

MAJOR BORERS OF SUGARCANE AND THEIR MANAGEMENT STRATEGIES

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Abstract

Sugarcane (*Saccharum officinarum* L.) is one of the most important commercial crops cultivated in tropical and subtropical regions worldwide and serves as a major source of sugar, jaggery, ethanol and several industrial by-products. Due to its long crop duration (10–18 months), sugarcane is highly vulnerable to attack by a number of insect pests, among which borers are considered the most destructive. Major sugarcane borers in India include root borer (*Emmalocera depressella*), early shoot borer (*Chilo infuscatellus*), internode borer (*Chilo sacchariphagus indicus*), top borer (*Scirpophaga excerptalis*), stalk borer (*Chilo auricilius*) and Gurdaspur borer (*Acigona steniella*). These pests infest the crop at different growth stages and damage roots, shoots, stalks and internodes, resulting in dead hearts, tunneling, poor cane growth, reduced cane weight and lower sugar recovery. Yield losses caused by borer infestation may range from 10 to 30 per cent depending upon pest

species, crop stage and environmental conditions. The incidence and severity of borers vary across tropical and subtropical sugarcane-growing regions due to differences in climate and cropping practices. Effective management of sugarcane borers requires an integrated approach involving cultural, mechanical, biological and chemical methods. Adoption of practices such as field sanitation, destruction of infested plant parts, use of healthy seed cane, release of egg parasitoids (*Trichogramma* spp.) and judicious application of recommended insecticides can significantly reduce pest populations and crop losses. This review summarizes the distribution, biology, damage symptoms and integrated management strategies of the major borers of sugarcane, highlighting sustainable approaches for enhancing cane productivity and sugar recovery.

Keywords: Sugarcane, insect-pest, symptom, bio-ecology and management

Introduction

Sugarcane (*Saccharum officinarum* L.) is one of the most important commercial crops of India and serves as the principal raw material for the sugar industry, the second-largest agro-based industry in the country after textiles. In addition to sugar production, sugarcane supports several rural industries through the manufacture of jaggery, khandsari, ethanol and other value-added products. By-products such as molasses, bagasse and press mud are widely

utilized in alcohol production, cogeneration of electricity and the preparation of organic fertilizers, contributing significantly to the national economy. During 2024–25, sugarcane was cultivated on approximately 5.8 million hectares in India, with an estimated production of about 490 million tonnes and an average productivity of 84–85 t ha⁻¹. India is among the leading sugarcane-producing countries of

the world and possesses the largest area under sugarcane cultivation.

Despite its economic importance, sugarcane productivity is constrained by several biotic stresses, among which insect borers are considered the most destructive pests. Owing to the long crop duration of 10–18 months, sugarcane remains vulnerable to borer attack throughout its growth period. The major borers infesting sugarcane in India include root borer (*Emmalocera depressella*), early shoot borer (*Chilo infuscatellus*), internode borer (*Chilo sacchariphagus indicus*), top borer (*Scirpophaga excerptalis*), stalk borer (*Chilo auricilius*) and Gurdaspur borer (*Acigona steniella*). These pests attack different parts of the crop, including roots, shoots, stalks and internodes, causing dead hearts, tunneling,

poor cane growth, reduced cane weight and lower sugar recovery. Yield losses due to borer infestation may range from 10–30 per cent depending upon pest species, crop stage and environmental conditions. The incidence and severity of sugarcane borers vary across tropical and subtropical regions because of differences in climate, cropping systems and varietal preferences. Therefore, the adoption of Integrated Pest Management (IPM) strategies involving cultural, mechanical, biological and chemical approaches is essential for minimizing crop losses, improving cane productivity and ensuring sustainable sugarcane production. This review provides an overview of the major borers of sugarcane, their biology, damage symptoms and integrated management strategies.

1. Root Borer, *Emmalocera depressella* (Swinhoe) (Lepidoptera: Pyralidae)

Symptoms

- Yellowing and drying of leaves.
- Formation of dead hearts in young plants.
- Reduced tillering and stunted growth.
- Larval tunneling in the root zone and basal portion of the stalk.
- Drying of affected clumps under severe infestation.
- Significant reduction in cane yield and quality.

