

Emerging pests

of millets and their management

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There are about 150 insect pests reported in millets out of which shoot flies, stem borers and earhead midges are considered as major pests. In India, yield losses of 10–20% have been reported in millets due to insect pests. Shoot flies and stem borers are associated with millets and cause huge damage apart from many sucking pests. Few pests are newly observed attacking millets and few minor pests have become major in some regions. For most of the recently recorded pests, information on factors responsible for their outbreak, bionomics, yield losses etc is needed before planning their control operations. As an immediate remedy, chemicals have been used mainly on high yielding varieties and hybrids. However, a combination of cultural practices and resistant cultivars has proved to be effective.

Keywords: Insect pests, Integrated pest management, Millets, Sorghum

THE overall incidence and damage by different pests varies in time and space and is reflected in low grain yields at farmer's fields. Some insect pests are associated with millet crops whereas pests like white grubs are specific to some region (Table 1). Sporadic attacks of blister beetles, armyworms, grasshoppers, chinch bugs, leaf beetles, head caterpillars and head bugs result in severe yield losses in certain seasons.

Table 1. Major insect pests of millets and sorghum in India and their status

Common name	Damaging stage	Plant part attacked
<i>Pearl millet</i>		
Shoot fly	Maggot	Growing point
Grey weevil	Grubs	Roots
Spotted stem borer	Larvae	Stem, leaves, growing point
Pink borer	Larvae	Stem, leaves
White grubs	Grubs	Roots
<i>Kodo millet</i>		
Shoot fly	Maggot	Growing point
Gall midge	Maggot	Spikelet
Stem or Pink borer	Caterpillar	Stem
<i>Foxtail millet</i>		
Shoot fly	Maggot	Growing point
Flea beetle	Adult	Leaf
Army worm	Caterpillar	Leaf
<i>Common name</i>		
<i>Damaging stage</i>		
<i>Plant part attacked</i>		
Leaf roller	Caterpillar	Leaf
<i>Little millet</i>		
Shoot fly	Maggot	Growing point
Gall midge	Maggot	Spikelet
<i>Proso millet</i>		
Shoot fly	Maggot	Growing point
Termites	Workers	Seed to seedling
<i>Barnyard millet</i>		
Shoot fly	Maggot	Growing point
Pink borer	Caterpillar	Stem/leaf
<i>Finger millet</i>		
Pink or stem borer	Caterpillar	Stem/leaf
Sorghum stem borer	Caterpillar	Stem
Earhead caterpillar	Caterpillar	Ear
Root aphid	Nymph and Adult	Root
Leaf hopper	Nymph and Adult	Leaf
<i>Sorghum</i>		
Shoot fly	Maggot	Growing point
Stem borer	Caterpillar	Stem/leaf
Pink stem borer	Caterpillar	Stem/leaf
Shoot bug	Nymph and Adult	Leaf
Aphids	Nymph and Adult	Leaf/panicles
Earhead bug	Nymph and Adult	Ear

Seedling stage pests

Shoot flies: Shoot fly is a seedling pest and normally occurs in the 1st–4th week after germination. The adult is small (3 mm long); dark grey housefly like with its abdominal segments marked with dark spots. The maggot enters the seedling through the whorl and destroys the growing point and exhibit 'dead heart' symptoms.



Shoot fly damage in millets

Foliage pests

Leaf caterpillars: Moths of leaf caterpillars emerge with the onset of monsoon and lay eggs in clusters. Early-stage larvae feed gregariously on plants, later stages spread across the field and feed voraciously. Fully grown larvae are reddish brown and hairy all over the body causing severe defoliation.

Cutworms and army worms: They cut tender stems of young and growing plants. Larvae hide during day time in the soil and become active at dusk. In severe cases, entire foliage is eaten making the field appear as if grazed by cattle.

Sucking pests

Both nymphs and adult of aphids, shoot bugs, plant bugs, suck the sap from young leaves and whorls causing distortion, yellowing and wilting of plants leading to shrivelled and chaffy grains. Few sucking pests are also vectors of plant diseases.

Aphids: Colonies of immature and adult aphids can be seen in central leaf whorl, stems, or in panicles sucking the plant sap. Severe infestation causes yellowish mottling of the leaves and marginal leaf necrosis, and stunted plants. Aphids produce honeydew on which molds grow.

Shoot bug: The adult is yellowish brown to dark brown with translucent wings. Nymphs and adults suck the plant sap causing reduced plant vigour and yellowing. In severe cases, the younger leaves start drying and gradually extend to older leaves. Heavy infestation at vegetative stage may twist the top leaves and prevent either the formation or emergence of panicles.

