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The egg morphology of some species of *Sennius* Bridwell (Coleoptera: Chrysomelidae: Bruchinae) based on scanning electron micrographs[1]

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Abstract

Eggs of *Sennius crudelis* Ribeiro-Costa & Reynaud, *S. nappi* Ribeiro-Costa & Reynaud and *S. bondari* (Pic) are described based on scanning electron micrographs and compared with eggs of other species of Bruchinae (Chrysomelidae).

Key words: *Sennius*, Bruchinae, eggs, scanning electron micrograph

Introduction

The pattern and sculpturing of the surface of insect eggs are useful taxonomic characters to identify species when adults can not be found. The egg morphology of Bruchinae (Chrysomelidae) has been very rarely studied. Wightman and Southgate (1982) made a significant contribution, based on scanning electron micrographs, by describing the eggs of nine species that damage stored legumes. The same technique was used by other authors to study the eggs of three species of *Megacerus* Fåhraeus, *Gibbobruchus mimus* (Say), *Pygiopachymerus lineola* (Chevrolat) and *Sennius leptophyllicola* Ribeiro-Costa & Costa (Pfaffenberger *et al.* 1984; Pfaffenberger 1986; Ribeiro-Costa & Costa 2002).

Sennius Bridwell encompasses 48 species occurring in the Neartic and Neotropical regions (Silva *et al.* 2003) and according to Johnson (1984) most of the species feed in the leguminous seeds of *Senna*.

The egg morphology of *Sennius* has been studied by Bondar (1937), Center and Johnson (1973), Terán and L'Argentier (1979) and Ribeiro-Costa (1998). Nevertheless, all these works are only a beginning in studies of egg structures of Bruchinae beetles.

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The primary purpose of this research is to describe the eggs of *Sennius crudelis* Ribeiro-Costa & Reynaud, *S. nappi* Ribeiro-Costa & Reynaud and *S. bondari* (Pic) based on scanning electron micrographs in order to add to our knowledge of Bruchinae immature stages.

Materials and methods

In order to obtain the eggs of *Sennius crudelis* and *S. nappi*, adults were collected on *Senna multijuga* from Jardim Botânico Municipal de Curitiba, Paraná, Brazil and put into a plastic box with immature pods and mature seeds. Honey (10%) was used as food. The eggs of *S. nappi* were collected from infested seeds of the same host from a previous rearing at the Laboratório de Sistemática e Bioecologia de Coleoptera (Insecta), in the Departamento de Zoologia da Universidade Federal do Paraná. The *S. bondari* eggs were collected from infested seeds of *Senna macranthera* from the same laboratory.

The micrographs were taken with the scanning electron microscope of the Faculdade de Saúde Pública, Universidade de São Paulo, São Paulo, Brazil. The eggs were previously covered by carbon and then gold.

Results and discussion

Sennius crudelis Ribeiro-Costa & Reynaud

Eggs laid singly, elongate, 0.88 mm in length and 0.25 mm in width (n=10), slightly enlarged on one end (Fig. 1) and covered by a membrane, not ornamented (Fig. 2). There are two bands of anchoring strands on each side, one internal and with shorter strands and other external with longer strands; all of them with an area enlarged near surface to form a homogeneous adhesive flange (Figs. 1, 3). Two others elongate strands are placed at each end of the egg and also have the function of attaching the egg to the surface (Fig. 4). The size of the egg and flange together are 1.46 mm in length and 0.40 mm in width (n=10).

The elongate form of the egg is similar to that of *Pachymerus nucleorum* (Fabricius), some *Acanthoscelides* Schilsky and some *Sennius* (Bondar 1937; Terán & L'Argentier 1979; L'Argentier & Terán 1980; Wightman & Southgate 1982; Ribeiro-Costa & Costa 2002). Terán and L'Argentier (1979) when describing the egg of *S. laminifer,* wrote that the egg enlargement corresponded with the size of the larva head.

