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OBSERVATIONS ON THE BIOLOGY OF *AMBLYCERUS SUBMACULATUS* (PIC) AND *SENNIUS BONDARI* (PIC) (COLEOPTERA: BRUCHIDAE) IN *SENNA ALATA* (L.) ROXBURGH (CAESALPINACEAE)

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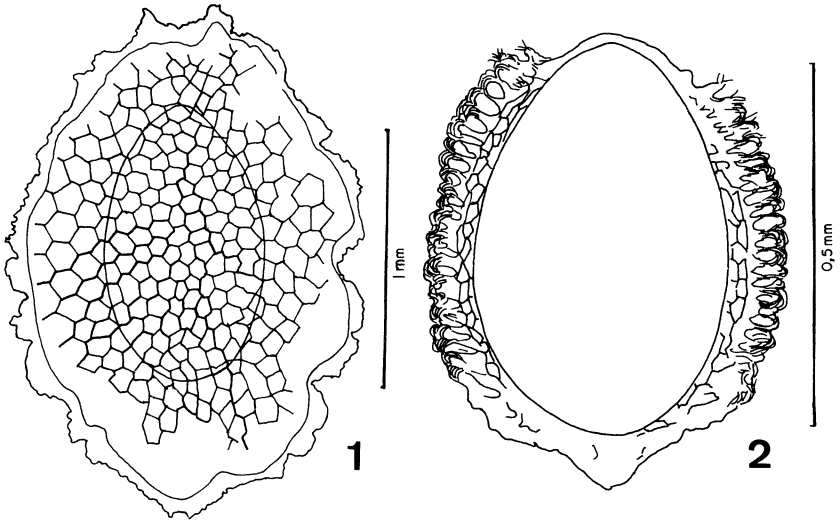
Abstract

Two species of Bruchidae, *Amblycerus submaculatus* (Pic) and *Sennius bondari* (Pic), are recorded for the first time preying upon the seeds of *Senna alata* (L.) Roxburgh (Caesalpinaceae). Biological aspects of these species in this host plant are presented. There is evidence that *Horismenus* sp. (Eulophidae) parasitize both bruchids. Specimens of *Acylomus* sp., a phalacrid beetle, were also found inside some seeds.

Mature pods of *Senna alata* (L.) Roxburgh (Caesalpiniaceae) from Itaparica, Bahia, Brazil, were collected 1 March 1991. From this single lot, consisting of dried and some slightly opened pods with several seeds inside, adults of two species of Bruchidae species belonging to different subfamilies emerged: *Amblycerus submaculatus* (Pic) and *Sennius bondari* (Pic). *Amblycerus submaculatus* and an unidentified *Sennius* were reared from seeds of *Senna hirsuta* (L.) Irwin and Barneby, at the same time and in the same host plant, by Terán and Muruaga de L'Argentier (1981). According to Ribeiro-Costa (1992) this *Amblycerus* was erroneously identified as *A. hoffmanseggi* (Gyllenhal). Janzen (1980) reported *Amblycerus obscurus* (Sharp) and *Sennius instabilis* (Sharp) preying upon the seeds of *Senna alata.* The presence of different bruchid species in the same host plant is not a novelty since Bridwell (1918) registered up to ten bruchids species in one species of legume. It also would be expected since most Bruchidae select legumes as hosts (Johnson 1970).

The bruchid genus *Amblycerus* Thunberg occurs in 11 plant families (Southgate 1979). *Amblycerus submaculatus* has been recorded from *Senna* only: *S. occidentalis* (L.) Link, *S. hirsuta, S. obtusifolia* (L.) Irwin and Barneby and *S. bicapsularis* (L.) Roxburgh (Ribeiro-Costa 1992). The genus *Sennius* Bridwell is largely restricted to the genus *Senna* (Johnson 1984). This is confirmed by the recorded hosts found in literature for *Sennius bondari*: *Senna splendida* (Vog.) Irwin and Barneby, *S. multijuga* (Rich.) Irwin and Barneby, *S. occidentalis, S. surattensis* (L. L. Burman) Irwin and Barneby, *S. bicapsularis, S. pendula* (Willd.) var. *advena* (Vog.) Irwin and Barneby and *S. pistaciifolia* (H.B.K.) Irwin and Barneby (Silva *et al.* 1968; Johnson 1984; Macêdo, Lewinsohn and Kingsolver 1992). *Senna alata* is recorded here as host for *Amblycerus submaculatus* and *Sennius bondari* for the first time. Some observations about the biology of these species are reported below.



