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Revena plaumanni Bondar (Coleoptera: Curculionidae)

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Abstract. Redescription of adult and observations of the weevil *Revena plaumanni* Bondar (Coleoptera: Curculionidae), preying on seeds of the palm tree *Butia eriospatha* (Mart. ex Drude) Becc. (Arecaceae), as well as oviposition and larval behavior, pupation site, and adult emergence are reported for the first time in Brazil. Photos of host plant, immature forms (egg, larva and pupa) and adult are given. Illustrations of male and female genitalia are also provided.

Key Words. Arecaceae, *Butia*, host plants, immature, Brazil

Introduction

The weevil genus *Revena* (Curculionidae, Baridinae) was established by Casey (1922) based on two new Brazilian species, *R. remota* and *R. sexualis*, the latter now considered a synonym of *R. rubiginosa* (Boheman, 1836). This genus is widely distributed in South America (Wibmer and O'Brien 1986; Alonso-Zarazaga and Lyal 1999). According to Wibmer and O'Brien (1986) *Revena* is represented by nine species: *R. rubiginosa* recorded for Bolivia (Cuatro Ojos) and Brazil (Minas Gerais, São Paulo and Santa Catarina); *R. maculiventris* Hustache, 1950 for French Guiana; *R. brevis* Hustache, 1950, *R. exarata* Hustache, 1950, *R. laevipennis* Hustache, 1950 and *R. trapezicollis* Hustache, 1950 for Brazil (Amazonas and Pará); *R. vagans* Bondar, 1943, *R. remota* Casey, 1922 and *R. plaumanni* Bondar, 1943 for Brazil, respectively Bahia, Minas Gerais, Santa Catarina (Bondar 1943; Silva et al. 1968; Alves-Costa and Knogge 2005; Silva et al. 2011, 2012) and recently Tonietto and Schindwein (2016) reported *R. plaumanni* for Rio Grande do Sul state, Brazil.

In relation to host plant and ecological aspects Bondar (1943) commented on the possibility that each species of *Revena* should be associated with a particular species of Arecaceae Bercht & J. Presl. Currently the host plants are known only for four species: *R. vagans* [about 20 specimens obtained by Bondar in fruit of "ariri", *Syagrus vagans* (Bondar) A. D. Hawkes] (Bondar 1943); *R. rubiginosa* in *Syagrus romanzoffiana* (Cham.) Glassman (Alves-Costa and Knogge 2005; Silva et al. 2011, 2012) and in *Butia paraguayensis* (Barb. Rodr.) C. H. Bailey (Silberbauer-Gottsberger et al. 2013); *R. trapezicollis* recorded in flowers of *Bactris acanthocarpa* Martius (Valente 2000) and *R. plaumanni* in *Butia odorata* (Barb. Rod.) Noblick (Tonietto and Schindwein 2016).

The oviposition of *Revena* species occurs in fruits of palm trees that present the endocarp still soft and not yet ripe. The larvae develop inside the fruit (one or more in each fruit) and complete the cycle (pupa and adult) in the soil at variable depth. The attacked fruits may have deformations and may suffer early maturation, and fall to the ground before the healthy fruits. The larvae of some species

of *Revena* are able to survive passing through the intestinal tract of vertebrates protected within the seeds (Silva et al. 2012). The life cycle of some species appears to be synchronized with the seasons and consequently with flowering and formation of clusters of palm trees and fruit development (Bondar 1943; Alves-Costa and Knogge 2005; Silva et al. 2011, 2012).

Considering the lack of information about *Revena* species, the aim of this study was to improve the knowledge of *R. plaumanni* with respect to adult morphology and its bionomics aspects.

