

Weevils

(Family: Curculionidae)

<i>Caulophilus oryzae</i>	Broad-nosed weevil
<i>Sitona</i> spp.	Sitona weevils
<i>Sitophilus granarius</i>	Granary weevil
<i>Sitophilus linearis</i>	Tamarind weevil
<i>Sitophilus oryzae</i>	Rice weevil
<i>Sitophilus zeamais</i>	Maize weevil

Summary

Feeding strategy	primary pest
Commodities attacked (major pest species)	whole cereal grains, solid cereal products, some pulses
Distribution	worldwide
Economic importance	grain feeding <i>Sitophilus</i> spp. – high
Eggs	inserted individually into grain
Larvae	apodous (legless), immobile, live concealed within grain
Adults	long lived, feed on commodity, can fly – except <i>S. granarius</i> which is flightless

Introduction

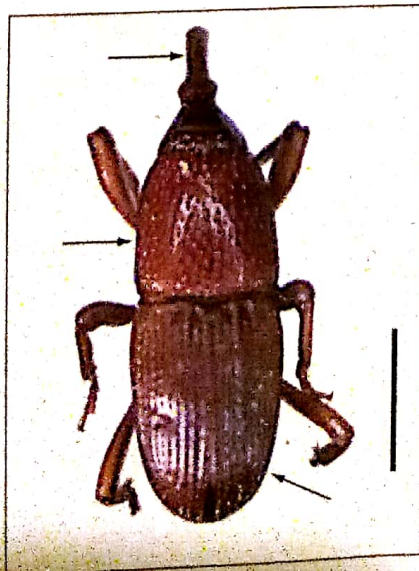
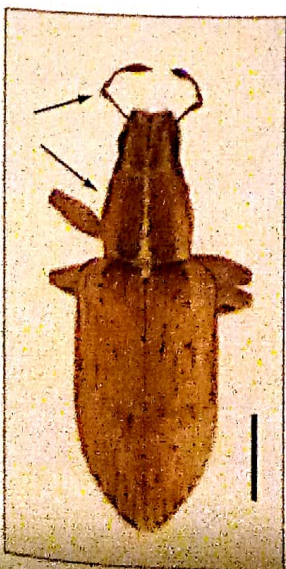
The Curculionidae or true weevils is the largest family of beetles known. They are found in a wide range of habitats and many species are important pests of agriculture, horticulture and forestry. They attack the stems, roots and seeds of plants and some are wood borers. The head of many adult weevils has a characteristic snout. Members of the genus *Sitophilus* are among the most important pests of stored grain. Other genera are minor pests or are accidental on grain.

Identification

The distinctive appearance of these insects (Figures 56–67) makes it unlikely that they will be confused with other common beetle pests of stored products. *Sitophilus* spp. are brown to black insects, 2.5–4 mm long (Figure 57–67). The size of adult varies somewhat with seed size from which it emerged. Grain feeding species can be identified to species as below. Externally *S. zeamais* and *S. oryzae* are identical; however, they may be reliably separated by examination of genitalia which is easiest to perform with male specimens. Adults are easy to sex by external characteristics.

S. linearis (Figure 60) is usually identifiable by its close association with tamarind (*Tamarindus indica*) pods. Other genera of weevils are sometimes found on stored grain. Sitona weevils (*Sitona* spp.) are pests of clover often grown under wheat crops and can be a contaminant of harvested grain in many temperate regions (Figure 56). At 6 mm long, they are larger than *Sitophilus* spp. and lack a long snout. *Caulophilus oryzae* is similar in appearance to *Sitophilus*, but has a shorter fatter snout and lacks the spots on the elytra.

Larvae of weevils are legless (apodous) (Figure 65).



