Revista Brasileira de Entomologia 65(3):e20210034, 2021

SOCIEDADE BRASILEIRA DE ENTOMOLOGIA
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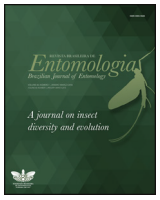
REVISTA BRASILEIRA DE
Entomologia
A Journal on Insect Diversity and Evolution



A new species of *Zalepidota* Rübsaamen, 1908 (Diptera, Cecidomyiidae) on *Piper vicosanum* (Piperaceae), an endemic plant to Brazil

Valéria Cid Maia[1]*

[1]*Museu Nacional, Departamento de Entomologia, Rio de Janeiro, RJ, Brasil.*
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ARTICLE INFO

Article history:
Received 31 March 2021
Accepted 23 August 2021
Available online 10 September 2021
Associate Editor: Sarah Oliveira

Keywords:
Gall midge
Piperaceae
Morphology
Taxonomy

ABSTRACT

Zalepidota distincta sp. nov. (Diptera, Cecidomyiidae) is described based on male, female, pupa and larva morphological characters. The new species induces galls on *Piper vicosanum* (Piperaceae), an endemic plant to Brazil. Types (mounted on slides) were deposited in the Entomological Collection of the Museu Nacional/ Universidade Federal do Rio de Janeiro. Illustrations of the most relevant morphological characters are provided. The new species has some morphological characters that differ from those of the genus diagnosis. Therefore, the concept of *Zalepidota* was broadened.

Introduction

Zalepidota Rübsaamen, 1908 is a Neotropical genus known from only four species until this moment: *Z. ituensis* (Tavares, 1917), *Z. piperis* Rübsaamen, 1908, *Z. reticulata* (Felt, 1915), and *Z. tavaresi* Kieffer, 1913 (Gagné and Jaschhof, 2017).

Adults have dense network of circumfila, one- to two-segmented palpus, wide wing, and swollen basal part of the tarsal claws. Males exhibit gonostyli with some separate denticles, and females a single lobe at the base of the ovipositor. Pupa has antennal horns with a ventral lobe, widely separated upper frontal horns, elongated spiracles on the 1st through 7th abdominal segments, no spiracles on the 8th segment, and one or two rows of dorsal spines that do not attain the dorsal row of papillae. Larva has a short spatula (Gagné, 1994).

Zalepidota ituensis, *Z. piperis* and *Z. tavaresi* were described from Brazil, while *Z. reticulata* from Guatemala. Three of them are known only from the type localities, except *Z. piperis*. Furthermore, the morphological characterization of most is incomplete - *Z. ituensis* is known from the female and pupa, *Z. reticulata* only from the female and *Z. tavaresi* only from the pupa. *Zalepidota piperis* is the single species whose adults of both sexes, pupa and larva are known. Nevertheless, it was described based on male, female and pupa. The larva was later described by Möhn (1973).

Data on most host plants are partial, since *Z. reticulata* was caught in flight, and *Z. tavaresi* and *Z. ituensis* induce galls on undetermined species of *Piper* L. (Piperaceae) and *Porophyllum* Guett. (Asteraceae), respectively (Gagné, 1994), while *Zalepidota piperis* is the single species whose host plant is known, *Piper arboreum* Aubl., reported by Monteiro and Oda (1999).

Zalepidota distincta is the first species of the genus described based on larva, pupa, male and female, and the second whose host plant species is determined - *Piper vicosanum* Yunck., an endemic shrub to Brazil, with occurrence in the Amazon, Atlantic Forest, and Cerrado (JBRJ, 2020). Galls of *Zalepidota* on this plant were characterized Maia and Siqueira (2020, Fig. 5T) and they are similar to those induced by *Z. piperis*, as both are on buds, spongy, brown, apple-shaped and multichambered.

Material and methods

Galls on *Piper vicosanum* Jacq. (Piperaceae) were collected in the state of Rio de Janeiro, in the Reserva Biológica União (22° 25' 35" S 42° 2' 4" W) from April to June, 2013. Larvae were obtained by gall

*Corresponding author.
E-mail: maiavcid@acd.ufrj.br (V.C. Maia).

https://doi.org/10.1590/1806-9665-RBENT-2021-0034

dissecation, while adults of both sexes and pupa specimens by rearing in laboratory. Galls were kept in plastic pots padded with paper towel, covered by organza at room temperature, and labeled. These pots were examined every day (except weekends) for emergence. Whenever adults were found, these pots were kept for few minutes in the refrigerator to provoke their lethargy. Then, adults were collected with a wet brush, placed in a labeled microvial with 70% ethanol. Later, all material was mounted on microscope slides following the methods outlined in Gagné 1994.

The genus was identified based on the key of Gagné 1994, and the new species was proposed after comparison with literature data (host plants, gall morphology and cecidomyiid descriptions). All specimens were deposited in the Cecidomyiidae 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 using a microscope slide with scale from 0.01 to 5.0mm. All drawings were scanned and then edited using Corel DRAW®. Adult morphological terminology follows Cumming and Wood (2009) and that of the larval and pupal stages follows Gagné (1994).

Results

Description

Zalepidota distincta, **new species** (Figs. 1-10)

Diagnosis. Palpus one-segmented with short apical projection, 1st and 2nd flagelomeres not connected, circumfila strongly anastomosing in both sexes, 12th flagellomere with apical process only in male, vertex without eye facets, male 8th tergites rectangular at basal ½ and triangular at distal ½, female 7th tergite with basal margin serrated, with a central reentrance, pupa: lower facial horn bidentate, 2nd to 6th abdominal segment with long spiracles, segments 7 and 8 with stigma-like spiracles, 2nd to 8th abdominal segments with two rows of spines, terminal segment bilobed, larva without spatula and terminal segment bilobed.