Figs. 1, 2. Egg structure. **1**) *Amblycerus submaculatus*; **2**) *Sennius bondari.*

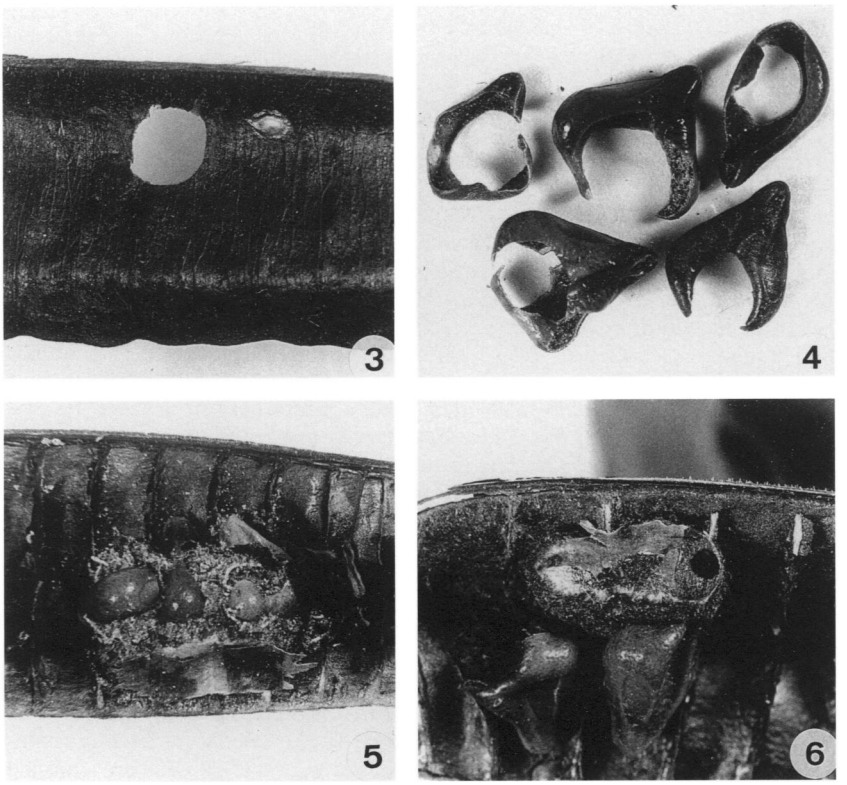
Amblycerus submaculatus (Pic)
Figs. 1, 3–6

Oviposition. Eggs, from 0.08–1.17mm in length and from 0.50–0.67mm in width (Fig. 1), are deposited on the external surface of pods, probably before they start to ripen and dehisce (Fig. 3). This behavior of oviposition includes *A. submaculatus* in a list of bruchids belonging to Johnson's Guild A (Johnson 1981). The only species of *Amblycerus* known to deposit eggs directly on seeds is *Amblycerus longissimus* (Pic) (Bondar 1931, 1937). Only isolated eggs were observed, but in some other *Amblycerus* eggs may be clustered (Bondar 1931, 1937; Pfaffenberger 1979; Terán 1984; Ribeiro-Costa 1992).

The egg structure of *A. submaculatus* is similar to that described by Johnson and Kingsolver (1975) for *A. vitis* (Shaeffer) and by Pfaffenberger (1979) for *A. robiniae* (Fabricius). The egg is protected by a substance that forms a reticulate membrane (Fig. 1), ranging from 1.42–1.75mm in length and from 1.00–1.25mm in width. The membrane has a peripheral, adhesive flange which fixes the egg firmly to the surface. This egg type probably prevents the egg from becoming detached during the emergence of the first instar larva and it also keeps the egg glued to a smooth surface that later wrinkles and shrivels (Johnson and Kingsolver 1975).

The design observed in the egg membrane (Fig. 1) is shared by other species of *Amblycerus* (Bondar 1931, 1937; Pfaffenberger 1979; Terán and L'Argentier 1979; Terán 1984; Ribeiro-Costa 1992) except by *A. vitis,* where it is smooth (Johnson and Kingsolver 1975).

Larval Development. Eclosion occurs through the lower surface of the egg chorion. First instars penetrate into the fruit wall through a round hole (0.20 mm in diameter). Each larva feeds upon several seeds in the course of its development, apparently walking freely among septa of the fruit. Janzen (1980) observed the same behavior when a bruchid larva is much larger than a single seed. The only two species of *Amblycerus* species recorded in the literature



Figs. 3–6. *Amblycerus submaculatus.* **3**) egg and an adult exit hole in pod valve; **4**) destroyed seeds; **5**) cocoon inside pod valves; **6**) cocoon with adult exit hole of eulophid parasite.