Biology

- Eggs are laid singly on the underside of sugarcane leaves.
- Egg period: 5–10 days.
- Newly hatched larvae move through soil cracks and bore into the underground portion of the stalk.
- Larval period: 30–45 days (most destructive stage).
- Mature larvae hibernate in sugarcane stubbles during winter.
- Pupation occurs in March–April; pupal period lasts 7–18 days.

- Adult moths emerge during April–May.
- Life cycle is completed in about 55–70 days under favourable conditions.
- Warm and humid weather (30–34°C) favours pest development.

Management

- Remove and destroy infested stubbles after harvest.
- Deep summer ploughing to expose larvae and pupae.
- Avoid ratooning heavily infested fields.
- Intercrop sugarcane with cowpea, green gram or black gram.
- Flood infested fields wherever feasible.

Chemical Control

- Fipronil 0.3G @ 25 kg/ha.
- Chlorantraniliprole 0.4G @ 25 kg/ha.
- Phorate 10G @ 15 kg/ha.
- Chlorantraniliprole 18.5 SC @ 150 ml/ha as root-zone drenching in severe infestations.

2. Early Shoot Borer, *Chilo infuscatellus* Snellen (Lepidoptera: Crambidae)

Symptoms

- Infests sugarcane mainly during the first 2–4 months after planting.
- Young larvae enter the central shoot through the leaf midrib and tunnel downward.

- Formation of characteristic **dead hearts**, which can be easily pulled out and emit a foul smell.
- Presence of entry holes on leaves and the basal portion of the shoot.

- Affected plants show reduced tillering, poor growth and thinning of the crop stand.
- Severe infestation may cause significant reduction in cane yield.

Biology

- Female moths lay eggs in clusters on the underside of sugarcane leaves.
- Egg period lasts about 4–7 days.
- Newly hatched larvae feed on leaf tissues before boring into the central shoot.
- Larval period lasts 25–35 days and causes maximum damage.
- Pupation takes place inside the stem tunnel or in dried leaf sheaths.
- Pupal period lasts 7–10 days.
- Adult moths are straw-coloured with characteristic dark markings on the forewings.
- The complete life cycle is completed in approximately 40–55 days.
- Warm and humid weather favours pest multiplication.

Management

- Plant the crop at the recommended time to avoid peak pest incidence.
- Avoid excessive nitrogen application.
- Remove and destroy dead hearts periodically.
- Maintain proper irrigation and field sanitation.
- Earthing-up during the early crop stage helps reduce infestation.
- Release *Trichogramma chilonis* @ 50,000 parasitoids/ha at weekly intervals for 6–8 releases starting 30–45 days after planting.

Chemical Control

- Apply Chlorantraniliprole 0.4G @ 25 kg/ha in the furrows at planting or during early infestation.
- Apply Fipronil 0.3G @ 25 kg/ha in the root zone followed by irrigation.
- Apply Carbofuran 3G @ 33 kg/ha (where permitted by local regulations).
- Spray Chlorantraniliprole 18.5 SC @ 150 ml/ha in 500–750 L water at the early stage of infestation.
- Apply Cartap Hydrochloride 4G @ 25 kg/ha in endemic areas followed by irrigation.

3. Internode Borer, *Chilo sacchariphagus indicus* (Kapur) (Lepidoptera: Crambidae)

Symptoms

- Infestation generally occurs from the grand growth stage onwards.
- Larvae bore into the internodes of the cane and feed internally.
- Small circular entry holes plugged with frass are visible on the cane surface.
- Tunneling within internodes reduces cane weight and juice quality.
- Affected internodes become shortened, deformed and may show reddish discoloration internally.
- Severe infestation results in poor cane development, reduced sugar recovery and lower yield.
- Infested canes are more prone to lodging and secondary infections.

