

## The Use of Host Preferences as Taxonomic Characters of Bruchid Beetles (Coleoptera: Bruchidae) Feeding in the Seeds of *Cassia* (Leguminosae)

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**ABSTRACT:** Host preferences of bruchids that feed in *Cassia* seeds are useful as taxonomic characters primarily at the species group level. Many species of *Cassia* bruchids feed in the seeds of only one host but usually the host supports more than one species of bruchid. Thus, few *Cassia* bruchids have unique host characters. More often, the species groups of *Sennius* feed in a subgenus, section or series of *Cassia* in common. Species groups 1, 5, and 6 of *Sennius* especially show host specificity to a category of *Cassia*. A valuable character for *Pygiopachymerus lineola* is that it exhibits remarkable specificity to the subgenus *Cassia*. Species groups 2 and 3 of *Sennius* are not classified as well as the other groups using host preferences because several species in these groups have 5 to 10 hosts, have a wide distribution, and thus are less specific in their choice of hosts.

Most bruchid beetles feed in the seeds of the Leguminosae and recent studies have shown that congeneric species of bruchids feed in seeds of plants which are in the same taxonomic group. Johnson and Kingsolver (1976) showed that species of the genus *Stator* attacked seeds of species of plants in the subfamily Mimosoideae (Leguminosae) much more often than they did those of other plants. Kingsolver and Johnson (1978) also showed that species of the genus *Mimosestes* preferred seeds in the same subfamily. Johnson (1970, 1977a, 1977c) published data that showed that species of the genus *Acanthoscelides* preferred seeds of species in the subfamily Papilionoideae and that some species of *Acanthoscelides* are restricted to individual genera and species. However, Johnson and Kingsolver (1971) and Forister and Johnson (1971) showed that some *Acanthoscelides* feed only in non-leguminous seeds (e.g., Rhamnaceae, Sterculiaceae).

The above indicates that host preference data are often useful in evaluating relationships. Unfortunately, as with other characters, characters such as food preference sometimes are so variable that they are not of great value. Interesting evolutionary problems are suggested by the studies of

Table 1. Species groups of the seed beetle genus *Sennius* whose hosts are known.

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Group 1.	<i>guttifer</i> , <i>russeolus</i> , <i>inanis</i> , <i>breveapicalis</i> , <i>colima</i> , <i>panama</i>
Group 2.	<i>abbreviatus</i> , <i>instabilis</i> ,* <i>lawrencei</i> , <i>medialis</i> , <i>durangensis</i> , <i>celatus</i> ,* <i>leucostauros</i> , <i>trinotaticollis</i>
Group 3.	<i>fallax</i> ,* <i>auricomus</i> , <i>biflorae</i> , <i>discolor</i>
Group 4.	<i>incultellus</i>
Group 5.	<i>cruentatus</i> , <i>simulans</i> , <i>obesulus</i> , <i>morosus</i> ,* <i>ensiculus</i>
Group 6.	<i>militaris</i>

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\* Generalists with 5 to 10 hosts.

level is valid only for a few species. Many species of bruchids are restricted to one host but usually that host supports other species of bruchids as well. Only *S. abbreviatus* (in *C. marilandica*), *S. ensiculus* (in *C. patellaria*), and *S. obesulus* (in *C. wrightii*) are in a one bruchid-one host category (Table 2). Two species feed only in seeds of closely related cassias: *Sennius breveapicalis* feeds in seeds of three species of the subgenus *Senna*, Section *Chamaefistula*, series *Bacillares*; while *S. discolor* feeds in seeds of two species of *Senna*, Section *Earleocassia*. Thus, their preference for closely related plants facilitates classification at the species level. On the other hand, *Acanthoscelides obrienorum*, is the only North American member of its genus that is known to feed in cassias and it feeds only in them. Its habits are more diverse than the *Sennius*, discussed earlier in this paragraph, but it is confined to the subgenus *Senna* and to its sections, *Prosoesperma* and *Chamaesenna*. *Pygiopachymerus lineola* and *P. theresae*, the only 2 species in this genus, have only been reliably reported from seeds of several species in the subgenus *Cassia* (Table 2).

The use of host preferences for determining relationships of *Cassia* bruchids is of greater value at the species group level, although there is some variability as with the use of all characters. All of Species group 1 feeds in the subgenus *Senna*, most in Section *Chamaefistula*, and these are about equally divided between series *Bacillares* and *Corymbosae*. Species group 5 (Tables 1, 2) is very specific to the subgenus *Lasiorhagma* and illustrates best the principle of the use of host specificity in determining relationships of species groups. The exceptional *S. morosus* is discussed below. Species groups 2 and 3 are not as clear cut in their host specificity as the previous groups. This is due in part to the large number of species and thus hosts and to 3 generalist species with 5 to 10 hosts in the 2 groups. Group 2 feeds only in seeds of *Senna* but bruchid species within the group are about equally divided in their preferences for Sections *Chamaefistula*, *Oncolobium*, and *Chamaesenna*, with a slight preference for *Oncolobium*. Group 3 feeds mostly in seeds of *Senna* and shows a very distinct preference for

Table 2.—Classifications of *Cassia* and *Sennius* between the generic and specific levels and other bruchids attacking *Cassia* seeds at the specific level. The species groups of species of *Sennius* are in parentheses after each name.

