# Part III. Insects and Arthropods

Insects and related arthropod pests occupy every conceivable niche on the peanut plant. Insects feed in terminal buds and flowers; on leaves, roots, and pods; behind leaf axils and petioles; on plant fluids by inserting their mouthparts into cells or directly into the nutrient transport system; in tunnels that they form in the leaves, main stem, lateral branches or roots; and on or in peanut pods and seed. They damage the plant directly by removing photosynthate that would otherwise be used for vegetative or reproductive plant growth; damaging cells in photosynthetically active tissue; removing foliage that produces photosynthate; feeding on developing pegs, pods, and seed; damaging the root-hypocotyl region by the removal of periderm, cortex, and phloem tissue; and increasing the rate of water loss from an injured, stressed plant. To add to this biological complexity, arthropod pests generally do not occur in single-species groups but in groups of several species.

Equally important as the direct damage to plants by insects is the indirect damage that may result from the injury they cause. Insects are vectors of plant pathogens such as the groundnut rosette, bud necrosis, and tomato spotted wilt viruses. In addition, injured plant tissue is vulnerable to secondary infection by pathogens such as *Aspergillus flavus* and *Sclerotium rolfsii*. Economic losses attributable to plant pathogens transmitted by insects often exceed losses caused by the insects themselves. For example, the peanut rosette virus, transmitted by *Aphis craccivora* Koch, was credited with decimating peanut production in West Africa in 1975. Likewise, the plant viruses that cause bud necrosis and tomato spotted wilt are transmitted by thrips and cause significant crop losses in Asia and the United States, respectively.

The feeding by multiple species of insect pests can best be understood by grouping the insects into feeding guilds based on the plant's physiological response to the injury they cause. There are six categories of plant injury or crop damage caused by insect feeding: stand reduction, leaf-mass removal, assimilate removal, water balance disruption, pod destruction, and architectural modification.

For the purpose of this discussion, insects and other arthropods that cause damage to peanut are divided into the following guilds: foliage feeders, intracellular feeders, root and pod feeders, and stored-product feeders. A general description of the injury caused by arthropod pests and its physiological effect on the plant is presented with a brief description of selected species in each guild.

## Foliage Feeders

The foliar feeding guild of insects that injure peanut is composed primarily of immature lepidopterans. Plant injury by these larvae is diverse. Examples include the groundnut leafminer, *Aproaerema modicella*, which initially feeds between the epidermal layers of the leaf and forms mines while feeding on the mesophyll tissue; the rednecked peanutworm, *Stegasta bosqueella* (Chambers), which feeds almost exclusively within a developing terminal; and the corn earworm, *Helicoverpa zea*, which consumes terminals, young foliage, flowers, and immature pegs. The major mechanism of yield reduction in legumes such as peanut, caused by feeding of foliar insects, is the removal of photosynthetically active tissue, which thereby reduces the production of photosynthate. Many lepidopterous defoliators of peanut prefer to feed on young leaves and terminals found in the upper plant canopy. The upper canopy is more active in light interception and production of photosynthate than shaded leaves of the mid- and lower canopy.

### Armyworms

Several species of armyworms are major defoliators of peanut, including the fall armyworm, *Spodoptera frugiperda* (J. E. Smith) (Plate 150), and the beet armyworm, *S. exigua* (Hübner) (Plates 151 and 152), in the United States; the tobacco armyworm, *S. litura* (Fabricius) (Plate 153), in Asia; and the African armyworm, *S. littoralis* (Boisduval), in Africa and western Asia. Armyworm moths lay masses of 20–1,000 eggs on the leaves and stems of peanut (Plate 154). The egg masses often are covered with body scales and silk webbing, giving them a green to golden bronze color. Newly emerged larvae feed cryptically on the undersides of leaflets, in terminals, or between the leaf petioles and stems while older larvae feed openly on the plant on terminals and younger leaves. Older *S. litura* larvae feed primarily at night and hide under debris or soil clods at the base of the plant during the day. The fall armyworm prefers to feed on young leaf tissue and consumes about 100 $cm^2$ of foliage during larval development, 80% of which is consumed during the last two instars. Fall armyworm larvae require almost twice as much foliage to complete development when feeding on older foliage than on younger foliage. In India, defoliation of peanut by *Spodoptera* larvae has a greater effect on yield during the dry season (December–April) than during the rainy season (June–October). This difference in susceptibility to injury probably occurs because of the plant's inability to compensate for the effects of defoliation during the short, cooler, dry season.