Male. Body length: 4.60-5.07 mm (n= 9). Head (Fig. 1a): 0.45mm-0.54mm long and 0.59-0.62mm wide (n= 6); eye facets hexagonal closely appressed (Fig. 1b), vertex without facets; antenna: scape obconical, 0.10-0.11 mm long, 0.10-0.11 mm wide (at midlength), 1.60-2.20 as long as pedicel (n= 6) with numerous setae; pedicel ovoid,

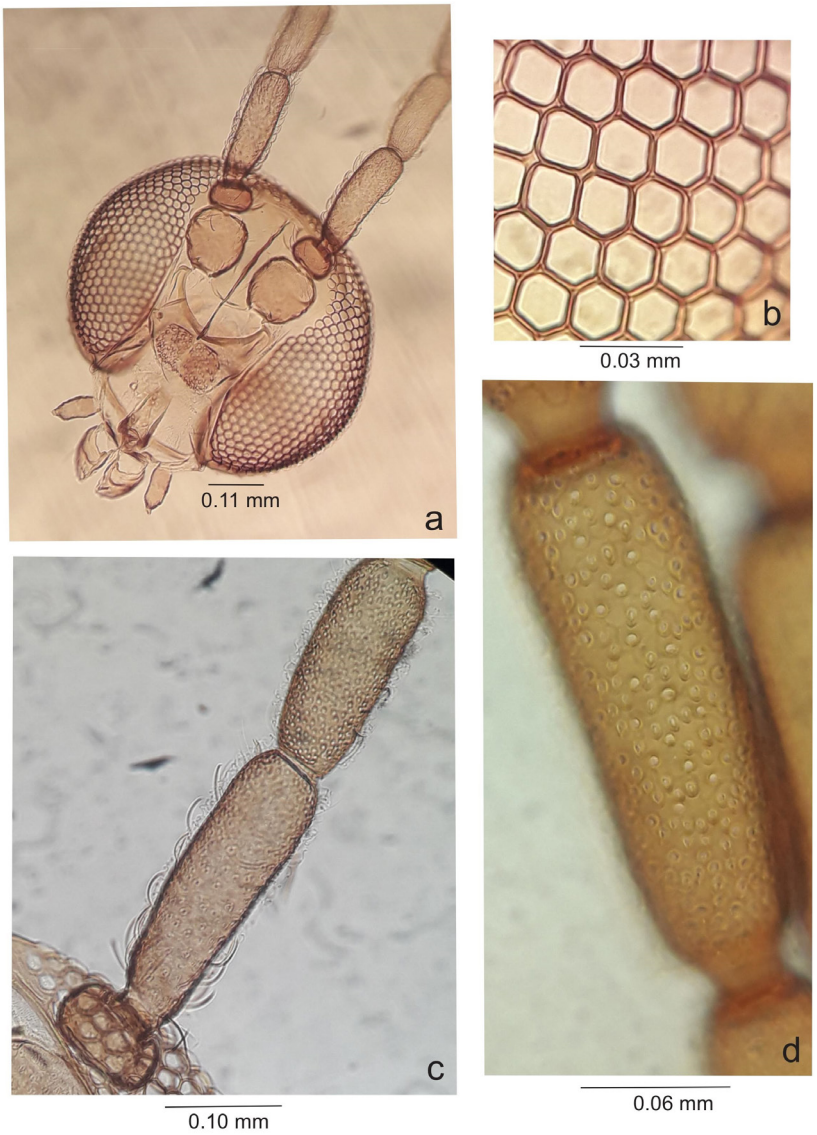

Figure 1 *Zalepidota distincta* new species, male: a) head, ventral view; b) eye facets; c) 1st and 2nd flagellomeres; d) 3rd flagellomere.

0.05-0.06mm long, 0.08mm wide (at midlength), 0.62-0.75 as long as wide, with several setae (n= 6); flagellomeres 1 and 2 not connate (Fig. 1c), flagellomeres 1-12 cylindrical, with circumfila strongly anastomosing and dense complement of setae (Fig. 1d); flagellomere 12 with terminal bud covered with microtrichia (Fig. 2a); flagellomere necks bare, short, 0.02 mm long, node with microtrichia, 7.5-8.5 as long as neck; flagellomere 1 the longest, flagellomere 12 the shortest, all flagellomeres of same width (0.07mm), flagellomere 1: 0.21-026mm long,1.0-1.23 as long as flagellomere 2 (n= 6), flagellomere 2: 0.21-0.24mm long, 1.14-1.23 as long as flagellomere 3 (n= 5), flagellomeres 3-9 similar in length, 0.17-0.21mm long, 1.00-1.16 as long as flagellomere 10 (n= 5), flagellomeres 10-12 progressively somewhat shorter (Fig. 2b), flagellomere 10: 0.17-0.18mm long, 1.00-1.13 as long as flagellomere 11 (n= 3), flagellomere 11: 0.15-0.18mm long, 1.05-1.07 as long as flagellomere 12 (n= 4), flagellomere 12: 0.14-0.17mm long (n= 4); frons densely setose, with 114 to 128 setae (Fig. 2c); mouth parts: labrum long-attenuate, 0.09-0.11mm long, 0.03-0.04mm wide (n= 7), without visible ventral sensory setae (n= 3); hypopharynx of the same shape of labrum, with long anteriorly directed lateral setulae; labella elongate-convex, 0.08-0.11mm long, 0.05-0.06mm wide (n= 6), each with lateral setae and several short mesal setae; palpus 0.07-0.11mm long, 0.03-0.04mm wide (n=10), one-segmented, cylindrical, with a group of setae subapically, and a short apical projection (Fig. 2d). Thorax: Scutum with 2 dorsocentral rows double, anteriorly with a group of dense setae on each side, and a group of lateral setae extending from base to distal ¾,; scutellum with several scattered setae; anepimeron densely setose; anespisternum densely setose at ½ basal; katepisternum with some scattered scales; other pleural sclerites asetose; wing (Fig. 2e): 2.89-3.11 mm long (from arculus to apex), 1.50-1.60 mm wide (at midlength) (n= 4), R1 reaching C near wing midlength, R5 reaching C immediately before wing apex, M3+4 present, Cu forked near wing midlength; first tarsomere with apical projection 0.025mm long (n= 3) (Fig. 3a); tarsal claws simple, robust and strongly pigmented, curved near midlength, empodia not reaching bend in claws (Fig. 3b). Abdomen