A. Subgenus <i>Senna</i> according to Bentham		
Sect. <i>Thamaefistula</i>		bruchids
Sec. <i>Bacillares</i>		
<i>C. bacillaris</i>		<i>Sennius breveapicalis</i> (1)
<i>C. standieri</i>		<i>S. colima</i> (1), <i>S. fallax</i> (3), <i>Amblycerus</i> #3
<i>C. densiflora</i>		<i>S. breveapicalis</i> (1)
<i>C. oxyphylla</i>		<i>S. trinotaticollis</i> (2)
<i>C. undulata</i>		<i>S. breveapicalis</i> (1), <i>S. panama</i> (1)
Sec. <i>Corymbosae</i>		
<i>C. leucostauris</i>		<i>Sennius celatus</i> (2), <i>S. fallax</i> (3), <i>S. guttifer</i> (1), <i>S. inanis</i> (1), <i>S. leucostaurus</i> (2), <i>S. russeolus</i> (1)
<i>C. laevigata</i> (= <i>C. floribunda</i> )		<i>S. celatus</i> (2)
<i>C. tomentosa</i>		<i>S. medialis</i> (2)
Sect. <i>Leptocassia</i>		
<i>C. lemninioides</i>		<i>Sennius morosus</i> (5)
<i>C. ovesii</i>		<i>S. durangensis</i> (2), <i>S. morosus</i> (5)
<i>C. bodheimeriana</i>		<i>S. discolor</i> (3)
<i>C. guemeriana</i>		<i>S. discolor</i> (3), <i>S. morosus</i> (5)
Sect. <i>Onobium</i>		
<i>C. leptocarpa</i>		<i>Sennius auricomus</i> (3), <i>S. celatus</i> (2), <i>S. instabilis</i> (2), <i>S. medialis</i> (2), <i>S. morosus</i> (5), <i>Zabrotes pondae</i>
<i>C. barilandica</i>		<i>S. abbreviatus</i> (2)
<i>C. occidentalis</i>		<i>S. celatus</i> (2), <i>S. fallax</i> (3), <i>S. instabilis</i> (2), <i>S. medialis</i> (2), <i>S. morosus</i> (5), <i>Amblycerus morelensis</i>
Sect. <i>Prososperma</i>		
Sec. <i>Prososperma</i>		
<i>C. obtusifolia</i>		<i>Sennius fallax</i> (3), <i>S. instabilis</i> (2), <i>S. morosus</i> (5)
<i>C. lora</i>		<i>S. celatus</i> (2), <i>S. fallax</i> (3), <i>S. instabilis</i> (2)
Sec. <i>Infertae</i>		
<i>C. villosa</i>		<i>Acanthoscelides obrienorum</i>
Sect. <i>Thamaesenna</i>		
Sec. <i>Thamaesenna</i>		
<i>C. schycarpae</i>		<i>Acanthoscelides obrienorum</i>
<i>C. binneri</i>		<i>Sennius fallax</i> (3)
<i>C. bipensis</i>		
Sec. <i>Bostratae</i>		
<i>C. biflora</i>		<i>Sennius auricomus</i> (3), <i>S. biflorae</i> (3), <i>S. celatus</i> (2), <i>S. fallax</i> (3), <i>S. instabilis</i> (2), <i>Acanthoscelides obrienorum</i> , <i>Amblycerus morelensis</i>
<i>C. rhiphoidea</i>		<i>S. auricomus</i> (3)
Sec. <i>Floridae</i>		

Table 2. Continued.