Armyworm larvae feed on a wide variety of cultivated and wild host plants. Mature larvae may reach a length of 3–4 cm, have a characteristic inverted Y pattern on their head capsules, and vary from light green to brown or black with longitudinal stripes along their sides. These insects are called armyworms because young larvae feed together on a host and crawl en masse to adjacent fields after all the foliage in one area has been consumed.

### *Helicoverpa* (*Heliothis*) spp.

*Helicoverpa* larvae are plant pests in all temperate, tropical, and subtropical regions of the world. In the New World, the corn earworm, bollworm, or tomato fruitworm (all approved common names), *Helicoverpa zea* (Boddie) (Plate 155), and the tobacco budworm, *Heliothis virescens* (Fabricius), are the most important pest species. In Africa and Asia, the most important pest species is the old world bollworm or gram pod borer, *Heliothis armigera* (Hübner) (Plate 156). On peanut, the

eggs are laid singly, primarily on the undersides of leaves in the outer plant canopy. Larvae of all these species feed on flowers and pods of numerous hosts including cotton, okra, pigeonpea, peanut, soybean, and cowpea. Early instars feed in leaf terminals while older larvae feed openly on terminals and young foliage. *Helicoverpa* larvae reach a length of almost 4 cm and may be rose pink, yellow green, brown, or almost black on their dorsa, with alternating light and dark longitudinal stripes on their sides and a lighter color on their undersides. Spiny projections are also quite noticeable on the surfaces of *Helicoverpa* larvae. A single corn earworm larva consumes 175–200 $cm^2$ of peanut foliage during development, of which 75–97% is consumed by the last two instars. In India, *H. armigera* feeds primarily on flowers, and its greatest effect on peanut is to extend the fruiting period of the plants.

### Velvetbean Caterpillar

The velvetbean caterpillar, *Anticarsia gemmatalis* Hübner, is a tropical to subtropical New World pest. It does not overwinter in peanut-producing regions of the United States and survives the winter only in the most southern latitudes. The moths migrate northward each year. Damage by the velvetbean caterpillar (Plate 157) in the United States is most severe in northern Florida and southern Georgia, where high larval densities often occur on peanut late in the growing season. Eggs are usually laid singly on the undersurfaces of leaves. Larvae feed openly on the plant, initially consuming terminals and young foliage. With increased larval age, this preference declines, and larvae consume leaves of all ages. They are voracious feeders on peanut, soybean, kudzu, and velvetbean and may rapidly and completely defoliate plants. A larva consumes approximately 100 $cm^2$ of leaf tissue during its development.

Larvae of the velvetbean caterpillar reach a maximum length of 4.5–5 cm and are characterized by a yellow head capsule and a body color ranging from light green to black with yellow to white longitudinal stripes along the entire length of the body. The last pair of prolegs projects backward, and the legs are prominent when larvae are at rest. When larvae are disturbed, they often drop to the ground and thrash from side to side in rapid, twitching contortions characteristic of the insect.

