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(Coleoptera : Bruchidae)

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Notes on the Systematics, Host Plants, and Bionomics of the Bruchid Genera *Merobruchus* and *Stator*

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Little has been published in recent years on the noneconomic Nearctic species of Bruchidae. Only Bottimer (1961), Southgate (1963), Johnson (1963), and Kingsolver (1964, 1965) have added to our knowledge of the systematics, bionomics, and host plants of the Nearctic Bruchidae since Bridwell (1946) divided most of the United States species originally named in the genus *Bruchus* into 12 new genera. In order to advance the knowledge of United States Bruchidae, some brief comments are made here on the systematics of *Merobruchus* Bridwell and results of studies conducted on the host plants and bionomics of *Merobruchus* and *Stator* Bridwell are presented and discussed.

METHODS AND MATERIALS

Bottimer (1961) gives an excellent account of how bruchids may best be reared in the laboratory. For the most part I followed his methods in studying the Bruchidae discussed in this paper but some departures from his techniques were made. Seeds which may be infested with bruchids are collected in the field in brown paper bags and the extraneous material removed in the laboratory. The seeds are then placed in wide mouth ring top pint canning jars and the jar tops are then covered with gauze. Sometimes mites of the family Pyemotidae may destroy bruchid cultures in the laboratory by feeding on larvae and pupae. Gauze impregnated with Kelthane has been effective in controlling these mites. Impregnation is accomplished by dipping the gauze in a one-half to one per cent Kelthane in acetone solution and then allowing the acetone to evaporate. As an added precaution against dispersing mites jars are stored on Kelthane impregnated paper towels.

Small gelatin capsules can be used to isolate seeds or bruchids for rearing or observation but observations in this study were made by placing bruchids in either stender dishes or petri dishes of various sizes.

SYSTEMATIC NOTES

Merobruchus placidus (Horn), 1873, new combination
Merobruchus major (Fall), 1912, new combination

Bridwell (1946) designated *Bruchus julianus* Horn (1894) as type species of the new genus *Merobruchus* but did not indicate other named

species which should be included in the genus. *Bruchus placidus* Horn and *B. major* Fall exhibit external characters which fit the generic limits of *Merobruchus* and I consider these species to be members of *Merobruchus*.

Schaeffer (1904) published notes about a species he considered to be *B. julianus* Horn. Unfortunately, Schaeffer, at first thinking the specimens to be an undescribed species, distributed specimens of this species under the "manuscript name" of *B. flexicaulis* prior to publication of this paper. He states "The examination of the type (of *B. julianus*) saved me from describing this species again," indicating he considered his *B. flexicaulis* to be a synonym of *B. julianus*.

I have examined the type specimens of *B. major* Fall (1912) and *B. flexicaulis* and I consider them to be members of the same species. In addition I have not seen specimens of *B. julianus* which were reared from *Acacia flexicaulis* (the host designated for *B. flexicaulis* by Shaeffer), only *B. major*. The specimens of *B. flexicaulis* distributed by Schaeffer have created problems among bruchid specialists in succeeding years in that specimens of the same species were identified either as *B. major* or *B. flexicaulis*. Since Schaeffer first published *B. flexicaulis* as a synonym of *B. julianus*, Article 11 (d) of the International Code of Zoological Nomenclature invalidates *B. flexicaulis* and *B. major* Fall becomes the valid name of this species.

HOST PLANTS

The literature contains numerous references to bruchid host plants which are, unfortunately, in error. These errors are due to misidentification of the bruchids or the host plants, and lack of discrimination as to what constitutes a bruchid host plant. Students of the Bruchidae consider the host plant as one which serves for larval nourishment. As an example Cushman (1911) indicates that *B. julianus* "undoubtedly breeds in pods of *Acacia flexicaulis*" and that it has been reared from *Siderocarpus flexicaule*. As there was confusion at that date between the identity of *M. julianus* and *M. major* (named in 1912) Cushman undoubtedly had specimens of *M. major* rather than *M. julianus*.

