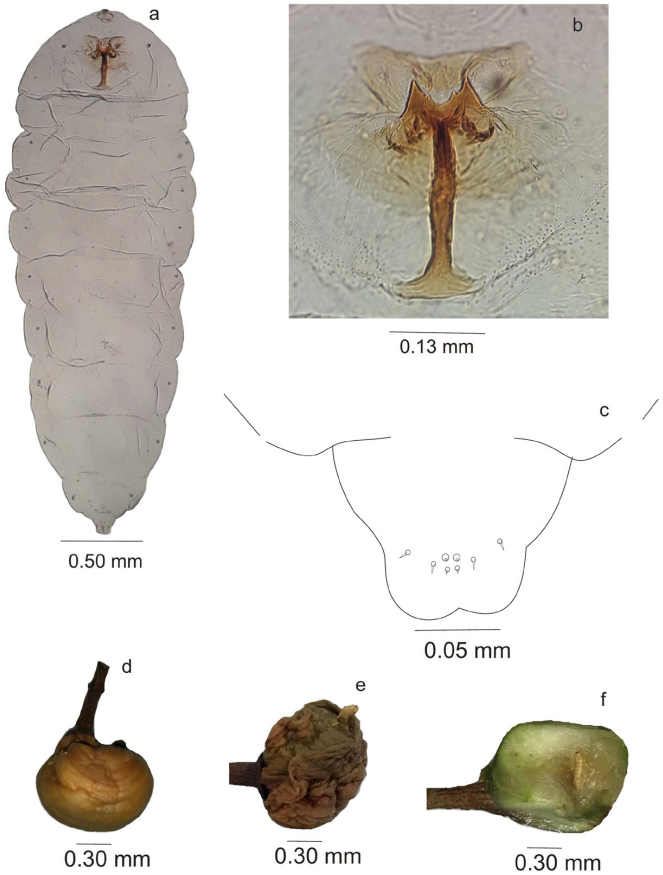

Figure 5 *Asphondylia hancorniae*, sp. n.: a) Larva, general aspect, ventral view, b) Prothoracic spatula, ventral view, c) Terminal segment, dorsal view, d) Gall, general aspect, e) Dehiscent gall, f) Gall, longitudinal section.

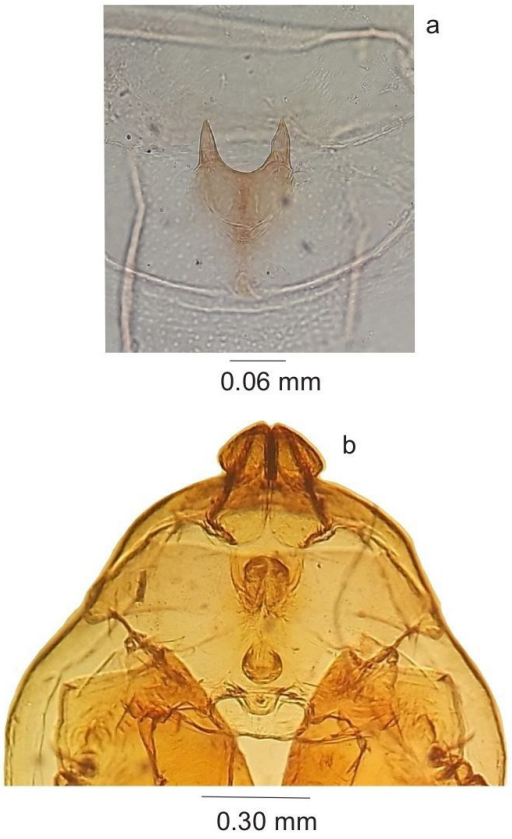

Figure 6 *Asphondylia peploniae* Maia, 2001: a) Larva, Prothoracic spatula, ventral view, b) Pupa, head, ventral view.

1st segment globoid, 0.02-0.03 mm long, 0.025-0.03 mm wide (n=7), 2nd segment cylindrical, 0.06-0.08 mm long, 0.025-0.03 mm wide (n=7), 3rd segment conical, 0.13-0.16 mm long, 0.02-0.03 mm wide (n=6), all segments with setae.

Thorax: scutum with two dorsocentral rows of setae, setae more abundant anteriorly and posteriorly, and irregular group of lateral setae on each side, scales intermixed; scutellum with scattered setae; anepimeron setose and anepisternum setose; remaining pleural sclerites bare; wing (Fig. 1d): 2.95-3.40 mm long, 0.95-1.10 mm wide (n=5); legs: first tarsomere of each leg with an apical hook-like projection 0.03-0.04 mm long (n=5) (Fig. 1e), tarsal claws curved beyond midlength, isomorphic, empodium longer than claws (Fig. 1f).