### Groundnut Leafminer

The groundnut leafminer, *Aproaerema modicella* Deventer, is a primary pest of peanut in India and Southeast Asia. The hosts of this leafminer are primarily legumes, and peanut and soybean are among its most important crop hosts. Moths deposit eggs singly on the undersides of leaves or on petioles and stems. First-instar larvae tunnel into the leaflet and feed on the mesophyll between the upper and lower epidermis, forming blotch mines. Severe infestations may result in complete loss of photosynthetic tissue and defoliation as leaflets turn brown, shrivel, and desiccate. Third-stage larvae leave their mines, web two or more leaflets together, and continue to consume foliage as they complete their development (Plate 158). At maturity, larvae reach a length of 6–8 mm and pupate within webbed leaflets. Populations of leafminers increase during the rainy season and may become severe pests during the pod-filling stage. Problems caused by this pest may intensify when irrigation allows peanut production to extend beyond the rainy season into the dry season. Moths then move from fields with mature plants to fields with immature plants, which are particularly susceptible to damage by this species.

### Hairy Caterpillars

Arctiid larvae of the genus *Amsacta* are among the most important defoliators of peanut in India, although they produce only sporadic losses on peanut. The red-headed hairy caterpillar, *A. albistriga* Walk. (Plate 159), is most important in southern India, and *A. moorei* (Butler) is most important in northern India. These insects are named "hairy caterpillars" because of the numerous, long hairs on the bodies of older larvae. Hairy caterpillars have one generation per year. Moths are brownish white with a wing span of 40–50 mm (Plate 160). They emerge shortly after the first rains of the rainy season and lay clusters of 50–100 eggs in or around any available plant. As a peanut seedling emerges, young larvae move and feed en masse on the undersides of leaves. Older larvae disperse through the field and feed on terminals, leaves, and flowers. Larvae reach a length of 5 cm and may completely defoliate all peanut plants in a field before migrating and feeding in an adjacent field.

## Intracellular Feeders

Peanut hosts a number of intracellular feeders including aphids, leafhoppers, thrips, mites, and whiteflies. These insects generally have rasping or piercing-sucking mouthparts and directly damage plants by consuming photosynthate. Several of the intracellular feeders, especially thrips and aphids, are vectors of plant pathogens. Feeding by the potato leafhopper, *Empoasca fabae*, on leaves reduces photosynthesis and increases respiration. A reduction in photosynthesis occurs immediately after *E. fabae* feeds. The duration of photosynthesis reduction is related to the length of the feeding period, the stage of plant development, and the stage of leafhopper development. Injured plants partially recover photosynthetic activity, but the reduction is permanent, affects all stages of plant development, and is most pronounced in bloom and postbloom growth stages. In plants damaged by the twospotted spider mite, *Tetranychus urticae*, both photosynthesis and transpiration are reduced in severely damaged cells while moderate damage may increase transpiration and cause development of smaller, deformed leaves with a lower chlorophyll content. Increased leaf transpiration also increases water loss, resulting in plant stress and closure of leaf stomates.

### Leafhoppers

Several species of leafhoppers, especially members of the genus *Empoasca*, are pests of peanut. These include the potato leafhopper, *E. fabae* (Harris) (Plate 161), in North America; the groundnut jassid, *E. kerri* Pruthi (Plate 162), in India; and *E. facialis* Jacobi and *E. dolichi* Paoli in West Africa. Both adult and nymphal leafhoppers feed primarily on the undersides of peanut leaflets or leaves by inserting their mouthparts into the midribs and extracting plant fluids. Adult leafhoppers are 3–5 mm long, wedge shaped, and light green to yellow. Leafhopper feeding causes leaves and leaflets to turn yellow from the point of injury to the tip in a typical V shape (Plate 163), probably as a result of the injection of salivary toxin or toxins before feeding. The symptom, called "hopper burn," may become so severe that the injured area dies. In the United States, the potato leafhopper does not survive the winter in northern latitudes and overwinters only in mild climates along the gulf coast. Adults disperse northward during the growing season on wind currents associated with weather fronts, reaching as far north as Canada by early June. In the United States, injury to peanut by leafhoppers is generally most severe during June and July; in India, injury is most severe during August and September of the rainy season and February and March of the dry season.