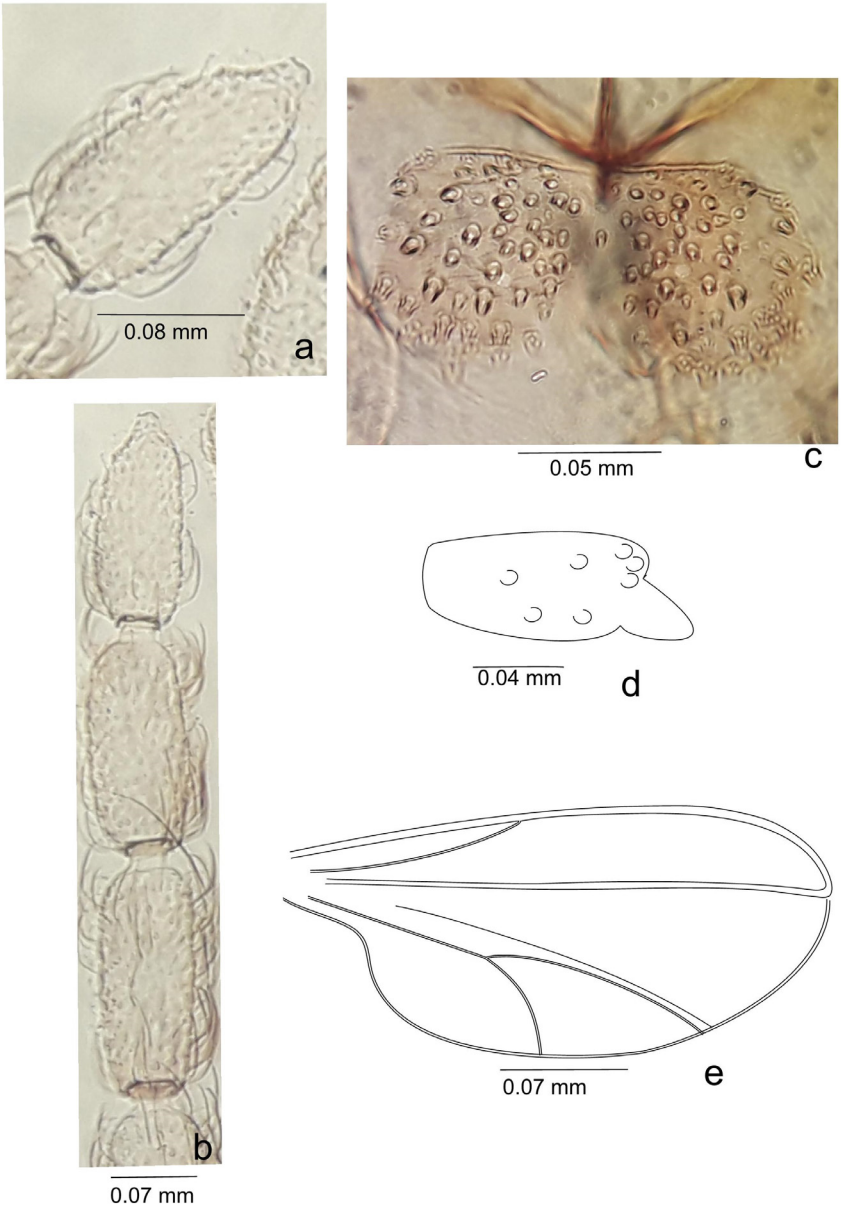

Figure 2 *Zalepidota distincta* new species, male: a) 12th flagellomere; b) 10th–12th flagellomeres; c) frontal setae, ventral view; d) palpus, ventral view; e) wing.

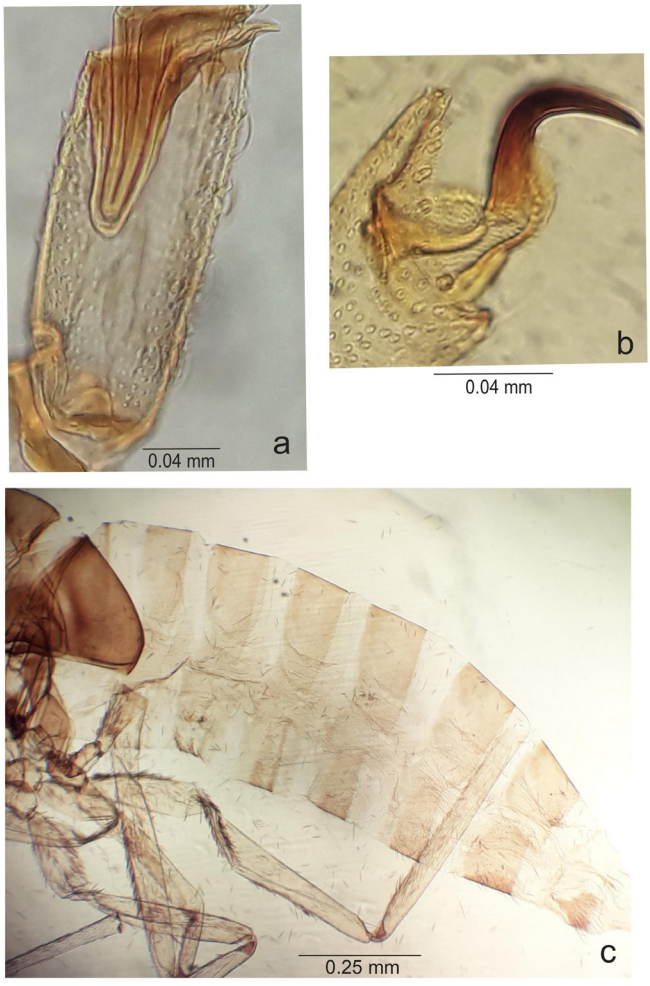

Figure 3 *Zalepidota distincta* new species, male: a) foreleg, 1st tarsomere; b) foreleg, tarsal claw and empodium, lateral view; c) abdomen, lateral view.

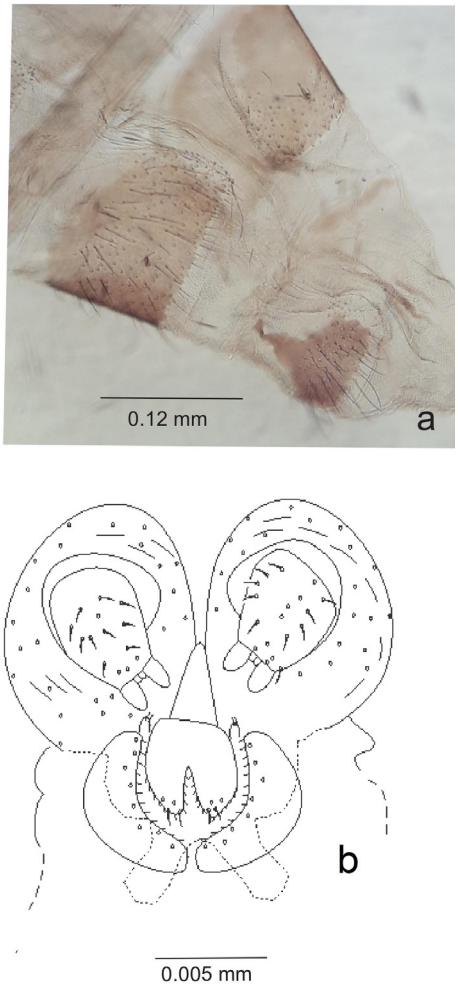

Figure 4 *Zalepidota distincta* new species, male: a) last abdominal segments, lateral view; b) terminalia, dorsal view.