Biology

- Female moths lay eggs in clusters on the underside of sugarcane leaves, usually near the midrib.
- Egg period lasts 4–7 days.

- Newly hatched larvae initially feed on leaf tissues and then bore into the internodes.
- Larval period lasts 30–45 days and is the most damaging stage.
- Pupation occurs inside the larval tunnel within the cane.
- Pupal period lasts 7–12 days.
- Adult moths are pale brown with characteristic markings on the forewings.
- The complete life cycle is completed in approximately 45–60 days.
- Warm temperatures and high humidity favour pest development and multiplication.

Management

- Use healthy, pest-free seed cane for planting.
- Remove and destroy infested canes and crop residues after harvest.
- Avoid excessive nitrogen fertilization.
- Maintain proper field sanitation and balanced crop nutrition.
- Release *Trichogramma chilonis* @ 50,000–100,000 parasitoids/ha at 10–15 day intervals during the active infestation period.

- Encourage natural enemies such as parasitoids and predators.

Chemical Control

- Apply Chlorantraniliprole 0.4G @ 25 kg/ha in the leaf axils or root zone followed by irrigation.
- Apply Fipronil 0.3G @ 25 kg/ha during the early stage of infestation.

- Spray Chlorantraniliprole 18.5 SC @ 150 ml/ha in 500–750 L water.
- Apply Cartap Hydrochloride 4G @ 25 kg/ha in endemic areas.
- In severe infestations, apply Flubendiamide 39.35 SC @ 125 ml/ha in sufficient water for effective control.

4. Top Borer, *Scirpophaga excerptalis* Walker (Lepidoptera: Crambidae)

Symptoms

- Infestation occurs from April to October, particularly in subtropical sugarcane-growing regions.
- Young larvae enter through the midrib of leaves and bore towards the spindle.
- Characteristic parallel rows of shot holes appear on unfolding leaves.
- Dead hearts may develop during the early stage of crop growth.
- In older canes, larvae bore into the growing point, causing drying of the central shoot.
- Severe infestation results in bunchy top appearance, stunted growth and reduced cane yield.
- Affected canes show tunneling in the upper internodes, leading to poor juice quality and sugar recovery.

Biology

- Female moths lay eggs in masses on the underside of leaves and cover them with buff-coloured hairs.
- Egg period lasts 6–8 days.
- Newly hatched larvae feed on leaf tissues and enter the leaf midrib before reaching the spindle region.
- Larval period lasts 30–45 days and causes maximum damage.
- Pupation occurs inside the tunnel near the top portion of the cane.
- Pupal period lasts 8–12 days.

- Adult moths are creamy white with an orange tuft of hairs at the tip of the abdomen in females.
- The complete life cycle is completed in approximately 45–60 days.
- The pest passes through several overlapping generations during the crop season.

Management

- Remove and destroy dead hearts and infested shoots during the early stages of infestation.
- Collect and destroy egg masses whenever observed.
- Avoid ratooning heavily infested crops.
- Maintain proper field sanitation and balanced fertilizer application.
- Release *Trichogramma japonicum* @ 50,000–100,000 parasitoids/ha at 10–15 day intervals during the active period of moth emergence.
- Encourage conservation of natural enemies such as parasitoids and predators.

Chemical Control

- Apply Chlorantraniliprole 0.4G @ 25 kg/ha in the leaf whorls or root zone followed by irrigation.
- Apply Fipronil 0.3G @ 25 kg/ha during the early stage of infestation.
- Spray Chlorantraniliprole 18.5 SC @ 150 ml/ha in 500–750 L water directed towards the spindle.
- Apply Cartap Hydrochloride 4G @ 25 kg/ha in endemic areas.

5. Stalk Borer, *Chilo auricilius* Dudgeon (Lepidoptera: Crambidae)

Symptoms

- Larvae bore into the stalk through the leaf sheath and feed internally.
- Small circular entry holes plugged with frass are visible on the cane surface.