### Thrips

In the United States, the tobacco thrips, *Frankliniella fusca* (Hinds) (Plate 164), is the most abundant species of thrips on peanut, while in Southeast Asia, *Scirtothrips dorsalis* Hood and *Thrips palmi* (Bagnall) are the most abundant species on this crop. Thrips are extremely small (1.5–2 mm), delicate insects that feed in peanut leaf buds and flowers. Eggs are depos-

ited in plant tissue and hatch in 5–7 days. Immature stages resemble the adults but lack the fringed wings. Immatures are pale yellow to white, while adults range from light yellow to gold to black. Thrips have rasping mouthparts and feed by scraping the upper surfaces of developing terminals and imbibing the exuded fluid. Thrips injury to terminals results in deformed leaves that are crinkled and slightly cupped upon emergence (Plate 165). Thrips damage to peanut foliage is most severe during the first 30 days after plant emergence. Once plants begin to bloom, most thrips are found in the peanut flowers.

Results from several studies indicate that thrips injury to peanut does not significantly decrease pod yield. However, two recent findings have altered opinion on the importance of thrips. Thrips injury and herbicide injury to seedlings interacted to significantly reduce main stem height, canopy width, yield, and value of peanut. Secondly, and probably most importantly, thrips transmit the bud necrosis and tomato spotted wilt viruses, both of which cause important diseases in peanut. However, control of thrips does not reduce virus incidence.

### Aphids

Several aphid species have been reported on peanut, but the cowpea or groundnut aphid, *Aphis craccivora* Koch, is the most important. This aphid occurs in the United States, Asia, and Africa, but it is a major vector of the groundnut rosette virus only in Africa. The adult aphid is black, rounded, and slightly oblong with brown legs, a prominent cauda, and thin, black cornicles. They reproduce asexually, and nymphs are dark brown. As populations increase on peanut, winged aphids are produced and disperse to form new colonies. Nymphs and adults feed primarily on new tissue including leaf buds and unfurling leaves (Plate 166), pegs, and flowers (Plate 167) by inserting their piercing-sucking mouthparts into the phloem and extracting sap.

### Twospotted Spider Mite

The twospotted spider mite, *Tetranychus urticae* Koch, is a major pest of peanut in the United States, especially in Virginia and North Carolina. The adult mite is approximately 0.5 mm long and light green to yellow with two black dots on the dorsum. The mites injure plants by inserting their piercing-sucking mouthparts into plant cells and sucking out the contents. They overwinter as diapausing females or, in areas with a mild winter, as actively reproducing adults. In the spring, mites initially feed on early hosts and then become established on corn. Populations increase rapidly on tasseling corn and then disperse as it begins to senesce. Dispersal from senescing corn occurs during flowering and pod development on peanut, stages that are favorable for mite establishment and population increase (Plate 168). Mite outbreaks in peanut are thought to be induced by application of fungicides and insecticides; the interaction between the two pesticides reduces the number of natural enemies that regulate mite populations on peanut.

### Whiteflies

The sweetpotato whitefly, *Bemisia tabaci* (Gennadius), is a relatively new pest of peanut in the United States, but it has been a pest of peanut in India for many years. The first whitefly infestations on peanut in the United States coincided with the identification of a new strain, B, that devastated vegetable crops in Florida, California, Arizona, and Texas during 1987 and 1988. Strain B was also found on peanut in Georgia. Recent research on strain B of the sweetpotato whitefly has shown that it may be a new species, and the names silverleaf whitefly and *B. argentifolii* Bellows & Perrin have been proposed. This whitefly is a serious threat to peanut because of its ability to increase its population rapidly, its occurrence on the undersides of leaves where it is difficult to control with insecticides, its resistance to a number of insecticides, and its role as a vector of plant viruses.

