culionidae. European workers have broken these families into many smaller ones but without adequate basis unless one is willing to elevate nearly all subfamilies and many tribes to family status. This may eventually be justifiable, but at the present time it seems too radical to be acceptable.

ABSTRACT—The following features should be found in a good classification catalog: All species and infraspecific taxa are listed and arranged by senior synonyms, with complete citations to original descriptions and the location of the types noted. Citations are given for synonymizations, generic and specific. Type species of genera are cited, including those improperly designated, and the method for designation. Taxa are arranged according to an acceptable classification scheme, giving citations to the arrangement followed (new classifications must be documented either in the catalog or elsewhere with citations given). Indication of the geographical range covered, and citations to the source of the geographical distribution information is listed. The bibliographic scope of the catalog, with references to search resources examined, is provided. References to identification keys, useful revisions or reviews, and subsequent descriptions are cited. If the list is selective, an indication of the extent of the omissions should be given. Finally, biological notes are included.

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(3.0022)

Bionomics of *Merobruchus julianus* (Coleoptera: Bruchidae)

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From 24 June to 4 September 1969 seed samples of *Acacia greggii* Gray were collected in Yavapai County, Arizona, at Black Canyon City, the mouth of Sycamore Canyon, and from four to ten miles south of Camp Verde. The seed beetles *Merobruchus julianus* (Horn) and *Stator limbatus* (Horn) were reared from seeds from all three localities. Observations on the bionomics of both species were recorded during the study and those of *M. julianus* are reported upon here.

Reports of *M. julianus* infesting *A. greggii* have only recently been published (Johnson, 1968) and an earlier host record clarified (Bottimer, 1969). Johnson published information concerning the bionomics of *M. julianus* after it was found infesting *Acacia berlandieri* Bentham. His observations will be compared to our observations of *M. julianus* infesting *A. greggii*.

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EGGS AND OVIPOSITION

Eggs of *M. julianus* are about 0.55 mm. long and 0.24 mm. wide and are unlike eggs of any other species of bruchid that we have observed in that the anchoring glue is not spread out evenly. An egg is apparently systematically tacked down with the glue-like "anchoring ropes" or filaments radiating from and encircling the egg (fig. 1). This method of attachment may provide for expansion of the seed pod which probably occurs during the several days required for the embryo's development into a first instar larva. Most eggs of *M. julianus* drop off as the green pods expand.

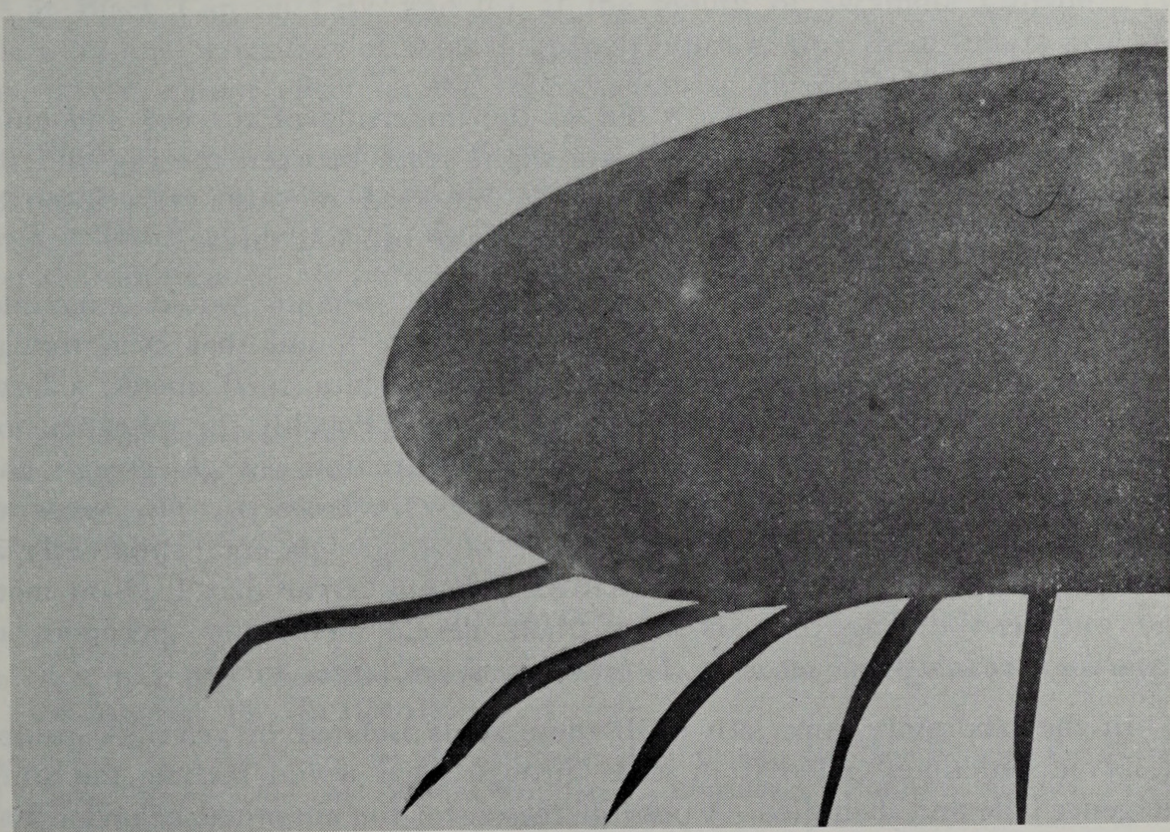

Fig. 1. Posterior portion of an egg of *M. julianus* showing filaments which provide for attachment of the egg. X 280