Materials and Methods

For morphological studies the dry specimens were boiled in water briefly. In order to study the male and female genitalia, the abdomen was removed and cut laterally along the pleural region and the tergites were pulled out. The genitalia were then removed, boiled in potassium hydroxide solution (KOH) at 10% and examined under a stereomicroscope. All specimens studied are deposited in the Entomological Collection “Pe. Jesus Santiago Moure”, Department of Zoology, Federal University of Paraná, Curitiba, Brazil (DZUP), except the lectotype. The terminology herein adopted follows Santos and Rosado-Neto (2010) for male and female genitalia.

The bionomics study of *R. plaumanni* was conducted in the experimental area of the Wheat National Research Center – Embrapa CNPT (28°13'50.04"S 52°24'13.71"W) in Passo Fundo, state of Rio Grande do Sul. The climate, according to Köppen classification is subtropical humid (Cfa), with rain well distributed throughout the year (Rio Grande do Sul 1994). The local altitude is 673 meters. The minimum mean temperatures range from 11 to 15 °C and the maximum between 22 °C and 26 °C during the year. The average annual rainfall is approximately 1650 mm (Martinez et al. 2008).

In January 2009, four samples of 25 fruits from four plants of *Butia eriospatha* (Mart. ex Drude) Becc. were collected. Each sample was placed inside a PVC tube with 200 mm of circumference that were sealed with a screen cover on the top (Fig. 1). The fruits remained on the soil surface and below the tree canopy until the emergence of adults.

In November of the following year shortly after the anthesis period of *B. eriospatha*, the oviposition behavior of adults in young fruits with approximately 10 mm of diameter was monitored. Some fruits with some oviposition signals were collected and opened under the stereoscopic microscope to observe the eggs and the places where they were deposited.

At fruit maturation, a sample was collected and cleaned of the pulp. When the seed outlet holes of the larvae were found (Fig. 2), they were opened to observe the larvae and damage on the seeds. In that same period, another sample of 25 fruits from each plant was placed in the PVC tubes for adult emergence. When the first adults began to emerge, two of the four tubes were removed and the site was excavated to observe the pupae and pupal chambers.

Label data for lectotype is cited within quotation marks (“”). Slash bars (/ /) are used to indicate label separation. How the specimen is preserved, the condition of the specimen and where it is deposited are also reported.

Results and Discussion

Taxonomy

Revena plaumanni Bondar, 1943

(Fig. 3–13)

Bondar 1943: 383 [original description]; Blackwelder 1947: 904 [catalog]; Wibmer and O'Brien 1986: 328 [checklist]; Tonietto and Schindwein 2016: 1–5 [ecology, host plant].

Adult redescription. Body length (rostrum excluded), male: 5.2–6.3 mm; female: 7.3 mm (Fig. 3). Integument reddish brown to dark brown, slightly shining, seeming glabrous; punctures fine and sparse

on rostrum, head and pronotum, little coarse on the elytral interstriae and coarser on the sides of pronotum, legs and ventrally; each puncture bearing a minute seta that are longer ventrally and on the legs.

Head: globose, distance between eyes as large as the base of rostrum dorsally and ventrally. Rostrum weakly curved, dorso-ventrally flattened, gradually slender from base (male) and from antennal insertion (female) to apex, thicker at base, as long as (male) and slightly longer (female) than pronotum, 6.50–7.11 (male), 8.56 (female) times longer than its apical width; antennal insertion near base, scape short, as long as funicle article 1.

Thorax: Pronotum transverse, 1.2–1.3 times as long as wide at base, with a median longitudinal smooth line, apical margin slightly sinuate, widest at base and here strongly bisinuate, sides rounded and weakly convergent to apex. Scutellum short, subquadrate. Elytra (male and female) 1.7–1.8 times longer than prothorax, 1.1–1.2 times as long as wide, widest at base, sides gradually narrowing towards apex and here conjointly rounded, with ten complete striae, striae 9 and 10 fused at apical third, declivital calli rounded and not prominent; interstriae wider than striae, flat dorsally and subcarinate laterally and apically. Prosternum (male and female) flat, medially broad and weakly concave. The anterior coxae separated by their own width; femora and tibiae unarmed; all tibiae (male and female) with a cluster of setae and with a strong spur in inner apical margin.