Abdomen (Figs. 2a,b, c): 1st-7th tergites sclerotized, rectangular with a posterior row of setae, few lateral setae, mostly covered elsewhere with scales; 8th tergite dumbbell shaped, bare; 2nd-8th sternites more sclerotized than tergites, rectangular, 2nd-5th sternites with concave anterior margin, 6th-8th sternites with convex anterior margin, 2nd-7th sternites with a posterior row of setae, several setae at midlength and laterally, mostly covered elsewhere with scales; 8th sternite entirely covered with setae, more abundant posteriorly, mostly covered elsewhere with scales. Trichoid sensillae not visible.

Terminalia (Fig. 2c): gonocoxite short and stout, 0.13-0.18 mm long, 0.10-0.12 mm wide (n=8), gonostylus spherical, 0.06-0.07 mm long, 0.06-0.07 mm wide (n=7), teeth 0.01 mm long, 0.03 mm wide (n=2), hypoproct slightly bilobed, lobes conical; cercal lobes ovoid; aedeagus conical, tapering towards apex.

Female: Body length: 5.10-5.40 mm (n=3). Head: 0.70 mm long, 0.65-0.70 mm wide (n=2); antennae: flagellomeres 1 and 2 not fused (Fig. 3a), scape 0.17-0.18 mm long, 0.09 mm wide (n=3), pedicel 0.08 mm long, 0.08 mm wide (n=3), 1st-10th flagellomeres cylindrical, 11th ovoid, 12th spheroid (Fig. 3b), circumfila comprising two longitudinal bands connected sub basally and apically by two transverse bands (Fig. 3c), 1st flagellomere 0.40-0.42 mm long, 0.05 mm wide (n=3), 2nd flagellomere 0.26-0.28 mm long, 0.05-0.06 mm wide (n=3), 3rd flagellomere 0.26 mm, 0.05 mm wide (n=3), 4th flagellomere 0.25 mm long, 0.05 mm wide (n=3), 5th flagellomere 0.23-0.25 mm long, 0.05 mm wide (n=3), 6th flagellomere 0.23 mm long, 0.05 mm wide (n=3), 7th flagellomere 0.20 mm, 0.05 mm wide (n=3), 8th flagellomere 0.18 mm, 0.05 mm wide (n=3); 9th flagellomere 0.13-0.15 mm, 0.05 mm wide (n=3), 10th flagellomere 0.09 mm long, 0.05 mm wide (n=3), 11th flagellomere 0.06-0.07 mm, 0.05 mm wide (n=3), 12th flagellomere 0.05-0.06 mm long, 0.05-0.06 mm wide (n=3), proportion flagellomere neck-node: 1:11; frons with 27-31 setae (n=3); mouthparts: labrum 0.12 mm long (n=1), hypopharynx 0.19 mm long (n=1), labellum 0.08-0.09 mm long (n=2), palpus 0.24-0.27 mm long (n=2): 1st segment 0.03 mm long, 0.02-0.03 mm wide (n=2), 2nd segment 0.09 mm long, 0.025-0.03 mm wide at midlength (n=2), 3rd segment 0.12-0.15 mm long, 0.02 mm wide at midlength (n=2).

Thorax: apical projection of first tarsomere with 0.03 mm long (n=3), wing: 3.50 mm long, 1.20-1.30 mm wide (n=3); tarsal claws curved beyond midlength, isomorphic, empodium longer than claws (Fig. 3d).

Abdomen (Fig. 3e): 1st–8th tergites sclerotized, 1st-7th tergites rectangular with a posterior row of setae, few lateral setae, and mostly covered elsewhere with scales, 8th tergite with distal margin with lobes 0.15-0.16 mm long (n=2), 2nd-4th sternites with concave anterior margin, 5th-8th sternites with convex anterior margin; 6th sternite 0.40-0.42 mm long (n=3), 7th sternite 0.70-0.73 mm long, 1.74-1.75 X length sternite 6 (n=2), setose (except basally), setae more abundant distally, and mostly covered elsewhere with scales.

Ovipositor: needle part 1.75-1.80 mm long, 2.4-2.5 X length sternite 7 (n=2). Other characters as in male.

Pupa (Fig. 4a): Color: brownish. Body length: 4.40-5.95 mm (n=8). Head (Fig. 4b): dorsal plate 0.65 mm long, 0.15 mm wide (n=1); face with lateral projection; antennal horn triangular, 0.43-0.49 mm long (n=6), apical part 1.5 X length of basal part, inner margin serrated; apical seta 0.07 mm long, 0.8 X wide of antennal flagellomere (n=5); upper facial horn simple, triangular, 0.03 mm long (n=4), shorter than width of basal flagellomere (Fig. 4b); lower facial horn tridentate, 0.03 mm long (n=3), shorter than width of basal flagellomere, teeth triangular, lateral teeth slightly above mesal tooth (Fig. 4b); two pairs of lower facial papillae: one pair setose, the other bare; three pairs of lateral facial papillae: one pair setose, two bare; upper cephalic margin thickened laterally. Thorax: integument wrinkly (Fig. 4c), prothoracic spiracle short, 0.07-0.08 mm long, setiform, curved (n=4) (Fig. 4d). Abdomen: segments 2-8 with transverse rows of crescent dorsal spines; posterior row with 14-21 spines in the 2nd segment, 14-23 in the 3rd, 13-19 in the 4th, 13-23 in the 5th, 14-18 in the 6th, 10-13 in the 7th and 6-9 in the 8th (n=4) (Fig. 4e).

