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Major Insect Pests of Sugarcane (*Saccharum officinarum*) Crop and Their Integrated Management Approaches

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Abstract:

Sugarcane has a fair variety of insect pests that flourish on it, and on average, these insect pests cause a 15-20% loss in yield, in addition to a decrease in produce quality (Majumder, 2020). It is accepted that half of these total insects are of new world origin, while the other half are of old world or oriental origin. In other words, approximately 650 insects visit sugarcane in the old world, to which India belongs. A larva enters the cane by a small hole in the epidermal tissues (leaf, leaf sheath, and stalk) and feeds within the tissues. Sugarcane borer infestations cause direct injury. Sugarcane borer infestations cause direct injuries owing to galleries produced along the sugarcane stems, which might lower yield and indirectly allow fungal colonisation (Pannuti *et al*., 2013). Furthermore, losses are exacerbated by lower sugar content and contamination of sugarcane juice, which impedes fermentation in the ethanol manufacturing process (Rossato Junior *et al*., 2013).

Keywords: *Saccharum officinarum*, Insect-pests, Borers, Management approaches

Introduction

Sugarcane, *Saccharum officinarum*, has grown to be one of India's most important crops, giving thousands of direct, indirect, temporary, and permanent jobs. Sugarcane attracts a variety of insect pests, which cause a production loss of 15-20% each year on average, as well as a decline in output quality (Majumder, 2020). Box (1953) conducted a global census of sugarcane-feeding insects, identifying 1300 species that visit sugarcane on a regular basis. However, not all of these insects are found in a single country or continent; each country's insect fauna has only a portion of them. It is accepted that half of these total insects are of new world origin, while the other half are of old world or oriental origin. In other words,

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approximately 650 insects visit sugarcane in the old world, to which India belongs. So far, around 220 insects have been identified as sugarcane pests in India (David *et al*., 1986). Borer larvae cause harm to the sugarcane crop. Except for the rare foray outside in search of a new feeding place, a larva spends most of its time beneath the protective cover of the cane tissues. Thirteen species of borers have been identified as sugarcane pests in India. Only nine of these are regarded important and have a significant economic impact. These nine species are from six Lepidoptera genera (five Pyralids), namely *Acigona* (1), *Chilo* (4), *Emmalocera* (1), *Raphimetopus* (1), *Scirpophaga* (1), and (one Noctuid) *Sesamia* (1) (Majumder, 2020). Among the limiting factor for good performance and crop yield of sugarcane in India are sugarcane borers such as early shoot borer, *Chilo infuscatellus* Snellen (Lepidoptera: Crambidae); Green borer, *Raphimetopus ablutella* (Zeller) (Lepidoptera: Pyralidae); Pink borer, *Seasmia inferens* (Walker) (Lepidoptera: Noctuidae); Root borer, *Emmalocera depressella* (Swinhoe) (Lepidoptera: Pyralidae); Top borer, *Scirpophaga excerptalis* (Walker) (Lepidoptera: Crambidae); Plassey borer, *Chilo tumidicostalis* (Hampson) (Lepidoptera: Crambidae); Stalk borer, *Chilo auricilius* Dudgeon (Lepidoptera: Crambidae); Internode borer; *Chilo saccharphagus indicus* (Kapur) (Lepidoptera: Crambidae); Gurdaspur borer, *Acigona steniellus* (Hampson) and maize or sorghum borer, *Chilo partellus* (Swinhoe) (Lepidoptera: Crambidae) (Majumder; 2020 and Sallam, 2006). Sugarcane borer infestations cause direct injuries owing to galleries produced along the sugarcane stems, which might lower yield and indirectly allow fungal colonisation (Pannuti *et al*., 2013). Furthermore, losses are exacerbated by lower sugar content and contamination of sugarcane juice, which impedes fermentation in the ethanol manufacturing process (Rossato Junior *et al*., 2013). The damage could cause apical meristem mortality, aerial root growth, lateral sprouting, and biomass loss (Cheavegatti Ginotto *et al*., 2011; Vargas *et al*., 2015). Chemical treatment of sugarcane borers with synthetic insecticides is hampered by the larvae's cryptic feeding habit inside sugarcane stems for five to seven instars. Infestations of sugarcane borers continue to be a problem for sugarcane productivity. However, biological management using larval-pupal parasitoids has been successful for this group of insects (Chichera *et al*., 2012, Dinardo-Miranda *et al*., 2014, Parra, 2014, and Vargas *et al*., 2015).