Abdomen: Ventricle I with median depression in both sexes; pygidium not exposed.

Male: (Fig. 4–9): median lobe of aedeagus shorter than the apodemes, about 3 times as long as wide, subparallel sides, apex slightly rounded and narrowed (Fig. 4), weakly arcuate in lateral view (Fig. 5). Tegmen (Fig. 5–6) dorsal lobes connate at base and divergent towards apex, as long as the manubrium. Abdominal tergite 8 subquadrate with setae on posterior half (Fig. 7); abdominal sternite 8 with two transversal plates subtriangular, glabrous (Fig. 8). Spiculum gastrale curved on the base, apex asymmetrical (Fig. 9).

Female: (Fig. 10–13): abdominal tergite 8 trapezoid, wider at base; slightly longer than wide, sides subparallel from base to near middle and in sequence moderately converging towards the apex, and here smooth with short and thin setae (Fig. 10). Abdominal sternite 8 (Fig. 11) with elongated and narrow apical lobes, a little longer and wider than the spiculum ventrale, apical edge with thin setae. Coxites (Fig. 12) glabrous, elongated, wider on the basal half next to the middle; styli very short and with few setae on the apex. Spermathecal capsule elongated, curved, well sclerotized. Spermathecal gland elongated, 2 times longer than the spermathecae (Fig. 13).

Sexual dimorphism: Male: rostrum thicker at base and gradually slender towards apex, and as long as pronotum, more densely punctate and rugose. Female: rostrum thicker at base, slender and smooth from antennal insertion to apex, slightly longer than pronotum.

Type data. The lectotype male, designated by Vaurie (1953: 31), is labeled “Brasilien, Nova Teutonia, 27°11’ B. 52°23’ L, Fritz Plaumann _194” / “State of Santa Catarina” / “♂” / “Gregorio Bondar Collection, David Rockefeller Donor” / “LECTOTYPE *Revena plaumanni* Bondar, P. Vaurie”. This lectotype is double mounted (paper triangle), is in excellent condition, and is deposited in the American Museum of Natural History, New York (AMNH), and was examined by the first and second authors.

Specimens examined. BRAZIL: Rio Grande do Sul: Passo Fundo, Embrapa Trigo, 24.viii.2009, M. Savaris, S. Lampert col. (1 male, DZUP); same data, except 26.xi.2009 (4 male, 1 female, DZUP); Viamão, Fepagro, 06.xii.2010, G. Schilindwein col. (3 female, DZUP), same data, except x.2012, A. Tonietto col. (4 female, 1 male, DZUP).

Distribution. Brazil: So far known only from southern Brazil, in the states of Santa Catarina (Seara – Nova Teutonia) and Rio Grande do Sul (Passo Fundo and Viamão) (Fig. 19).

Host plant. *Butia eriospatha* (Mart. ex Drude) Becc. and *Butia odorata* (Barb. Rod.) Noblick (Arecaceae).

Observations on Bionomics

The adults of *R. plaumanni* are found in the fruit bunches foraging in search for oviposition sites (Fig. 14) when the fruits of *B. eriospatha* are approximately 10 mm in diameter. The developing fruit is perforated (Fig. 15) by *R. plaumanni* females, who oviposit inside the endocarp 1 or 2 eggs that are curved and hyaline staining (Fig. 16). The endocarp of the fruit is soft and gelatinous during the egg laying process. This process is similar to the observations described by Alves-Costa and Knogge (2005) for *R. rubiginosa* in fruits of *S. romanzoffiana*.

