Bruchid or seed beetles

(Family: Chysomelidae, Subfamily: Bruchinae – formerly Family: Bruchidae)

Acanthoscelides obtectus	Bean weevil
Acanthoscelides zeteki	
Bruchus spp.	Pea weevils
Bruchidius spp.	
Callosobruchus analis	
Callosobruchus chinensis	Southern cowpea weevil
Callosobruchus maculatus	Cowpea weevil
Callosobruchus phaseoli	
Callosobruchus rhodesianus	
Callosobruchus subinnotatus	
Callosobruchus theobromae	
Caryedon serratus	Groundnut bruchid
Zabrotes subfasciatus	Mexican bean weevil

Summary

Feeding strategy	primary pest
Commodities attacked	pulses
Distribution	worldwide, especially tropics
Economic importance	high
Eggs	laid or stuck individually onto seed or pod
Larvae	scarabaeiform, immobile, concealed within seed
Adults	can be long lived, do not feed on commodity, fly readily

Introduction

Bruchid beetles attack ripe and ripening seeds. They are especially associated with the seeds of legumes. Species associated with stored products are almost exclusively pests of dried and ripening seeds of legumes and are by far the most important storage pests of these commodities. Bruchids do not attack cereal grain or cereal-based products.

Identification

Bruchids are distinctive globular beetles with long legs and long antennae (Figures 36–55). Species that attack stored products are 3–7 mm in length. The elytra are patterned with light and dark patches, and are short so they do not fully cover the abdomen. The underside of the abdomen is covered in fine hairs. Adults are very active and will readily fly and run rapidly. However, when disturbed they may feign death and remain motionless for minutes.

The general form and appearance of these insects together with their association with pulses make it unlikely that bruchids will be confused with other beetles associated with stored products.

The most reliable feature to identify storage bruchids to genus, and in some cases to species, is by examination of the arrangement of spines and teeth-like structures on the hind leg. The general appearance of specimens is somewhat unreliable as colour patterns are variable and specimens quickly become worn. Specimens of *Bruchus* and especially *Caryedon* are somewhat larger than other species but the remainder are similar in size. Once identified to genus the structure of the male genitalia can be reliably used to identify specimens to species. Adults of most storage species can be identified by the keys of Haines (1989, 1991) and Kingsolver (1987).
Larvae are scarabaeiform and have greatly reduced legs (Figure 51).

Morphological characters to separate genera of storage bruchids

Acanthoscelides (Figures 36–38)

- Inner ridge of ventral margin of hind femur with 3 or 4 'teeth' (Figure 37)

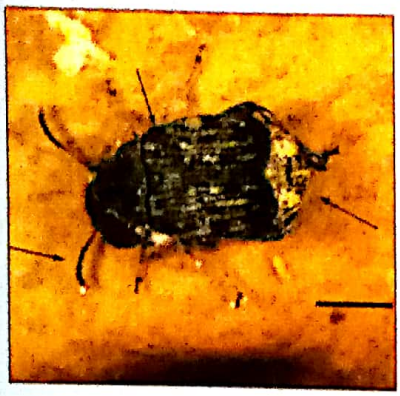

Figure 36 *Acanthocselides obtectus*, adult, live, showing long antennae, patterned elytra and exposed final segments of abdomen

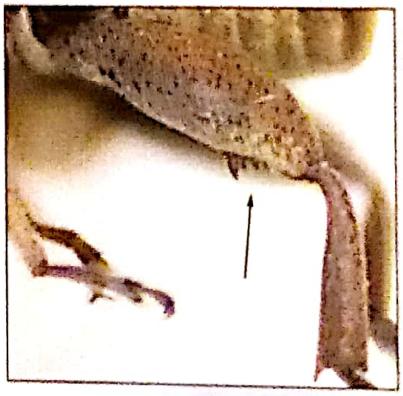

Figure 37 *Acanthoscelides obtectus*, adult, hind leg, spines on ventral margin of hind femur

Figure 38 *Acanthoscelides obtectus*, infestation in kidney beans with emergence holes

Bruchidius (Figures 39–40)