(Figs. 3c, 4a): tergites 1-7 rectangular with complete row of posterior setae, several lateral setae, two basal trichoid sensilla and scattered scales; tergite 8 band-like, very narrow, with only two basal trichoid sensilla as vestiture; sternites 2-7 rectangular, narrower and shorter than tergites, with several setae at ½ distal and a complete row of posterior setae, lateral setae, and scattered scales, two basal trichoid sensilla in membranous area; sternite 8 triangular at ½ proximal and rectangular at ½ distal, setose and with scattered scales only at 1/2distal, without vestiture elsewhere. Terminalia (Fig. 4b): gonocoxites globose and setose, 0.11-0.14 mm long, 0.10-0.12 mm wide and 1.00-1.16 as long as wide (n= 4), without apical lobe; gonostylus short, ovoid, and setose, 0.05-0.065 mm long, 0.04-0.05 mm wide, 1.25-1.30 as long as wide (n= 5), cercus reniform, completely separate, setose, 0.07-0.09 mm long, 0.02-0.03 mm wide (n= 2); hypoproct bilobed and setose; parameres cylindrical membranous; aedeagus conical, tapering gradually towards apex and pointed apically.

Female. Body length: 4.90-5.50 mm (from vertex to tergite 8) (n= 4). Head: 0.51-0.55mm long, 0.55-0.71mm width (n= 3); antennae: scape: 0.12-0.13mm long, 0.12-0.13mm wide (at midlength) (n= 4), with numerous setae; pedicel: 0.06-0.07mm long, 0.09 mm wide (at midlength), 0.66-0.77 as long as wide (n= 4), with several setae; flagellomeres 1-11 cylindrical; flagellomere 12 ovoid without projection (Fig. 5a); flagellomere necks bare, short, 0.015 mm (N= 3), node 10.5-13.5 as long as neck with microtrichia; flagellomere 1: 0.27-0.30 mm long, 1.15-1.23 as long as flagellomere 2 (n= 4), flagellomere 2: 0.22-0.26mm long, 1.04-1.13 as long as flagellomere 3 (n= 4), flagellomeres 3-9 similar in length, 0.21-0.23mm long, 1.05-1.09 as long as flagellomere 10 (n= 4), flagellomeres 10-12 progressively shorter, shortening more evident than in males, flagellomere 10: 0.20-0,21mm long, 1.16-1.25 as long as flagellomere 11 (n= 4), flagellomere 11: 0.16-0.18mm long, 1.06-1.38 as long as flagellomere 12 (n= 4), flagellomere 12: 0.13-0.15mm long (n= 4); circumfila strongly anastomosing and dense complement of setae (Fig. 5b). Mouth parts: labrum long-attenuate, 0.12-0.14mm long, 0.05-0.06mm wide (n= 3); labella elongate-convex, 0.07-0.11mm long, 0.05-0.06mm wide (n= 3); palpus 0.08-0.10mm long, 0.04mm wide (n= 3) with apical projection shorter than male (Fig. 5c). Thorax: wing: 3.70-3.84 mm long (from arculus to apex) (n= 4); first tarsomere with apical projection 0.03mm long (n= 3), tarsal claw simple (Fig. 5 c). Abdomen (Figs. 6a, b): sternites more strongly sclerotized than tergites, tergites 1-7 as in male, tergite 8 with basal margin sparsely serrated with central reentrance, and distal margin with a large lobe 0.18-0.21mm long, 0.20mm-0.21mm wide, almost straight apically, sternites 2-6 as in male, sternite 7: 0.8mm long, 2.42 as long as sternite 6 (n= 4), sternite 8 not sclerotized. Ovipositor (Fig. 6c): striated part 0.9-1.10 mm long, 0.4-0.5 mm wide (n= 5), needle part 1.40-1.60 mm long (n= 5), 1.75-2.00 as long as sternite 7 (n= 4). Otherwise as in male.

Pupa. Color: brownish. Length: 6.10-6.80 mm (n= 6). Head (Fig. 7a): dorsal plate with integument grainy and a pair of cervical papilla asetose; antennal horns conical, with smooth margin, 0.34-0.3 mm long, 0.15-0.21mm wide (basal width) (n= 7) (Fig. 7b); antennal ventral

