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Revisão Taxonômica, Descrição de Imaturos e Aspectos de História Natural de *Ulotingis* Drake & Hambleton (Heteroptera, Tingidae)

RONALDO ANTONIO PAESI

PORTO ALEGRE, RS

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Dissertação apresentada ao Programa de Pós-graduação em Biologia Animal, Instituto de Biociências da Universidade Federal do Rio Grande do Sul, como requisito parcial à obtenção do título de Mestre em Biologia Animal.

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Orientador: Prof.Dr. Luiz Alexandre Campos

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“**Revisão Taxonômica, Descrição de Imaturos e Aspectos de História Natural de *Ulotingis* Drake & Hambleton (Heteroptera, Tingidae)”**

Ronaldo Antonio Paesi

Comissão examinadora:

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Prof(a). Dr(a). Aline Barcellos

_____

Prof.(a).Dr(a). Luiza Rodrigues Redaelli

_____

Dr(a). Thereza Garbelotto

_____

Prof. Dr. Luiz Alexandre Campos (Orientador)

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Sumário

Resumo

O gênero *Ulotingis* (Heteroptera, Tingidae) foi descrito por Drake & Hambleton em 1935 sendo então composto por quatro espécies: *Ulotingis brasiliensis* (Drake, 1922*), U. uniseriata* (Drake, 1922), *U. decor* Drake & Hambleton 1935, *U. nitor* Drake & Hambleton 1935. O histórico taxonômico do gênero não possui atos nomenclaturais após a descrição do mesmo. No presente trabalho revisamos o gênero com descrições detalhadas das espécies e propomos uma nova sinonímia; *U. nitor* como sinônimo júnior de *U. decor*. Também ampliamos as informações sobre plantas hospedeiras e distribuição. Os imaturos de espécies neotropicais da família Tingidae não são muito conhecidos, e o gênero *Ulotingis* não é uma exceção. Imaturos *de U. decor*, incluindo ovos e todos os ínstares foram descritos. Além disso, são apresentados novos dados sobre a biologia da espécie, como a duração do período de incubação dos ovos, duração dos ínstares, longevidade e ocorrência da mesma ao longo dos meses do ano.

Introdução Geral

Tingidae (Hemiptera: Heteroptera)

A família dos percevejos-de-renda foi estabelecida por Laporte em 1833, e pode aparecer grafada de diversas maneiras: Tingidae, Tingideae, Tingidida, Tingididae, Tingiditae, Tingitidae, Tingidites (a última sendo a originalmente grafada por Laporte). Entretanto, o nome "Tingidae" foi adotado pela Comissão Internacional de Nomenclatura Zoológica, e confirmado no Boletim de Nomenclatura Zoológica (Froeschner, 1996).

O nome popular do grupo (percevejos-de-renda) deriva da estrutura do pronoto e dos hemiélitros que lembra a aparência da renda (devido às células areoladas) o que os torna relativamente fáceis de distinguir de outros heterópteros (Stonedahl *et al*. 1992).

A família inclui em torno de 300 gêneros que podem somar mais de 2500 espécies, as quais possuem tamanho relativamente pequeno, 2 a 8 mm de comprimento (Guidoti *et al*. 2015). A distribuição do grupo inclui todos os continentes (com exceção da Antártica) e muitas das ilhas oceânicas (Drake & Ruhoff, 1965). As espécies da família são exclusivamente fitófagas, e tanto as ninfas como os adultos se alimentam através da sucção dos líquidos presentes em tecidos vegetais (Drake & Ruhoff, 1960). Algumas espécies podem se tornar pragas agrícolas com importância econômica, sendo que existem registros de representantes da família tanto em cultivos de grãos como em plantas ornamentais (Schaefer & Panizzi, 2000). Em relação a outros aspectos interessantes da biologia da família está à capacidade única (entre os heterópteros) de certas espécies em induzir a formação de galhas em plantas (Schaefer, 2009). Além disso, algumas espécies apresentam cuidado parental (Guidoti *et al*. 2015).

No catálogo mundial sobre os tingídeos (Drake & Ruhoff, 1965), são reconhecidas três subfamílias (Cantacaderinae, Tinginae e Vianaidinae) se assemelhando à classificação já proposta por Drake & Davis (1960). Cantacaderinae, com 15 gêneros, é formada por espécies principalmente do hemisfério sul, e usualmente é classificada como possuindo duas tribos (Cantacaderini e Phatnomini). Vianaidinae é um grupo Neotropical relativamente pequeno, com três gêneros recentes e dois fósseis.

Já a subfamília Tinginae inclui a maioria dos tingídeos conhecidos, sendo tradicionalmente dividida em três tribos (Litadeini, Tingini e Ypsotingini) com cerca de 230 gêneros (Schuh & Slater, 1995). Análises filogenéticas recentes tem resultado em alterações nessa classificação tradicional da família. Lis (1999) propôs algumas mudanças, como o reconhecimento da superfamília Tingoidea, composta pelas famílias Vianaididae, Tingidae *sensu novo* e Cantacaderidae *status novo*. Guilbert (2012) descreve um novo gênero e apresenta uma nova análise da matriz proposta por Lis (1999), na qual recupera a monofilia dos táxons propostos, mas com relações conflitantes para as tribos propostas para Cantacaderidae.

A taxonomia de Tingidae é baseada quase que exclusivamente em morfologia externa, e usualmente não são descritos caracteres genitais (Drake, 1922; Monte, 1941; Froeschner, 1989). Para Drake & Davis (1960) os caracteres genitais masculinos são notavelmente uniformes, e só pequenas diferenças poderiam ser visualizadas mesmo entre diferentes subfamílias, o que dificultaria seu uso para fins taxonômicos. Para Lee (1969) a genitália masculina pode ser utilizada como critério taxonômico. Entretanto, é incomum a utilização de caracteres genitais nas descrições de novos táxons (Guilbert 1999; Lis 2009; Montemayor *et al*. 2011).

Os imaturos da família são pouco estudados, com menos de 8% das espécies descritas possuindo imaturos conhecidos, e ainda, a maior parte são de espécies paleárticas (Guilbert, 2004a). Poucos trabalhos apresentam descrições de estágios pós-embrionários para espécies neotropicais (ver Guidoti & Barcellos, 2013). Existe a possibilidade de os caracteres dos imaturos serem informativos para a sistemática da família (Livingstone, 1978). Entre as características dos imaturos que podem ser interessantes para trabalhos taxonômicos estão formações notavelmente conspícuas (projeções) na superfície do corpo, com grande variação em sua morfologia. Para Guilbert (2004b) o conhecimento sobre os imaturos da família proporciona informações tão importantes quanto as dos adultos para o estudo da evolução e ecologia do grupo.

O Gênero *Ulotingis*

O gênero *Ulotingis* (Tingini) foi proposto originalmente por Drake & Hambleton (1935), para abrigar quatro espécies. Dessas espécies, duas haviam sido anteriormente

descritas no gênero *Acysta* Champion, 1898; *Ulotingis uniseriata* (Drake, 1922) foi descrita como variedade de *U. brasiliensis* (Drake, 1922) e elevada ao nível de espécie por Drake & Bondar (1932). O gênero atualmente mantem quatro espécies (Drake & Ruhoff, 1965) sendo elas: *U. brasiliensis*; *U. uniseriata*; *Ulotingis decor* Drake & Hambleton, 1935 e *Ulotingis nitor* Drake & Hambleton, 1935, todas neotropicais e, exclusivas do Brasil. O gênero foi separado de *Acysta* devido às espessas nervuras, paranoto carenado e comprimento das carenas laterais (Drake & Hambleton, 1935).

Existem poucos dados sobre a distribuição das espécies do gênero, e mesmo esses, muitas vezes limitam-se aos Estados nos quais os exemplares foram encontrados. Trabalhos anteriores registram *Ulotingis brasiliensis* para o Pará, Bahia, Minas Gerais e São Paulo; *U. uniseriata* para Bahia e Minas Gerais (Monte, 1940). Já *U. decor* e *U. nitor* são registradas para São Paulo (Drake & Hambleton, 1935). Como plantas hospedeiras, são citadas *Psidium guayava* para *U. brasiliensis*, *Byrsonuma verbascifolia* e *B. sericea* para *U.uniseriata* e somente a informação sobre a família das plantas (Myrtaceae) para *U.decor* e *U.nitor* (Monte, 1940).

Tanto em *U. brasiliensis* como em *U. uniseriata*, existem duas regiões elevadas nas nervuras dos hemiélitros, sendo uma no ápice da área discoidal e outra na região central da nervura que limita as áreas discoidal e sutural (Drake, 1922). A diferenciação dessas duas espécies se dá principalmente pela organização das aréolas da área costal, descrita como totalmente bisseriada em *U.brasiliensis* e como unisseriada em *U.uniseriata* (Drake & Bondar, 1932). Já *U. decor* é descrito como semelhante a *U. brasiliensis* mas distinguível pelas elevações muito menos proeminentes nos hemiélitros. Já *U.nitor* é descrito como não possuindo essas elevações em nenhum grau (Drake & Hambleton, 1935).

Além dos trabalhos relacionados com a descrição do gênero *Ulotingis* e de suas espécies; na literatura constam informações basicamente em listas e catálogos (Monte, 1939; Monte, 1940; Drake & Ruhoff, 1965). Até o momento não havia sido realizada nenhuma revisão taxonômica para o gênero. Além disso, as formas imaturas não são conhecidas para nenhuma das espécies descritas, e outros elementos relacionados com a biologia, ecologia ou comportamento das espécies são pouco ou nada conhecidos.

Objetivos

Objetivo Geral

Realizar a revisão de *Ulotingis* e incluir a descrição de imaturos e aspectos de História Natural.

Objetivos Específicos

Os objetivos desde trabalho foram: 1) realizar a revisão taxonômica do gênero; 2) redescrever as espécies; 3) estabelecer a diagnose diferencial das espécies; 4) fornecer uma chave de identificação para as espécies do gênero; 5) ampliar as informações sobre as plantas hospedeiras das espécies; 6) ampliar as informações sobre a distribuição das espécies; 7) elaborar um mapa de distribuição atualizado para o gênero; 8) descrever a morfologia dos ovos de *U.decor*; 9) descrever a morfologia dos cinco ínstares de *U.decor*; 10) registrar o tempo médio de incubação dos ovos de *U.decor*; 11) registrar o tempo médio de duração dos ínstares de *U.decor*; 12) registrar a longevidade dos adultos de *U.decor*.

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Capítulo 1

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Description of immature stages and notes on the natural history of *Ulotingis decor* (Hemiptera: Tingidae)

RONALDO A. PAESI[1], MARCUS GUIDOTI[1,2], LUIZ A. CAMPOS[1]

[1]*Programa de Pós Graduação em Biologia Animal, Universidade Federal do Rio Grande do Sul (UFRGS), Av. Bento Gonçalves, 9500, Prédio 43.435, 91501-970, Porto Alegre, RS, Brazil.*
[2]*Muséum National d'Histoire Naturelle, Adaptive Mechanisms & Evolution, UMR 7179 MNHN/CNRS, Paris, France.*
Email:ronaldopaesi@gmail.com

Abstract

The external morphology of eggs and the five nymphal instars of *Ulotingis decor* Drake & Hambleton are described. The study was performed using scanning electron microscopy. The nymphs present different outgrowths (e.g. ampulla-like projections and spatula-like projections). The duration of incubation period of the eggs, instars and adult longevity are informed. This information is discussed based on the available literature about the family and their importance for phylogenetic and comparative studies.