I have reared *M. julianus* from the seeds of *Acacia berlandieri* Bentham (Texas, Mexico). Dr. John M. Kingsolver of the U. S. Department of Agriculture provided the following host plants of *M. julianus* from specimens deposited in the U. S. National Museum: *Acacia wrightii* Bentham (Rio Grande City, Texas) and *Acacia greggii* Gray (Plesenton (*sic*), Texas). Dr. L. E. Caltagirone of the Department of

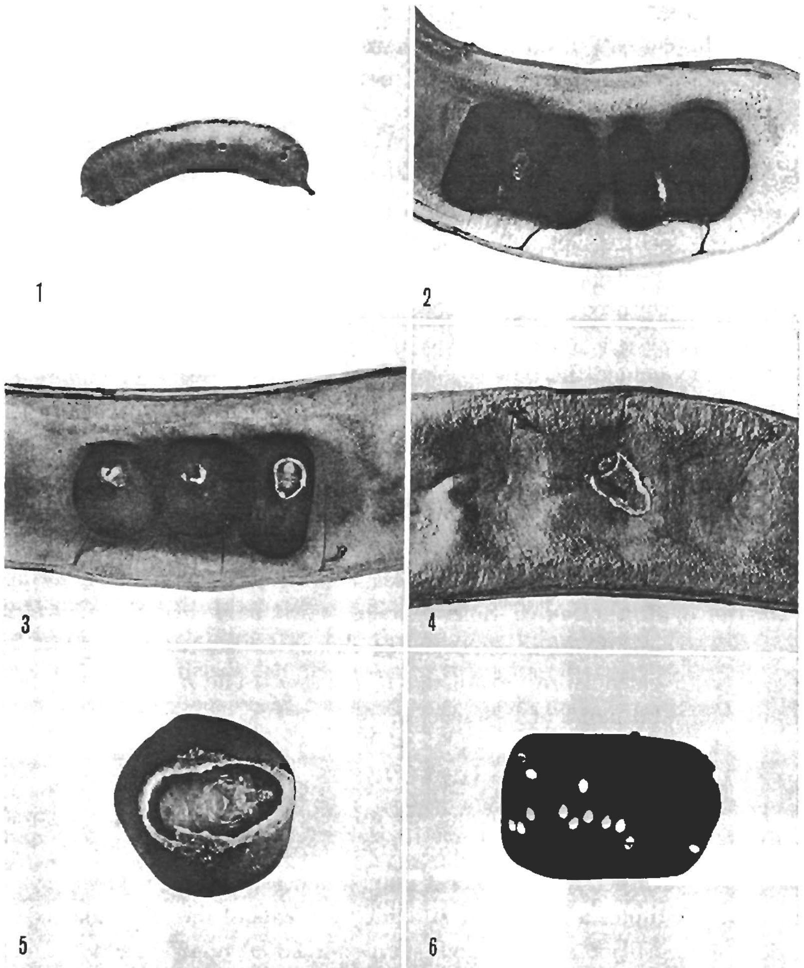

Fig. 1. Seed pod of *Acacia berlandieri* showing *Merobruchus julianus* exit holes. ×1

Fig. 2. Infested seeds of *A. berlandieri* glued to pod valve by *M. julianus* larvae. ×3

Fig. 3. Seeds of *A. berlandieri* showing surface normally attached to pod valve by *M. julianus* larvae. Note pupae of *M. julianus* inside the seeds. ×3

Fig. 4. Interior of pod valve of *A. berlandieri*. Note white material with which the larva of *M. julianus* attaches the seed to the pod valve and the oval area chewed by *M. julianus* as the beginning of an exit hole. ×3

Fig. 5. Pupa of *M. julianus* inside the seed of *A. berlandieri*. ×6

Fig. 6. Eggs of *Stator limbatus* and *S. pruininus* deposited on the surface of a seed of *A. berlandieri*. ×6

Entomology and Parasitology, University of California, has reared *M. major* from seeds of *Pithecollobium flexicaule* Bentham.