Egg anchoring strands are common in *Sennius*. Bondar (1937) commented that the eggs of *Sennius lateapicalis*, *S. subdiversicolor* and *S. laminifer* have two elongated anchoring strands at each end and it is surrounded by numerous anchoring strands. Center and Johnson (1973) observed numerous anchoring strands on the eggs of *S. morosus* and *S. simulans*, while eggs of *S. medialis* have only two anchoring strands at each end. Ribeiro-

Costa and Costa (2002) also observed that eggs of *Sennius leptophyllicola* are surrounded by numerous anchoring strands.

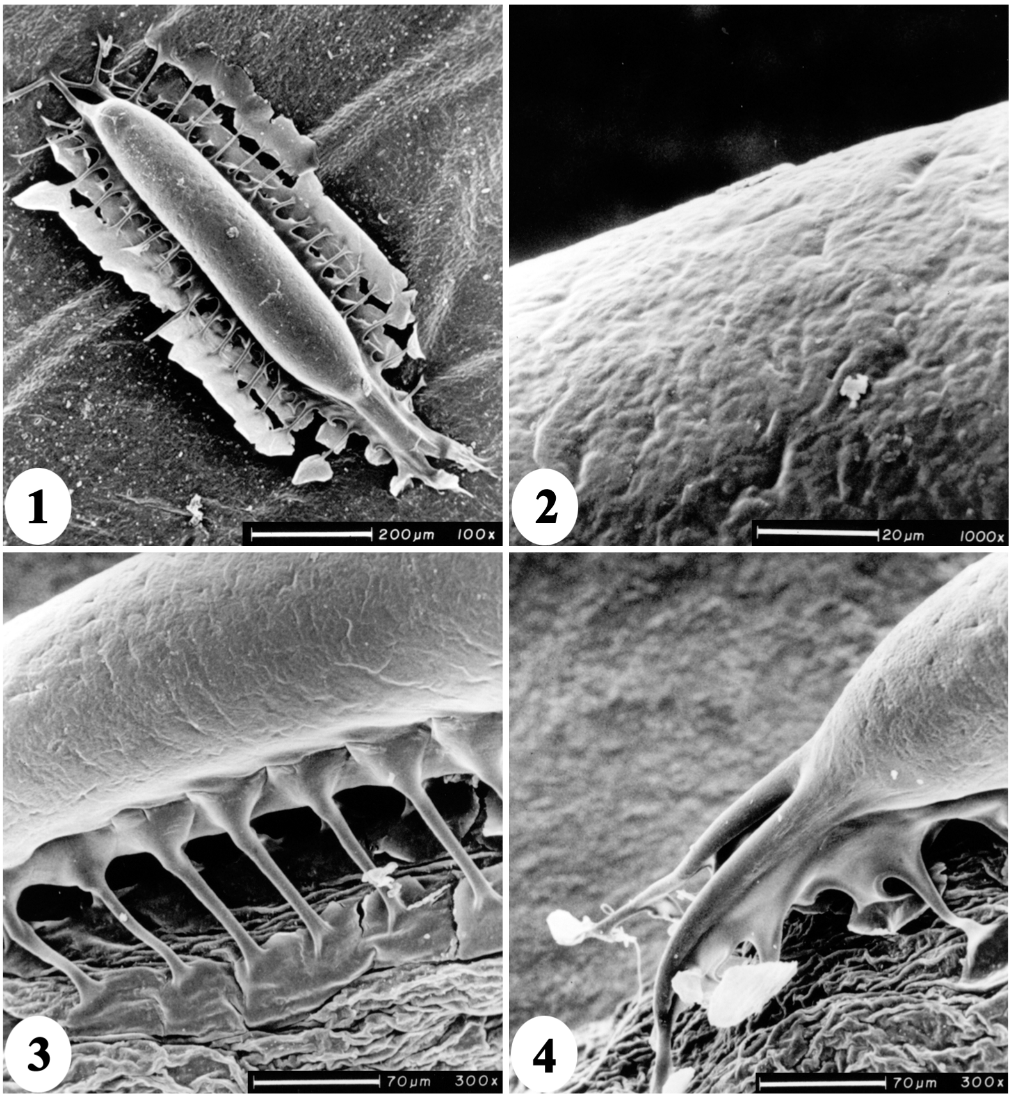
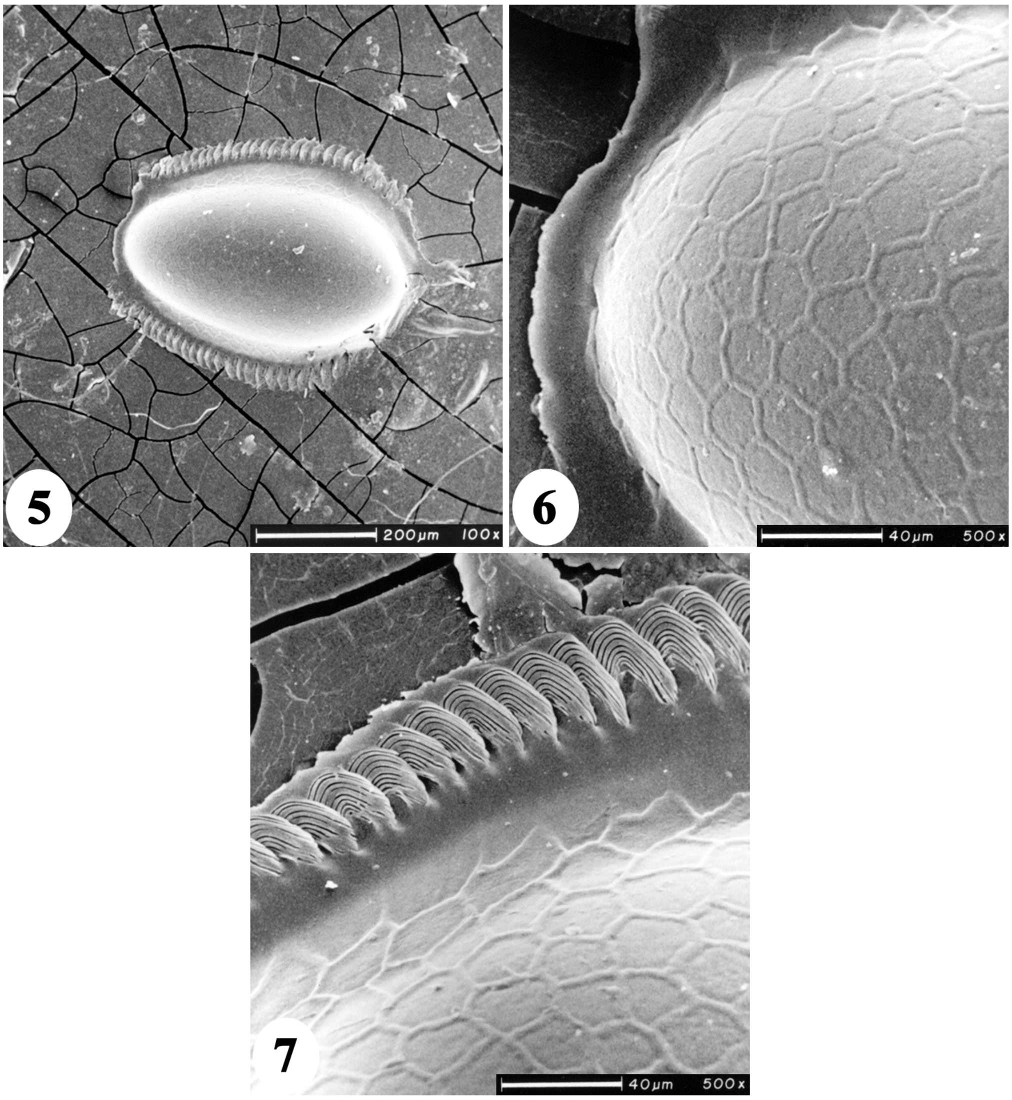


FIGURE 1–4. Scanning electron micrographs of *Sennius crudelis* Ribeiro-Costa & Reynaud egg: (1) general view; (2) membrane covering the egg; (3) lateraly anchoring strands; (4) end anchoring strands.