The white larvae (Fig. 17) were observed feeding of the seeds down into the kernel which can be mono- or bisseminated. The percentage of damaged seeds was 28.0%, with one larva per seed. Each fruit can present up to 2 eggs inside the endocarp at the time of oviposition. However, only one larva was observed per compartment (in the case of bissemination) and the larvae feed only from one seed, completely destroying it and making germination impossible. After the fruits fall to the ground, the larvae leave the kernel through a hole they make (Fig. 2), and burrow into the ground to pupate at depths which vary from 4 to 10 cm. The larvae construct a protective pupal chamber. Alves-Costa and Knogge (2005) report that although there was more than one egg in each fruit of *S. romanzoffiana*, in all infested fruit only one larva per seed develops into the second, third or fourth instar.

In this study only mature larvae of the last instar were observed. Therefore, it is not possible to determine whether the first-instar larvae have falcate mandibles, as reported by Alves-Costa and Knogge (2005). It is likely, however, that they do have falcate mandibles, as up to two eggs per seed were observed in the initial stage of development of the fruit, and only one last-instar larva was found per seed.

The pupa is similar to the adult form, but the wings are not wholly developed and setae are present on the prothorax and abdomen. The pupae (Fig. 18) are white in color when first formed, are approximately 4 mm in length, and become yellowish with dark eyes.

Adults were collected between November and December, in the state of Rio Grande do Sul, which is the spring season, coinciding with the flowering and early fruit development periods of *B. eriospatha*. The adult emerges 10 to 12 months after oviposition in the fruit, and starts the cycle again in young fruits.

The occurrence of *R. plaumanni* feeding on seeds of *B. odorata* is reported by Tonietto and Schindwein (2016), but in *B. eriospatha* is recorded for the first time in Brazil, and so far, each species of *Revena* has a different species (sometimes of the same genus) of Arecaceae as host plant, as already mentioned by Bondar (1943).

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Figures 1–2. *Butia eriopatha*. 1) Plants and PVC tubes used for obtaining adults of *Revena plaumanni*. 2) Fruit with larvae exit hole.