Key words: egg, nymphs, integumentary structures, scanning electron microscopy

Introduction

Tingidae (Hemiptera: Heteroptera: Cimicomorpha) is composed by more than 2100 species distributed in about 350 genera (Froeschner 1996). The family is characterized by the lace-like aspect of pronotum and hemelytra of many of its species, which explains the popular name of the group, "lace bugs" (Lis 1999; Guilbert 2001). Traditionally, the taxonomy and systematics of tingids were exclusively based on these

adults non-genital characters (Guilbert 2004a). Some species are considered agricultural pests of economic importance for commercial crops and ornamental plants (Guidoti *et al.* 2015a). The species vary the oviposition site in the plant (different parts of leaves and flowers), the number of eggs (in groups or solitary), and oviposition frequency along the year (univoltines, bivoltines or multivoltines) (Livingstone & Yacoob, 1987).

The immature stages of Tingidae species are poorly known, most of the descriptions are focused only on the fifth instar (Guidoti & Montemayor, 2014) and are from the Palearctic, Afrotropical and Eastern region (Guilbert, 2004a). Few studies covered the descriptions of all immature instars of Neotropical nymphs (Guidoti & Barcellos 2013; Moreira *et al.* 2014; Wengrat *et al.* 2015). However, the nymphal characters have been considered in phylogenetic and evolutionary analyses of the group (Guilbert, 2004b; Guilbert *et al.* 2008).

The taxonomy, systematics and biology of the Neotropical genus *Ulotingis* Drake & Hambleton (1935) were rarely addressed. *Ulotingis* was proposed to include four species, *Ulotingis decor* Drake & Hambleton 1935, *U. nitor* Drake & Hambleton 1935, and two previously described in the genus *Acysta*, *U. brasiliensis* (Drake 1922a) and *U. uniseriata* (Drake 1922b). Information on the morphology of *Ulotingis* species is restricted mainly to the original descriptions, and morphology of immatures, biology and natural history are unknown. The only available information are records of host plants (Monte, 1940), including *Psidium guajava* (Myrtaceae) and *Acca sellowiana* (Myrtaceae), in which the species of the genus can be occasional pests (Chirinos & Geraud-Pouey, 2011).

This article aims to provide the first set of information on the immatures of a *Ulotingis* species, by describing the immature stages of *U. decor* with comments on its natural history.

Material and Methods

Taxonomic Descriptions

Nymphs of all instars were manually collected on *Acca sellowiana* (Myrtaceae) leaves in Passo Fundo and Porto Alegre, Rio Grande do Sul, Brazil, in 2014. Eggs were found by cutting the midrib of the leaves. Nymphs and eggs were kept in 70% ethanol.

Photographs of nymphs were taken using a Nikon AZ100M stereomicroscope with the software NIS-Elements Advanced Research. All stages were observed in scanning electron microscopy (SEM) using a JSM6060 scanning electron microscope at the Microanalysis and Microscopy Center of UFRGS. The material went through an alcoholic series (gradually decreasing the concentration: 70%, 50%, 30%, 10%), a contact lenses cleaning solution for 24h, and it was exposed to acetone (10%, 30%, 50%, 70%, 90%, 100%). After, it was dried by critical point and coated with gold. Measurements of nymphs were obtained from 75 specimens (15 of each instar) under stereomicroscope with measuring reticule. They are presented (in millimeters) after the descriptions of each instar with the Standard Deviation within parenthesis. The following measurements were taken: Total Body Length (TBL); Head Length (HL); Head Width (HW); Interocular Distance (ID); Scape Length (SCP); Pedicel Length (PDC); Basiflagellomere Length (BSF); Distiflagellomere Length (DSF); Pronotum Length (PRL); Pronotum Width (PRW); Mesonotum Length (MSL); Mesonotum Width (MSW); Maximum Width (MXW). The terminology followed Guilbert (2004b) and Guidotti & Barcellos (2013) for nymphs, and Baker and Brown (1994) for eggs.

Natural History

Duration of instars, incubation period of eggs and longevity of adults were obtained. The specimens were kept undercontrolled conditions, 25 °C, 12h of light; 20 °C, 12 hours of dark, in Petri dishes containing leaves of the host plant (*A. sellowiana*) with a moistened cotton at petiole. The leaves were replaced every 3 or 4 days or even before if they had a dried appearance.

The incubation period of eggs was obtained from two groups of couples (5 couples in each Petri dish). The leaves were isolated after one day with the specimens, and checked daily for the presence of first instar nymphs (n =49). The leaves were observed for 30 days, and an extension of 5 days was added if new first instars were found after the day 30.

To obtain the time duration of each instar, first instar nymphs were isolated on the day they emerged and the individuals were checked daily (n=55).

In order to verify adult longevity, newly emerged adults were placed in pairs (one male and one female) in Petri dishes (n=18) and observed daily. In addition to the

data obtained in laboratory, *in situ* observations were made of a natural population within the university campus [-30.068.350, -51.117.750,] for registering the presence of the species over one year (April 2015 until March 2016).

Results

Eggs and Oviposition

Oviposition is endophytic and eggs were found singly totally inserted inside the midrib of the leaves on the abaxial surface (Fig. 1a). The eggs are transparent to whitish and it is possible to see the eyes of immatures inside the eggs near to hatch. Eggs elliptical, slightly curved, narrower at the operculum, chorion smooth (Fig. 1c). Rim covering the lateral margin of cap (Fig. 1b). Cap concave, reticulated (Fig. 1b, 1d). The vitelline covering is visible after removal of the cap (Fig. 1e).

First instar

Body elongated, slightly curved dorsally (more evident in abdomen); yellowish. Head and central region of III-IX abdominal segments light brown.Apex of antennae and tarsi light brown (Fig. 2a).

Head. Slightly wider than long, armed with five tubercles: an occipital pair, one dorsomedial, and a frontal pair, all directed up-forward (Fig. 3a), bearing ampulla-like setae (AS) at apex (Figs. 3a, 4a, 4b, 4c). Clypeus prominent, rounded at anterior margin, with few AS. Rostrum reaching the posterior margin of IV urotergite. Buculla not fused anteriorly. Basiflagellomere about two times longer than distiflagellomere and five times longer than pedicel; scape subequal to pedicel. Scape, basifagellomere and distiflagellomere bearing spatula-like setae (SS) more densely distributed in basiflagellomere and distiflagellomere. Occipital tubercles twice the size of dorsomedial. Frontal tubercles subequal to dorsomedial. Scale-like Projections (SP) and Granulae-like Projection (GP) present (about three) near posterior margin of head (Figs. 3a, 4e).

Thorax. Central area slightly darker than margins. Pronotum rectangular, about four times wider than long. Anterior and posterior margins of pronotum slightly curved. Pro- and mesonotum with two pairs of tubercles: one at lateral margins and one in the central area. Metanotum with one pair of tubercles at lateral margin. Tubercles bearing AS at apex (Fig. 5a). Meso- and metanotum rectangular and slightly elevated in the central area.

Abdomen. Ten segments visible dorsally. Segments I-VII elevated in the central area. First urotergite with SP sparsely distributed in central area. A pair of tubercles bearing AS at apex in central area of second urotergite; these light brown. Segments II-IV bearing few and sparsely distributed SP and GP at central area and a pair of Spatula-like Setae (SS) at lateral area. Fourth and fifth urotergite with central opening gland at anterior margin (Fig. 4f). Segments VI-VIII with one pair of tubercles at lateral margins, bearing AS at apex. Segment VIII bear one branched tubercle (with AS at apex) at central area. Segments V-VII with a pair of SS at central area. Segment IX with two pairs of SS in central area and lateral margin. Segment X about two times narrower than IX; two pairs of tubercles with AS at apex: one sublateral and one posterior.

Measurements. TBL, 0.48 (± 0.075); HL, 0.13 (± 0.006); HW, 0.16 (± 0.008); ID, 0.13 (± 0.008); SCP, 0.03 (± 0.003); PDC, 0.03 (± 0.003); BSF, 0.15 (± 0.021); DSF, 0.09 (± 0.010); PRL, 0.04 (± 0.012); PRW, 0.17 (± 0.014); MSL, 0.04 (± 0.009); MSW, 0.18 (± 0.023); MXW, 0.18 (± 0.027).

Second instar

Central region of proto- mesonotum light brown. Apex of central tubercles on II and VIII abdominal segments dark brown (Fig. 2b).

Head. Basiflagellomere more than five times the length of scape. Rostrum reaching the middle of second urotergite. Occipital tubercles slightly curved and divergent, not reaching the posterior margin of eyes. Occipital tubercles a four times longer than dorsomedial. Occipital tubercles bearing few SS over the base (about five or six) (Fig. 3b).

Thorax. Anterior and posterior margins of pronotum slightly curved. Pro-, meso- and metanotum with large number of SP and GP centrally. Central tubercles on pro-

mesonotum dark brown. Pronotum bearing SP at the posterior margin. Posterior margin of mesonotum slightly curved. Trapezoidal mesonotum. Base of the lateral and central tubercles larger than in the previous instars.

Abdomen. First urotergite with SP distributed in central area and posterior margin. A single branched tubercle bearing AS at apex on second urotergite. Segments II-IV bearing about three SS at lateral margins; III-IV with two more in the central area; V-VIII with SS evenly distributed in the dorsal tegument; IX concentrated in the posterior margin. Segments V-VIII with SP in the anterior and posterior margins, more concentrated in segments V-VI.

Base of tubercles more developed than in the previous instar (Fig.6b). The number of SS, SP and GP over the integument increases. Remaining characters as described in the previous instar.

Measurements. TBL, 0.71 (± 0.014); HL, 0.18 (± 0.009); HW, 0.22 (± 0.009); ID, 0.17 (± 0.004); SCP, 0.04 (± 0.003); PDC, 0.04 (± 0.005); BSF, 0.22 (± 0.014); DSF, 0.11 (± 0.008); PRL, 0.06 (± 0.005); PRW, 0.25 (± 0.010); MSL, 0.06 (± 0.003); MSW, 0.27 (± 0.007); MXW, 0.28 (± 0.008).

Remarks: The central region of pro- and mesonotum is darker in this instar. This instar also presents longer tubercles on head, thorax and abdomen. Second instar can be distinguished from the previous by the longer pro- and mesonotum and by the more curved margins of pronotum. The number of SS in the occipital tubercles and abdominal segments, and the amount of SP and GP on thorax and abdomen also distinguishes this instar from the previous one.

Third instar

Occipital tubercles; central regions of pro- and mesonotum, the anterior part of the central region of metanotum; and the V-IX abdominal segments dark brown. Central tubercles on II and VIII segments blackish. (Fig. 2c).

Head. Rostrum reaching the posterior margin of first urosternite. Occipital tubercles curved, slightly surpassing the anterior margin of the eyes; about one and a

half longer than dorsomedial. Frontal tubercles subequal to dorsomedial in lenght. All tubercles bearing SS; greater number in the occipital pair (Fig. 3c).