Anchoring strands appear in eggs of other genera of Bruchinae, like *Caryedes minor* (Pic), *Merobruchus julianus* (Horn), *Acanthoscelides bicoloripes* (Pic) and *A. nigronotaticeps* (Pic) (Bondar 1931, 1937; Forister & Johnson 1970; L'Argentier & Terán 1980).

Sennius bondari (Pic)

Eggs laid singly, ovoid, 0.68 mm in length and 0.42 mm in width (n=10) (Fig. 5), covered by an ornamented membranous flange that forms a continuous pattern of hexagonal rings (Fig. 6). This membranous flange is larger than and surrounds the egg, then becomes smooth and on lateral areas forms an undulate flange that attaches the egg on the surface (Figs. 5, 7). The size of egg and flange together are 0.85 mm in length and 0.64 mm in width (n=10).



FIGURES 5–7. Scanning electron micrographs of *Sennius bondari* (Pic) egg: (5) general view; (6) membrane covering the egg; (7) undulate flange.

The egg of *S. bondari* has already been described by Ribeiro-Costa (1998), however not based on scanning electron micrographs. For this author, the ornamented areas of the membrane are restricted to the lateral borders. Moreover, the eggs were smaller than recorded in the present paper, which is possible because egg size is highly plastic and very subject to maternal effects (Credland 1992; Fox 2000; Fox et al. 1997a, b; Fox et al. 2001).

An ornamented membrane has been reported on the eggs of other species of Bruchinae, like *Acanthoscelides argillaceus* (Sharp), *Bruchidius atrolineatus* (Pic), *Caryedon serratus* (Olivier) and some species of *Amblycerus* Thunberg (Bondar 1937; Terán & L'Argentier 1979; Pfaffenberger 1979; Wightman & Southgate 1982; Biémont *et al.* 1982; Ribeiro-Costa 1998).

The characteristic of the membranous flange that surrounds the egg, is not unique to *S. bondari*, appearing, for example, in *Caryedon serratus*, *Gibbobruchus mimus*, *Neltumius texanus* (Schaeffer), *Pectinibruchus longiscutus* Kingsolver, *Pygiopachymerus lineola*, *Zabrotes subfasciatus* (Boheman), some species of *Amblycerus*, some species of *Callosobruchus* Pic, some species of *Megacerus* and some species of *Stator* Bridwell (Johnson & Kingsolver 1975; Johnson 1978; Pfaffenberger 1979, 1981, 1986; Terán & L'Argentier 1979; Wightman & Southgate 1982, Pfaffenberger *et al.* 1984; L'Argentier 1990; Ribeiro-Costa 1998; Johnson *et al.* 2001; Ribeiro-Costa & Costa 2002). Nevertheless, in those species, the flange is irregular, except in *Stator vachelliae* Bottimer, on which the flange is serratulate; in *Sennius bondari* the flange is undulate.

