



Fig. 1: Adult



Fig. 2: Eggs on pod surface



Fig. 3: Grubs



Fig. 4: Pupae in cocoons



Fig. 5: Infested kernels



Fig. 6: Infested pods



Fig. 7: Exit holes made by bruchids



Fig. 8: Mould growth on infested kernels



Fig. 9: Pods stored in super grain bag



Fig. 10: Farmer storing seeds in galvanized metal bins

and Chandra which are least preferred by bruchids,

2. Ensure earthing-up soil around the plants before peg initiation,
3. Harvest the produce at right maturity stage,
4. Avoid heaping the produce in the field itself,
5. Prefer sun drying of pods for reducing seed moisture content to the safe level (<9%) as well as reducing carryover of pest infestation from field to store,
6. Sort out and dispose any broken and damaged seeds (pods/kernels) from the seed lot for reducing attack by secondary pests,
7. Clean and fumigate godowns and storage structures as well,
8. Treat pods with neem seed powder (0.25%) or black pepper powder (0.25%) or parthenium powder (1.0%) or annona seed powder (0.5%). Also the pods can be treated with either neem oil at 5% (v/w) or pongamia/eucalyptus/castor oil at 10% (v/w) and with methyl parathion 2 DP @ 1% or fenvalerate 0.4 DP @ 1%.
9. Store pods in air tight polythene or super grain bags (Fig. 9) or galvanized metallic/PVC seed bins (Fig. 10),
10. If stored in gunny bags, then spray safe pesticides like, deltamethrin 2.5 SC @ 0.5 ml/L or malathion 50 EC @ 5.0 ml/L or spinosad 45 SC @ 0.3 ml/L on the gunny bags,
11. Keep aluminium phosphide 56% @ 1 pouch (10 g)/ton of pods in air tight godowns.

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BRUCHID: A MAJOR STORAGE PEST OF GROUNDNUT



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Groundnut, *Arachis hypogaea* is an important legume oilseed crop. The crop is grown on an area of 5.3 Mha with a production of 6.6 Mt and yield of 1257 kg/ha (triennial period, 2010–2013). The post-harvest losses in groundnut caused by insect-pests, moulds and rodents vary from 10 to 25%. About 65 per cent of produce is stored for a period of 6–9 months for various purposes by farmers (seed), processors (oil extraction and confectionaries) and exporters (export). The export of groundnut during the same triennial period has been noticed to the tune of 0.6 Mt.

Seed being the basic and the most critical input for agriculture, keeping healthy seed for good crop is a challenge. The groundnut productivity is highly dependent on the selection and use of high quality seeds that are healthy, vigorous and viable. Groundnut being a self-pollinated crop (with <2% natural out-crossing), most of the farmers are using home grown seeds for sowing, which results in poor seed replacement ratio (<2%) with promising varieties. Groundnut growers by tradition, store seeds either as pods or kernels, therefore it becomes more important to save healthy seeds for ensuring good crop.

The major limitation in storing groundnut produce/seeds is the damage caused by insect-pests, moulds and rodents during storage. The tamarind/groundnut bruchid, *Caryedon serratus* is a primary pest of stored groundnut inflicting damage up to 73%. However, other insect-pests like, pod sucking bug, *Elasmolomus sordidus*; rust-red flour beetle, *Tribolium castaneum*; the rice moth, *Corcyra cephalonica*; the merchant grain beetle, *Oryzaephilus mercator* and almond moth, *Ephestia cautella* are of minor importance where, the latter four species are secondary pests of groundnut which prefer broken or infested pods.

Bruchid, *Caryedon serratus* (Coleoptera: Chrysomelidae)

Bruchid adults are dark brown in colour, 4–7 mm long and show sexual dimorphism where, antennae are long and serrated in males than in females, whereas the pygidium (dorsum of posterior abdomen) is exposed in females than in males (Fig. 1). The hind leg femur is serrated and 5 mm wide in both females and males. Grubs are pink in colour, 10 mm long and possess abdominal uromeres. Grubs inflict damage to both kernels as well as pods. Infestation starts from field where the adults lay eggs on exposed pods and it is carry forwarded to storage.