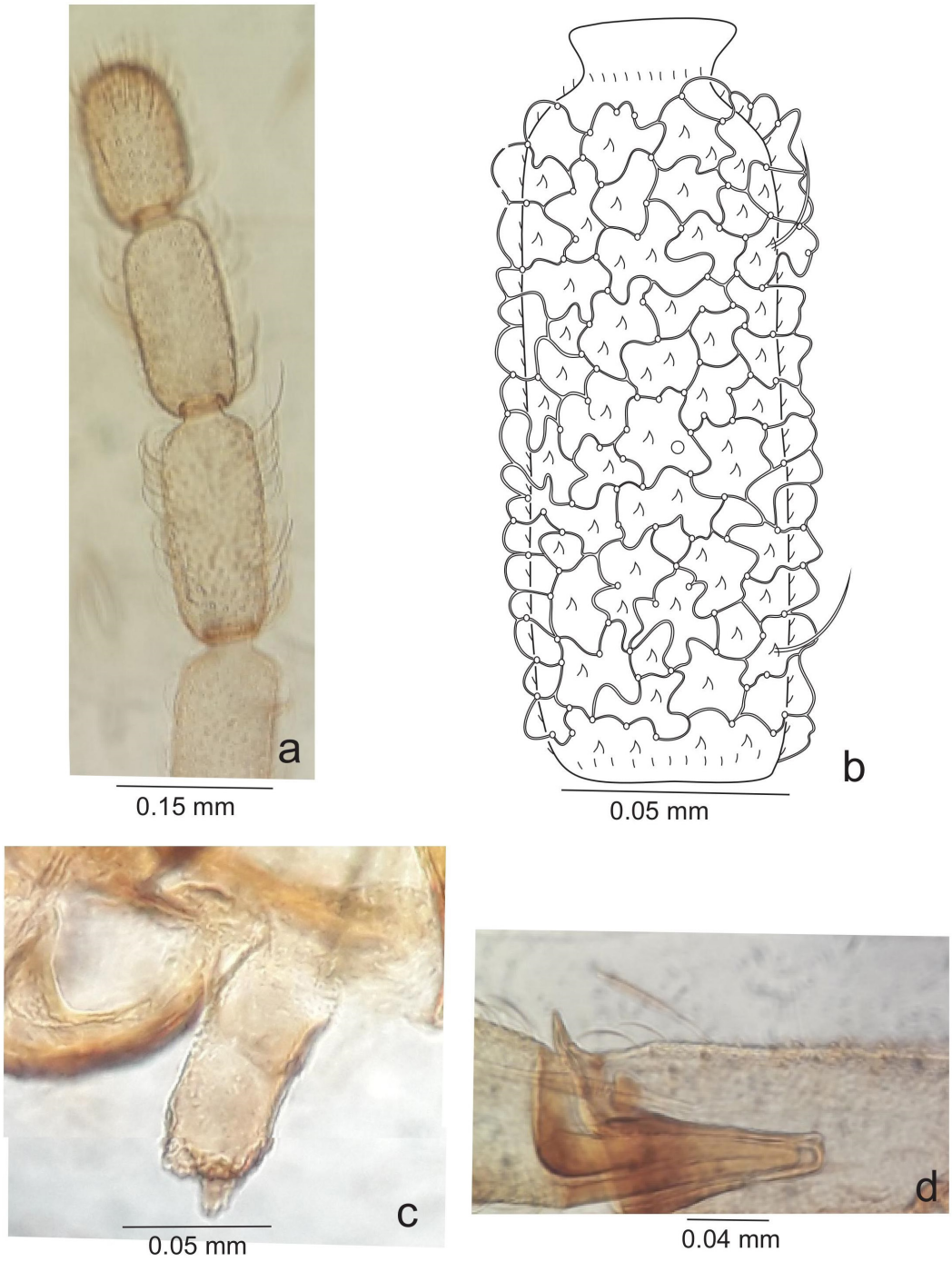

Figure 5 *Zalepidota distincta* new species, female: a) 10th -12th flagellomeres; b) 3rd flagellomere: c) palpus; d) foreleg, tarsal claw and empodium, lateral view.

lobe conical, 0.10-0.13mm long, 0.06-0.11mm wide (basal width) (n= 5); one pair of upper frontal horns conical, 0.08-0.14mm long, 0.07-0.12mm wide (basal width) (n= 5) (Fig. 7c); lower frontal horn bidentate, 0.05-0.06mm long, 0.03-0.04mm wide (basal width) (Fig. 7d); a single pair of lower facial papilla asetose; two pairs of lateral facial papillae asetose; upper cephalic margin thickened laterally; face with integument grainy near lower frontal spines and along ecdisial suture. Thorax: Integument grainy laterally; prothoracic spiracle little sclerotized, relatively short, 0.24-0.27mm long (n= 7), rounded apically, trachea reaching end of spiracle (Fig. 8a). Abdomen: segments 2-6 with elongated spiracles (Fig. 8b), 0.20-0.32mm long (n= 8); segments 7 and 8 with stigma-like spiracles; segments 2-8 with rows of dorsal spines only at basal ½, not reaching dorsal papillae (Figs. 8c, 9a); last row with 17-26 spines. Terminal segment 9 with two apical conical projection in both sexes (Figs. 9b, c).

Larva. Body elongate and cylindrical, 4.35-4.55 mm long, 1.70-1.90 mm wide (n= 3). Integument rough. Cephalic capsule 0.04-0.05mm long and 0.07-0.08 mm wide 9 (at base) (n= 3) (Fig. 10a); antenna 0.02 mm long (n= 3); tentorial arms 0.06-0.07 mm long. Spatula prothoracic absent; sternal papillae setose; two pairs of setose lateral papillae on each side; four dorsal papillae setose from 1st to 7th abdominal segments.