Far left: Figure 56 *Sitona* spp., adult, showing elbowed antennae, lack of snout, markings on prothorax

Left: Figure 57 *Sitophilus granarius*, adult, showing long snout, oval pits on thorax, heavily ridged elytra without coloured spots



Figure 60 *Sitophilus linearis*, adult



Figure 61 *Sitophilus oryzae*, adult, showing round pits on thorax, coloured patches on elytra

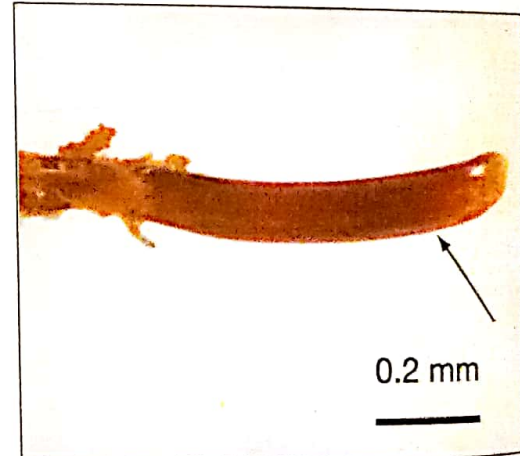


Figure 62 *Sitophilus oryzae*, adult, aedeagus, convex outer surface

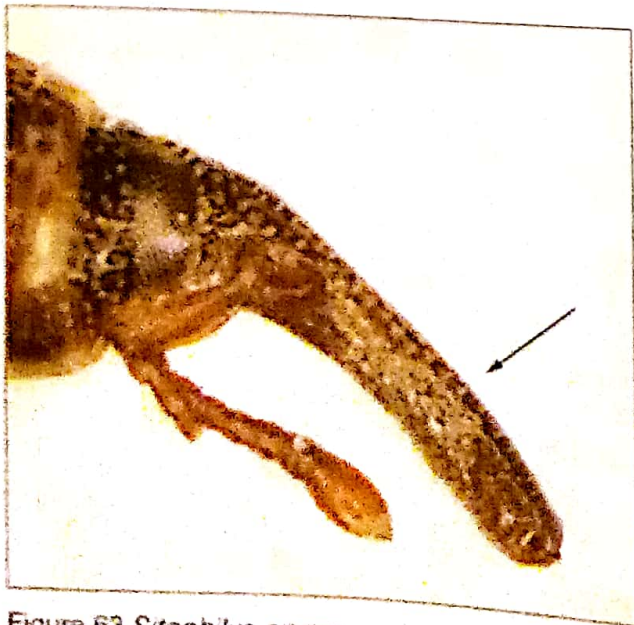


Figure 63 *Sitophilus oryzae*, male, showing snout short relative to width with heavy irregular pitting



Figure 64 *Sitophilus oryzae*, female, showing snout long relative to width with light regular pitting

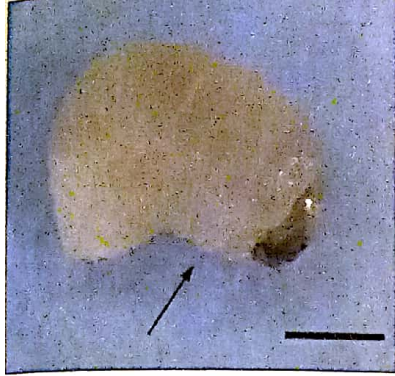


Figure 65 *Sitophilus oryzae*, larva, without legs



Figure 66 *Sitophilus oryzae*, X-ray of internal infestation of wheat

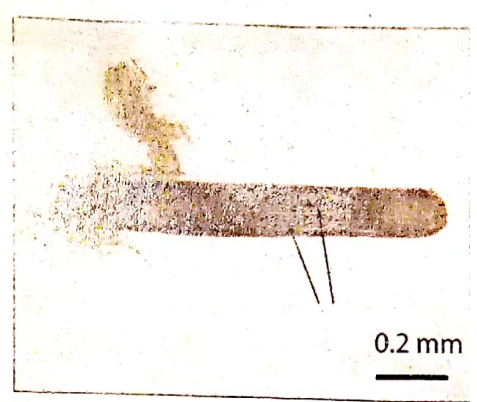


Figure 67 *Sitophilus zeamais*, adult, aedeagus, outer surface with three longitudinal ridges

