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ORIGINAL ARTICLE

Description of the immature stages of *Saccharosydne subandina* Remes Lenicov & Rossi Batiz (Hemiptera: Delphacidae)

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The genus *Saccharosydne* Kirkaldy 1907 includes eight species, two of which are pests of sugarcane in tropical America and rice in Asia. *Saccharosydne subandina* Remes Lenicov & Rossi Batiz described from Argentina feeds on pampas grass, garlic and rye in agricultural subandean areas of different provinces. This study provides information on the immature stages of *S. subandina*, including a key for their separation, based on laboratory reared specimens and field observations.

El género *Saccharosydne* Kirkaldy 1907 incluye 8 especies, dos de ellas conocidas como pestes de la caña de azúcar en América tropical y del arroz en Asia. *Saccharosydne subandina* Remes Lenicov & Rossi Batiz fue la primer especie descripta para Argentina como la más frecuente sobre cortadera, ajo y centeno en áreas agrícolas subandinas de diferentes provincias. Este estudio aporta información sobre del desarrollo postembrionario de *S. subandina*, incluyendo una clave para la separación de los estadíos ninfales, sobre la base de especímenes criados en laboratorio y observaciones en el campo.

Keywords: *Saccharosydne subandina*; Argentina; crop pest; nymphal development

Introduction

The genus *Saccharosydne* Kirkaldy 1907 includes eight species, seven of which are found in America and two in Asia (Metcalf 1943; Asche 1985; Rossi Batiz & Remes Lenicov 2009). The very scant biological knowledge of this genus includes information on host plant associations (Westwood 1833; Muir 1926; Osborn 1926; Matsumura 1931; Rossi Batiz & Remes Lenicov 2009), and biological studies of life cycles, plant damage, particularly of graminaceous plants, natural enemies and control of *S. saccharivora* (Westwood), a pest of sugarcane in tropical America (Guagliumi 1953; Metcalfe 1969; Arocha et al. 2005), and *S. procerus* (Matsumura) on rice (*Oryza sativa* L.) and water bamboo (*Zizania caduciflora* L.) in China (Yu et al. 1999).

This genus was first mentioned in Argentina by Rossi Batiz & Remes Lenicov (2009) who provided data on distribution and host plants of a new species, *S. subandina* Remes Lenicov & Rossi Batiz. It was the commonest species living on pampas grass (*Cortaderia* spp.), garlic (*Allium sativum* L.) and rye (*Secale cereale* L.) in agricultural subandean areas of different provinces. *Saccharosydne subandina* shares the general morphological characteristics of the genus, such as the slender elongated form but with a particular coloration pattern: uniformly light green-yellowish with reddish eyes, a distinctive rounded black macula on both genae and ocelli, a longitudinal black stripe on antennal segments I and II, and dark brown tips of legs spinulation, spur teeth, claws, parameres and anal stylus. Field observations showed higher population densities on these graminaceous plants during spring (Rossi Batiz et al. 2007). In this paper we describe the immature stages of *S. subandina* (based on laboratory reared specimens and field observations), and include a key for their separation. Some biological information is also included.

Materials and methods

Laboratory rearing

In an 8-year period (2002–2010), adults and nymphs of *S. subandina* were collected in different sites in Argentina. Specimens collected in 2008 from Córdoba were used to establish a laboratory colony in order to describe each stage of development. Pampas grass was used as host plant because it is the ordinary host in natural conditions (Rossi Batiz, personal observations).

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Morphological studies

The description of each stage was based on 24-h hatched nymphs from the laboratory colony. Specimens were anesthetized by freezing to register coloration, cleared in 10% KOH solution, and fixed in glycerine for microscopic examination and illustration.

The first and fifth instars are described in detail; only major changes are highlighted in the other instars. The nomenclature for carination and arrangement of pits follows Yang and Yeh (1994). Drawings were made with stereoscopic microscope with a camera lucida.