<i>C. emarginata</i>	<i>S. militaris</i> (6), <i>Amblycerus</i> #1
<i>C. maxonii</i>	<i>S. trinotaticollis</i> (2)
<i>C. polyantha</i>	<i>S. fallax</i> (3), <i>Acanthoscelides obrienorum</i>
<i>C. wislizenii</i>	<i>Acanthoscelides obrienorum</i>
ser. <i>Pictae</i>	
<i>C. alata</i>	<i>Sennius instabilis</i> (2)
<i>C. reticulata</i>	<i>S. celatus</i> (2), <i>S. fallax</i> (3), <i>S. lawrencei</i> (2)
<i>C. nicaraguensis</i>	<i>S. guttifer</i> (1)
B. Subgenus <i>Cassia</i>	
<i>C. grandis</i>	<i>Megasennius muricatus</i> , <i>Zabrotes interstitialis</i> , <i>Pygiopachymerus lineola</i> , <i>P. theresae</i>
<i>C. hintoni</i>	<i>Sennius fallax</i> (3), <i>Amblycerus</i> #2
<i>C. fistula</i>	<i>Pygiopachymerus lineola</i> , <i>P. theresae</i>
<i>C. javanica</i>	<i>P. lineola</i>
<i>C. moschata</i>	<i>P. lineola</i>
<i>C. ferruginea</i>	<i>P. lineola</i>
<i>C. carnaval</i>	<i>P. lineola</i>
<i>C. nodosa</i>	<i>P. lineola</i>
C. Subgenus <i>Lasiorhagma</i>	
<i>C. fasciculata</i>	<i>Sennius cruentatus</i> (5)
<i>C. leptadenia</i>	<i>S. simulans</i> (5), <i>Zabrotes planifrons</i>
<i>C. nictitans</i>	<i>S. cruentatus</i> (5)
<i>C. patellaria</i>	<i>S. ensiculus</i> (5)
<i>C. wrightii</i>	<i>S. obesulus</i> (5)

Section *Chamaesenna*. Species group 6 has only one species with one host so we can only say that it has done what most of the other groups have done—exploit the subgenus *Senna*.

Several other species of bruchids in different genera (*Zabrotes*, *Amblycerus*, *Megasennius*) feed in *Cassia* seeds but there are so few host records and the habits of especially *Zabrotes* and *Amblycerus* are so variable that no conclusions can be drawn at this time.

*Acanthoscelides obrienorum*, *Pygiopachymerus lineola*, *Sennius fallax*, *S. instabilis*, *S. morosus*, and *S. celatus* feed in the seeds of from 5 to 10 species of *Cassia*. The other species treated in this paper feed in from 1 to 3 species of *Cassia*. The reasons for the differences in numbers of host species are discussed in Johnson and Slobodchikoff (1979). It is enough to mention here that the 6 "generalist" species are very difficult to classify by host preferences because their ecology, physiology, and behavior have be-

come modified due to their wide range of hosts but their morphology has remained rather static.

*Pygiopachymerus lineola* and *P. theresae* Pic are the only two species in this genus and all of their host records (Table 2) are in species in the subgenus *Cassia*. *C. bicapsularis* in the subgenus *Senna* has also been reported as a host for *P. lineola* but this record is probably the result of a misidentification of the plant (see Janzen, 1971). Also, *P. theresae* has only been reported from the same hosts as *P. lineola*. This bruchid genus then is very specialized to feed in seeds of the subgenus *Cassia*.

To summarize, most obvious trends in the data in Table 2 are that most of the species of bruchids feed in seeds of the large subgenus *Senna*. In *Senna*, bruchid species in *Sennius* groups 2 and 3 feed in the seeds of all of the sections and series of hosts (Table 2), although some are unique to a section or series (e.g., *S. leucostauros*, *S. durangensis*, *S. lawrencei*, *S. discolor*, *S. biflorae*). Bruchid species in groups 1 and 6 are more specific in their host preferences. All 6 species in *Sennius* species group 1 feed in the seeds of *Cassia* species in section *Chamaefistula* although one species (*S. guttifer*) also feeds in seeds of a host species in section *Chamaesenna*. *Sennius militaris* in group 6 has only one known host and that is in Section *Chamaesenna*.

The 5 generalist species, *Sennius celatus*, *S. fallax*, *S. instabilis*, *S. morosus*, and *Acanthoscelides obrienorum*, show less host specificity at the subgeneric level of the plants but some are conspicuously absent from certain plant groups. The only generalist species that attacks species in the section *Earleocassia* is *Sennius morosus*: 3 of its 6 hosts are in this section. Other host preferences are evident among the generalist species except for *S. fallax* which has been found in almost all the subgeneric groupings of *Cassia*.

Of the 5 species which develop in seeds of the subgenus *Cassia*, only one is a *Sennius*, the generalist *S. fallax*, which develops in the seeds of *C. hintoni*. This *Cassia* is the only species in the subgenus to host either a *Sennius* or an *Amblycerus*. Perhaps the placement of *C. hintoni* in the subgenus *Cassia* should be re-examined. Three of the 5 bruchid species are distantly related and are unique to this subgenus. The subgenus *Lasiiorhagma* is attacked only by species in Johnson and Kingsolver's group 5 of *Sennius* and occasionally by *Zabrotes planifrons*.

The classifications of the species of *Cassia* and the species of bruchids that feed in them show that, in general, related groups of bruchids feed in seeds of related groups of plants. Presumably biochemical and morphological similarities of plants are the result of a long period of coevolution with the bruchids whose behavioral and digestive abilities have been modified to feed on these plants. Even the more general feeders show some specificity

although *S. fallax* has the ability to feed in seeds of almost all groups of *Cassia*.

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