- Inner ridge of ventral margin of hind femur with spine or no spine (Figure 40)

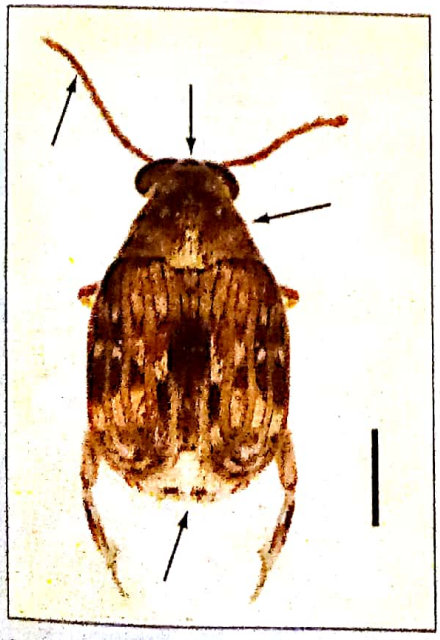

Figure 39 *Bruchidius*, adult, showing antennae, head capsule narrow relative to width of pronotum, short patterned elytra and exposed final segments of abdomen

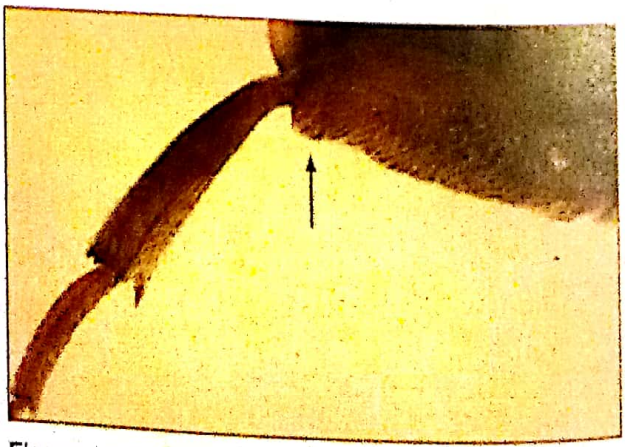

Figure 40 *Bruchidius* spp., adult, hind leg, spine on ventral side of hind femur

Bruchus (Figures 41–43)

- Inner ridge of ventral margin of hind femur with spine (Figure 42). Side of pronotum with spine (Figure 43)

Figure 41 *Bruchus pisorum*, adult, live

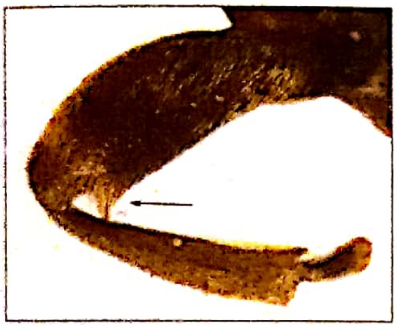

Figure 42 *Bruchus pisorum*, adult, spine on ventral side of hind femur of hind leg

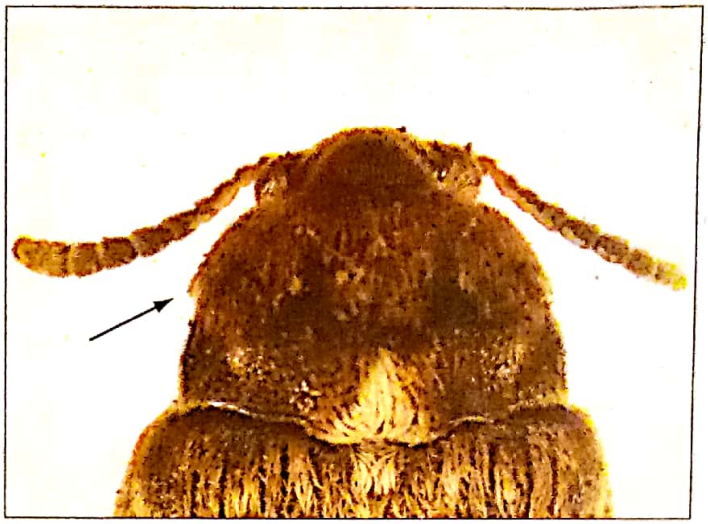

Figure 43 *Bruchus pisorum*, adult, showing blunt spine on margin of thorax

Callosobruchus (Figures 44–51)