(Johnson and Kingsolver 1975) that develop within a single seed are *A. robiniae* (Fabricius) and *A. vitis.*

As the successive instars consume much of the seed coat and almost all of its contents (Fig. 4), the damage of *A. submaculatus* in seeds of *Senna alata* is readily discernible from that of *Sennius bondari* (Fig. 8).

Pupation and Emergence. The last-instar larva spins a cocoon made by silk aggregated with frass and sometimes with destroyed seeds (Figs. 5, 6). The cocoon is cemented internally in the pod valves, transverselly to the septa. The construction of a silken cocoon is usual in *Amblycerus* (Johnson and Kingsolver 1971; Pfaffenberger 1979; Ribeiro-Costa 1992; Bondar 1931, 1937; Terán 1984) and rarely the pupal chamber is made only with frass and exuviae (Johnson and Kingsolver 1975; Terán and L'Argentier 1979). Pfaffenberger (1979) commmented that the pupation of *A. robiniae* most generally occurs within seed remnants, eventually silken pupal chambers are also constructed when small seed fragments remained following larval feeding.

In pod valves the round exit hole of the adult ranges from 2.92–3.17mm in diameter (Fig. 3).

Sennius bondari (Pic)
Figs. 2, 7–10

Oviposition. The eggs, 0.48–0.56mm in length and 0.32mm in width (Fig. 2), are deposited directly onto the seed surface (Figs. 7, 10). This suggests that *S. bondari* attacks *Senna alata* after the *A. submaculatus* attack, when pod valves are opened and seeds exposed. This *S. bondari* behavior is similar to that of bruchids in Johnson's (1981) Guild B. Frequently only one egg is deposited on a single seed (Fig. 10) and when two or more eggs were observed only one adult emerged. The egg structure (Fig. 2) is similar to that described for *A. submaculatus.* A membrane, from 0.56–0.60 mm in length and 0.44–0.48 mm in width, covers and protects the egg. The reticulate areas of the membrane are restricted to the lateral borders of the egg chorion and the adhesive edge appears to be the area with many filaments (Fig. 2). The feature of the egg being covered by this membrane appears only to prevent the egg becoming detached from the seed during larva emergence.

Larval Development. The first instar burrows directly into the seed and in process pushes back whitish frass to the egg. The minute holes range from 0.12–0.16 mm in diameter. When more than one larva enters, only one adult emerges, suggesting that cannibalism occurs in *S. bondari.* The entire larval life is spent inside one seed (Fig. 7), although larvae of some species of *Sennius* consume several seeds (Center and Johnson 1973). The content is not completly destroyed by larval development as in *A. submaculatus* and, in most instances, the cotyledons are the preferable area consumed (Figs. 8, 9).

Pupation and Emergence. Pupation occurs inside one seed and the seed coat is conserved intact. This behavior is usual *Sennius* that consume only one seed during development (Center and Johnson 1973). The larval feeding chamber is a real pupal chamber where the amount of frass and exuviae are smashed (Fig. 9). There is no record of a cocoon being spun by species of *Sennius.*

Adults first emerged through round exit holes in the seed coats (1.04–1.32 mm in diameter) (Fig. 7) and afterward through the opened valves; no holes compatible with body circumference of *S. bondari* were found in the pod wall.