The silverleaf whitefly lays its eggs on the undersides of peanut leaves, and immatures can be found on both the upper and lower leaf surfaces, which does not occur on most other hosts. The nymphs are distributed equally among the tetrafoliates of a peanut leaf and pass through four nymphal instars. They are most abundant on leaves three, four, and five, and then abundance declines as leaf age increases. Adult whiteflies are white and approximately 2 mm long and are found on the lower leaf surfaces (Plate 169). Plant damage is by direct removal of photosynthate from the phloem and by the production of honeydew, which drips onto leaves below the nymphs and is colonized by a sooty mold, *Capnodium* spp., that reduces light interception and photosynthesis.

## Root and Pod Feeders

Several soil-inhabiting insects and other arthropods are key pests of peanut worldwide and represent a diverse group of species, including white grubs, wireworms, earwigs, ants, lepidopterous larvae, termites, and millipedes. These pests feed on roots, stems, and pods, causing stunting; decreased leaf area; diminished root, pod, and seed dry weight; reduced xylem pressure; reduced photosynthate flow in the phloem; decreased nitrogen fixation; and wilting of plants caused by insufficient transport of water. In addition, injury to plants by insects predisposes them to invasion by secondary pathogens such as *Aspergillus flavus*.

### Lesser Cornstalk Borer

The lesser cornstalk borer, *Elasmopalpus lignosellus* (Zeller) (Plate 170), is among the most important insect pests of peanut in the United States. This insect is a pest of numerous crops, including peanut, when soil moisture is deficient; it seldom causes damage when soil moisture is high. This insect also is more important as a pest on peanut grown in sandy soil than in heavier soil that has a higher organic content and greater water-holding capacity. Soil moisture affects every stage of *E. lignosellus*. Under wet conditions, moths lay eggs singly on the plant and larvae feed between leaf axils and stems or in flower buds. Under dry conditions, moths lay eggs just below the soil surface around the base of the plant and larvae feed under leaves touching the ground or on the main stem at or just below the soil surface. Larvae form feeding tubes in the soil from which they feed on roots and developing pods. They also may tunnel through the main stem or lateral branches of plants. Moths are approximately 12.5 mm long; females are charcoal gray to black, often with brown markings toward the anterior (Plate 171), and males are buff to light yellow with charcoal gray bands on their wings (Plate 172). Young larvae are bright red, and older larvae have dark mahogany and blue green alternating bands around their bodies and may reach 2 cm in length. Larvae prefer to feed on immature peanut pods and damage developing seed when they penetrate. Older larvae feed externally on more mature pods by scarifying the exocarp without actually penetrating the pod (Plate 173). This external damage to pods is sufficient to enhance infection by *A. flavus* and the formation of aflatoxin.

A model for predicting an infestation by the lesser cornstalk borer (LCB) has been developed. The model is used to calculate LCB days, i.e., the number of hot, dry days (on which the temperature is at or above 35°C and rainfall is less than 2.54 mm) minus the number of cool, wet days (on which the temperature is less than 35°C and rainfall is at or above 2.54 mm). Scouting for LCB damage is recommended when the running total of LCB days approaches zero. Values below zero indicate that the LCB is unlikely to be a problem in peanut, while values of 10 or greater represent conditions under which outbreaks of this insect are likely to occur.

### Southern Corn Rootworm

The southern corn rootworm, *Diabrotica undecimpunctata howardi* Barber, is a major pest of peanut in Virginia and North Carolina and of peanut grown on poorly drained soils in the southeastern United States. The adults, often called spotted cucumber beetles, are about 6–6.5 mm long and are easily recognized by the twelve spots on their greenish yellow elytra (Plate 174). Adults prefer to oviposit at the bases of plants in moist, dark soil with moderate levels of organic material and clay. The presence of weeds among peanut plants increases oviposition. The larvae are slender, fragile, and white with dark brown to black head capsules and anal plates and may reach a length of 12.5–18.0 mm at maturity (Plate 175). Adult rootworm beetles feed above the ground on peanut leaves, and larvae feed below ground on roots or developing pegs and pods. Larvae make almost cylindrical entry holes and feed on the immature pods and developing seed. Damage by rootworm larvae also predisposes pods to invasion by fungi that induce pod rot. Three to four generations may occur each year in the southern latitudes, while only one generation occurs in the northern latitudes.