Key to grain-feeding *Sitophilus* species

- 1 Colour – uniform dark brown, elytra not marked with spots, flight wings (under elytra) absent, pronotum marked with oval shaped punctures (Figure 57–59) *Sitophilus granarius*
 Colour dark to black in mature specimens, each elytra marked with two dull orange or yellow spots. Flight wings (under elytra) present, pronotum marked with circular-shaped punctures (Figure 61) 2
- 2 (By dissection) outer surface of aedeagus (functions as penis) of male smooth and convex in cross-section (Figure 62) *Sitophilus oryzae*
 (By dissection) outer surface of aedeagus of male with two grooves in cross-section (Figure 67) *Sitophilus zeamais*

To sex adult *Sitophilus*

Rostrum (snout) is relatively short and wide, punctures along rostrum irregular and large, often touching each other to give 'rough' appearance (Figure 63) male

Rostrum (snout) is relatively long and narrow, punctures along rostrum in regular rows and small and not touching each other to give 'smooth' appearance (Figure 64) ... female

Life cycle

Eggs are laid singly into grains. The female selects a spot on the grain surface then chews a small hole, into which she lays an egg. The hole is then plugged with a waxy secretion. *Sitophilus* females lay up to 150 eggs over their lifespan. Larvae develop hidden within a cavity hollowed out within the grain. Larvae are cannibalistic and larger larvae may eat less developed individuals should they meet. Pupation takes place within the cavity made by the larva and upon emergence from the pupa the adult may spend several days within the cavity. Eventually it will chew its way out, leaving a ragged hole. Adult beetles continue to feed on grain and are long lived (lifespan of 3 to 6 months, longer in cooler months).

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
<i>Sitophilus granarius</i>	11–34°C, > 40% r.h.	25 days at 30°C, 70% r.h.	15
<i>Sitophilus oryzae</i>	15–34°C, > 40% r.h.	25 days at 30°C, 70% r.h.	25
<i>Sitophilus zeamais</i>	15–34°C, > 40% r.h.	25 days at 30°C, 70% r.h.	25

S. oryzae and *S. zeamais* breed most rapidly under humid tropical conditions. *S. granarius* is cold-hardy, and the low minimum temperature at which this species breeds allows it to be an important pest in temperate regions.

Economic importance

Caulophilus oryzae is a minor pest of maize most frequently encountered under conditions of tropical subsistence agriculture, where infestation can begin prior to harvest.

Sitophilus spp. are major pests of whole cereal grains and dried root crops such as cassava. Along with *Rhyzopertha dominica* and *Prostephanus truncatus* (Col. Bostrichidae), they rank as the most important pests of whole grain. *Sitophilus oryzae* is a well known pest of dried pasta. Certain strains of *S. oryzae* can attack stored pulses, including chickpeas (*Cicer arietinum*), cowpeas (*Vigna unguiculata*) and peas (*Pisum sativum*).

If left unchecked, infestations of *Sitophilus* spp. can cause devastating damage to stored grain. Currently, in well-run bulk grain storage systems, *Sitophilus* infestations are generally kept under control, but the potential threat remains. They remain a serious pest of farm-stored grain and of bag-stored grain in warehouses, especially under tropical conditions.

S. linearis can cause severe damage to tamarind pods when stored under tropical conditions.

Type of damage and symptoms

Damage is distinctive (Figure 66). Feeding by larvae leaves large cavities inside grains and newly emerging adults leave behind large ragged emergence holes. Adults cause further damage by feeding, mainly by attacking previously damaged grain. *Sitophilus* infestations produce a lot of heat and moisture – this encourages extensive quality loss, mould growth and growth of populations of other insect species.