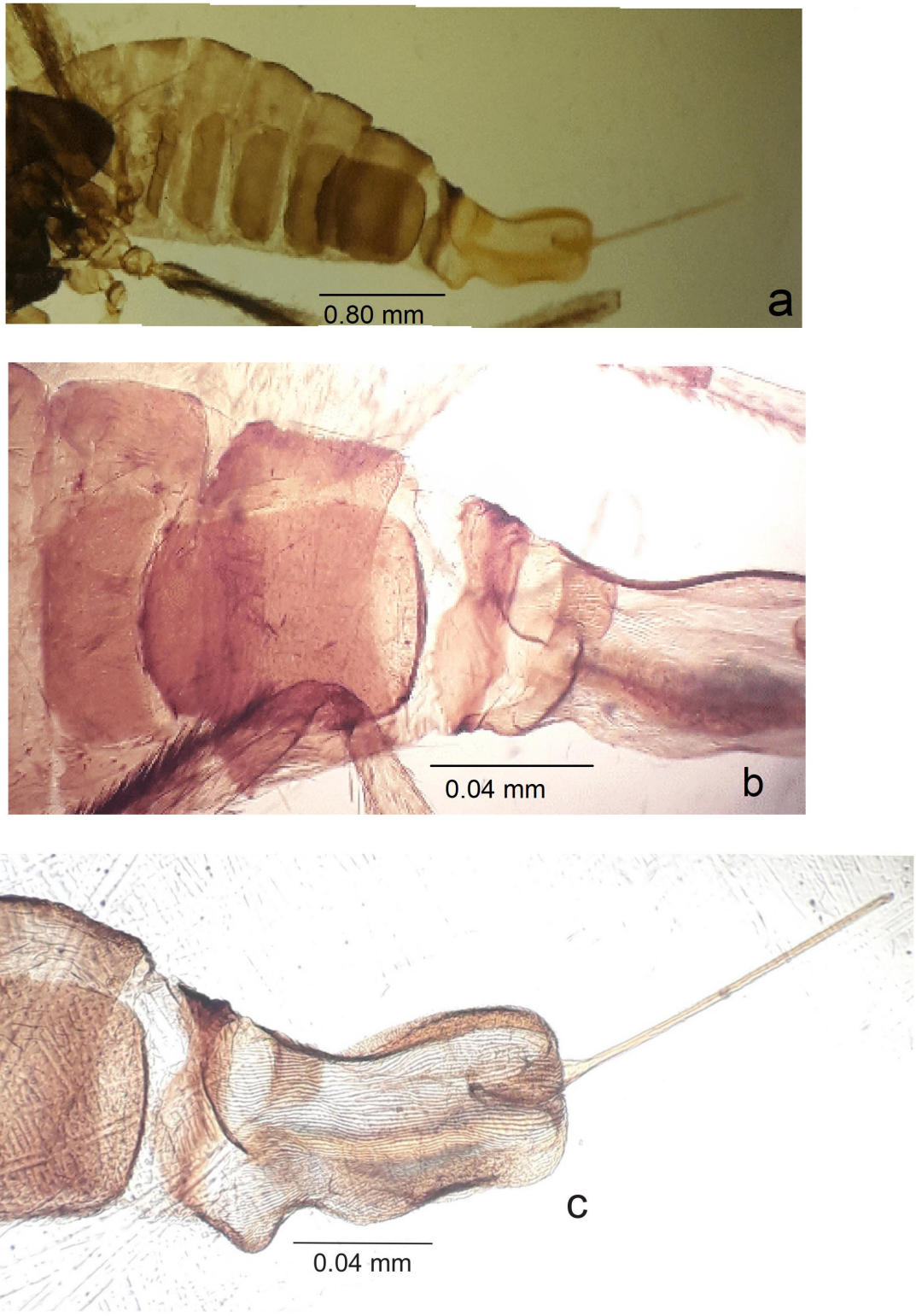

Figure 6 *Zalepidota distincta* new species, female: a) abdomen, lateral view; b) last abdominal segments, ventrolateral view; c) abdominal 7th segment to ovipositor, ventrolateral view.

Terminal segment with integument spinny dorsally, bilobed apically, each lobe conical, slightly sclerotized, 0.10mm long (n= 3); terminal papillae not visible (Fig. 10b).

Gall. On bud, brown, glabrous, multichambered. Host plant: *Piper vicosanum* Yunck. (Piperaceae) (Fig. 5T in Maia & Siqueira, 2020).

Material examined. Holotype: male, BRAZIL, Rio de Janeiro, Reserva Biológica União, 25.VI.2013, Maia & Fernandes col., MNRJ. Paratypes: same data as holotype, 4 larvae; same locality and collectors, 25.IV.2013, 8 males, 3 larvae, 26.IV. 2013, 1 male, 5 females, and 7 pupal exuviae, MNRJ.

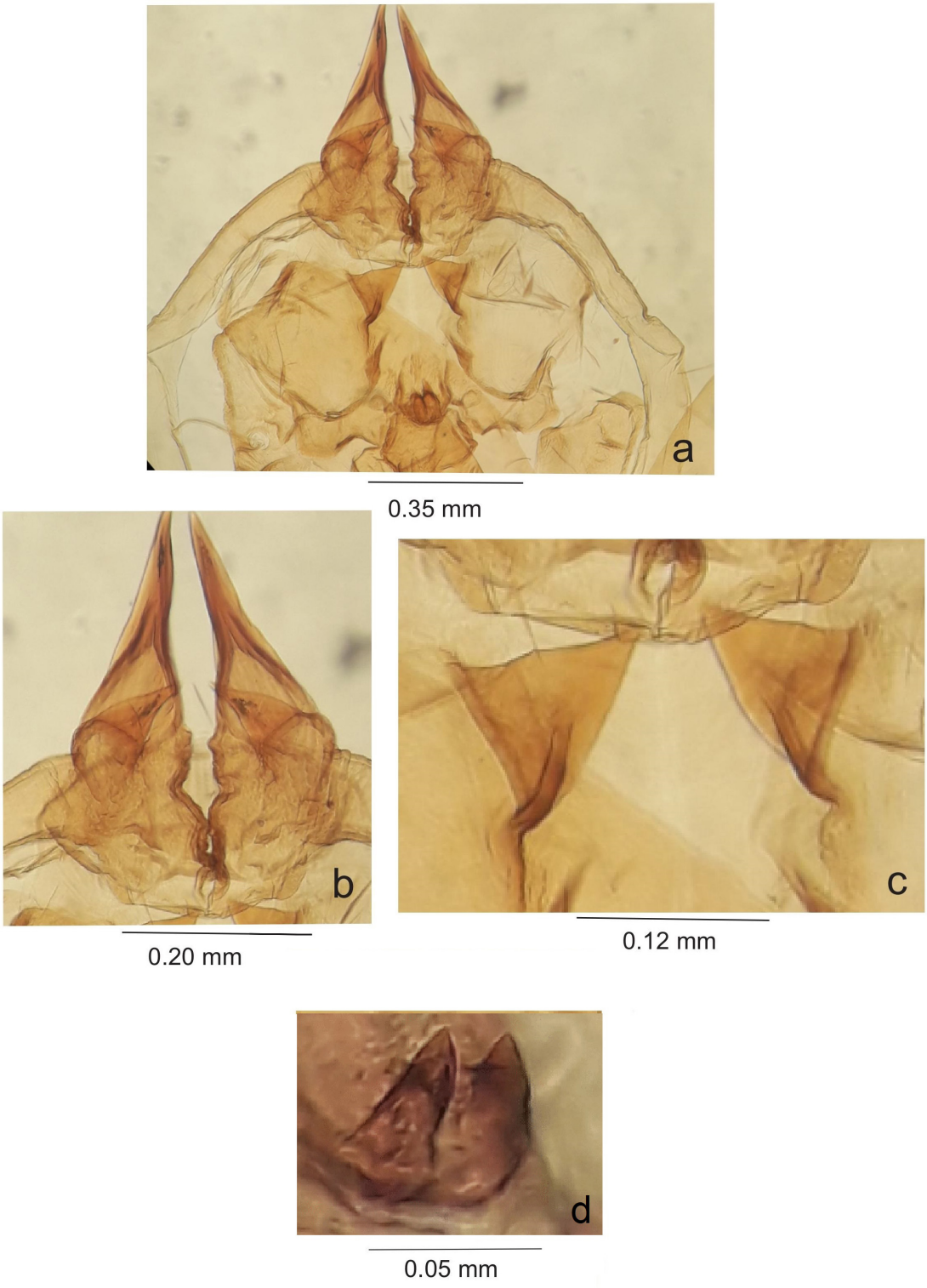

Figure 7 *Zalepidota distincta* new species, pupa: a) head, ventral view; b) antennal horns; c) upper frontal horns; d) lower frontal horn.