Thorax. Pronotum trapezoidal, slightly curved in anterior and posterior margins. Three times wider than long. The SP and GP forms a "V" pattern in pronotum (Fig. 5b). Posterior margin of mesonotum slightly curved and lateral margins rounded. Spatula-like Setae sparsely distributed near lateral tubercles in pro- and mesonotum and on central tubercles of mesonotum. Posterior margin of metanotum slightly curved. Central area and posterior margin of meso- and metanotum bearing a great number of SP and GP (Fig. 5b). A non-identified secretion sparsely distributed within SP and GP (Figs. 5c).

Base of tubercles more developed than in previous instars (Fig.6c). The number of SS, SP and GP increases over the integument. Remaining characters as described in the previous instar.

Measurements. TBL, 0.88 (± 0.040); HL, 0.21 (± 0.011); HW, 0.26 (± 0.007); ID, 0.19 (± 0.007); SCP, 0.05 (± 0.003); PDC, 0.05 (± 0.003); BSF, 0.30 (± 0.016); DSF, 0.14 (± 0.012); PRL, 0.10 (± 0.011); PRW, 0.31 (± 0.012); MSL, 0.10 (± 0.007); MSW, 0.36 (± 0.014); MXW, 0.38 (± 0.017).

Remarks: The central region of thorax and abdomen become dark brown in this instar. The tubercles of head, thorax and abdomen are conspicuously more developed. The third instar can be distinguished from the second by the occipital tubercles more curved and extending beyond the anterior margin of eye, by the more developed thoracic and abdominal lateral tubercules and by the longer mesonotum.

Fourth instar

Head. Occipital tubercles greatly surpassing the anterior margin of the eyes Frontal tubercles slightly longer than dorsomedial. Number of SS in occipital tubercles enhanced (Fig. 3d).

Thorax. Pronotum two times wider than long. Posterior margin of pronotum projected backwards in the middle (Fig. 5c). Spatula-like setae sparsely distributed near posterior margins of pronotum and over tubercles. Wing pads rounded, reaching the

anterior margin of second urotergite; SS present over the lateral margins (Fig. 5d). Lateral region of metanotum hidden by wing pads. The number of SP and GP over the integument increased in pro-mesonotum.

Abdomen. Lateral region of first urotergite hidden by the wing pads (Fig. 5d). Segments II-IV bearing about three SS at lateral margins, more concentrated in the second urotergite. Scale-like Projections in posterior margin of segment II, and in the anterior and posterior margins of segments III-IV.

Base of tubercles more developed than in previous instars (Fig.6d). Remaining characters as described in the previous instar.

Measurements. TBL, 1.11 (± 0.045); HL, 0.22 (± 0.021); HW, 0.32 (± 0.011); ID, 0.23 (± 0.012); SCP, 0.08 (± 0.007); PDC, 0.07 (± 0.008); BSF, 0.40 (± 0.027); DSF, 0.18 (± 0.013); PRL, 0.20 (± 0.009); PRW, 0.42 (± 0.014); MSL, 0.25 (± 0.016); MSW, 0.50 (± 0.021); MXW, 0.56 (± 0.015).

Remarks: This instar can be differentiated from the previous one by de development of wing pads in mesonotum, which reaches the anterior margin of the second abdominal segment. The body length is greatly enhanced and the tubercles are also more evident than in the previous instars.

Fifth instar

Anterior region of distiflagellomere and lateral tubercles of thorax dark brown (Fig. 2e).

Head. Rostrum attaining the posterior margin of metasternum. Amount of SS in the dorsomedial tubercle greatly increased.

Thorax. Posterior margin of pronotum sharply projected backwards in the middle (Fig. 5e). Two pairs of lateral tubercles with AS at apex in wing pads: one at middle and the other at distal part. Wing pads elongated, reaching the posterior margin of fifth urotergite (Fig. 5f). A non-identified secretion distributed within SP and GP evident on integument (Fig. 5g).

Abdomen. Lateral region of I-IV abdominal segments hidden by the wing pads. Lateral margin of V segment only partially hidden.

Base of tubercles more developed than in previous instars (Fig.6e). Remaining characters as described in the previous instar.

Measurements. TBL, 1.54 (± 0.040); HL, 0.26 (± 0.027); HW, 0.35 (± 0.049); ID, 0.25 (± 0.026); SCP, 0.10 (± 0.007); PDC, 0.08 (± 0.009); BSF, 0.50 (± 0.043); DSF, 0.21 (± 0.015); PRL, 0.41 (± 0.021); PRW, 0.52 (± 0.063); MSL, 0.60 (± 0.014); MSW, 0.76 (± 0.045); MXW, 0.79 (± 0.047).

Remarks: The most striking differences between the fifth and forth instars are the fully developed wing pads, reaching the fifth urotergite.

Natural History

The species was found on two host plants, *A. sellowiana* and *Myrcia bombycina* (Myrtaceae). Adults and immatures are found on the leaves abaxial surface, and normally feed on the leaf veins. One or more couples can be found on the same leaf frequently with a large number of immatures of all instars.

The average period of development from egg to adult was 42.53±5.89 days. The eggs have an incubation period similar to the development time of all instars combined (Tab.1). The fifth instar was the longest, followed by the first instar (Tab.1). Mortality was low and exclusively recorded for the first and second instars (Tab. 1). Males showed greater longevity than females: the male specimen that lived longer reached 98 days (Tab. 1). Both adults and immatures were found during all observed months in natural *in situ* observations, with no clear perception of population decrease.

Discussion

The immature stages and aspects of natural history described in the present work are the only known for *Ulotingis* so far and also one of the few complete descriptions (including egg and all instars) for Neotropical species of Tingidae. The morphology of tingid nymphs may have well-developed tubercles in the form of outgrowths. These structures (present on head, thorax and abdomen) represent interesting possibilities as taxonomic characters (Lee 1969; Guidoti & Barcellos, 2013). The evolution of such

structures is not well understood, but Guilbert (2004b) states that they have adaptive function. In this way, outgrowths may be associated with secretory activity involved in defensive functions (Mason *et al.* 1991), osmoregulation (Livingstone, 1978), and intraspecific communication (Aldrich *et al.* 1991). In our investigation we found the nymphs to bear a set of tubercles with two types of associated projections: SS (which were not found in other species of the family studied) and AS, found also for other tingid species, as *Teleonemia scrupulosa* Stål (Guidoti & Barcellos, 2013). which were not found in other family work

Overall, throughout the development, the outgrowths of nymphs become more robust and longer, with the possibility of developing branches (Guidoti & Barcellos 2013; Moreira *et al.* 2014; Wengrat *et al.* 2015). In this study this same general pattern was observed. On head all five tubercles become progressively larger and with more projections (spatula-like setae) throughout development. On thorax and abdomen there is a similar pattern with more developed lateral and dorso-central tubercles. Furthermore, the amount of projections increases (spatula-like setae, scale-like projections and granulae-like projection), not only those related to the tubercles but in other regions of the dorsal integument.

Features found for the eggs are similar to those expected for the family. Eggs can be placed on the plant surface (exophytic oviposition), partially inserted in the vegetal tissue (pseudo-endophytic oviposition) or within the plant tissue with only the operculum out (endophytic oviposition) (Guidoti *et al.* 2015b), the latter being found in *U. decor*. The chorion is generally smooth and the hexagonal sculpturations like in *Haedus* sp. are rare (Livingstone & Yacoob 1987). The Cap of *U. decor* differs from other species such as *Corytucha arcuate* (Baker & Brown 1994) and *Vatiga manihotae* (Wengrat *et al.* 2015).

According to Guilbert (2001, 2004b) during the evolution of tingids, in both adults and nymphs, it seems to be a general trend for increasing complexity (for pronotal and hemelytral expansions in adults and outgrowths in nymphs). Thus, the absence of outgrowths would be a plesiomorphic condition (Guilbert, 2004b). Besides the lack of complex structures in adults of *Ulotingis* species, the immatures of *U.decor* present such outgrowths. However, none of the *Ulotingis* species were included in these studies.

There are few studies on the biology of Neotropical tingids, and these involve species of economic importance (Kogan 1960; Braman *et al*. 1992; Cividanes *et al.* 2004; Silva 2004; Moreira *et al*. 2013).

The mean incubation time in days of *U. decor* (22.51 days) was higher than in others species of tingids reared under similar conditions, whose incubation span from 7.0 to 13.6 days, in *Gargaphia torresi* Lima and *Stephanits pyrioides* (Scott), respectively (Braman *et al*. 1992; Zhang *et al.* 2011; Cividanes *et al*. 2004; Silva 2004). As reported for *S. pyrioides*, *Leptopharsa heavea* Drake & Poor, and *G. torresi* it is possible that variation in temperature changes incubation time also for *U. decor* eggs. In addition, a longer time of incubation of the eggs than in the development of instar (taken individually) as found in *U. decor* was also found for such species.

Kogan (1960) did not study systematically the longevity of adults of *Corythaica cyathicollis* (Costa, 1864), but he recorded a female lived to 77 days, considerably longer than the longevity presented by the females of *U. decor*. For similar temperatures, Silva (2004) found equivalent longevity average times for *G.torresi* (44.9 days for females and 63.5 days for males), and Cividanes *et al.* (2004) found a similar value for females of *L. heveae* (39.3 days) and lower for males (40.1 days). The lower longevity of females of *G. torresi* can be linked to different energy requirements for oviposition activity (Silva, 2004) and this may be related to the same pattern found in *U.decor*.

In *in situ* observations, adults and immatures were observed in all observed months, suggesting that *U. decor* is a multivoltine species. Although usually the representatives of Tingidae are uni- or bivoltine, there are known multivoltine species, such as in *Corythucha* Stål (Neal & Douglas, 1990). Some species, like *C. cydoniae* (Fitch), have voltinism which varies according to the region they are found (Neal & Douglas, 1990), so it may be an aspect also variable in *U. decor*.

This study presents new information on the biology and morphology of immatures of a Neotropical species of Tingidae. Since the structures present in the nymphs are a source of information for phylogenetic studies, the present work provides an important contribution for future phylogenetic analyses. Also, the information collected on natural history is an addition to the little that is known about the biology of the family.

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Table 1. Developmental time of immatures and longevity of adults of *Ulotingis decor* (SD – Standard Deviation) (25ºC, 12h of light; 20ºC, 12h of dark).