Stem borers

Among the stem borers, *Chilo partellus* and *Sesamia inferens* are pre-dominant in India. Pearl millet appears to be immune to stem borer attack at initial stages of crop growth, but it becomes susceptible to internodes injury in latter stage.

Spotted stem borer: The larvae feed on the upper surface of whorl leaves leaving the lower surface intact as transparent windows. As the severity of the feeding increases, blend of punctures and scratches of epidermal feeding appears prominently. Sometimes, dead heart symptoms also develop in younger plants due to early attack. Subsequently, the larvae bore into the stem resulting in extensive stem tunneling. Peduncle tunneling results in either breakage or complete or partial chaffy panicle. During the dry season, the larva enters into diapause and survives in harvested stalks/stems as well as stubbles left in the field.

Ragi stem borer/pink borer: The female moth lays about 150 creamy-white and hemi-spherical eggs that are arranged in 2 or 3 rows between the leaf sheath and the stem. The pink larva bores into the stem and damages the central shoot resulting in dead heart.



Stem borer damage in millets

Earhead pests

Sorghum midge: The adult fly is small, fragile with a bright orange abdomen and a pair of transparent wings. It lays eggs singly in developing florets resulting in pollen shedding. Larvae are colourless, but when fully grown, they are dark orange. It pupates beneath the glumes and when the adult emerges the white pupal skin remains at the tip of the spikelet.

Head beetles: Several species of beetles have been recently recorded in millet growing areas. They feed on flowers and inhibit the grain formation.

Head caterpillars: They feed on the developing grains and webbings with frass are often seen on the panicle.

Head bugs: Head bugs suck the sap from the developing grains, causing distortion and shrinking. Grains are later infected by fungus, causing blackening.

Pest management

Cultural methods

- Collect and burn stubbles and chaffy ear heads which will prevent the carryover of overwintering pest.
- Deep ploughing one month before planting will expose the immature stages of insects and predators that prey upon them.
- Adopt synchronous and timely/early sowings of cultivars with similar maturity to reduce the damage by shoot fly, midge and head bugs.
- Crop rotation is recommended with cotton, groundnut or sunflower, to reduce the damage by shoot fly, midge and earhead bugs. Intercropping

sorghum with pigeon pea, cowpea, or lablab also reduces the damage by stem borers.

- Use high seed rates 1.5 times more and delay thinning (to maintain optimum plant stand) to minimize shoot fly damage.

Mechanical method

- Set up light traps till midnight to monitor, attract and kill adults of stem borer, grain midge, June beetle and other moth pests.
- Set up the fishmeal traps impregnated with insecticide @12/ha till the crop is 30 days old.

Biorational methods

- Apply balanced fertilizers having adequate NPK to promote better plant growth, that results in reduced damage by shoot fly and stem borers.

Chemical methods

- Treat the seeds with thiamethoxam 30 FS @10 ml/kg of seeds to reduce the damage by shoot fly and to some extent stem borer and sucking pests.
- When the shoot fly damage reaches 5–10% of the plants with dead hearts, the crop may be sprayed with cypermethrin 10 EC (750 ml/ha) or quinalphos 25 EC (400 g a.i./ha) or carbofuran granules (5–7 granules/plant) may be applied in the leaf whorls.
- For stem borers, carbofuran 3 G granules may be applied in the whorls @8–12 kg a.i./ha.

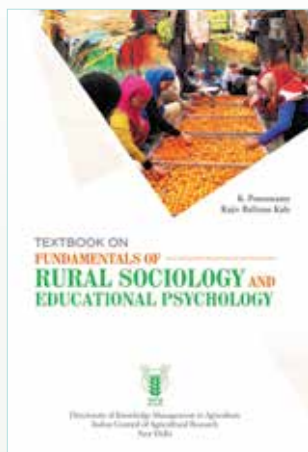
- For earhead bugs (1–2 bugs/panicle) and head caterpillars (2–3 larvae/panicle), the crop may be sprayed at the completion of flowering and at the milk stage with cypermethrin 25 EC @0.5 ml/litre.
- For managing sucking pests like shoot bug, aphids, apply dimethoate 0.03% and neem seed kernal suspension 0.04%+soap.

SUMMARY

The available evidence suggests that pearl millet and finger millet are relatively less affected by insect pests compared to other millets and sorghum. There is a need to generate data on yield loss due to key pests of millet crops and determine economic injury levels, the effectiveness of natural enemies and their use in existing ecosystems. There is a need to standardize screening techniques for shoot flies and borers. The traits responsible for resistance must be incorporated into agronomically suitable cultivars. New pests and changes in the status of minor or occasional pests should be closely watched. Looking to the status of the pests in changing climate, an integrated approach for management of millet pests is the need of the hour.

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TECHNICAL SPECIFICATIONS

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