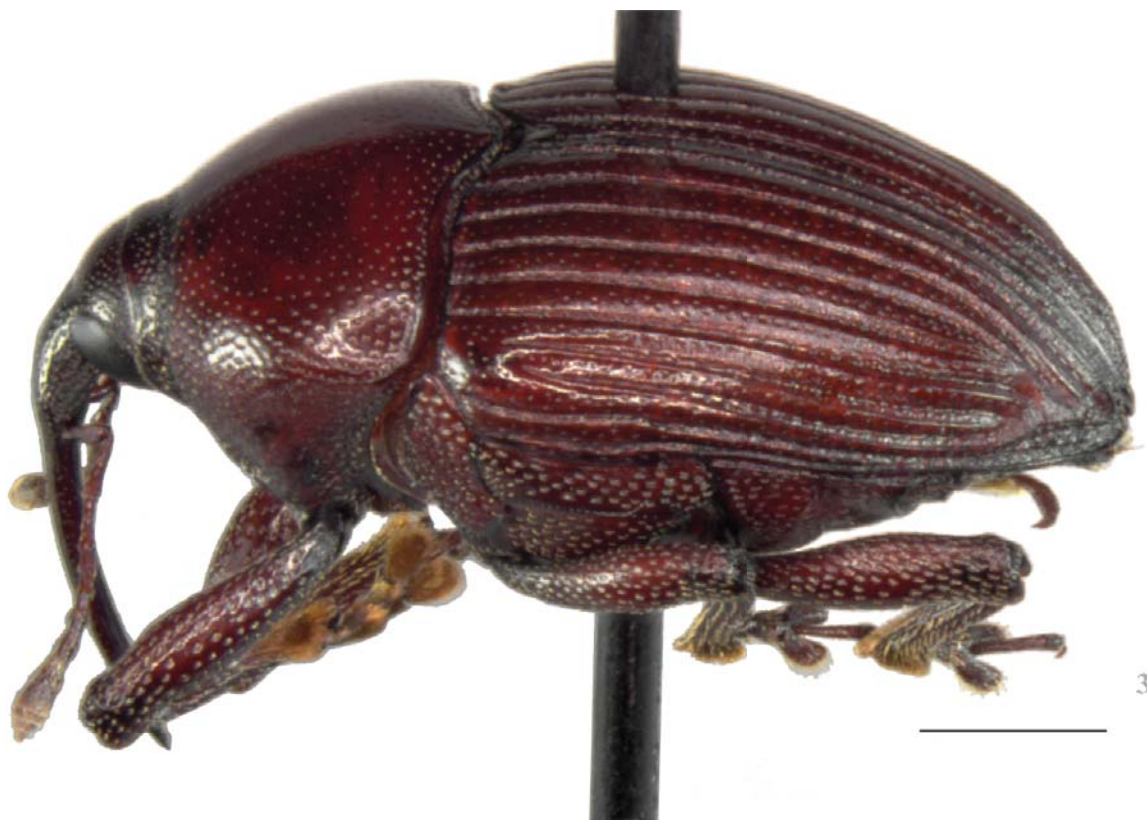
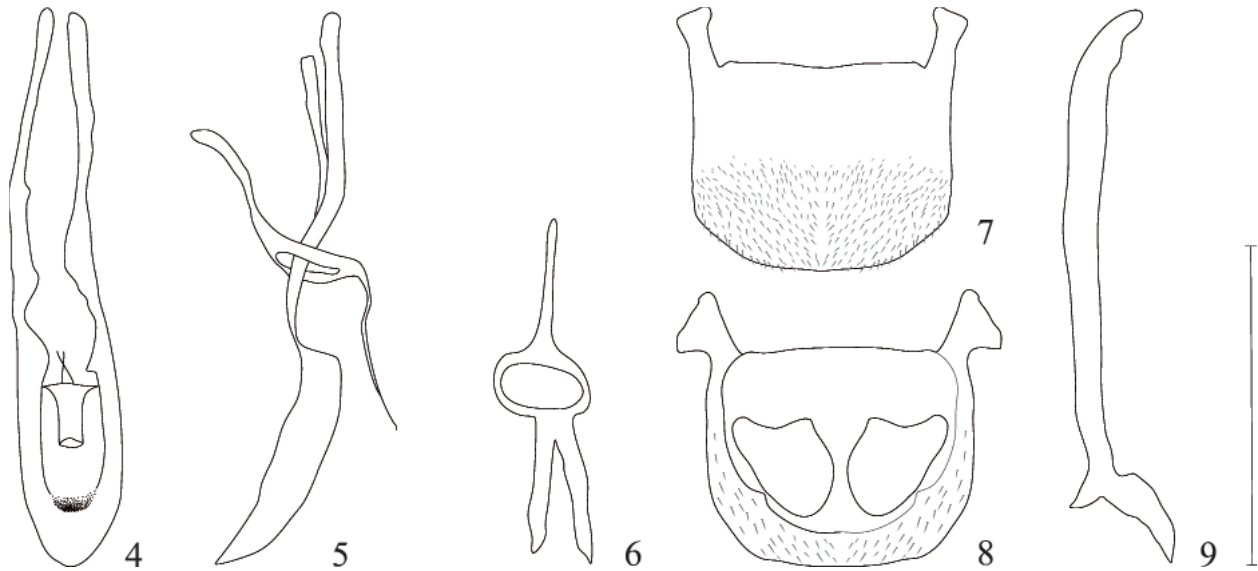