The measurements derive from 10 anesthetized specimens of each stage and are given in millimeters. Measurements are expressed as mean ± standard error (SE) (Table 1). Abbreviations are as follows: L: body length from the tip of the vertex to the distal apex of the abdomen; W: body width measured across the widest part of the thorax; VL: vertex length; VW: vertex width; FL: frons length; FW: frons width; other measurements are relative.

Results

A distinctive feature of the nymphs is the white layer of wax that covers the whole body. Numerous fine filaments extend laterally from the abdomen, grouped in long bundles tails, some as long as the whole body.

Eggs. L: 0.55 mm; W: 0.05 mm. (Figure 1)

Eggs cylindrical, with cephalic apex and opposite end rounded; ventral surface slightly concave, dorsal convex. Chorion transparent and smooth, embryo yellowish white.

First instar. L: 0.65 mm; W: 0.16 mm. (Figure 2a, b)

Light yellowish color, abdomen orange; apex of rostrum, leg spination and region around the pits brown; eyes reddish. Body elongated, abdomen subcylindrical. Vertex longer than wide (1.23:1); projecting beyond eyes about 2/3 of its length; posterior margin straight with submedian carinae extending on to frons. Frons almost as long as wide (1.1:1), broadest just beneath eyes, with two submedian carinae reaching apical margin; interfrons much narrower than laterofrons. Clypeus longer than its width, narrowing distally. Rostrum three-segmented, extending beyond mesocoxae; segment I partially hidden by clypeus, II and III subequal. Antennae three-segmented; segment I wider than long (2.5:1); segment II subcylindrical, as long as wide; segment III bulbous, ending in a long bristle-like extension reaching anterior margin of prothorax. Thoracic nota divided into three pairs of plates by longitudinal mid-dorsal line. Pronotal plates subtrapezoidal, meso and metanotal plates subrectangular, posterior margin convex. Legs subcylindrical; metafemur and metatibiae subequal in length; metatibiae unarmed laterally, bearing apical row of four short black-tipped spines, the longest external one will become the spur of later instars. Metatarsi two-segmented; tarsomeres subequal in length, tarsomere I bearing apical row of four short black-tipped spines; tarsomere II with pair of apical claws. Abdomen 11-segmented, subcylindrical. The first three tergites rather small and appearing as short trapezoidal sclerites in dorsal view. Hind tergites trapezoidal the last abdominal segment bilobated in dorsal view.

Arrangement of pits (on each side). Head: two pits before eyes, between lateral carina and submedian carinae of vertex; six on frons, upper and lower pairs nearer median carinae and median pair nearer lateral carinae. Thorax: six pits on pronotum: two, between midline and lateral carinae, four on posterior margin outside lateral carinae; three on mesonotum, one near posterior margin on each side of lateral carinae and one on posterolateral angles; one on metanotum: near posterior margin. Abdomen: three on tergum of segments V–VII; one on segments IV, VIII–X.