Etymology. The name *distincta* refers to the distinct morphology of the new species.

Remarks. The new species was placed to *Zalepidota* by the dense network of circumfila, one-segmented palpus, wide wing, males with gonostyli with some separate denticles, females with a single lobe at the base of the ovipositor, pupa with antennal horns with a ventral lobe, widely separated upper frontal horns, two rows of dorsal spines that do not attain the dorsal row of papillae. Nevertheless, the tarsal claws are not swollen basally, the pupa has no elongate spiracles on the 7th abdominal segment, and the larva has no prothoracic spatula, differing from the single previously known larva of the genus, which exhibits a short spatula. Among Asphondyliina, the loss of spatula was found in *Heterasphondylia* Möhn, 1960 and *Sciasphondylia* Möhn, 1960. Other morphological similarities between *Heterasphondylia* and

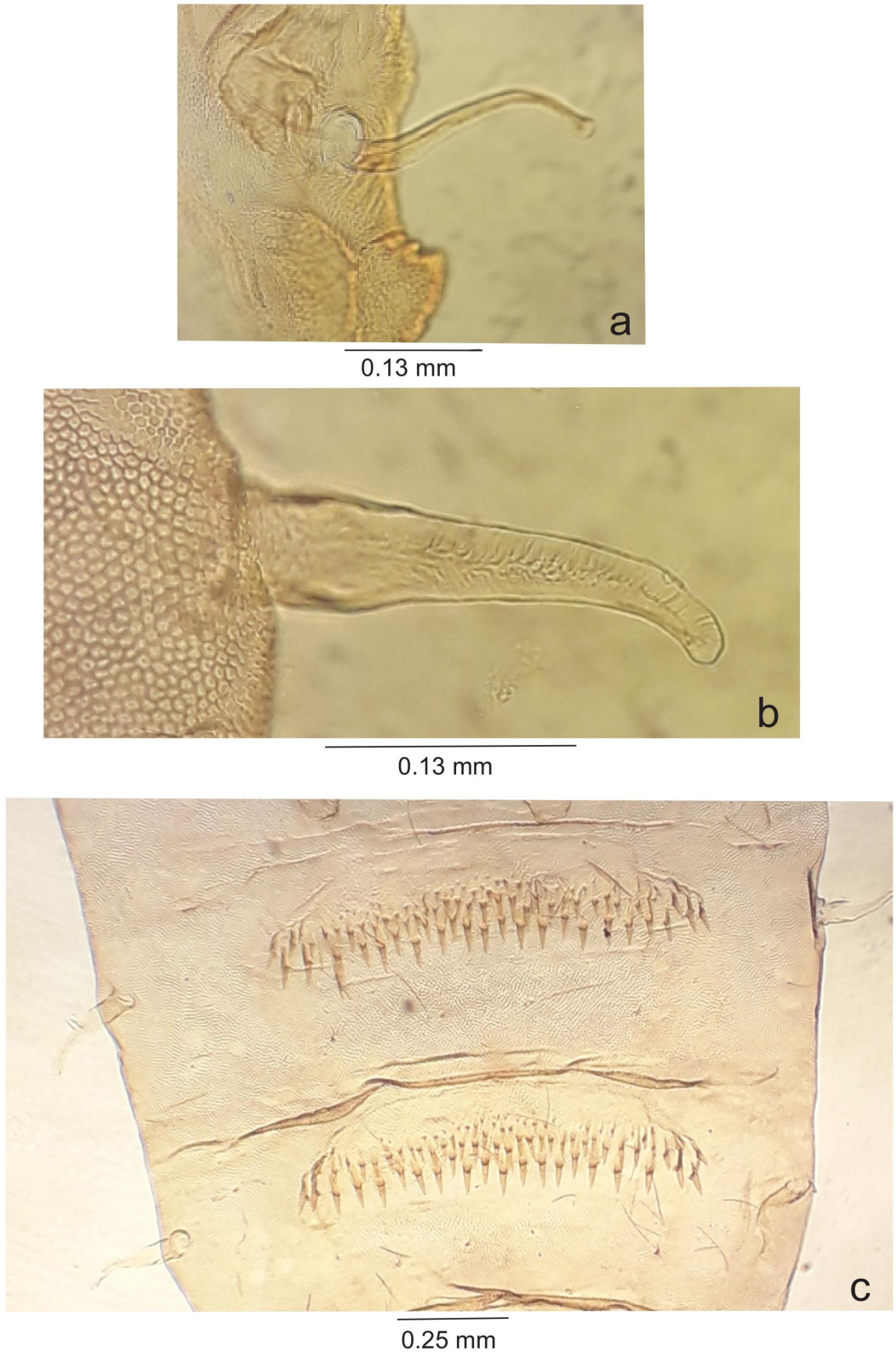

Figure 8 *Zalepidota distincta* new species, pupa: a) prothoracic spiracle; b) abdominal spiracle; c) abdominal spines, dorsal view.

Zalepidota are shared by the pupae – the presence of a ventral lobe on each antennal horn, widely separate upper frontal horns, and elongated abdominal spiracles. Nevertheless, *Zalepidota* is unique genus whose males have gonostyli with some separate denticles.