Many leguminous host plants for *Stator limbatus* (Horn) and *S. pruininus* (Horn) have been reported in the literature by Bridwell and and others. Following is a list of host plants for these species that have not been previously recorded in the literature. All were reared by the author.

S. LIMBATUS.—*Acacia berlandieri* (Mexico, Texas); *Acacia acatlensis* Bentham (Mexico); and *Lysiloma divaricata* Jacquin (Mexico).

S. PRUININUS.—*A. berlandieri* (Texas); *Mimosa biuncifera* Bentham (Mexico, Arizona); and *Desmanthus* sp. (Mexico). *Desmanthus virgatus* (Linnaeus) was infested experimentally with this species by Bridwell (1918) but this is the first report of this plant genus being infested by *S. pruininus* in nature. However, other bruchid species commonly are found breeding in the seeds of species of *Desmanthus*.

BIONOMICS

Female bruchids oviposit into flowers, green pods, or seeds or glue their eggs directly on the mature pod or seed. The larvae then burrow into the host seeds, feed, and complete their development. Pupation ordinarily occurs within the seed. The adults then emerge through symmetrical exit holes (fig. 1). Most Nearctic bruchid species I have reared usually use only one seed or part of a seed in the course of their development.

During June and July 1964, I collected several lots of *Acacia berlandieri* seeds in Texas and in the state of Coahuila, Mexico. Drs. C. W. and L. B. O'Brien also collected seeds of the same species from Texas in July 1965. Observations of bruchids in these seed lots are reported below.

Most *A. berlandieri* pods (fig. 1) remain attached to the plant, dehisce soon after they ripen and the seeds fall to the substrate. However, seeds which are infested by *M. julianus* remain attached to the inner wall of the pod valve by a glue-like substance that is apparently provided by the larva. The seeds may remain attached to the pod long after the adult bruchid has emerged. Fig. 2 shows the position of infested seeds in the pod. Fig. 3 shows three seeds that have been removed from their attachment to the valve. The openings in the seeds are normally those portions of the seeds which are attached to the pod valve. Part of a pupa is visible in the seed on the right. Some of the glue-like substance which remains on the pod after the infested seed is removed from the pod valve is shown in fig. 4. The partially completed adult exit hole is the oval area with the raised central portion seen at the top of the glue-like area. Adults emerging through a hole burrowed directly from the seed through the valve of a dehiscent pod is unique. In all other Nearctic species of bruchids I have reared from dehiscent pods to this date, the adults emerge through the seed coat but not through the pod valve. Bruchid species which infest indehiscent pods emerge through the pod valve.

Careful examination of both pods and seeds of *A. berlandieri* has yielded no evidence of what might be eggs of *M. julianus*. This, together with the fact that the larvae are mature when the seeds mature, indicates that oviposition probably occurs when the pods are tender and immature. If eggs are oviposited into an immature pod, plant growth would tend to obliterate the scar or, if laid on the pod, the egg case is lost. No observations of oviposition in green pods were possible.

Another unique feature of *M. julianus* larval behavior is that they often feed on more than one seed during their development. When more than one seed is used, two or even three seeds are glued to one another as well as to the pod valve. Seeds which are glued together are connected by tubes apparently produced when the larvae pass from one seed to another. Fig. 2 shows five seeds which have been used by two larvae. Three seeds are attached on the left of the figure and two are attached on the right of the figure. The attachment tube is visible between the two seeds on the right.

When the larva has completed its development the seed test on one side may be almost completely eaten through or may consist of a small hole (fig. 3).

Pupation occurs in the seed. Fig. 5 shows the pupa in its normal position, lying on its back facing the opening in the seed and the pod valve. Over 70 pupal chambers were examined and in all cases the pupa or adult in the chamber was in this position. Apparently there is no shift of position prior to the adult emerging from the seed.