	Durations (days) Mean ± SD	Minimum (days)	Maximum (days)	Mortality (%)
Egg (n=49)	22.51 ± 1.98	19	29	-
1º instar (n=55)	4.37 ± 1.13	01	06	0.073
2º instar (n=51)	3.30 ± 0.74	02	05	0.039
3º instar (n=49)	3.26 ± 0.72	02	06	00
4º instar (n=49)	3.67 ± 0.68	02	05	00
5º instar (n=49)	5.42 ± 0.64	04	07	00
All instar period	20.02 ± 3.91	-	-	-
Adults (#m, n=18)	60.11 ± 23.90	27	98	-
Adults (#f, n=18)	38.83 ± 14,00	18	77	-

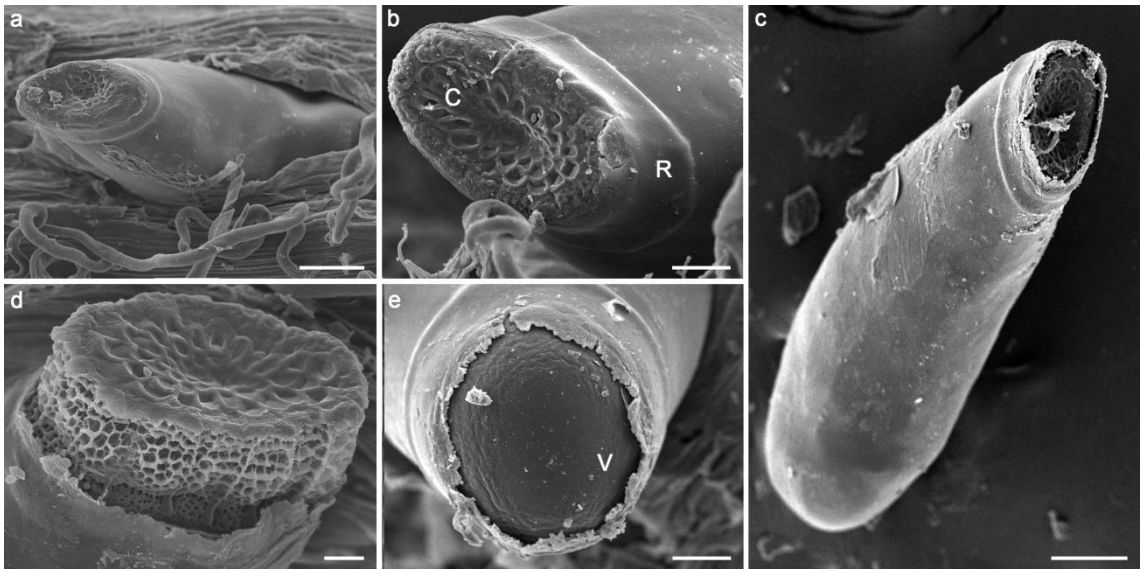

FIGURE 1. *Ulotingis decor* egg: a, egg partially inserted in the midrib, cut to reveal a larger part of the egg; b, detail of rim and cap; c, lateral view of the egg; d, cap with rim removed; e, detail of the vitelline covering (without the cap). C = cap, R = rim, V = vitelline covering. Scale bars: 50, 20, 50, 10 and 20 µm, respectively.

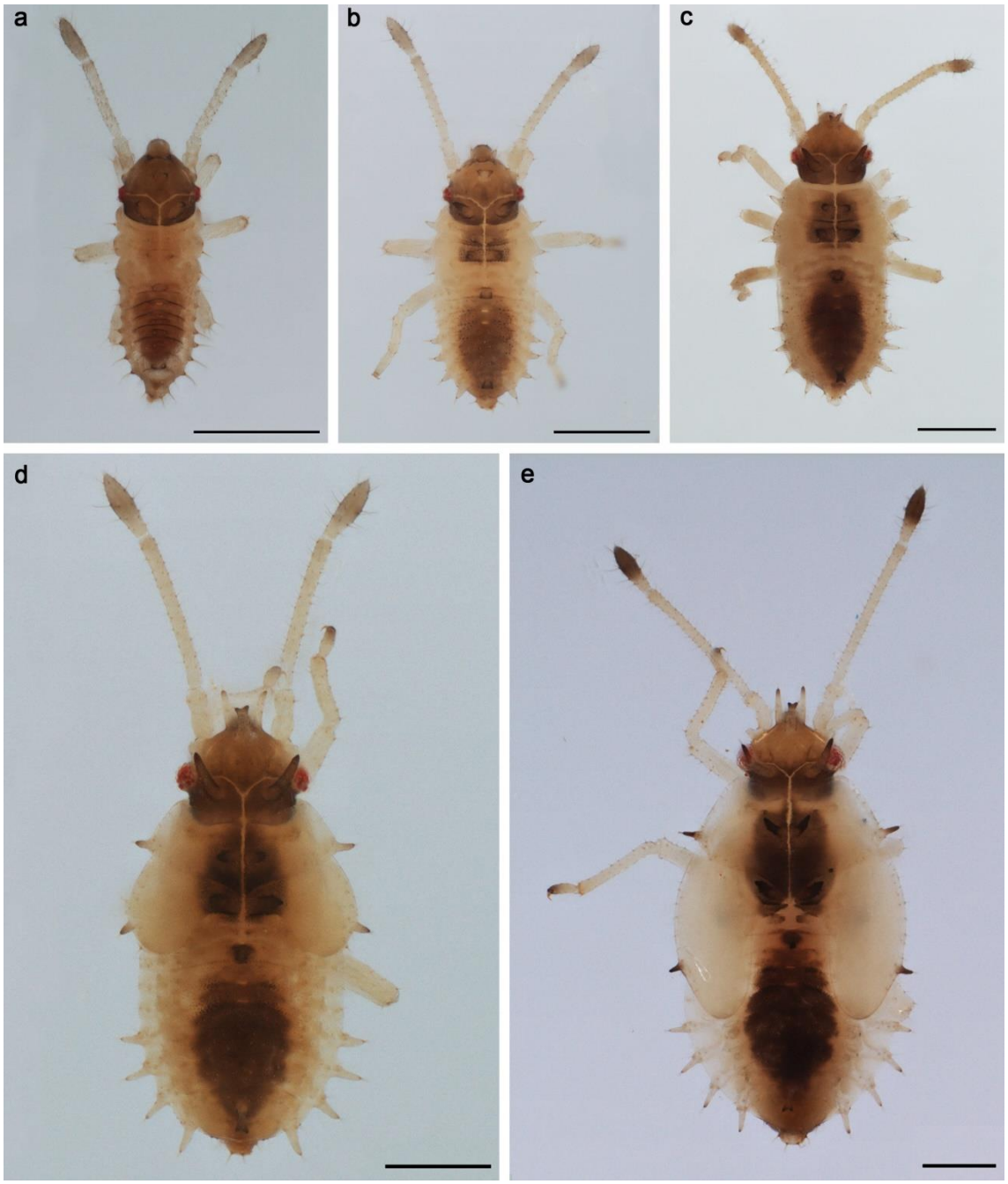

FIGURE 2. Dorsal *habitus* of *Ulotingis decor* nymphs: a, first instar; b, second instar; c, third instar; d, fourth instar; e, fifth instar. Scale bars: 0.25 mm.

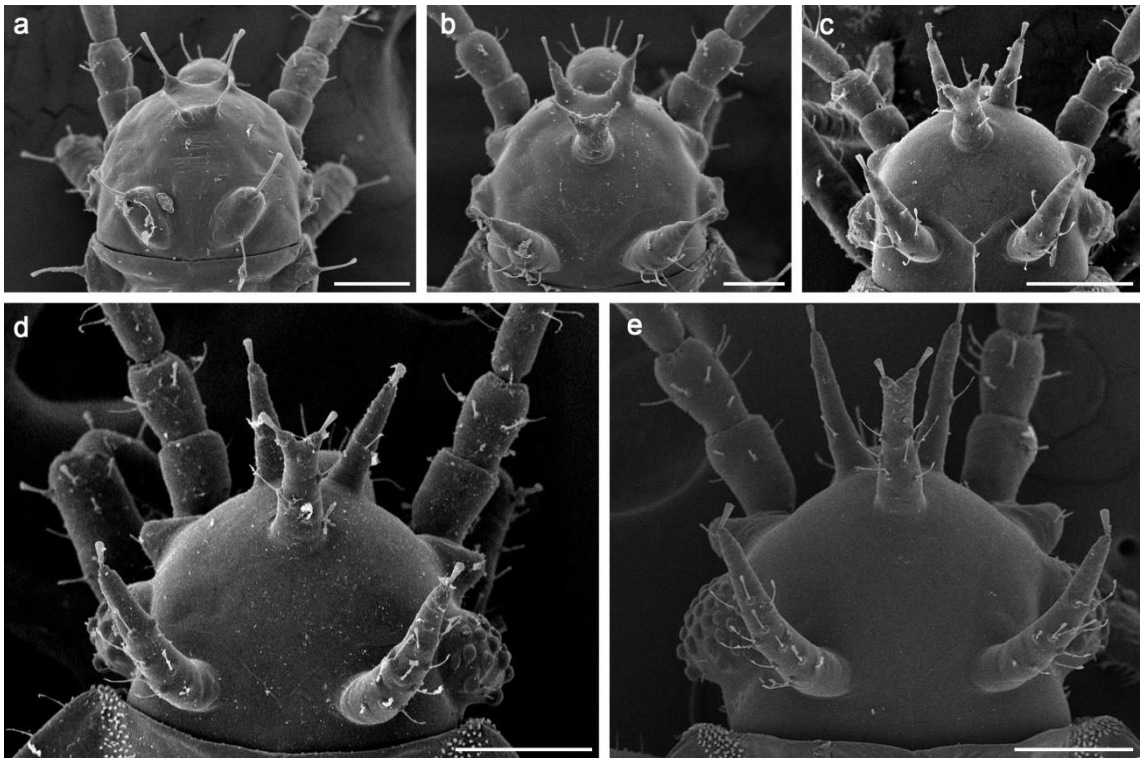

FIGURE 3. Dorsal view of the head of *Ulotingis decor* nymphs: a, first instar; b, second instar; c, third instar; d, fourth instar; e, fifth instar. Scale bars: 50, 50, 100, 100 and 100 µm, respectively.

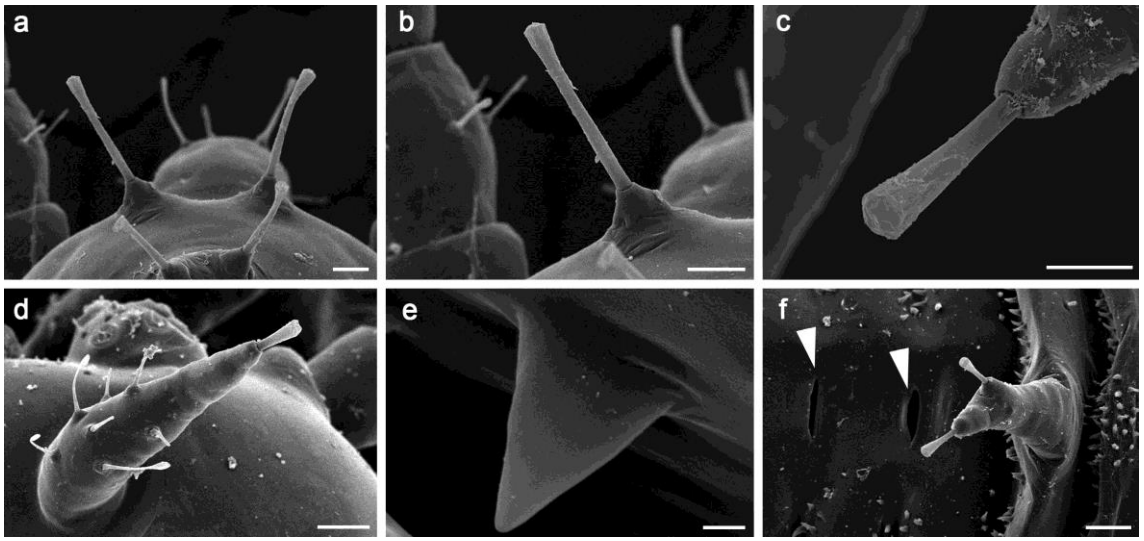

FIGURE 4. Integumentary structures of *Ulotingis decor* nymphs. a-c, ampula-like projections (AS); d, six spatula-like setae (SS) ; e, scale-like projections (SP); f, abdominal opening glands (white arrows). Scale bars: 10, 10, 10, 20, 1 and 20 µm, respectively.