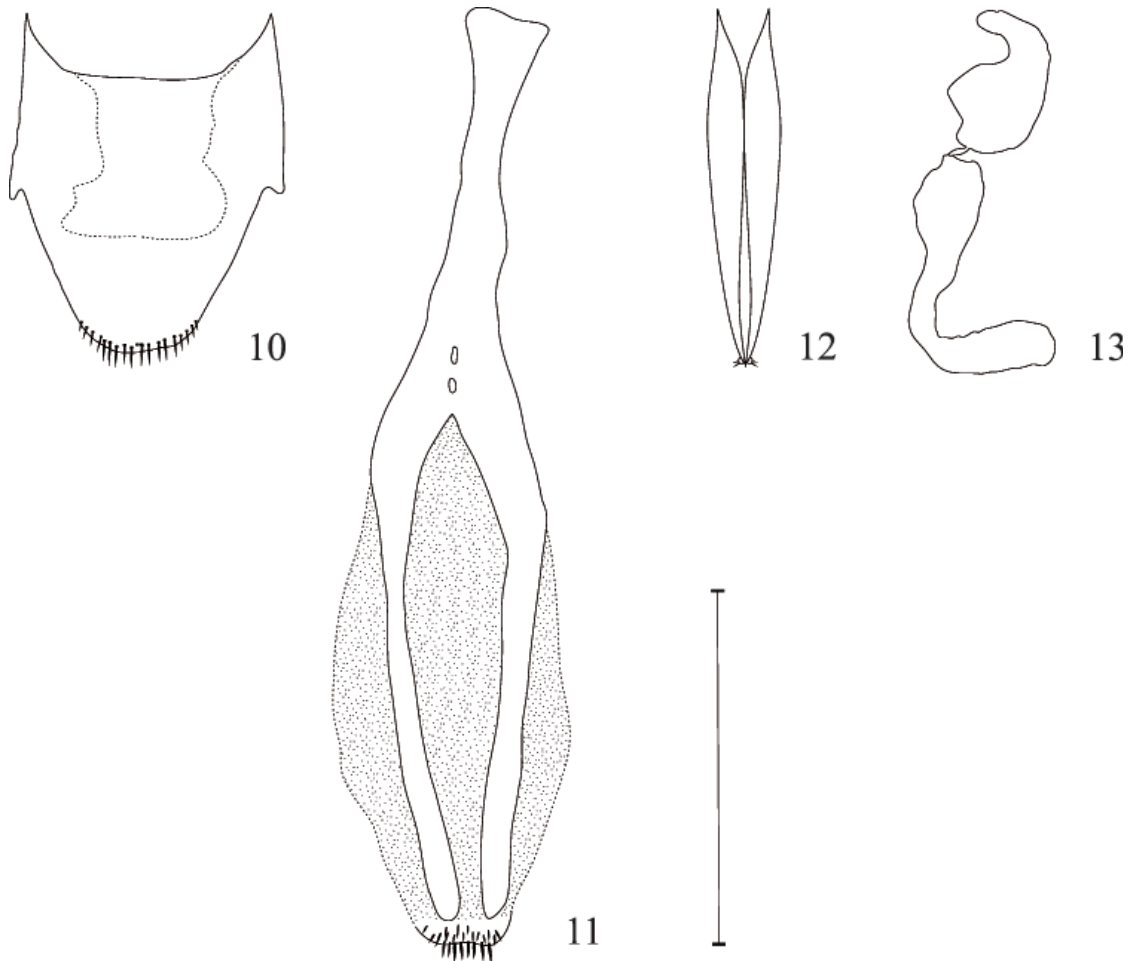