- Inner and outer ridge of ventral margin of hind femur each with spine (Figure 46, 49)

Figure 44 *Callosobruchus* infestation on dried peas, showing attached eggs and adult emergence holes

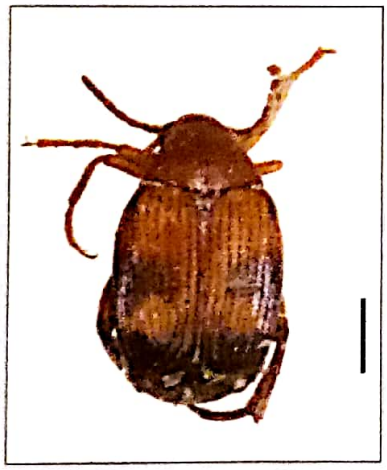

Figure 45 *Callosobruchus analis*, adult

Figure 46 *Callosobruchus analis*, adult, hind leg, spines on ventral side of hind femur

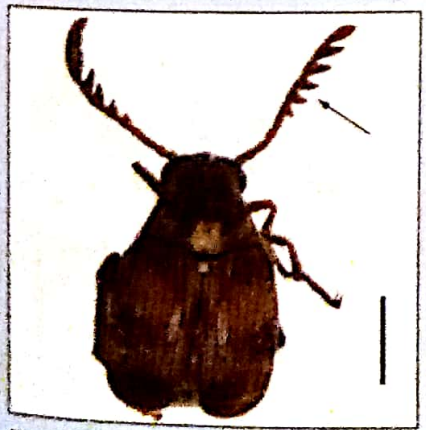

Figure 47 *Callosobruchus chinensis*, adult, male with distinctive antennae

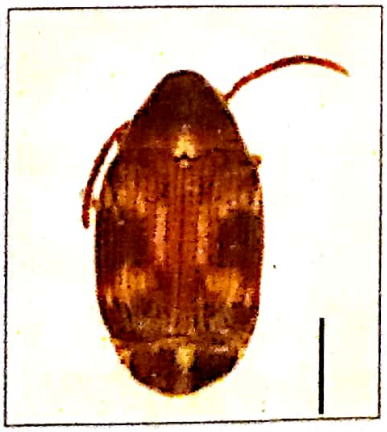

Figure 48 *Callosobruchus maculatus*, adult

Figure 49 *Callosobruchus maculatus*, adult, hind leg, spines on ventral side of hind femur

Identification of *Acanthoscelides* species collected in rural environments in tropical America needs to be undertaken with care. More than 250 species are known and a few other than *A. obtectus* have occasionally been associated with stored products, e.g. *A. zeteki*. Outside this area it is unlikely that species other than *A. obtectus* infest stored beans.

Life cycle

Eggs are laid individually on the seed coat or pod. Eggs of *Acanthoscelides* spp. are laid loose but those of the other genera are glued firmly to the seed or pod. Newly hatched larvae burrow directly into the seed. As they do so, the case of an attached egg becomes white (and obvious to see, especially in dark seeds) as the egg shell is filled with frass from the excavations. Larvae complete development within an individual seed in which they excavate a large cavity. Before pupation, larvae eat a round hole to the surface of the seed but leave the seed coat intact. This is visible on the seed surface as a circular translucent 'window'. Pupation takes place within the cavity in the seed; the adult emerges by biting and pushing its way through the 'window', leaving a neat circular hole in the seed (Figures 38, 44). Adults do not feed on the dried seed but may consume nectar and pollen from flowers. Adult lifespan is very variable. It may be less than 10 days for populations confined to stored pulses stored under tropical conditions but may be greater than 100 days when adults hibernate and/or have access to flowers and nectar. Populations of *Bruchus* and *Bruchidius* spp. survive as adult beetles between crops by hiding under bark or in crop debris.