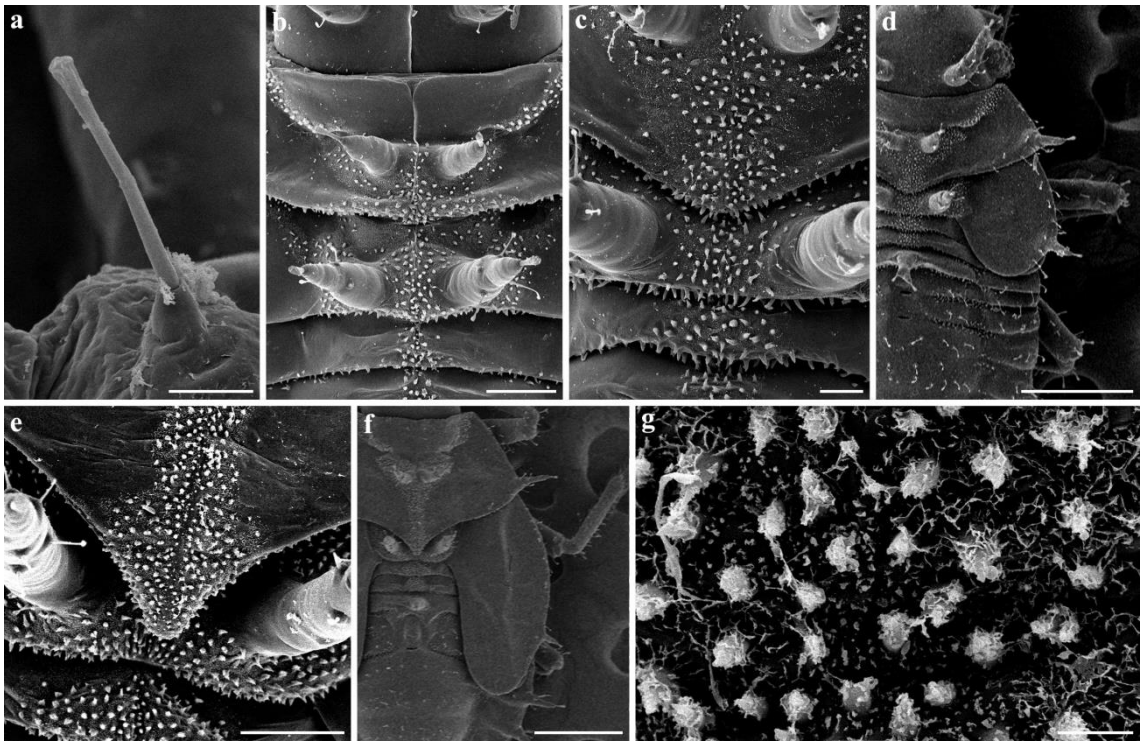

FIGURE 5. Disposition of the integumentary structures of *Ulotingis decor* nymphs. a, lateral margin of pronotum with a ampula-like setae (first instar); b, "V" patterning formed by the scale-like projections (third instar); c, posterior margin of pronotum markedly projected backwards in the middle (fourth instar); d, detail of the wing pads (fourth instar); e, posterior margin of pronotum sharply projected backwards in the middle (fifth instar); f, detail of wing pads (fifth instar); g, detail of the SP and GP with the non-identify material (fifth instar). Scale bars: 10, 50, 20, 200, 50, 250, and 5 µm, respectively.

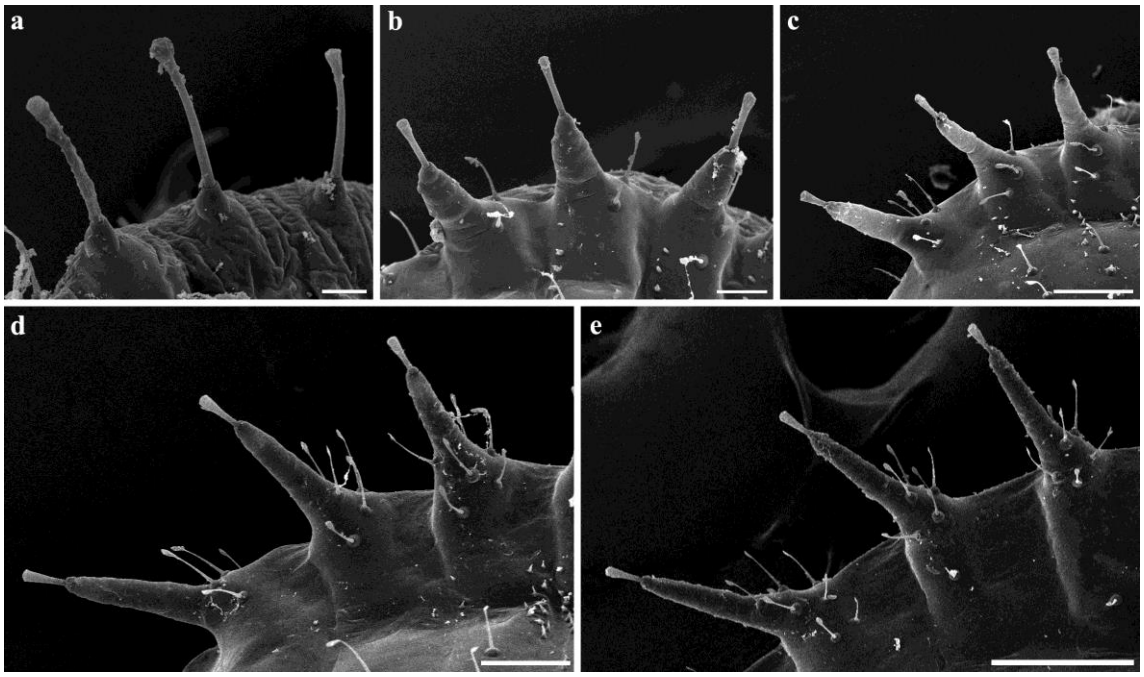

FIGURE 6. Development of the lateral abdominal tubercles VI - VIII. a, first instar; b, second instar; c, third instar; d, fourth instar; e, fifth instar. Scale bars: 10, 20, 50, 50 and 100 µm, respectively.

Capítulo 2

(redigido conforme normas da revista Zootaxa)

Review of the genus *Ulotingis* Drake & Hambleton (Heteroptera, Tingidae)

RONALDO A. PAESI[1], MARCUS GUIDOTI[1,2], NATHALIA RUSSI[1], LUIZ A. CAMPOS[1]

[1]Programa de Pós Graduação em Biologia Animal, Universidade Federal do Rio Grande do Sul (UFRGS), Av. Bento Gonçalves, 9500, Prédio 43.435, 91501-970, Porto Alegre, RS, Brazil.
[2]Muséum National d'Histoire Naturelle, Adaptive Mechanisms & Evolution, UMR 7179 MNHN/CNRS, Paris, France.
Email:ronaldopaesi@gmail.com

Abstract

The genus *Ulotingis* Drake & Hambleton was proposed in 1935 and includes four species, *U. decor* Drake & Hambleton 1935, *U. nitor* Drake & Hambleton 1935, and two previously described in the genus *Acysta*, *U. brasiliensis* (Drake 1922a) and *U. uniseriata* (Drake 1922b). Here, the genus is revised and a new synonym is proposed, *U. nitor* being considered junior synonym of *U. decor*. A key to species is provided, as well as illustrations of the diagnostic characters and dorsal habitus photographs, and a distributional map.

Key words:; lacebugs; redescription; synonym; taxonomic act.

Introduction

Ulotingis Drake & Hambleton, 1935 (Heteroptera, Tingidae) is a Neotropical genus, exclusively distributed in Brazil. *Ulotingis* was proposed to include four species, *Ulotingis decor* Drake & Hambleton 1935, *U. nitor* Drake & Hambleton 1935, and two

previously described in the genus *Acysta*, *U. brasiliensis* (Drake 1922a) and *U. uniseriata* (Drake 1922b). *Ulotingis uniseriata* was initially described as a variety of *U. brasiliensis*, but Drake & Bondar(1932) raised to species level. There was no other taxonomic act proposed after the genus description.

The genus is distinguished from *Acysta* by the narrower paranota, shorter lateral carinae, shorter hemelytra and thicker veins (Drake & Hambleton 1935). Its species were classified using mostly characters of hemelytra, as the areolae in the coastal area and the elevation in hemelytra veins (Drake & Hambleton 1935). Host plants reported for the species of the genus are: *Psidium guayava* (Myrtaceae) (*U. brasiliensis)*; *Byrsonima verbascifolia* (Malpighiaceae) and *B. sericea* (*U. uniseriata)*. *Ulotingis decor* and *U. nitor* has only reports at family level (Myrtaceae – Monte 1940). Information on biology and immatures are only available for *Ulotingis decor* (Paesi *et al., in prep*).

In this present contribution, we revised the genus, and we propose *U. nitor* as a junior synonym for *U. decor*. A key to species is provided together with dorsal habitus photographs and illustrations of the main characters. The distributional information is updated and a map is provided.

Material and Methods

Specimens belonging to the following scientific institutions and collections were studied: National Museum of Natural History, Smithsonian Institution, Washington, D.C., United States (NMNH); Estação Experimental de Videira, Empresa de Pesquisa Agropecuária e Extensão Rural de Santa Catarina (EEV); Museu Nacional, Universidade do Rio de Janeiro, Rio de Janeiro, Brazil (MNRJ); Instituto Biológico, São Paulo, Brazil (IBSP); Museu de Zoologia, Universidade de São Paulo, São Paulo, Brazil (MZSP); Museu de Entomologia Padre Jesus Santiago Moure, Universidade Federal do Paraná, Curitiba, Brazil (DZUP); Instituto de Biociências, Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil (UFRG); Museu Anchieta, Porto Alegre, Brazil (MGAP). Photographs of the holotypes of *U. brasiliensis*, *U. nitor* and *U. decor* and of the *U. uniseriata* paratype were studied.

Digital photographs were taken using a Nikon AZ100M stereomicroscope with the software NIS-Elements Advanced Research. Vectorized drawings were made from

these images. The terminology used in the descriptions and in the identification key follows Drake & Davis (1960). The geographical coordinates were obtained in Google Earth when not available. Global Gazetteers were used to check and update the localities found in both literature and studied specimens.