Top borer, *Scripophaga excerptalis* (Walker)

It is a major pest of sugarcane in India, particularly in the subtropical area, where it is recognised as the most serious entomological concern in sugarcane farming (Majumder, 2020).

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The top borer pupa is exceedingly fragile, slender, and cylindrical. The pupa's body wall (cuticle) is exceedingly thin and translucent. The pupal colour varies as it matures. Male pupas develop ochrous, but female pupas become primarily white. Female pupas' anal ends turn white and then orange, whilst male pupas retain their body colour.

Stalk borer, *Chilo auricilius* Dudgeon

It is a sugarcane borer that causes considerable damage to the mature cane stalk. This is also known as the "Tarai borer" because to its predominance in the Tarai region (a damp and cold subtropical belt). A newly produced pupa is yellowish-white or creamy yellow in appearance, and with time, the pupa's colour changes to light brown. The pupa is small and tiny. If a pupa is present in the dark decaying stalk tissues, it turns exceedingly dark. On the 9th segment of a male pupa, the genital region appears as a small depressed furrow between two broadly elevated lobes. A lengthy triangular area develops from the anal area up to the base of the 8th segment in female pupas, and the genital area is marked by a noticeable dark coloured depression (Majumder, 2020).

Pink borer, *Sesamia inferens* (Walker)

It is a polyphagous pest that infects a variety of crops such as rice, wheat, maize, sorghum, sugarcane, finger millet, and others. The pink borer is active all year because one or more host crops are available. It is commonly known as the pink borer due to the larva's distinctive pale pink body colour or raw flesh colour, and it can also live in sugarcane habitat. Pink borer pupas have many uneven rows of characteristic depressions (pits) on each abdominal segmental body. The anal projections (cremaster) are smaller and darker brown to black in hue. In rice pink borer, the upper portion of the pupal body is mostly covered with white substances, while sugarcane pink borer is infrequently found (Majumder, 2020). The white powdery stuff may occasionally reach the vaginal area. The male pupa has two noticeable elevated lobes with a centre depression on the 9th segmental. Female pupas are larger and have multiple concentric light triangular patterns on the 8th and 9th segments.

Root Borer, *Emmalocera depressella* (Swinhoe)

E. depressella infestation causes "dead hearts" and general yellowing of the leaves, as well as poor tillering in mature plants (Bhatt *et al*., 1996). The ideal temperature for this insect pest is 30-35°C, with a high relative humidity. Extremely high or low temperatures, when combined with low humidity, are adverse to insect development (Sardana, 1997). Larvae usually make tunnel inside the base of the stalk or in the stubble. Last instar larvae hibernate

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in sugarcane stubble from the middle of November to the first week of December. In the majority of cases, only one larva may be found hibernating per plant (Kundu et al., 1994). Females lay eggs singly, mostly on the underside of the leaves. Newly hatched creep downhill towards the plant's base through soil fissures and burrows into the stalk's base (Kundu *et al*., 1994), and sandy, sandy loam soils that receive frequent irrigation have greater infection rates.