- Extensive tunneling inside the stalk weakens the cane and reduces nutrient translocation.
- Affected canes show poor growth, reduced girth and lower cane weight.
- Infested internodes may become hollow and susceptible to lodging.

- Severe infestation leads to a reduction in cane yield, juice quality and sugar recovery.
- Damaged canes are more vulnerable to secondary infections by pathogens.

Biology

- Female moths lay eggs in clusters on the underside of sugarcane leaves.
- Eggs hatch within 4–7 days.
- Newly emerged larvae feed briefly on leaf tissues before boring into the stalk.
- The larval period lasts 25–40 days and is the most destructive stage.
- Pupation takes place inside the larval tunnel within the cane stalk.
- The pupal period lasts 7–12 days.
- Adult moths are pale brown with characteristic dark markings on the forewings.
- The complete life cycle is completed in approximately 40–55 days under favourable conditions.
- Warm and humid weather favours rapid multiplication of the pest.

Management

- Use healthy and pest-free seed cane for planting.

- Remove and destroy infested canes and crop residues after harvest.
- Avoid excessive nitrogen application and maintain balanced fertilization.
- Undertake regular field monitoring for early detection of infestation.
- Release *Trichogramma chilonis* @ 50,000–100,000 parasitoids/ha at 10–15 day intervals during the active infestation period.
- Conserve natural enemies such as parasitoids and predators by adopting IPM practices.

Chemical Control

- Chlorantraniliprole 0.4G @ 25 kg/ha applied in the root zone or leaf axils followed by irrigation.
- Fipronil 0.3G @ 25 kg/ha applied at the early stage of infestation.
- Chlorantraniliprole 18.5 SC @ 150 ml/ha in 500–750 L water.
- Flubendiamide 39.35 SC @ 125 ml/ha in sufficient water for effective management.
- Cartap Hydrochloride 4G @ 25 kg/ha in endemic areas followed by irrigation.
- Spray Flubendiamide 39.35 SC @ 125 ml/ha in sufficient water for effective management under severe infestation.

6. Gurdaspur Borer, *Acigona steniella* Hampson (Lepidoptera: Crambidae)

Symptoms

- Larvae bore into the stalk from the base and feed internally.
- Presence of small bore holes plugged with frass on the cane surface.
- Extensive tunneling inside the cane results in weakening of stalks.
- Affected canes become hollow and may dry prematurely.
- Infested plants show poor growth, reduced cane weight and lower sugar recovery.
- Severe infestation causes lodging and substantial yield losses.
- Damage is generally more pronounced in ratoon crops than in plant crops.

Biology

- Adult moths emerge during the warmer months and are active during the evening.
- Females lay eggs in clusters on sugarcane leaves and leaf sheaths.

- Eggs hatch within 5–8 days.
- Newly hatched larvae initially feed externally and then bore into the cane stalk.
- The larval stage lasts 35–50 days and causes maximum damage.
- Pupation occurs within the larval tunnel inside the stalk.
- The pupal period lasts 8–12 days.
- The complete life cycle is completed in approximately 50–70 days.
- The pest survives in crop residues and ratoon stubbles between seasons.

Management

- Use healthy and pest-free seed cane.
- Remove and destroy infested canes, stubbles and crop residues after harvest.
- Avoid rationing heavily infested fields.
- Deep summer ploughing helps expose overwintering stages.

- Maintain field sanitation and balanced fertilizer application.
 - Release *Trichogramma chilonis* @ 50,000–100,000 parasitoids/ha at regular intervals during moth activity.
 - Encourage conservation of natural enemies under IPM practices.
- Chemical Control**
- Chlorantraniliprole 0.4G @ 25 kg/ha applied in the root zone or leaf axils followed by irrigation.
 - Fipronil 0.3G @ 25 kg/ha applied during the early stage of infestation.
 - Chlorantraniliprole 18.5 SC @ 150 ml/ha in 500–750 L water.
 - Flubendiamide 39.35 SC @ 125 ml/ha in sufficient water.
 - Cartap Hydrochloride 4G @ 25 kg/ha in endemic areas followed by irrigation.