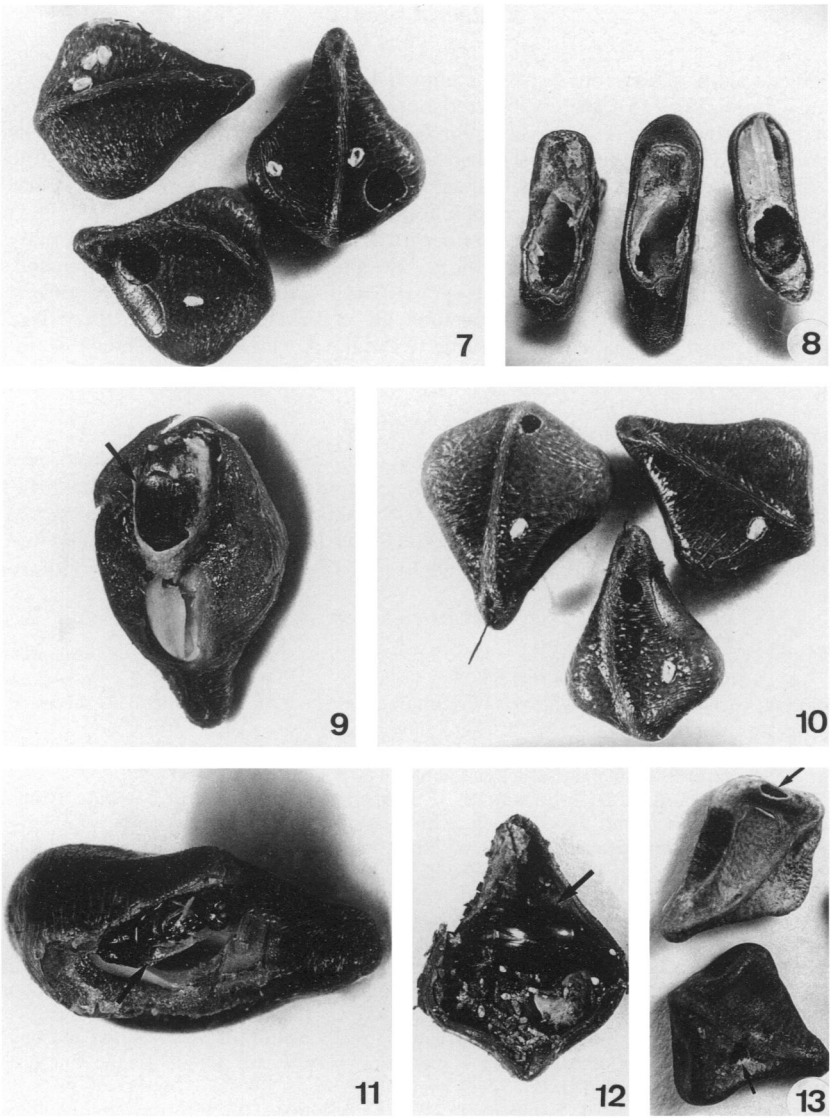
Parasitism

Figs. 6, 10, 11

Some silken cocoons of *A. submaculatus* had a round hole, about 0.83 mm in diameter (Fig. 6), smaller than the adult bruchid emergence hole (Fig. 3). These cocoons were dissected and inside them there were black exuviae of *Horismenus* sp. (Eulophidae) and larval exuviae of the bruchid. Ribeiro-Costa (1992) found exuviae of *Horismenus* sp. inside cocoons of *A. hoffmanseggi* and Terán (1984) found an unidentified parasite inside a cocoon of *A. testaceus* (Pic 1917).

Seeds with *S. bondari* eggs and no adult exit holes or even seeds with a hole 0.56–0.68 mm in diameter (Fig. 10), smaller than the adult body circumference of *S. bondari* (Fig. 7), were dissected. For this purpose seeds were soaked in water for about one day. Remains of black exuviae, and occasionally an adult *Horismenus* sp. were found inside many of the seeds (Fig. 11).

Janzen (1980) recorded in the same seed sample one parasite species being reared from many species of bruchids.



Figs. 7–13. Seeds of *Sennna alata.* **7**) seeds with *S. bondari* eggs and adult exit holes; **8**) dissected seeds showing *S. bondari* damage; **9**) dissected seed showing pupal chamber with newly emerged *S. bondari* adult; **10**) seeds with *S. bondari* eggs and adult exit holes of eulophid parasite; **11**) newly emerged eulophid adult; **12**) dissected seed with *Acylomus* sp. adult inside and excrement left from larval development; **13**) seeds where *Acylomus* sp. were found.

Phalacrid beetles
Figs. 12, 13

Seeds with a different aspect, somewhat crumpled, yellowish, with mold and a hole (Fig. 13), were dissected before being soaked in water. Most of them contained single dead adult *Acylomus* sp. (Phalacridae) along with excrement and exuviae left from their larval development (Fig. 12). The possible explanation is that after the seed attack by S. *bondari,* fungi developed on and in the seed providing food for phalacrid larvae and adults. Steiner (1984) commented that species of *Acylomus* breed in dried legume pods previously infested by Lepidoptera and Bruchidae. No adults were observed in the seed. An interesting fact is that no endosperm was found in seeds with *Acylomus* sp. Since *S. bondari* does not consume all of the seed contents, there is a possibility that the phalacrids consume it. All the *Acylomus* discussed by Steiner (1984), however, feed on mold.

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