Sennius nappi **Ribeiro-Costa & Reynaud**

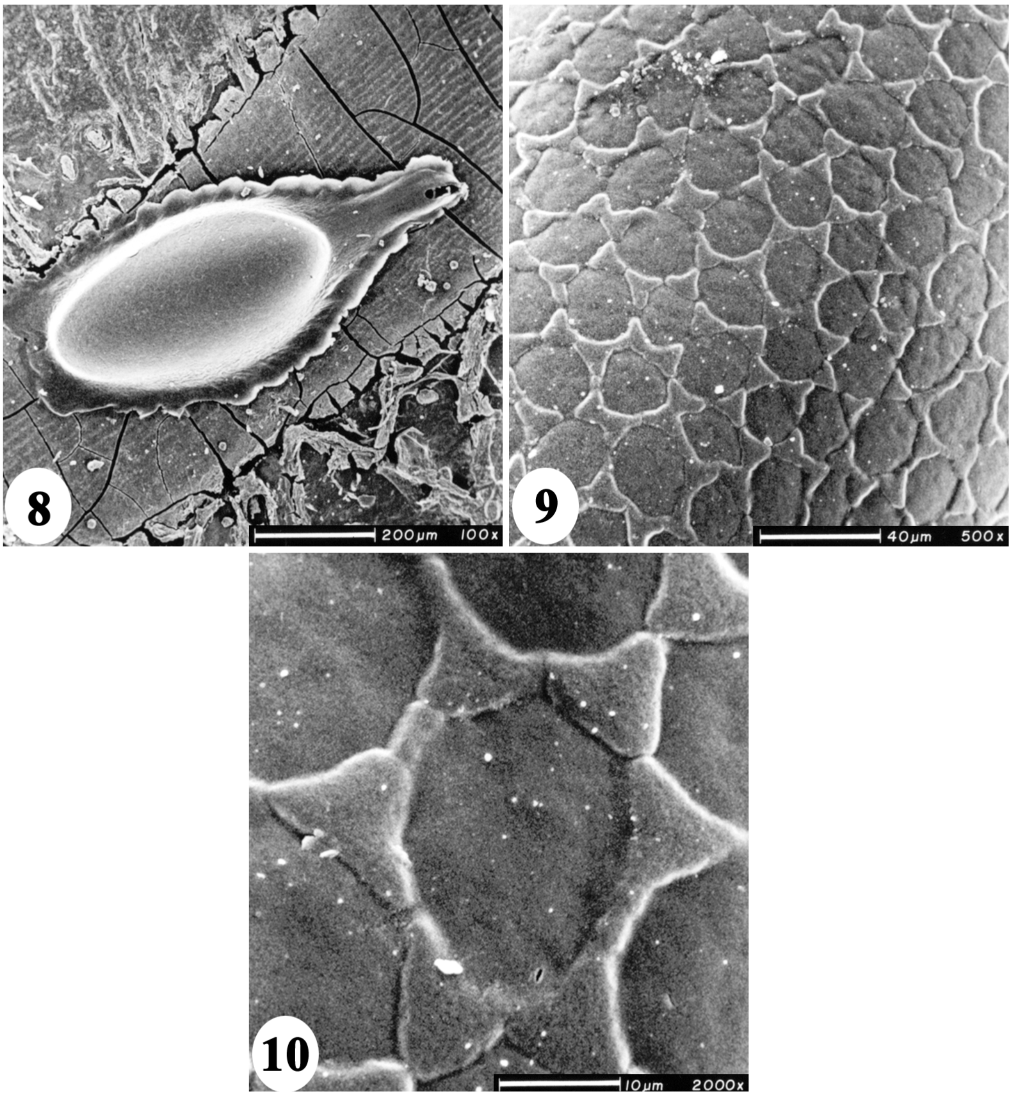
Eggs laid singly, ovoid, 0.74 mm in length and 0.39 mm in width (n=10) (Fig. 8), covered by an ornamented membranous flange composed of small triangles (Figs. 9, 10). Membranous flange surrounding egg larger, smooth at one end, elongate, truncate and tubular at other end, respiratory tube 0.23 mm in length (n=10), with a small aperture (Fig. 8). The size of egg and flange together are 1.07 mm in length and 0.55 mm in width (n=10).

Due to its ovoid form, the egg of *S. nappi* is more similar to the egg of *S. bondari* when compared to the other *Sennius* that have elongated eggs.

An ornamented membrane is found in other bruchine species as already quoted in this work. Nevertheless, the type of the ornamentation, composed of small triangles, is described for the first time.

The flange of the membrane that surrounds the egg of *S. nappi* is irregular, similar to those found in some other species of Bruchinae (Johnson & Kingsolver 1975; Johnson 1978; Pfaffenberger 1979, 1981, 1986; Terán & L'Argentier 1979; Wightman & Southgate 1982; Pfaffenberger *et al.* 1984; L'Argentier 1990; Ribeiro-Costa 1998; Johnson *et al.* 2001; Ribeiro-Costa & Costa 2002).