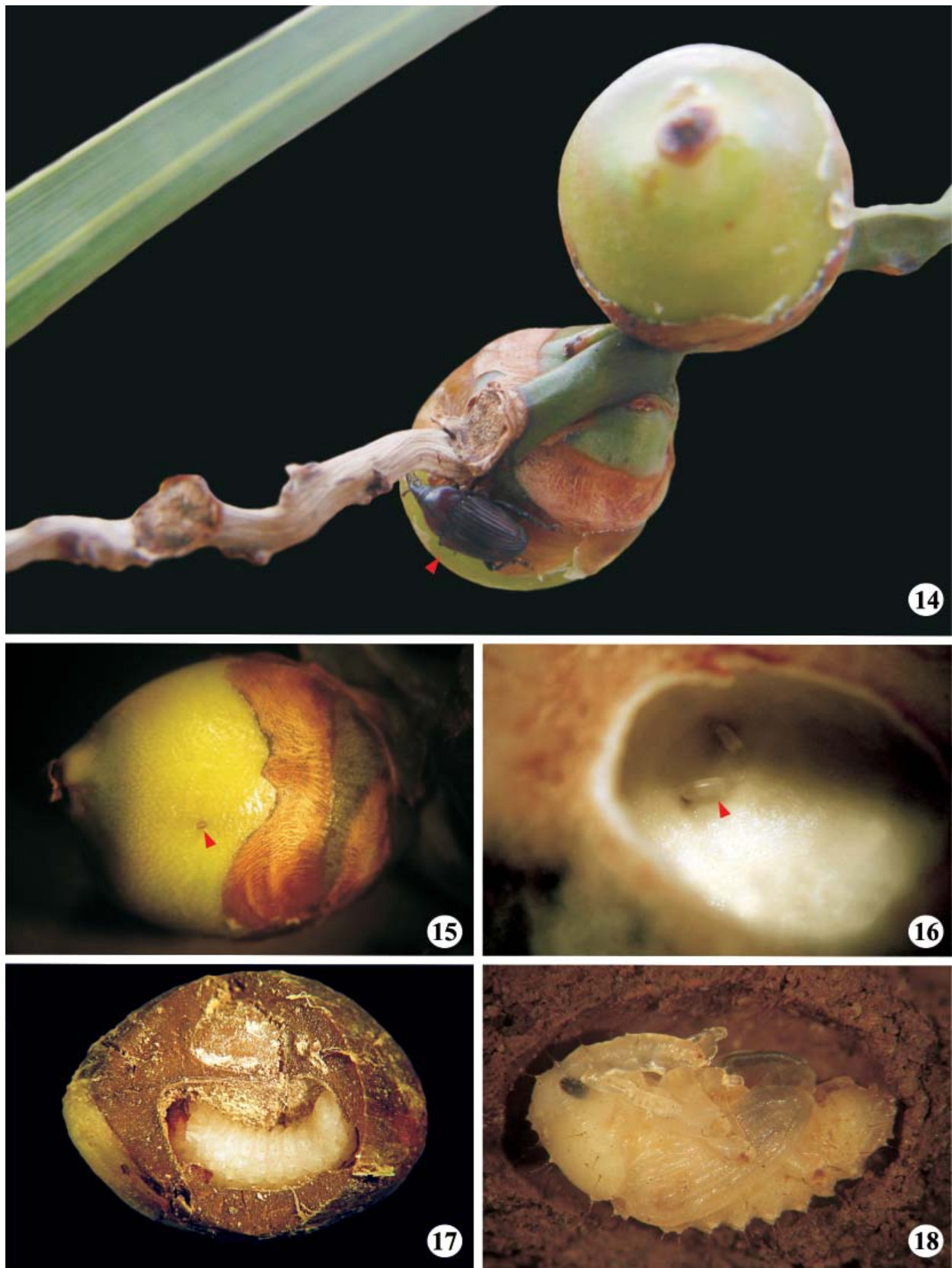
Figure 3. Adult of *Revena plaumanni*, lateral view. Scale line = 1 mm.