Physical limits and optimum rate of multiplication

Species	Conditions within which breeding takes place	Shortest development period, with optimum conditions	Maximum monthly rate of increase
Acanthoscelides obtectus	15–33°C	27 days at 30°C, 80% r.h.	25
Bruchus pisorum	c. 60 days		
Callosobruchus analis	18.5–37°C	27 days at 32.5°C, 90% r.h	
Callosobruchus chinensis	17.5–37°C	22 days at 32°C, 90% r.h	
Callosobruchus maculatus	18–37°C, 20–90% r.h.	21 days at 32°C, 90% r.h.	50
Callosobruchus phaseoli	13–35°C		
Callosobruchus rhodesianus	17–35°C	25 days at 30°C, 70% r.h.	
Caryedon serratus	23–35°C	42 days at 30–33°C, 70–90% r.h.	
Zabrotes subfasciatus	20–38°C	24–27 days at 32°C, 70% r.h.	

The number of generations of *Bruchus* and *Bruchidius* that occur in a year is linked to the cropping cycle and the availability of ripening seeds. Often this amounts to only one generation a year. Development of populations of bruchids capable of infesting pulses in storage is rapid and continuous, especially under tropical conditions. Compared to most other storage pests, population development of *C. chinensis* and *C. maculatus* is especially rapid. *A. obtectus* and *C. phaseoli* can both breed at relatively low temperatures that allows them to become significant pests in more temperate regions.

Economic importance

In terms of the damage they cause, *A. obtectus*, *Callosobruchus* spp. and *Z. subfasciatus* rank among the most important insect pests of stored products. These pests cause considerable economic damage especially under conditions of tropical subsistence agriculture. A combination

of factors make this so. These include climatic conditions for optimal population growth, use of small storage structures (e.g. bags and baskets) that allow easy access by the beetle to the stored commodity, close proximity of production and storage places – making pre-harvest infestation likely, and the limited availability and use of chemical control measures. Even in commercial storage, infestations can be severe, especially in warm to hot climates and when commodities are stored in bags. Damage to bulk-stored pulses is likely to be less severe and be limited to surface layers as bruchids cannot easily penetrate deep into bulks, especially of small-seeded commodities.

Bruchid species are quite specific as to which pulse they attack. Species that attack beans (*Phaseolus* spp.) generally do not attack pulses of the genus *Vigna* and *vice versa*. This is an important aid to the identification of the genus involved (see below).

Host range of bruchid pests of stored pulses

Species	Pulse type (genus and common name)										
	Peanut, groundnut	Chickpea	Pigeon pea	Soybean	Lentils	Dolichos beans	Garden pea	Beans	Broad bean	Mung beans, grams, cowpeas	Bambarra groundnuts
	Arachis	*Cicer*	*Cajanus*	*Glycine*	*Lens*	*Lablab*	*Pisum*	*Phaseolus*	*Vicia*	*Vigna*	*Voandzeia*
Acanthoscelides obtectus								X	X		X
Acanthoscelides zeteki			X								
Bruchus spp.					X		X		X		
Bruchidius spp.					X				X	X	
Callosobruchus analis				X						X	
Callosobruchus chinensis		X			X	X?	X			X	
Callosobruchus maculatus		X	X	X	X	X?	X			X	
Callosobruchus phaseoli					X	X	X			X	
Callosobruchus rhodesianus							X			X	
Callosobruchus subinnotatus											X
Callosobruchus theobromae	X		X	X							
Caryedon serratus ▼	X										
Zabrotes subfasciatus								X		X#	

? Status unclear
Some strains capable of attacking this commodity.
▼In addition to attacking groundnuts, *C. serratus* is also a pest of Tamarind – *Tamarindus indica* L. (Caesalpinioidiae)

Type of damage and symptoms

Damage is distinctive (Figures 38, 45). As adults emerge from seeds they leave behind neat circular holes in the seed, behind which is a large cavity left by the larvae. Loss of seed material is considerable – each adult *Callosobruchus* emerging from a cowpea (*Vigna unguiculata*) would have consumed about 25% of the seed from which it emerged. Damaged seed often does not germinate or germinate well. Heavy infestations of bruchids can cause heating of commodity which results in quality loss and mould growth.