Shoot Borer, *Chilo infuscatellus* Snellen

Because the immature larvae of Chilo infuscatellus feed on the outer leaves of sugarcane plants, the crop is harmed during the shoot stage. The third instar larvae then burrow into the stem (Easwaramoorthy and Nandagopal, 1986). The borer burrows downward via young shoots. This causes the upper half of the central leaf whorl to be detached, which dries out and generates "dead hearts" in shoots that are one to two months old. These are easily removed, and the decaying component of the straw-colored dead heart emits an awful odour. A number of bore holes near the foot of the shot, just above ground level. An early attack kills the mother shoot completely, whereas a late strike produces considerable tillering. The caterpillar is brownish in colour with a white body and five violet stripes on the dorsal side. Crochets on the proleg are semicircular or crescentic. Every caterpillar moves and shoots at different shoots. The larval stage pupates within the stem and lasts about 35 days. The pupal phase lasts 10 days and the pupa is light brown in hue. The adult moth has pale greyish brown wings and whitish hind wings. Darker patterns can be found on the forewings, particularly around the outer margin.

Sugarcane leaf hopper, *Pyrilla perpusilla* (Walker)

Pyrilla is the most damaging pest that consumes sugarcane leaf. Adults and nymphs are both extremely energetic, leaping from leaf to leaf at the slightest disturbance. They absorb the leaf's cell sap and produce honeydew, which attracts the black fungus. The feeding turns the leaves yellow, giving them a scorched, withered appearance covered in black crust. As a result, photosynthesis suffers. High temperatures (26-30°C), high humidity (75-80%), irregular dry spells, and wind movement all contribute to the rapid accumulation of pyrilla. A dense and lush crop, an excess of nitrogen supplied, waterlogging, cane lodging, and cultivars with broad, succulent leaves are all factors that promote the formation of pyrillas.

Pyrilla is estimated to be responsible for approximately 28% of cane yield losses, with a 1.6% unit loss in sugar. The female bug sheds her wings and lays greenish yellow eggs in clusters, mainly on the underside of leaves and between the stem and the detached leaf sheaths.

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The eggs are covered in white, waxy, cottony threads. In about a week, a cluster of ten to fifteen eggs will hatch. The nymphs feed on plant sap and go through two unique anal procedures.

Integrated Approaches for Pest Management: -

- The collection of egg masses and also the infested portions of plants may be reduced the infestation level of all pests at brood emergence period.
- Reduction of incidence is accomplished by burning trash, eliminating plant residues, and eliminating "water shoots" in ratoon crops.
- Earthing up in the month of May and June and application of fertilizers at the pre-monsoon season is a very good for control of early shoot borer.
- To avoid the peak oviposition period of insect pests early planting is the best strategy.
- Early-stage mulching with cane waste has also been shown to decrease occurrence and help in moisture conservation.
- Taking off and destroying the infected tillers as close to the ground as possible is a best mechanical control for all pests.
- Applying 25 kg/ha of Cartap hydrochloride granules to the soil during planting, followed by other application on the 45th day for crops that were planted later.
- In the first month of planting, the egg parasitoid *Trichogramma chilonis* is released inundatively at the rate of 50,000/ha, at every 7–10 days interval.
- Release of pre-pupal pararsitoid of top borer *Isotima javensis* and egg parasitoid of all borers *Trichogramma japonicum* parasites is very effective for the incidence of insects at egg stage.
- After harvest, burning and destroying trash (detrash) helps in eliminating *Pyrilla perpusilla* egg masses.
- Eliminating grows from the stubble once in month of April may help in decreasing the accumulation of pests.
- Field flooding decreased the severity of root borer, *Emmalocera depressella* infestation.
- Infestation can be decreased by intercropping cowpea with sugarcane. It was discovered that other crops, like black and green grams, decreased infestation.
- For the management of sugarcane leaf hopper *Pyrilla perpusilla,* release of the lepidopteran ecto-parasitoid *Epiricania melanoleuca* @ 4000-5000 cocoons or @ 4-6 lakh eggs/ha and checks its multiplication.

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- In case of severe infestation without the occurrence of the ectoparasitoid, spraying of chlorpyriphos @ 2ml/lit. or phosphamidon@0.5ml/lit or dimethoate 2ml/lit. is quite effective.
- Effective insecticide against *E. depressella* is Regent® (Fipronil) 0.3 (granular formulation) at 75 g/ha.
- Application of Carbofuran 3-G @ 1.5 kg/ha is suitable for the control of stalk borer, *Chilo auricilius* infestation.

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