Measurements were taken under stereomicroscope with measuring reticule (minimum, maximum and mean are given in millimiters). The following measurements were taken: Scape length (SCL); pedicel length (PDL); bastiflagellomere length (BFL); distiflagellomere length (DFL); head length (HDL); head width (HDW); interocular distance (IOD); discoidal area length (DAL); discoidal area width (DAW); costal area width (CAW); hemelytra width (HMW); body length with hemelytra (BLH); body length without hemelytra (BL); body width (BW). The amount of specimens measured relies on their availability and preservation status. Body width measurements were not provided for *U. brasiliensis* and *U. uniseriata* due to the way specimens were mounted.

Results

Ulotingis Drake & Hambleton, 1935

Ulotingis Drake & Hambleton, 1935: 144; Monte, 1940: 148; Drake & Ruhoff, 1965: 421.

Type species. *Ulotingis brasiliensis* (Drake, 1922).

Description. Head dark brown or black; pronotum darker to light brown; hemelytra light brown with dark spots. Head wider than long, armed with five spines: one occipital pair, one dorsomedial, and one frontal pair, all directed forwardly; these lighter than head. Antennae light brownish; the distal part of distiflagellomere darker. Scape slightly longer than pedicel; basiflagellomere almost three times longer than distioflagellomere. Cephalic spines and antennae with several short white setae. Bucculae closed in front; light brownish, and may be darker in the superior half. Collar lighter than the pronotal disc. Pronotal disc punctate; punctuations enlarging towards the posterior process of pronotum, this lighter than pronotal disc, projected and reaching middle of discoidal area. Most of areolas in the posterior process round-shaped. Pronotum with three carinae: one median and a pair of lateral carinae. Median carina following the entire length of pronotum. Lateral carinae four times shorter than median carina, starting at the

posterior part of the pronotal disc, projected into the posterior process of pronotum; sometimes slightly divergent. Narrow paranota, carinated. Long white hairs may be present in pronotum and paranota, densely distributed on pronotal disc. Rostrum channel with light brownish laminae, this with short white hairs; mesosternal channel wider than the metasternal. Hemelytra light brownish, with embrowned areas, often with long white hairs, these more densely distributed in subcostal and discoidal areas. Costal area areolas larger than the areolas of subcostal and discoidal areas. The areolas of costal area on either side of the body are not symmetrical and may be different in number and shape. Subcostal and discoidal area with rounded areolas subequal in size. Sutural area with areolas subequal in size to the ones in discoidal area. In the widest part, subcostal area with three to five rows of areolas; discoidal area with four to five rows; sutural area with five to six rows of areolas. Legs light brownish with tarsi apex darker; covered with short white hairs. Black abdomen, with short white hairs sparsely distributed; widest region around third segment.

Comments. The characteristics used to distinguish *Ulotingis* from *Acysta* are consistent (Drake & Hambleton, 1935). In *Ulotingis*, the paranota is carinated, while in *Acysta* it can presents areolas. The lateral carinae is longer in *Acysta* and extends throughout the pronotal disc. Also, the specimens of *Acysta* are generally larger. The unique feature pointed out by Drake & Hambleton (1935) as diagnostic character of *Ulotingis* not observed was the thicker nervures on hemelytra.

Distribution. BRAZIL: **Pará**; **Bahia** – Água Preta; **Minas Gerais** – Belo Horizonte, Viçosa; **Rio de Janeiro** – Campo dos Goytacazes; **São Paulo** – Santo Amaro, São Paulo; **Santa Catarina** – Videira; **Rio Grande do Sul** – Passo Fundo, Porto Alegre (Fig.4).

Key to species of Ulotingis

1. Hemelytra with two prominently elevated regions in the hemelytra veins. One in the middle of the radius-media vein and another in the posterior joining of the radius-media with cubitus veins.……2

1’. Hemelytra with no prominent elevations in the veins……...……...…....*U. decor*

2. Costal area mostly irregularly biseriated.……*U. brasiliensis*

2’. Costal area with anterior half uniseriated…….……..……...*U. uniseriata*

Ulotingis brasiliensis (Drake, 1922) (Figs. 1a, 2a, 3a and 3b)
Acysta brasiliensis Drake, 1922a: 42;
Acysta brasiliensis uniseriata Drake, 1922b: 368, plate XXXIX, figure 10;
Ulotingis brasiliensis Drake & Hambleton, 1935: 145; Drake & Hambleton, 1938: 64; Monte, 1939: 84; Monte, 1940: 148; Drake & Ruhoff, 1965: 421; Silva *et al*. 1968: 85.

Holotype. BRAZIL, **Pará**, #f, no locality, no date, Baker col. (NMNH).

Material examined. BRAZIL, #f, no locality, no date, Monte col. (IBSP); #m, no locality, no date, Monte col. (IBSP); 2 #m, no locality, no date, Monte col. (IBSP); #m, no locality, no date, no collector (MZSP); **Bahia**, #m, Água Preta, 23.I.1939, Silva col. (MNRJ); **Minas Gerais**: #m, one undefined sex, no locality, no date, Monte col. (MNRJ); #m, Belo Horizonte, no date, Monte col. (IBSP); 2 #m, Belo Horizonte, no date, Monte col. (MNRJ); **Rio de Janeiro**, 6 #f, 4 #m, Campo dos Goytacazes, no date, Albuquerque col. (UFRG); **São Paulo**: #f, one undefined sex, Brotas, 7.I.1944, Monte col. (MNRJ); one undefined sex, São Paulo, 6.II.1955, Ferraciolli col. (MZSP).

Description. Head usually black (some specimens golden brown or reddish). Basiflagellomere a little more than twice longer than distiflagellomere. Rostrum light brownish, distal part of fourth segment black in some specimens, reaching the posterior margin of mesosternum. Costal area of hemelytra mostly biseriated (Fig. 2a); areolas in the anterior region rounded and smaller than the posterior ones, these subrectangular. Subcostal and discoidal areas with a darker stain in central part; both usually with four rows of areolae in its widest region. Each hemelytra has two prominent elevations in the radius-media vein and the radius-media + cubitus junction (Fig. 3a,b). These raised regions are darker, and in dorsal view seems like four dots (Fig. 1a, 2a).

Measurements. Males (up to 13 specimens measured). SCL, 0.093 (0.080 – 0.100); PDL, 0.084 (0.080 – 0.108); BFL, 0.634 (0.600 – 0.700); DFL, 0.299 (0.270 – 0.310);

HDL, 0.186 (0.140 – 0.210); HDW, 0.378 (0.360 – 0.420); IOD, 0.214 (0.200 – 0.240); DAL, 0.845 (0.780 – 0.900); DAW, 0.215 (0.200 – 0.260); CAW, 0.158 (0.140 – 0.190); HMW, 0.561 (0.520 – 0.600); BLH, 2.21 (2.06 – 2.32); BL, 1.803 (1.660 – 1.990). **Females** (up to eight specimens measured). SCL, 0.091 (0.080 – 0.100); PDL, 0.081 (0.080 – 0.090); BFL, 0.650 (0.620 – 0.670); DFL, 0.292 (0.260 – 0.320); HDL, 0.207 (0.200 – 0.240); HDW, 0.386 (0.360 – 0.420); IOD, 0.235 (0.200 – 0.270); DAL, 0.873 (0.820 – 0.980); DAW, 0.240 (0.200 – 0.290); CAW, 0.180 (0.160 – 0.240); HMW, 0.600 (0.580 – 0.660); BLH, 2.290 (2.160 – 2.480); BL, 1.754 (1.700 – 1.860).

Distribution. BRAZIL: **Pará**; **Bahia** – Água Preta; **Minas Gerais** – Belo Horizonte; **Rio de Janeiro** – Campos dos Goytacazes; **São Paulo** – São Paulo (Fig.4). There is a repport of the species in Venezuela (Chirinos & Geraud-Pouey, 2011). However, there are no photographs available, and we were not able to contact the authors in order to get access to their material. Therefore, we do not consider this as an official distribution record at this time.

Host plants. *Psidium guayava* (Myrtaceae)

Comments. *Ulotingis brasiliensis* differs from *Ulotingis uniseriara* by the costal area almost completely biseriated and from *Ulotingis decor* by the presence of four distinguishable raised areas on hemelytra veins. Some morphological variability was observed in the rostrum reach (one specimen with a rostrum surpassing the posterior margin of mesosternum), number of areolas of the costal and discoidal areas of hemelytra (three in one transversal line and five in the widest part, respectively).

Ulotingis decor Drake & Hambleton, 1935 (Figs. 1c, 2c, 3e and 3f)
Ulotingis decor Drake & Hambleton, 1935: 145; Monte, 1940: 148; Drake & Ruhoff, 1965: 422; Silva *et al*. 1968: 86.
Ulotingis nitoris Drake & Hambleton, 1935: 145; Monte, 1940: 149.
Ulotingis nitor Drake & Ruhoff, 1965 (emendation); Silva *et al*. 1968: 86; Hickel & Ducroquet, 1992: 103; **new synonym**.

Holotype of *U.decor*. BRAZIL, **São Paulo**: #m, Santo Amaro, 3.XI. 1934, Hambleton col. (NMNH).

Material examined. Type specimens: BRAZIL, **São Paulo**: #f, Santo Amaro, 5.XI.1934, Hambleton col. (MNRJ) [Paratype]; #m, São Paulo, 26.VIII.1934, Hambleton col. (NMNH) [type specimen *U. nitor*]; 2 #m, no locality, 26.VIII.1934, Hambleton col. (MNRJ) **[**Paratype *U. nitor*]; #f, no locality, 5.XI.1934, Hambleton col. (IBSP) **[**Paratype *U. nitor*]; #f, São Paulo (Parque do Estado), 5.XI.1934, Hambleton col. (IBSP) **[**Paratype *U. nitor*]; #m, no locality, no date, no collector (MNRJ) **[**Paratype *U. nitor*]. #f, São Paulo, 6.II.1940, Monte col. (MNRJ) [determined previously as *U. nitor*]; #f, São Paulo, 2.II.1940, Monte col. (MNRJ) [determined previously as *U. nitor*]; #m, São Paulo, 6.II.1940, Monte col. (IBSP) [determined previously as *U. nitor*]; #f, São Paulo, 6.II.1940, Monte col. (MNRJ) [determined previously as *U. nitor*]; **Santa Catarina**: 1 #f, 3 #m, Videira (Estação Experimental Agronômica), 5.I.1990, Hickel col. (EEV); 2 #f, 1 #m, Videira (Estação Experimental Agronômica), 10.VI.1991, Hickel col. (EEV); **Rio Grande do Sul**, 61 #f, 58 #m, Passo Fundo, [-28.228.167, -52.403.611], 2015, (Breeding Specimens) (UFRG); 1 #f, 3 #m, Passo Fundo, [-28.227.778, -52.403.861], 2.VII.2012, Marsaro Jr. col. (UFRG); 2 #m, Passo Fundo, [-28.228.167, -52.403.611], 2.VII.2012, Marsaro Jr. col. (UFRG); #f, Passo Fundo, [-28.227.778, -52.403.861], 25.XI.2012, Marsaro Jr. col. (UFRG); 3 #f, 4 #m, Passo Fundo, [-28.227.778, -52.403.861], 16.VII.2013, Marsaro Jr. col. (UFRG); 2 #f, 5 #m, Passo Fundo, [-28.228.167, -52.403.611], 01.XI.2012, Marsaro Jr. col. (UFRG); 10 #f, 10 #m, Porto Alegre, [-30.041.683, -51.171.767], 2015, Paesi col. (UFRG); #f, 2 #m, Porto Alegre, 4.VIII.1948, no collector, (MGAP).