### White Grubs

White grubs are the larvae of scarab beetles and are considered among the most important pests of peanut worldwide, especially in the developing nations of Africa and Southeast Asia. Several species of the genera *Lachnosterna, Adoretus, Anomala, Eulepida, Leucopholis,* and *Schizonycha* feed on peanut roots and pods. Adult beetles, called cockchafers, are fairly large, 18–20 x 6 mm. They emerge from the soil at dusk during the first few weeks of the rainy season. They often congregate on trees to mate and feed (Plate 176) before returning to the soil to lay their eggs. Eggs are laid singly or in small clusters 5–15 cm below the soil surface. Larvae are C shaped and white with brown to black head capsules and anal plates (Plate 177). Larvae of some species are up to 50 mm long and 20 mm in diameter. Older (third-instar) larvae may feed on the taproots, resulting in patches of stunted, wilted, or dead plants. Most injurious species of white grubs on peanut have one generation per year.

### Termites

Termites (Plate 178) of many genera, especially *Odontotermes* and *Microtermes*, are major pests of peanut in Africa and Asia. Termites tend to be a major problem on peanut during periods of insufficient rainfall, whereas white grubs are more of a problem in those areas where soil moisture is adequate for proper plant growth. Harvester termites feed at the bases of stems and, like beavers, can "fell" the whole plant. Other species cover a plant with soil and feed on the leaves, but the greatest damage is caused by species that feed on pods or tunnel into the taproot, main stem, or lateral branches. Termites damage pods in two ways: by externally scarifying the pod without pod penetration (Plate 179) and by penetrating the pod and feeding on the seed. Damage to pods is most severe late in the growing season when they are left in the soil past optimum maturity or during periods of insufficient rainfall. Damage by termites reduces yield and, equally important, enhances *A. flavus* invasion and aflatoxin contamination of seed.

### Wireworms

Wireworms, immature stages of click beetles, are increasingly important pests of peanut in the southeastern United States. Several species of the genus *Conoderus* have been collected from peanut; *C. scissus* (Schaffer) and *C. amplicollis* (Gyllenhal) are encountered most frequently. Wireworms have life cycles lasting 1–6 years, depending on the species. They tend to be more of a problem in moist soils and during years of higher than normal rainfall. Adult click beetles emerge from the soil during spring to early summer and lay eggs in the soil close to a plant host. Wireworm larvae are slender, hard-bodied insects with three pairs of inconspicuous legs on the front half of the body. They range in color from yellow to light brown and at maturity average 15–25 mm in length. Larvae feed on all underground parts of the peanut plant, but they are especially damaging to the pods (Plate 180). Wireworms make jagged entry holes in the pods and feed on the developing seed, often completely consuming the seed and leaving empty pods.

### Millipedes

Millipedes are a serious pest of peanut in several developing nations, particularly in western Africa. Of the 13 species of millipedes that damage peanut in Senegal, *Peridontopyge* spp. are the most prevalent. Millipedes spend the dry season deep in the soil below stumps and in or under termite mounds. During the rainy season, more than 50% of the millipedes are found in the upper 10 cm of soil, whereas during the dry season, more than 90% are found below 10 cm. They emerge from the soil shortly after the first substantial rains of the wet season and feed on seedling plants, including peanut, often reducing plant density by up to 20%. They also feed on developing pods and may reduce yield by 30–40%. Millipedes primarily attack immature, developing peanut pods, while termites attack more mature pods.

## Stored-Product Feeders

Peanuts in storage are attacked by a variety of stored-product pests that can rapidly reduce seed quality. More than 100 species of insects and related arthropods infest stored peanuts. Most stored-peanut pests penetrate the pod and feed on the seed. However, several species have difficulty penetrating undamaged peanut pods, and thus seed damage tends to be more severe in damaged or cracked pods. Other pest species easily bore through the pod to feed on the protein- and oil-rich seed. Heavy infestations with stored-product insects may leave damaged seed or seed contaminated with frass, webbing, insects, or insect parts, all of which can make the product unsuitable for human consumption.