Figures 4–9. *Revena plaumanni*, male genitalia. 4) Aedeagus, dorsal view. 5) Aedeagus and tegmen, lateral view. 6) Tegmen, dorsal view. 7) Tergite 8, dorsal view. 8) Tergite and sternite 8, ventral view. 9) Spiculum gastrale, dorsal view. Scale line = 1 mm.



Figures 10–13. *Revena plaumanni*, female genitalia. 10) Tergite 8, dorsal view. 11) Sternite 8, dorsal view. 12) Coxites, dorsal view. 13) Spermatheca and spermathecal gland. Scale line = 1mm.



Figures 14–18. *Revena plaumanni*. 14) Adult fruit foraging. 15) Developing fruits, with oviposition hole indicated by arrow. 16) Eggs. 17) Larva. 18) Pupa.

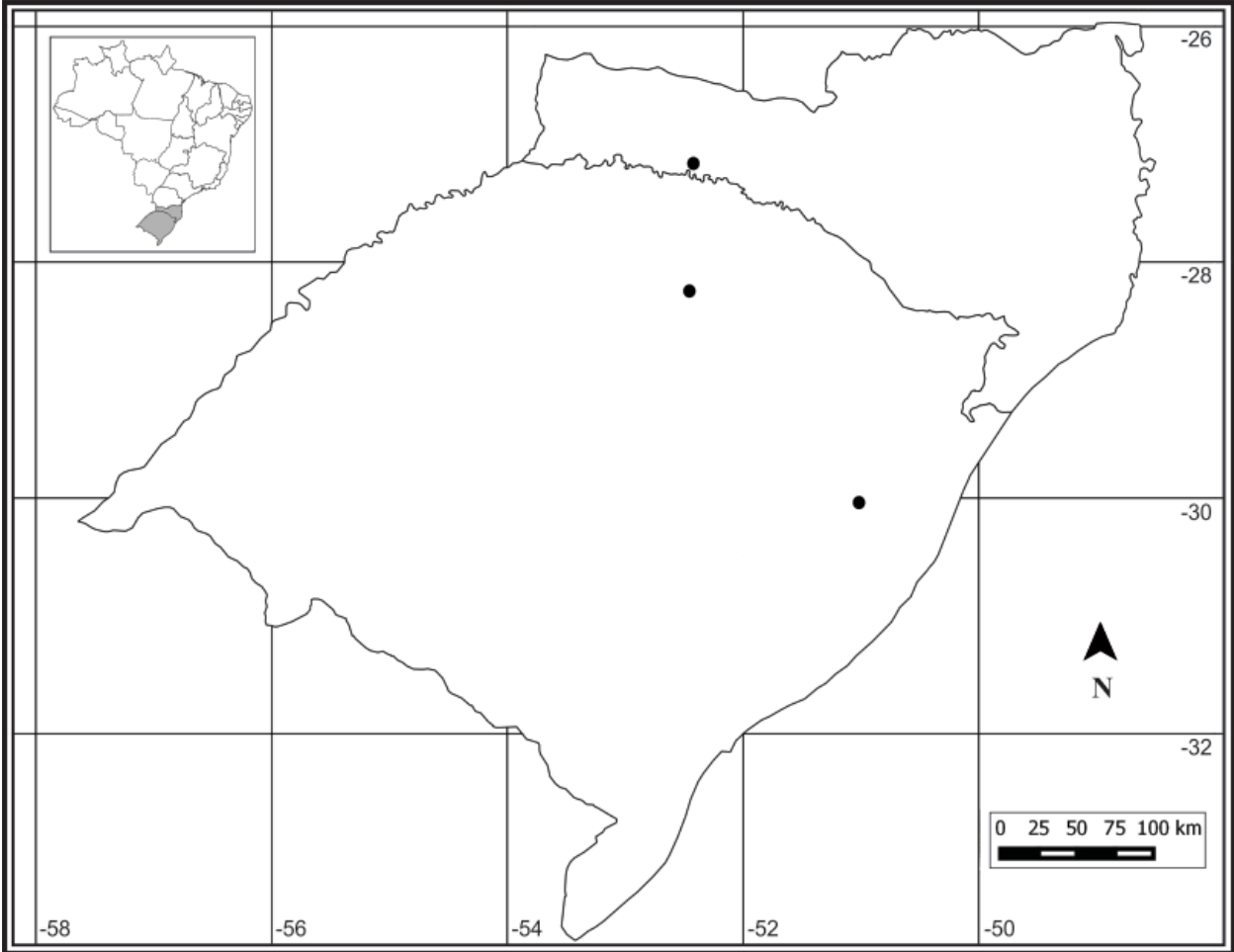


Figure 19. Distribution map for *Revena plaumanni* Bondar, 1943.