The tube with a small aperture occurs in some species of *Callosobruchus*. This structure is used as a route between the exterior and interior of the egg for exchange of respiratory gases and water loss or uptake (Wightman & Southgate 1982; Credland 1992; Daniel & Smith 1994). The morphology of this tube is used for species identification as in the case of *Callosobruchus* (Wightman & Southgate 1982), or for identification of strains (Daniel & Smith 1994).



FIGURES 8–10. Scanning electron micrographs of *Sennius nappi* Ribeiro-Costa & Reynaud egg: (8) general view; (9) membrane covering the egg; (10) small triangles that compose the membrane.

Final Considerations

Several authors have noted the presence of a membrane that covers the eggs of different bruchine species. This membrane probably is a product of the accessory glands (Snodgrass 1935).

Biémont *et al.* (1982) stated that the lack of chorionic structures of the egg of *Bruchidius atrolineatus* in scanning electron micrographs was related to the egg covering.

Pfaffenberger *et al.* (1984) studied the eggs of the three species of *Megacerus* with an electron microscopy. Analyzing the illustrations it was possible to see that in two species the chorion was evident, except in the areas near the surface that is concealed by a membrane that helps in attachment. In the third species, the chorion was not evident because of the membrane, and cracks reveal an irregular pattern of double and triple punctations, each of which appears to open to a single aeropyle.

Credland (1992) observed the oviposition behavior of four species of *Callosobruchus* and of *Zabrotes subfasciatus*, concluding that in all five species the eggs are attached to the surface by a membrane and when females oviposit, the eggs are covered by an adhesive substance that dries immediately.

The lack of any typical chorionic sculpture in the eggs of *S. crudelis*, *S. bondari* and *S. nappi* is a consequence, therefore, of the presence of a membrane covering the egg. This membrane probably has the special purpose to attach the egg firmly to the surface, and also, being a protection for the environmental injures, as, for example, high insolation and low relative humidity, which results in egg desiccation. However, in the system gas exchange is possible, principally in *S. crudelis* and *S. bondari*, that do not have a respiratory tube.

In the eggs of *S. bondari* and *S. nappi*, the membrane has a thick ornamentation as a possible result of the chorion impression, although, in *S. crudelis* the membrane is not ornamented, concealing chorion characteristics. In short, the lack or presence of the membrane ornamentation could depend on the amount of the secretion of the accessory glands over the chorion. Contrary to this hypothesis, the membrane of *Amblycerus* species is ornamented and enlarged beyond the limits of the egg (Ribeiro-Costa 1992; Johnson *et al.* 2001). In this example, the ornamentation is a membrane characteristic and not a chorion impression.

The anchoring strands of *S. crudelis* are shared by species in which females attach their eggs on green, still growing pods as *Sennius lateapicalis*, *S. subdiversicolor, S. morosus, S. simulans*, *S. medialis*, *S. laminifer* and *S. leptophyllicola* (Bondar 1937; Forister & Johnson 1970; Center & Johnson 1973; Terán & L'Argentier 1979; Ribeiro-Costa & Costa 2002). The eggs of *S. bondari* and *S. nappi* deposited their eggs directly on seeds and do not have strands, suggesting that the function of attachment must be associated with the membrane that covers them. Although, *S. nappi* also oviposited on immature pods, restricted to slight depressions. Similar behavior has been reported for *Amblycerus nigromarginatus* (Motschoulsky) (Bondar 1937) and *Pygiopachymerus lineola* (Janzen 1971;

Ribeiro-Costa & Costa 2002). Janzen (1971) observation revealed that these depressions in the pod wall are a result of the action of the mandibles. However, Johnson and Siemens (1997) observed in some bruchine species that oviposition occurs into crevices or cracks on pods. In both oviposition behaviors, the first instar larva has the advantage of being nearer to the seed.

Finally, morphological characters in *Sennius* eggs, as the presence of anchoring strands or the membrane concealing the chorion sculpture, maybe interesting not only to clarify phylogenetic relationships, but also with the understanding of the role in evolution of the oviposition behavior in non-natural species groups as Johnson (Johnson 1981) has pointed out.

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