Although Johnson found no eggs of *M. julianus* on seeds or pods of *A. berlandieri,* he postulated that oviposition probably occurs when the pods are immature. We also were not able to observe oviposition, but we did find many eggs of *M. julianus* on immature seed pods of *A. greggii* collected 24 June, and an identical egg on a mature but still somewhat green seed pod collected 24 July. Only the empty egg chorions of eggs which were laid on nearly mature but still green pods remained on the pods and thus allowed us to associate them with the adult bruchids. The tissues of these pods apparently did not expand enough to slough off the eggs. No empty egg chorions were found on the pod surfaces whose seeds revealed evidence of early entry into them by bruchid larvae. It is assumed that the above is also true of *M. julianus* when it attacks the seeds of *A. berlandieri.* All entry holes in the seeds made by first instar larvae were at least partially healed over, including entry holes in seeds collected late in the summer. This seems to substantiate Johnson's theory that oviposition occurs only on green seed pods.

Another reason for suspecting that eggs are laid only on green pods is that there was no second generation reared from the laboratory cultures. In the field it is probable that no more than one generation occurs per year because of the lack of green pods. The adults probably overwinter.

Eggs are always laid at the edges of the bulges in the pod made by the developing seeds but near the center of the valve on very immature seed pods and near the edge on relatively mature but still green pods.

LARVAE

The first instar larvae burrow out of the underside of the egg and enter the seed pod almost directly. There is a slight space between the egg and the pod and consequently they have not been observed to push frass into the empty egg chorions as do many other first instar bruchid larvae.

Johnson (1968) found that the larvae of *M. julianus* would sometimes consume more than one seed of *A. berlandieri*. We found that even though the seeds of *A. greggii* were sometimes as small as 6 mm. in diameter, a larva of *M. julianus* never consumed more than one seed. Possibly this phenomenon is because the seeds are separated by pod constrictions in *A. greggii* but apparently either touch or almost touch in *A. berlandieri*. The seeds of *A. berlandieri* are usually larger than those of *A. greggii* and, apparently as a result of this and the observation that *M. julianus* larvae may feed on more than one seed during the course of their development, the specimens of *M. julianus* reared from seeds of *A. berlandieri* are larger in size.

In the laboratory, especially with those seeds isolated in gelatin capsules, the larvae sometimes exited from seeds through what would become the adult emergence hole and then died. A possible reason for the abnormal behavior may have been the disturbance when the cultures were examined every two or three days.

Johnson noted that *A. berlandieri* seeds were glued to the inner wall of the pod valve, apparently by the larvae, and remained attached to the pod valve long after the adult bruchid had emerged. Although a glue-like substance was sometimes present on the pods and seeds of *A. greggii,* there was never enough to make the attachment of the seeds to the pod valves lasting. Possibly differences in the composition of the seeds enables the larvae, in the seeds of *A. berlandieri,* to produce more glue-like substance.

ADULTS

Adults of *M. julianus* usually emerge through holes burrowed directly from seeds through the valves of the pods apparently because the pods are indehiscent or tardily dehiscent. Johnson also noticed this habit of *M. julianus* when it exited from seeds of *A. berlandieri*. This is of interest because these pods were dehiscent and there is no apparent advantage to the insect in leaving the seed in this manner. It is possible that some *A. berlandieri* pods are tardily dehiscent like those of *A. greggii,* and the behavior of the bruchids is a necessity as it is with other bruchids infesting indehiscent pods.

The maximum time recorded for development from egg to adult for *M. julianus* was 60 days. More accurate information may be difficult to obtain since the adults apparently do not lay eggs on dry seed pods and may not mate under laboratory conditions.

The percentage of seeds destroyed was 4.6 from the Camp Verde area, 2.5 at Black Canyon City, and 0.7 at the mouth of Sycamore Canyon. The relatively low percentage of seeds destroyed indicates that these insects probably have a very minor effect on the reproduction of these plants.

Many *Eupelmus cushmani* (Crawford) and *Urosigalphis bruchi* Crawford, hymenopterous parasites of the immature stages of *M. julianus,* were reared from seeds collected at the Camp Verde and Sycamore Canyon sites. Parasites were reared from eggs of *M. julianus* collected at all three locations.

Acknowledgments

The Hymenoptera collected during this study were identified by P.M. Marsh and B.D. Burks of the Entomology Research Division, Agricultural Research Service, U. S. Department of Agriculture. Financial assistance for this study was provided by the same organization under Grant 12-14-100-9187 (33).

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Abstract—Bionomics of *Merobruchus julianus* (Coleoptera: Bruchidae) Glen W. Forister and Clarence D. Johnson. Bionomics of *Merobruchus julianus.* A unique method of attachment of bruchid eggs to immature seed pods was observed when *Merobruchus julianus* attack the seeds of *Acacia greggii.* The eggs are attached by thin filaments which apparently allow the egg to remain in position while the growing pod expands. In addition, it was observed that adult females oviposit only on immature seed pods; a period of about 60 days is necessary for development of *M. julianus* from egg to adult; these bruchids destroy from 0.7% to 4.6% of the seeds of *A. greggii;* and the hymenopterans *Eupelmus cushmani* and *Urosigalphus bruchi* parasitize the immature stages of *M. julianus.* When compared to an earlier report of the bionomics of this bruchid species attacking the seeds of *Acacia berlandieri,* it was found that the habits differ in that a single larva of *M. julianus* is known to destroy only a single seed; the larvae produce little, if any, glue-like substance; and a smaller adult size is reached when they develop in the seeds of *A. greggii.*

Descriptors: Coleoptera; Bruchidae; Bionomics.