Larva (Fig. 5a). Body length 2.95-4.80 mm (n=10), cephalic head 0.08 mm long, 0.10 mm wide (n=5). Spatula quadridentate, 0.25-0.30 mm long (n=10), lateral teeth 0.04 mm long, mesal teeth 0.03 mm long (n=3) (Fig. 5b); one sternal papillae setose and three setose lateral papillae of each side of spatula. Terminal segment with four pairs of papillae, three setose (setae not equal in length) and one pair corniform (Fig. 5c).

Gall (Figs. 5d-f): On fruit of *Hancornia speciosa* Gomes (Apocynaceae). Externally, galled immature fruits have the same aspect of ungalled fruits. When galled, the fruit grows irregularly, more than one side than the other. Thus, traces of the floral calyx are not on the side opposite the peduncle, but laterally, and the fruit acquires hook shape (Fig. 5d). The gall is only perceived when pale spots appear. Then, it becomes completely brown and soft (Fig. 5e), wilting afterwards, when it is possible to find the exuvia trapped in the adult's exit hole. Internally, the gall has one chamber (Fig. 5f), which is lined by fungal hyphae.

Material Examined. Holotype male, BRAZIL, Bahia, Lençóis, Chapada Diamantina, 07.X.2022, Vitor Matos col. (MNRJ-ENT1-69181). Paratypes: same data as holotype, 3 males (MNRJ-ENT1-69182, MNRJ-ENT1-69183, MNRJ-ENT1-69184), 3 females (MNRJ-ENT1-69165, MNRJ-ENT1-69166, MNRJ-ENT1-69167), 7 pupal exuviae (2 specimens on the same slide MNRJ-ENT1-69172, 3 specimens on the same slide MNRJ-ENT1-69173, 3 specimens on the same slide MNRJ-ENT1-69174), and 7 larvae of third instar (3 specimens on the same slide MNRJ-ENT1-69168, 4 specimens on the same slide MNRJ-ENT1-6919). Paratypes, BRAZIL, Bahia, Mata de São João, 11.X.2022, Vitor Matos col., 5 males (MNRJ-ENT1-69175, MNRJ-ENT1-69176, MNRJ-ENT1-69177, MNRJ-ENT1-69178, MNRJ-ENT1-69179), and 3 larvae of third instar (on the same slide MNRJ-ENT1-69170), BRAZIL, Bahia (municipality unstated), XI.2008-VII.2019, Vitor Matos col., 1 male (MNRJ-ENT1-69180), 4 females (MNRJ-ENT1-69161, MNRJ-ENT1-69162, MNRJ-ENT1-69163, MNRJ-ENT1-69164), and 5 pupal exuviae (on the same slide MNRJ-ENT1-69171).

Etymology. The name "*hancorniae*" refers to the genus of the host plant.

Comments. There are three previously known species of *Asphondylia* which induce galls on Apocynaceae in the world, *Asphondylia tabernaemontanae* and *A. thevetiae*, both species from El Salvador, and *A. peploniae* from Brazil. The new species differs from *A. peploniae* mainly in the following characters: larva – 1) shape of spatula: four-toothed with long stalk in the new species, and two-toothed with short stalk in *A. peploniae* (Fig. 6a); pupa – 2) shape of antennal horn: anterior part less splayed in the new species than in *A. peploniae* (Fig. 6b), 3) inner margin of antennal horn: serrated in the new species and not serrated in *A. peploniae* (Fig. 6b), 3) shape of upper and lower frontal horns (with pointed apex in the new species and rounded in *A. peploniae* (Fig. 6b), 3) male 8th tergite (dumbbell shaped in the former and band-like in the latter). *Asphondylia hancorniae* differs from *A. tabernaemontanae* and *A. thevetiae* in size (adults, pupa and larva of third instar are conspicuously longer in the new species than in these species from El Salvador) and the spatula of *Asphondylia hancorniae* is the only one with inner teeth far apart from each other. Moreover the anchor-shaped base is clearly wider, the sclerotized area around the anterior part of the spatula is more extensive, and the inner teeth are noticeable shorter in the new species than those of *A. tabernaemontanae* and *A. thevetiae* (Möhn, 1959).

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Conflicts of interest

No conflict of interest.

Author contribution statement

VCM proposed the new species, wrote the full text and was responsible for illustrations. VAMP and LSF collected galls, reared specimens of Asphondylia hancorniae, and photographed the gall.

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