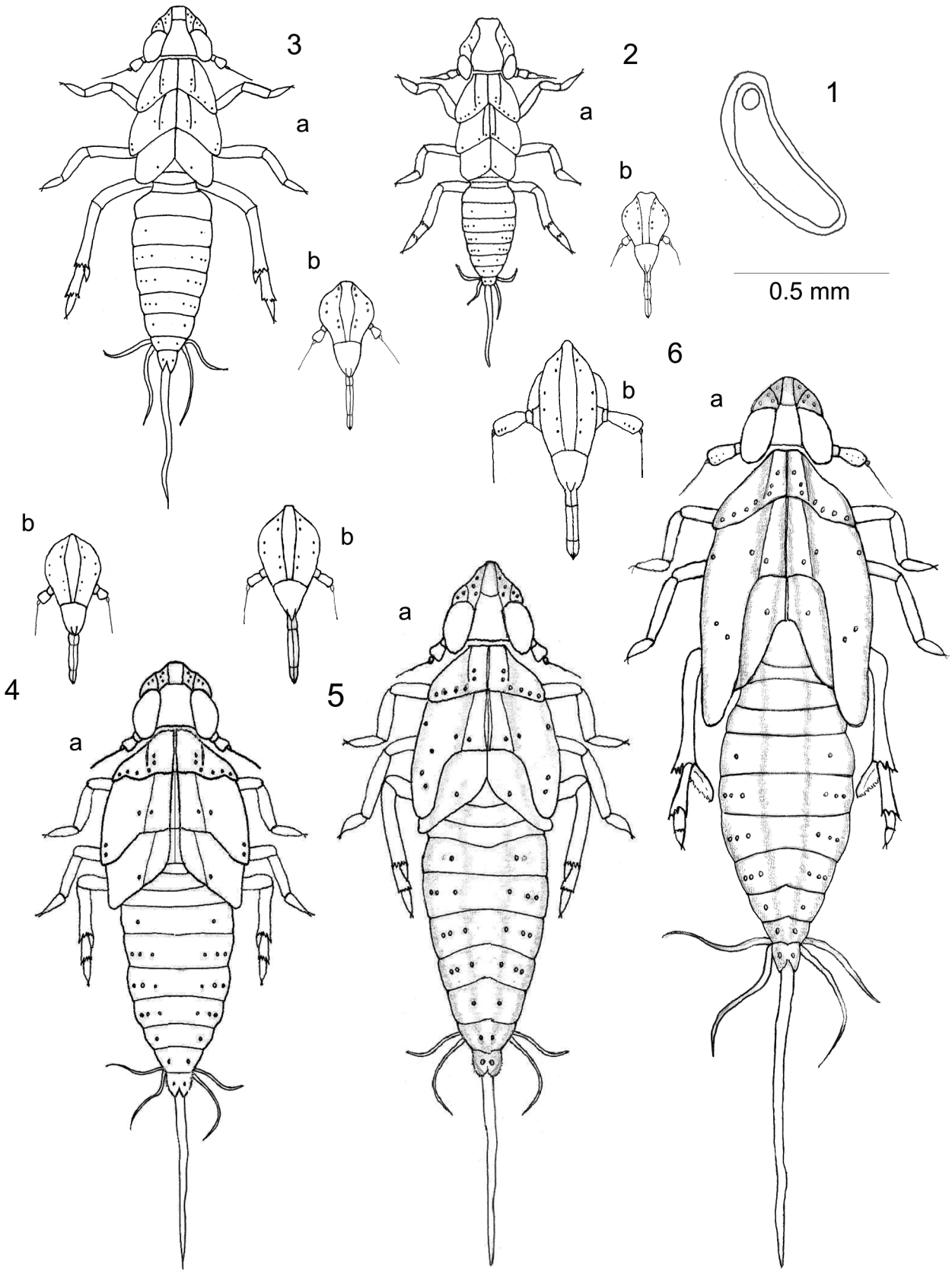
Second instar. L: 1.35 mm. W: 0.25 mm. (Figure 3a, b)

Same coloration as first instar, with two lateral inner and two outer light orange stripes along dorsal surface of body.

Frons almost as long as wide; interfrons wider at level of eyes. Rostrum segment II three times longer than segment III. Antennal segment I almost as long as wide; segment II slightly longer than wide (1.33:1)

Table 1. Measurements (mean ± SE, mm) of the immature stages of *Saccharosydne subandina*.

Stage	Body length	Body width	Vertex length	Vertex width	Frons length	Frons width
Egg	0.55 ± 0.050	0.05 ± 0.0001				
Nymph I	0.65 ± 0.166	0.16 ± 0.006	0.11 ± 0.0002	0.08 ± 0.011	0.15 ± 0.011	0.16 ± 0.022
Nymph II	1.35 ± 0.120	0.25 ± 0.055	0.15 ± 0.002	0.12 ± 0.005	0.20 ± 0.011	0.18 ± 0.011
Nymph III	1.60 ± 0.112	0.55 ± 0.059	0.23 ± 0.001	0.15 ± 0.002	0.30 ± 0.011	0.24 ± 0.011
Nymph IV	2.10 ± 0.111	0.56 ± 0.046	0.27 ± 0.001	0.17 ± 0.001	0.34 ± 0.015	0.24 ± 0.015
Nymph V	2.70 ± 0.111	0.89 ± 0.093	0.29 ± 0.021	0.20 ± 0.015	0.41 ± 0.033	0.26 ± 0.008