Heterasphondylia and *Sciasphondylia* are known from a single described species each, while *Zalepidota* from five, including the new one. As new species are discovered, the morphological knowledge of these genera will be improved and the limits of each can be properly

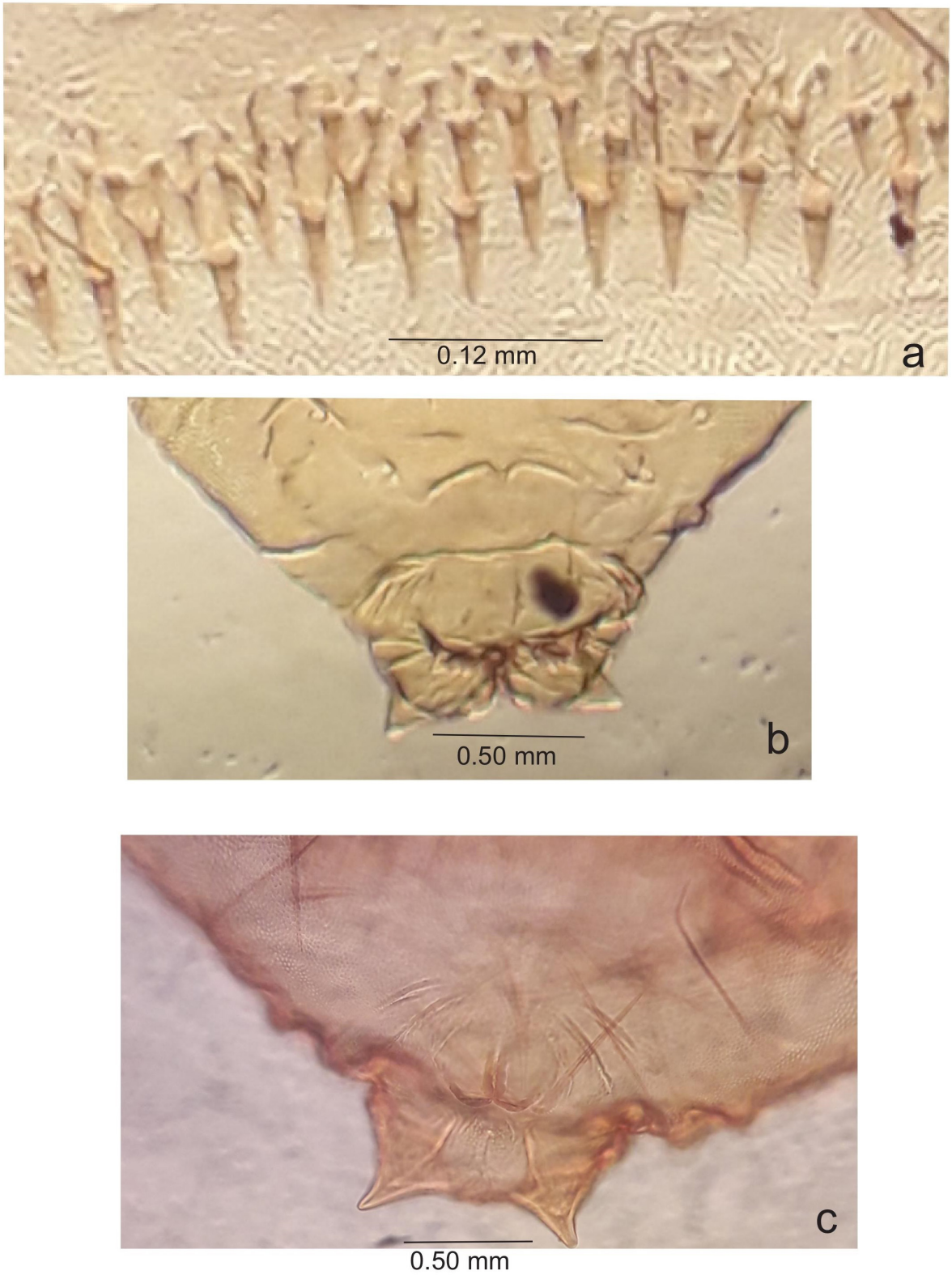

Figure 9 *Zalepidota distincta* new species, pupa: a) abdominal spines in detail, dorsal view; b) male pupa terminal segment, dorsal view; c) female pupa terminal segment, ventral segment.

established. At the moment, the best option is to broaden the concept of *Zalepidota* than to propose a new monobasic genus, adding the following variation: adults with tarsal claws swollen basally or not, pupa with elongated spiracles on the 1st through 6th or 7th abdominal segments and larva with reduced or absent prothoracic spatula.

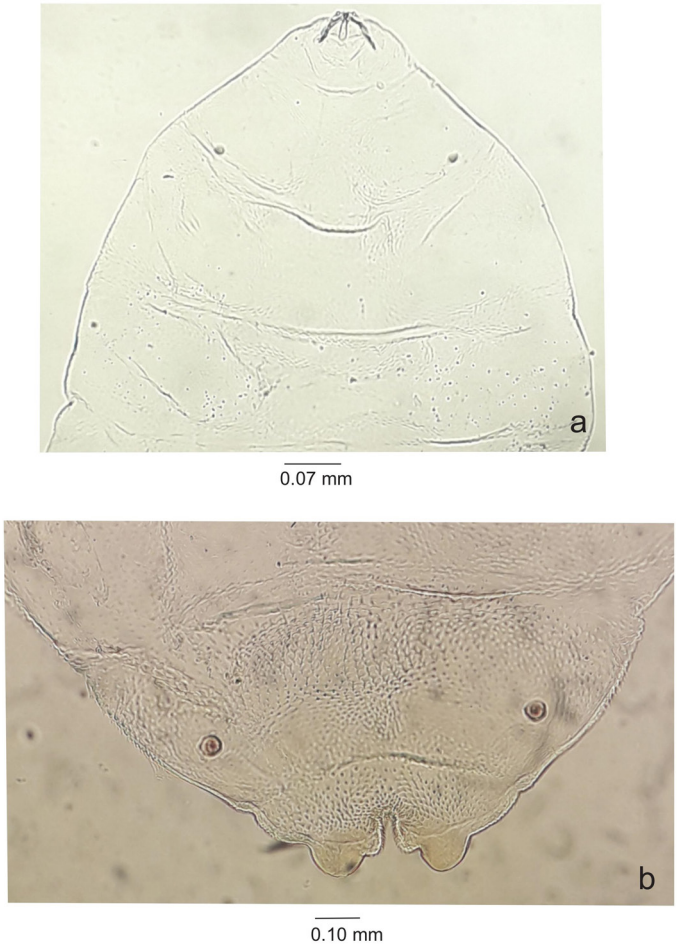

Figure 10 *Zalepidota distincta* new species, larva: a) head and thorax, ventral view; b) terminal segment, dorsal view.

Acknowledgments

To the staff of the Reserva Biológica União for logistical support, and to Dr. Sheila Patrícia Carvalho Fernandes and Dr. Barbara Proença for field assistance.

Funding

This work was supported by the Conselho Nacional de Pesquisa Científica e Tecnológica (Proc. 301481/2017-2).

Conflicts of interest

The authors declare no conflicts of interest.

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