Description. Antennae light brownish, almost the entire distiflagellomere black (but there are specimens less dark). Basiflagellomere more than two times longer than distiflagellomere. Rostrum light brownish, distal part of fourth segment black; reaching the posterior margin of mesosternum. Costal area of hemelytra mostly biseriated (Fig. 2c), very often with three rows of areolae in the widest part; areolas in the anterior region rounded and smaller than the posterior ones, these, slightly rectangular. Subcostal and discoidal areas with a darker stain in central part, sometimes, both areas are entirely darker; the former presents three to five and the later four rows of areolae in the widest part. Each hemelytra can present two unconspicous elevations in the radius-media vein and in the radius-media + cubitus junction (Fig. 3e,f). These regions are

darker, and in dorsal view seem like four dots, even in specimens without any elevations.

Measurements. Males (up to 52 specimens measured). SCL, 0.010 (0.080 – 0.110); PDL, 0.089 (0.080 – 0.100); BFL, 0.660 (0.580 – 0.760); DFL, 0.234 (0.200 – 0.290); HDL, 0.192 (0.140 – 1.220); HDW, 0.364 (0.340 – 0.430); IOD, 0.195 (0.180 – 0.230); DAL, 0.759 (0.670 – 0.890); DAW, 0.191 (0.180 – 0.220); CAW, 0.191 (0.160 – 0.240); HMW, 0.574 (0.500 – 0.680); BLH, 2.170 (2.000 – 2.500); BL, 1.772 (2.620 – 2.000); BW, 0.618 (0.520 – 0.820). **Females** (up to 48 specimens measured). SCL, 0.100 (0.090 – 0.110); PDL, 0.086 (0.080 – 0.100); BFL, 0.645 (0.580 – 0.760); DFL, 0.225 (0.200 – 0.290); HDL, 0.196 (0.140 – 0.240); HDW, 0.364 (0.340 – 0.440); IOD, 0.200 (0.190 – 0.240); DAL, 0.793 (0.720 – 0.940); DAW, 0.212 (0.180 – 0.270); CAW, 0.013 (0.160 – 0.220); HMW, 0.608 (0.530 – 0.680); BLH, 2.201 (1.960 – 2.520); BL, 1.740 (1.600 – 1.980). BW, 0.673 (0.600 – 0.900).

Distribution. BRAZIL: **São Paulo –** Santo Amaro, São Paulo; **Santa Catarina –** Videira; **Rio Grande do Sul –** Passo Fundo, Porto Alegre (Fig.4).

Host plants. *Acca sellowiana* (Myrtaceae); *Myrcia bombycina* (Myrtaceae).

Comments. *Ulotingis decor* can be easily differentiated from *U. brasiliensis* and *U. uniseriata* by the absence of the two prominently elevated regions in the hemelytra. Drake & Hambleton (1935) described *U. nitor* without any elevation in the hemelytra veins, and *U. decor* with a slightly elevation, conspicuously different than the ones presented by *U. brasiliensis* and *U. uniseriata*. However, after careful examination of the available material, *Ulotingis nitor* is here considered a junior synonym of *U.decor* because these diagnostic characters were found extremely variable and therefore not reliable for species delimitation.

Ulotingis uniseriata (Drake & Bondar, 1932) (Figs. 1b, 2b, 3c and 3d)
Acysta brasiliensis Drake, 1922a: 42;
Acysta brasiliensis uniseriata Drake, 1922b: 368, plate XXXIX, figure 10;
Acysta uniseriata Drake & Bondar, 1932: 91; Monte, 1937: 35;

Ulotingis uniseriata Drake & Hambleton, 1935: 145; Drake & Hambleton, 1938: 65; Monte, 1939: 84; Monte, 1940: 149; Drake & Ruhoff, 1965: 422; Silva *et al*. 1968: 86.

Holotype. BRAZIL, Chapada, #f, no date, Mr and Mrs. H.H. Smith col. (CMNH).

Material examined. BRAZIL, #m, two undefined sex, no locality, 30.VII.1945, no collector (DZUP); 2 #m, one undefined sex, no locality, no date, Mote col. (IBSP); **Minas Gerais**: #f, #m, Belo Horizonte, no date, Monte col. (MNRJ); #m, Belo Horizonte, no date, Monte col. (IBSP); #f, #m, Belo Horizonte, no date, Monte col. (IBSP); #f, one undefined sex, Belo Horizonte, no date, Monte col (MNRJ); #f, #m, Belo Horizonte, no date, Monte col. (MNRJ) [labeled previously as *U.similis*, probably by Oscar Monte]; #f, #m, Belo Horizonte, no date, Monte col. (MNRJ) [labeled previously as *U.similis*, probably by Oscar Monte]; #m, Viçosa, 29.IV.1934, Hambleton col. (MZSP).

Description. Antennae light brownish; almost the entire distiflagellomere black. Basiflagellomere more than two times longer than distiflagellomere. Rostrum light brownish, distal part of fourth segment black; usualy reaching beyond the posterior margin of metasternum. Costal area of hemelytra uniseriated in the first half (Fig. 2b); these areolas with rectangular shape. Most of the second half of the costal area with two rows of areolae. Subcostal and discoidal areas with a darker stain in central part; the former with three to four and the later with four rows of areolae in the widest part. Each hemelytra has two prominent elevations in the radius-media vein and the radius-media + cubitus junction (Fig. 2c,d). These raised regions are darker, and in dorsal view seems like four dots (Figs.1b, 2b).

Measurements. Males (up to nine specimens measured). SCL, 0.098 (0.080 – 0.110); PDL, 0.080 (0.070 – 0.090); BFL, 0.760 (0.660 – 0.800); DFL, 0.283 (0.260 – 0.330); HDL, 0.192 (0.140 – 0.240); HDW, 0.371 (0.340 – 0.420); IOD, 0.203 (0.190 – 0.240); DAL, 0.807 (0.680 – 0.940); DAW, 0.200 (0.170 – 0.240); CAW, 0.175 (0.150 – 0.210); HMW, 0.608 (0.540 – 0.760); BLH, 2.340 (2.260 – 2.480); BL, 1.938 (1.840 – 2.020). **Females** (up to five specimens measured). SCL, 0.102 (0.090 – 0.110); PDL, 0.085 (0.080 – 0.090); BFL, 0.720 (0.560 – 0.840); DFL, 0.313 (0.280 – 0.360); HDL, 0.174 (0.150 – 0.200); HDW, 0.402 (0.390 – 0.420); IOD, 0.202 (0.190 – 0.210); DAL

0.840 (0.800 – 0.900); DAW, 0.236 (0.190 – 0.280); CAW, 0.184 (0.170 – 0.200); HMW 0.644 (0.560 – 0.720); BLH, 2.384 (2.200 – 2.520); BL, 1.936 (1.840 – 2.060).

Distribution. BRAZIL: **Bahia**; **Mato Grosso**; **Minas Gerais** – Belo Horizonte, Viçosa (Fig.4). The type-locality in the holotype labels is "Chapada", which is not enough to correctly identify this geographical location. Drake & Bondar (1932) reported as the only distributional data available for this species the city "Chapada Diamantina", in the Bahia state. However, Monte (1940) listed Chapada, Mato Grosso, in the distribution of this species. Therefore, the type-locality remains unclear.

Host plants. *Byrsonima verbascifolia* (Malpiguiaceae); *B. sericea.*

Comments. Both *U. uniseriata* e *U. brasilensis* have the two prominently elevated regions in the hemelytra. However, they can be easily distinguished by the anterior region of costal area: uniseriated in *U. uniseriata* and biseriated in *U. brasiliensis*. The number of areolae rows in the costal area were preserved in between the analysed specimens: only one presented three rows in the widest part, and just in one side. Four specimens (two females and two males) of MNRJ are labeled as *U. similis* (Oscar Monte's official collection label), however, this is not a valid name due the lack of published official description. Moreover, these specimens have the same characters of *U. uniseriata*, and, therefore, were treated as such in this contribution.

Discussion

Differences in the number and organization of the costal area areolas, and the height of the elevations on the hemelytra veins (radius-media and cubitus) allow the unambiguous identification of *U. brasiliensis*, *U.uniseriata* and *U. decor*. Besides the fact that only a few genera were revised in Tingidae taxonomy, species that were delimited by differences in the organization of areolas in costal area usually have been proposed as synonyms (e.g., Froeschner, 1996). This might be due the fact that most of Tingidae species were described based only in a few individuals, and when a higher number of specimens are available, a great variability in these characters are also observed. In this

study it was found that most of the features applied to delimit species of *Ulotingis* remain useful.

Lack of bilateral symmetry between the right and left hemelytra regarding the organization and format of the areolas have been observed in other genera (Guidoti, personal communication) and here it was more often noticed in *U. brasiliensis and U. decor*. In addition, a high level of variation was observed in the elevations on the hemelytral veins in the *U. decor* and *U. nitor* material, including type specimens. Considering that this was the only character distinguishing this two species, here we proposed the later as a junior synonym of the former.

In addition, there are no other studies regarding natural history aspects, biological parameters or even immatures on this genus. Therefore, more is needed, and we believe this taxonomic review will allow the correct identification of the species for these further studies.

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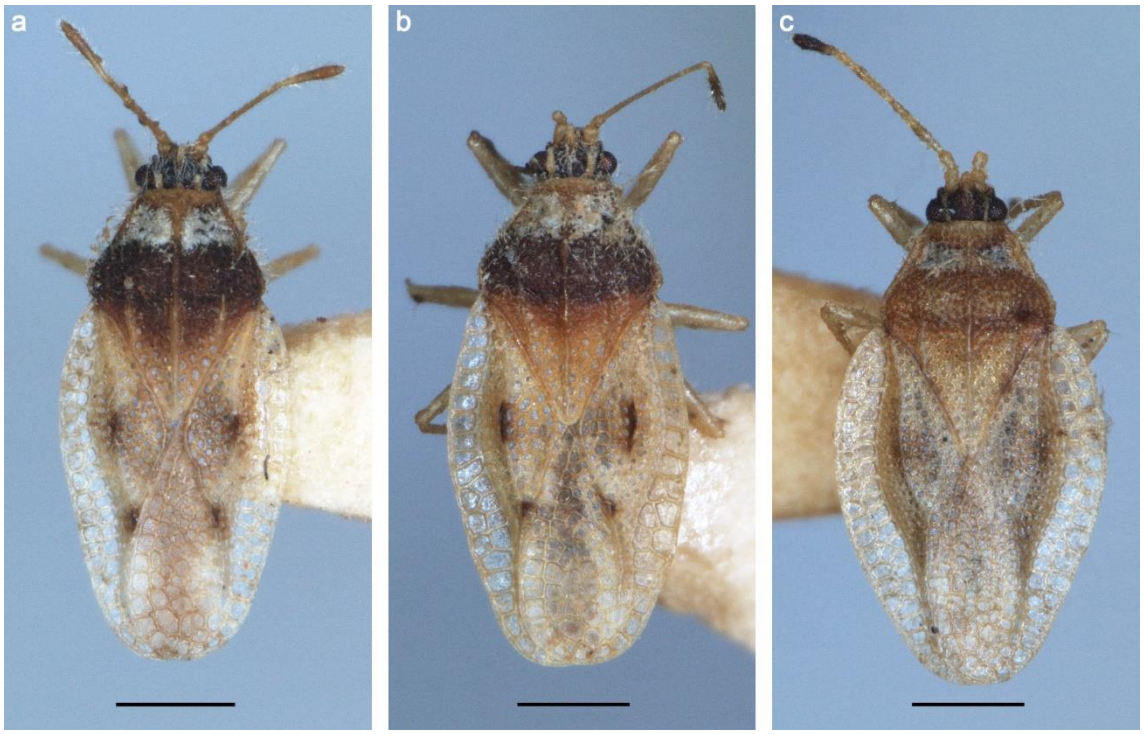

FIGURE 1: Dorsal habitus of *Ulotingis* species: a, *U. brasiliensis*; b, *U. uniseriata*; c, *U. decor*. Scale bars: 0.5 mm.