Distribution:

Bruchids are known to infest groundnut in storage in almost all the groundnut growing countries including Nigeria, Sudan, Senegal, Egypt, Brazil, India, China, Vietnam, Indonesia, Thailand, United States of America and Australia. In India, it is prevalent in Gujarat, Karnataka, Andhra Pradesh, Maharashtra and Tamil Nadu. In Gujarat, it is most severe in Junagadh, Rajkot, Jamnagar, Porbandar and Gir-Somnath districts.

Host range:

Bruchids are highly specific and attack only plants belonging to four genera of Fabaceae (*Bauhinia*, *Cassia*, *Piliostigma* and *Tamarindus*) in addition to groundnut. Tamarind is considered the most suitable host for bruchid multiplication in laboratories because of shorter generation doubling time *i.e.*, 12–13 days.

Seasonal occurrence:

Bruchids normally occur during June to December in areas where warm humid condition prevails. Further, the bruchid population increases with the increase in temperature and humidity. However, the combination of 28±2°C and 70±5% RH is highly conducive for growth and development of bruchids. The increase in temperature from 25 to 40°C results in shortening the time required for generation doubling by three times.

Life cycle:

The total span of life cycle varies from 65 to 80 days at 28±2°C and 70±5% RH. The adult longevity for males is 20 days, whereas for females is 17 days. The pre-oviposition period is two days, the oviposition period is 7 days and the post-oviposition period is 9 days. Maximum number of eggs were laid during first four days after the adult emergence and the average fecundity per female is 67 eggs (Fig.2).

The incubation period of egg is 4 days; the grubs (Fig. 3) upon hatching scrape the pod or kernel surface and penetrate the pod to feed on kernels. The grubs pass through four larval instars before pupation, *viz.*, first, second, third and fourth which complete in 13, 9, 13 and 17 days, respectively finishing total larval period in 52 days. The fully grown grubs emerge out by making an exit hole and construct a tough silken cocoon on the surface of pods or kernels (Fig. 4). Grubs pupate inside silken cocoons, where pupation lasts for 12 days. Generally sex

ratio in bruchids is recorded being 1: 0.7 (female: male). Irrespective of egg density (number of eggs laid), only two adults emerge out of one-seeded pod/kernel, however four and five adults can emerge out of two- and three-seeded pods, respectively.

Nature of damage:

Bruchids cause both quantitative and qualitative losses to the stored produce wherein, they cause extensive damage to kernels than pods (Fig. 5 and 6). First visual symptom is the exit hole of final instar larva before pupation (Fig. 7). Grubs feed on pods and kernels internally. The quantitative loss may go up to 73% depending upon the storage period and the level of infestation. The high metabolic activity of bruchids is due to their large population in storage which increases temperature and moisture contents, which ultimately favours mold growth (Fig. 8). This indirectly spoils the quality of groundnut by contaminating produce with mycotoxin (Aflatoxin), rendering it unfit for human and animal consumption, hence leading to huge qualitative losses.

Favourable factors:

Protecting the seeds from damage caused by insect-pests requires the information on the bio-ecology of insect-pests and favourable factors that are responsible for their establishment and infestation. The infestation of bruchids starts from the field, which later becomes critical during storage. The most favourable factors for the growth and development of bruchids are temperature (28±2°C), relative humidity (70±5%), seed moisture content (>9%) and the presence of previously infested/broken seeds in produce. The bruchid infested pods and kernels including broken seeds are highly prone to damage by the secondary insect-pests.

Management:

The eco-friendly management of the insect-pests (including bruchids and the secondary insect-pests) of stored groundnut could be achieved by targeting the weak points in the life cycle or by altering the favourable factors responsible for infestation and establishment of the pest. The following recommendations have been given by the Directorate of Groundnut Research, Junagadh for the safe storage of groundnut seed/produce:

1. Cultivate varieties like, TMV 10, GG 3, GG 4, GG 6, VRI 3, R 8808, TAG 24, Dh 8, DRG 12, DRG 17, RS 1, ICGS 44, ICGS 5