The adult chews a typical symmetrical bruchid emergence hole (fig. 1) in the pod valve. It chews in a circle (fig. 4), not chewing the center and when the area is sufficiently weakened, pushes off the small round area of the pod valve. The pressure exerted by the adult is sometimes sufficient to hurl the "lid" two inches. Adults are usually capable of flight upon emergence.

Numerous adults were observed in the laboratory for four months in an attempt to learn more of their mating behavior. They were isolated upon emerging from seeds and then a male and female were placed together in petri dishes and observed for 30 minutes a day for several days. No mating or attempts to mate were observed. The sex of *Merobruchus* species is difficult to determine externally so in order to be certain opposite sexes were in the same container, several individuals were then placed together in a large petri dish. No mating occurred but several attempts to copulate were observed. The male curved his abdomen underneath the abdomen of the female and his genitalia were protruded slightly in these attempts. The lack of mating could be due to a reproductive diapause or the laboratory conditions to which they were subjected.

In culture jars, although adult emergence was observed, a second generation was not reared. This would tend to strengthen the hypothesis that *M. julianus* is univoltine.

Inside the pupal chambers of *M. julianus* five pupae of parasitic Hymenoptera were found beside decomposing *M. julianus* pupae. When first discovered the wasp pupae were pale colored but gradually darkened until they eclosed in from 8 to 11 days after discovery. Four eclosed and the fifth died. One was identified as a species of *Eupelmus* and three as species of *Eurytoma*. Specific determinations were not made.

The following observations were made on the life histories of *Stator limbatus* and *S. pruininus* infesting seeds of *Acacia berlandieri*.

S. limbatus eggs develop into larvae capable of entering seeds in five to 12 days. The period of time in the seed from larvae to the emergence of the adults is 47 to 67 days.

Eggs of both *Stator limbatus* and *S. pruininus* usually are glued to seeds after the pods have dehisced. Numerous eggs can be seen glued to a seed in fig. 6. The egg chorion of both species is transparent and the embryonic changes are visible during development. The fully developed first instar larvae burrow through the chorion directly into the seed, leaving debris which gives most of the empty egg cases in fig. 6 their white appearance. The only external evidence of entry into the seed is the minute hole left by the first instar larva.

One seed may be used by several larvae although if too many infest a seed and utilize too much of it, some adults may be of small size.

In laboratory petri dishes eggs are laid on the underside of seeds. Perhaps this behavior is due to a negative response to light or a positive tactile response by the female adult which allows the larvae to penetrate the seed more readily as the dorsum of the egg is braced against another solid object, the bottom of the petri dish.

Observations of *S. limbatus* indicate that eggs usually are laid directly on the seeds after the pods dehisce. Eggs also were laid through *M.*

julianus adult emergence holes on the exterior of seeds through spaces between the pod and seed that were not completely glued to the pod valve. No eggs were observed to be laid in *M. julianus* pupal chambers. Perhaps a smooth surface is required to stimulate oviposition as the pupal chamber interior is roughened and seed exteriors are quite smooth and hard. A pod that had not dehisced was observed when opened manually to be filled with adult *S. limbatus* and seeds riddled with emergence holes. Closer examination revealed empty egg cases and larval entry holes on the pod exterior. Apparently eggs were laid on the pod exterior and the larvae burrowed through the pod valve to the seeds. Possibly enclosure in the laboratory culture jars was a stimulus to oviposit on the roughened pod exterior as this behavior was not observed on freshly collected pods.

S. pruininus adults were present in culture jars with *S. limbatus*. These cultures were maintained over a period of eight months and the *S. limbatus* adults gradually became more numerous to the exclusion of the *S. pruininus* adults. This may indicate that *S. limbatus* is better adapted than *S. pruininus* in this plant species. At least *S. limbatus* was more successful under study conditions.

S. pruininus eggs require seven to 14 days to develop into larvae. The larvae, after burrowing into the seed, emerge as adults in 48 to 49 days.

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