Figures 1–6. Immature stages of *Saccharosydne subandina*: (1) egg; (2) first instar (a) nymph and (b) frons; (3) second instar (a) nymph and (b) frons; (4) third instar (a) nymph and (b) frons; (5) fourth instar (a) nymph and (b) frons; (6) fifth instar (a) nymph and (b) frons.

and almost twice the length of I; segment III reaching mesothorax laterally. Mesonotal lateral margins slightly posteriorly projected. Metatibiae bearing apical row of five longer black-tipped spines, spur twice the length of longest spine, bearing one apical tooth. Metatarsomere I bearing apical row of five longer black-tipped spines, slightly longer than II.

Arrangement of pits: as the first instar nymph plus two pits between anterior margin of eye and lateral carina of frons + vertex, three pits between submedian and lateral carinae of vertex and one pit on each posterolateral angle of mesonotum.

Third instar. L: 1.60 mm; W: 0.55 mm. (Figure 4a, b)

Color patterns similar to former instar; becoming brown around pits. Frons oval, longer than wide (1.2:1); submedian carinae subparallel, interfrons uniformly wide. Antennal segment II twice longer than wide. Mesonotal wingpads covering basal half of metanotal wingpads laterally. Metanotal wingpads extending laterally, reaching third abdominal segment. Metatibiae bearing apical row of six black-tipped spines; spur slightly flattened, as long as half of metatarsomere I, bearing one apical and one or two acute marginal teeth.

Arrangement of pits: pattern similar to former instars.

Fourth instar. L: 2.10 mm. W: 0.56 mm. (Fig. 5a, b)

Coloration similar to former instar, but brown stripes (two inner and two outer) along dorsal surface and wing pads, and brownish on 1/3 basal and lateral areas of frons before anterior margin of eyes. Abdomen becoming flattened. Frons slightly longer than wide. Antennal segment II slightly longer than wide (1.33:1). Mesonotal wingpads covering more than 2/3 of metanotal ones; metanotal wingpads almost reaching fourth abdominal segment. Metatibiae bearing two small lateral spines, one near base, the other beyond mid-length, bearing apical row of seven black-tipped spines; spur as long as 2/3 of metatarsomere I, with four to seven more developed teeth; metatarsomere I bearing apical row of seven black-tipped spines; metatarsomere II with two weakly developed spines near middle of partially subdivided tarsomere.

Arrangement of pits: pattern similar to former instars adding four or five pits on antennal segment II; one pit at anterolateral angle of mesonotal wingpad.

Fifth instar. L: 2.70 mm; W: 0.89 mm. (Figure 6a, b)

Coloration similar to former instars but darker. Head slightly longer than wide at vertex base, protruding beyond level of eyes almost ½ of vertex length. Lateral carinae of vertex continuing on frons as lateral carinae; submedian carinae attaining laterally the basal margin of vertex; basal compartments more than half as long as vertex, area shallowly concave, median carina between them weak. Eyes 2.4 times longer than wide at widest part in dorsal view. Frons twice as long as wide at widest part, lateral carinae and submedian carinae subparallel (slightly arcuate); interfrons at its widest portion slightly narrower than laterofrons at its widest portion. Antennae: segment I as wide as long; segment II about 3 times longer than I. Rostral segment II longer than III (1.5:1). Wingpads lobate, mesonotal wingpads overlapping metanotal plates and basal half of fourth abdominal segment; metanotal wingpads extending to third abdominal segment. Spinal formula of hind leg 7 (5 + 2) − 8 (6 + 2) − 4. Metatibia slightly longer than metafemur, with two spines on its outer side. Metatarsi I + II + III almost as long as metatibia. Spur foliaceous, almost as long as metatarsi II, three times longer than broad, with 14–18 + apical teeth. Metatarsi three-segmented, tarsomere I bearing apical row of seven spines and II bearing four spines, tarsomere III similar to earlier instar.