### Indianmeal Moth

The Indianmeal moth, *Plodia interpunctella* (Hübner), is an important pest of stored peanut worldwide. Moths are readily distinguishable by the unusual color of the forewings; the front half of the forewing is white to gray while the outer one-half is reddish brown to purple with a copper luster (Plate 181). The wings are folded close to the body when the moth is resting, and each is marked with a prominent, reddish brown band. Adult moths have a wing spread of nearly 19 mm and a length of 8–13 mm when the wings are folded. Females lay eggs singly or in small groups. Larvae feed on shelled seed or on seed in damaged or cracked pods. Larvae form a silken, matted web on the seed; and under severe infestation, the entire surface of seed may be covered with webbing. At maturity, larvae average about 15 mm in length and are light yellow to creamy white, often with a pinkish hue. Damage is in the form of partially consumed seed, cast skins, and webbing on the pods and seed.

### Rice Moth

The rice moth, *Corcyra cephalonica* (Stainton), like many other stored-product pests, is considered a secondary pest of stored peanut because it is unable to penetrate and damage seed in sound pods. Moths of this species are gray brown to tawny with a wing span of 14–24 mm and a length of 12–15 mm with the wings folded along the sides of the abdomen (Plate 182). Veins in the wings are slightly darkened. Eggs are laid singly, and larvae feed on loose, shelled seed or on seed in cracked pods (Plate 183). Larvae form silken tubes that are attached to the seed on which they feed. They also spin a dense, tough, silken cocoon for pupation. A mature larva is

about 15 mm long and white to dirty gray with numerous long hairs and a dark brown head and pronotum.

### Flour Beetles

The red flour beetle, *Tribolium castaneum* (Herbst), and the confused flour beetle, *T. confusum* Jacquelin du Val, average 3–4 × 1.5–2.0 mm and are oblong and slightly flattened, reddish brown beetles that attack stored peanut worldwide (Plate 184). The two species are very similar in appearance, habits, and life history. An adult may lay up to 450 eggs among peanut pods and seed. Larvae are yellowish white with a brown head capsule and forked anal plate (Plate 185). Both adults and larvae feed on the surface of peanut seed and burrow into the seed. As a result of this feeding, seed become powdery and dusty and are unfit for human consumption. This damage also increases the percentage of split seed when pods are shelled.

### Groundnut Bruchid

The groundnut bruchid, *Caryedon serratus* Oliver, is an important pest because it can attack unshelled, undamaged peanut pods. It is a major pest of peanut in Asia and Africa. The adult is 4–7 × 5 mm, dark gray to brown, and slightly mottled and has large hind legs. Eggs are laid on the pods, and larvae chew directly through the eggshell and pod to feed on the seed. Thus, damage is not visible externally on the pods without careful observation. Often the first evidence of infestation is a hole cut in the pod by a larva before it pupates; the hole allows an adult to emerge from the pod. Larvae sometimes emerge and pupate outside an infested pod (Plate 186). Infestation may occur shortly after plants are inverted and while the pods are drying in the windrow or while the pods are stored in the open during the dry season.

### Pod-Sucking Bug

The "Wang," *Elasmolomus sordidus* (Fabricius), which may attack peanut pods while they are drying in the field or during storage, is a widespread pest of peanut in India. The adult is a dark brown, 10- × 2-mm, typical lygaeid-shaped bug with long legs and antennae (Plate 187). The adult pierces a pod with its long, slender mouthparts and feeds on the oil in the enclosed seed. This injury causes the seed to become wrinkled with dark spots and increases the probability of rancidity. In the field, the eggs are laid either in the soil or on vines, and in storage they are laid among the pods. First-instar nymphs have bright red abdomens, while later instars become progressively darker.

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