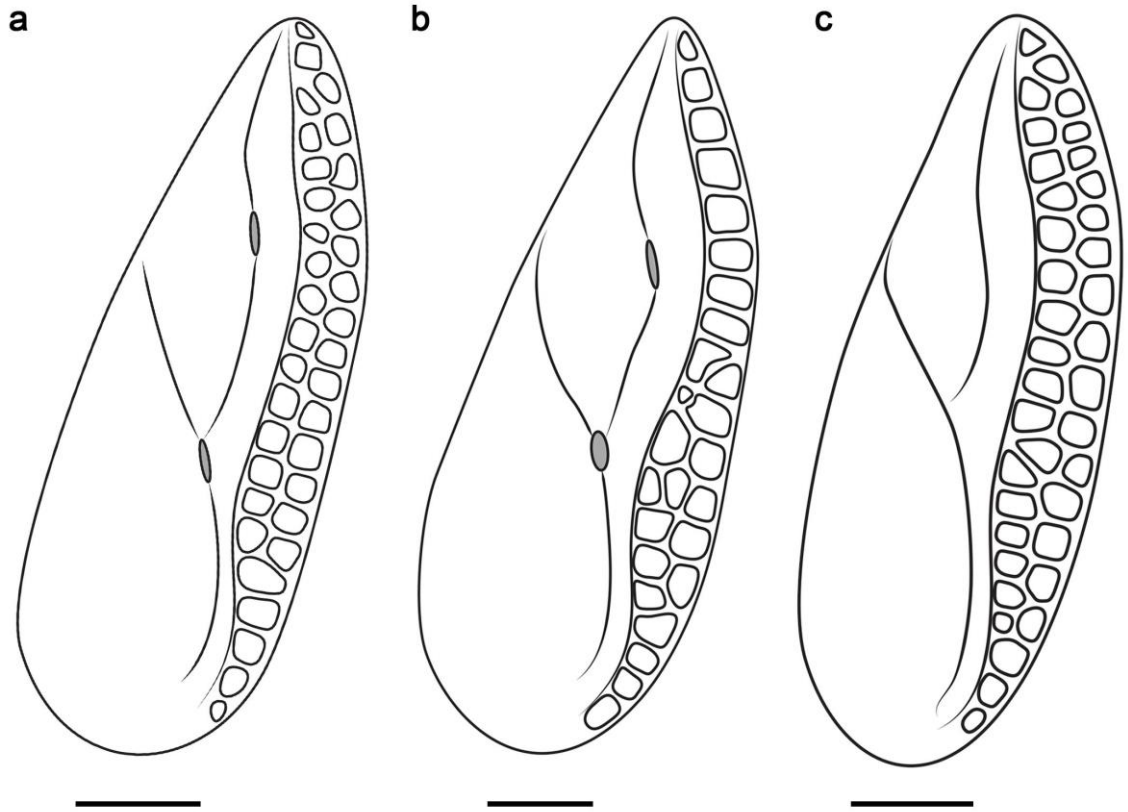

FIGURE 2: Dorsal view of costal area in *Ulotingis* species: a, *U. brasiliensis*; b, *U. uniseriata*; c, *U. decor*. Colored gray areas show the position of the prominently elevations on the hemelytra veins radius-media and radius-media + cubitus junction. Scale bars: 0.25mm.

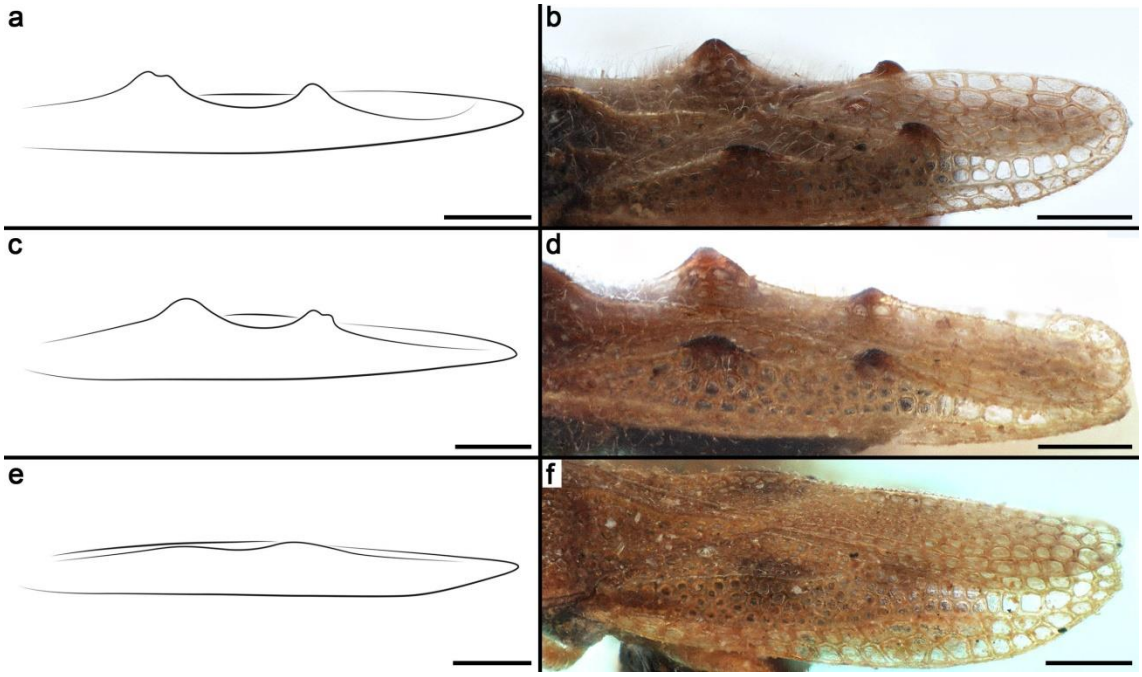

FIGURE 3: Lateral and dorso-lateral view of the hemelytra of *Ulotingis* species: a, b, *U. brasiliensis*; c, d, *U.uniseriata*; e,f, *U.decor*. Scale bars: 0,25mm.

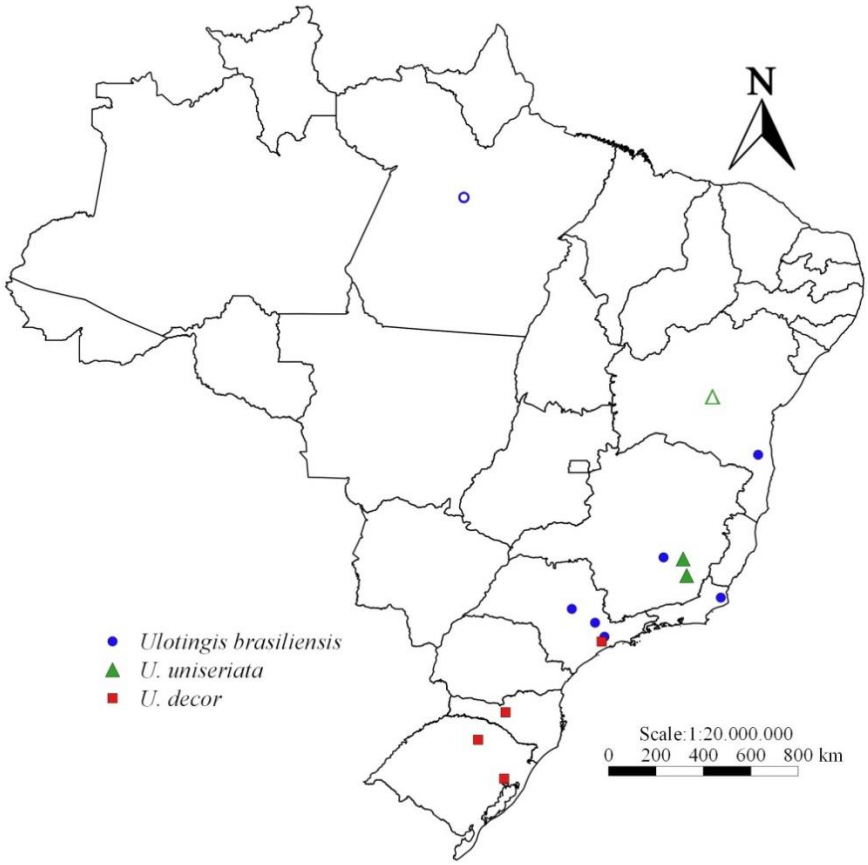

FIGURE 4: Distributional map for the species of *Ulotingis*. White symbols represent records that only inform the State.

Considerações Finais

Este trabalho contribui com a descrição de ovos e imaturos de uma das espécies do gênero *Ulotingis* sobre os quais até o momento não existiam informações. Pensando na própria família a descrição de imaturos do gênero também é importante, uma vez que imaturos de espécies neotropicais de Tingidae são poucos conhecidos. A morfologia descrita para ovos e imaturos pode servir como importante material em futuros trabalhos sistemáticos e taxonômicos. Também apresentamos dados novos sobre a biologia de *U.decor*, como o período de incubação dos ovos, tempo de duração dos ínstares e longevidade dos adultos.

A revisão taxonômica apresentada nesse trabalho altera a atual composição do gênero, uma vez que propomos *U.nitor* como sinônimo júnior de *U.decor*. Apesar das diferenças apontadas para diagnosticar essas duas espécies não terem sido observadas, outras características utilizadas para a delimitação das espécies do gênero se mostraram estáveis, como a organização das aréolas da área costal e as elevações presentes nas nervuras dos hemiélitros. Também informamos novos dados e mais específicos sobre as plantas hospedeiras das espécies do gênero e trazemos novos dados de distribuição com a inclusão de um mapa de distribuição atualizado para o gênero.

Esforços adicionais são necessários para uma compreensão mais ampla de diversos aspectos tratados na presente pesquisa, mas acreditamos que o presente estudo contribui para o conhecimento sistemático dos tingídeos neotropicais, com enfoque no gênero *Ulotingis*.

Anexo I

Normas aos autores:

Zootaxa

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Rider, David (david.rider@ndsu.edu) **Hemiptera: Heteroptera**
Department of Entomology, 1300 Albrecht Blvd., 202 Hultz Hall, Fargo, ND 58102, USA

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