Arrangement of pits: pattern similar to former instars plus two pits on vertex and one pit between anterior margin of eyes and lateral carinae of vertex, four to six pits on antennal segment II; one pit between midline and carinae of prothorax.

Key to the nymphal instars of *S. subandina*

1. Metatarsi three-segmented; if two-segmented, then with two spines in the middle of tarsomere II; metatibiae with two lateral spines **2**
1′. Metatarsi two-segmented; metatibiae with two lateral spines or without any spines; tarsomere II without spines **3**
2. Metatibial spur with 14–19 submarginal teeth; metatarsi I with seven apical spines; metatarsi II with four apical spines; mesonotal wingpads laterally overlapping the metanotal wingpads and attaining fourth abdominal segment (Figure 6) . . . . . **Fifth instar nymph**
2′. Metatibial spur with four to seven submarginal teeth plus apical tooth; metatarsi I with apical row of seven spines; metatarsi II with two spines; mesonotal wingpads beyond half length of metanotal wingpads, both attaining third abdominal segment (Figure 5) . . . . . **Fourth instar nymph**
3. Metatibiae with two lateral spines on shaft and six apical spines; metatibial spur without marginal teeth; metatarsomere I with apical row of six spines; metatarsomere II + III with one or two

spines at level of subdivision; mesonotal wingpads extending to half the length of metanotal wingpads, these attaining third abdominal segment (Figure 4) . . . . . **Third instar nymph**

3′. Metatibiae without lateral spines and three or four apical spines; metatibial spur marginal without teeth **4**

4. Metatibiae with four apical spines plus movable spur with apical tooth; metatarsomere I with apical row of five spines; notal plates of meso and metathorax slightly larger than prothorax (Figure 3) . . . . . **Second instar nymph**

4′. Metatibiae with three apical spines plus spur – differentiated from the other spines only by the size; metatarsomere I with apical row of four spines; notal plates of thorax similar in size (Figure 2) . . . . . **First instar nymph**

Other specimens examined

Argentina: 1 nymph V, San Martín de Los Andes, Neuquén, hand-captured on pampas grass, 26/II/07. Logarzo, leg.; 1 nymph IV, El Nihuil, Mendoza, hand-captured on pampas grass, 11/II/08. Virla leg.; 2 nymphs V, Huerta Grande, Córdoba, hand-captured on pampas grass, 29/VI/08. Virla leg.; 10 nymphs I, 10 nymphs II, 10 nymphs III and 10 nymphs IV, Huerta Grande, Córdoba, hand-captured on pampas grass, 23/X/08. Rossi Batiz leg.; 8 nymphs V, Santa Isabel, La Pampa, hand-captured on pampas grass, 10/II/08. Virla leg.; 1 nymph V, Zapala, Neuquén, hand-captured on pampas grass, 10/II/08. Virla leg.; 3 nymphs IV and 14 nymphs V, R. Villegas, Río Negro, hand-captured on pampas grass, 04/II/08. Virla leg.; 5 nymphs V, Río Manso, Río Negro, hand-captured on pampas grass, 07/II/08. Virla leg.

Biological aspects

Eggs are laid inside the host plant tissue and covered with white wax. It is common to find individuals grouped around the masses of eggs in any sector of the plant regardless of the eggs stage of development. The observed damages caused to the host plant by *S. subandina* includes injuries to tissues when feeding and ovipositing and infection by a black fungus growing on the wax excreted by the nymphs and females, which may prevent normal photosynthesis. Although *S. subandina* is associated with garlic crops, showing typical symptoms of diseases caused by phytoplasmas (Rossi Batiz et al. 2007), it has not been implicated as the vector. As a natural enemy of *S. subandina*, an unidentified species of Strepsiptera (Elenchidae) has been found parasitizing adults (Remes Lenicov & Rossi Batiz 2010).

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