AgriCos e-Newsletter
ISSN: 2582-7049
AgriCos e-Newsletter
Open Access Multidisciplinary Monthly Online Magazine
Volume: 03 Issue: 03 March 2022 Article No: 19

Mass Multplication of Larval Parasitoid of Sugarcane Top Shoot Borer –*Isotimajavensis* (Rohwer)

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SUMMARY

The borers are the major destructive pests on sugarcane, among them top shoot borer, Scirpophagaexcerplalis Walk. (Pyralidae ; Lepidoptera) is unique and it infests sugarcane during all the stages of crop growth causing 'bunchy top' appearance at the top of the sugarcane. Isotimajavensis (Rohwer) is an effective larval parasitoid of sugarcane top shoot borer.The parasitoid flourishes well during July to September when top borer activity is also as its peak.The mass multiplication of these parasitoids we can do both field and laboratory conditions. This biocontrol agent is ecofriendly and effective without dependence on pesticides.

INTRODUCTION

Sugarcane is an important cash crop in manysubtropicaland tropical countries and is one of the main sources of sugar production in the world.In the worldBrazil is the largest producer of sugarcane.In the 2019-2020 crop year, global sugar production was approximately 166.18 million metric tons, with 182 million metric tons expected for 2020-2021(FAO, 2020). Approximately 80% of the world's sugar is produced from sugar cane in subtropical and tropical climates. Presently sugarcane is grown in an area of 16 m.ha. and production (167 m.t) among the sugarcane growing countries of the world. In India, Uttar Pradesh has the largest area almost 50 per cent of the cane areafollowed by Maharashtra, Karnataka, Tamil Nadu, Andhra Pradesh, Gujarat, Bihar, Haryana and Punjab.Sugarcane crop sustains losses by insect pests under modern agriculture. Every part of sugarcane endures attack from one or the other pest since planting to harvesting. The utility of pesticides has not been spectacular against most species of moth borers, scalesand white grubs. This has diverted the attention of entomologists to biocontrol more than ever. Sugarcane borers are the major destructive pests, which cause 8–10% cane yield losses at farmer's level and 10–15% sugar recovery losses in sugar industries. Statistically the borers cause losses of 25.5 million tons at national level (Jasmine *et al.* 2012). Among the sugarcane insect pest, top shoot borer, *Scirpophagaexcerplalis* Walk. (Pyralidae ; Lepidoptera) is uniqueand it infests sugarcane during all the stages of crop growth. It occurs as a frequently and major pest in sugarcane growing areas. In grownup canes, the infestation appears in 'dead heart' formation which sprouting of the lateral buds giving a 'bunchy top'appearance at the top of the sugarcane. Top borer incidence led to 18.08% weight loss in cane yield and 21.54% decrease in cane length at harvest (Pandya *et al.* 1999). There is report for a loss of 20% in yield due to top shoot borer (kerla*et al.* 1965).

Aims

- Discover, identify and evaluate the biology, ecology, and efficacy of parasitoids as classical biological control agents against top shoot borer of sugarcane.
- To determine their ecological safety for release as classical biological control agents.
- Develop an improved understanding of mechanisms that influence successful establishment of introduced biological control agents, using parasitoids of target pest such as sugarcane top shoot borer as model systems.
- Conduct retrospective analyses of current or past biological control programs, where appropriate.
- Conduct laboratory and field studies of selected biological traits and ecological requirements relevant to the establishment and efficacy of biological control agent.
- To serve as guidelines for extending financial assistance to entrepreneurs who may be interested in getting up biological control unit.
- With collaborators, conduct field releases, monitor for establishment and evaluate the impact of natural enemies on target pest populations as well as non-target effects in the field.
- To promote setting up of a greaternumber of bio-control production units.

Scientific name and taxonomic position of larval parasitoid of sugarcane top shoot borer: *Isotimajavensis* (Rohwer)

Order- Hymenoptera
Family- Ichneumonidae
Genus-Isotima
Species-javensis



Hosts:
Larval parasitoid of *Scirpophaga* spp. occurring on sugarcane and rice.

Biology:

Isotimajavensis is an important larval parasitoid of sugarcane top borer *Scirpophagaexcerptalis* (Walker). It shot into prominence when a strain of this parasitoid was introduced from North India to South India. Between 1955 and 1958, 78% of the top borer population was parasitized by this parasitoid in Pugalur. The parasitoid can be multiplied and released in endemic areas for the suppression of top borer. The parasitoid flourishes well during July to September when top borer activity is also as its peak. The parasitoid generally appears in the field in March, parasitizing the top borer larvae at low level in 1st brood of top borer in March- April. Its activity in field increases soon after the rains *i.e.*, somewhere about the middle of July and reached maximum in between August and October, which synchronizes with the period of maximum activity of its host. With the approach of winter, parasitoid like its host enters into a long period of hibernation in larval stage. Its, however, resumes its activity a little earlier than the borer so as to emerge as adult before the over wintering larvae of *S. excerptalis* pupae.

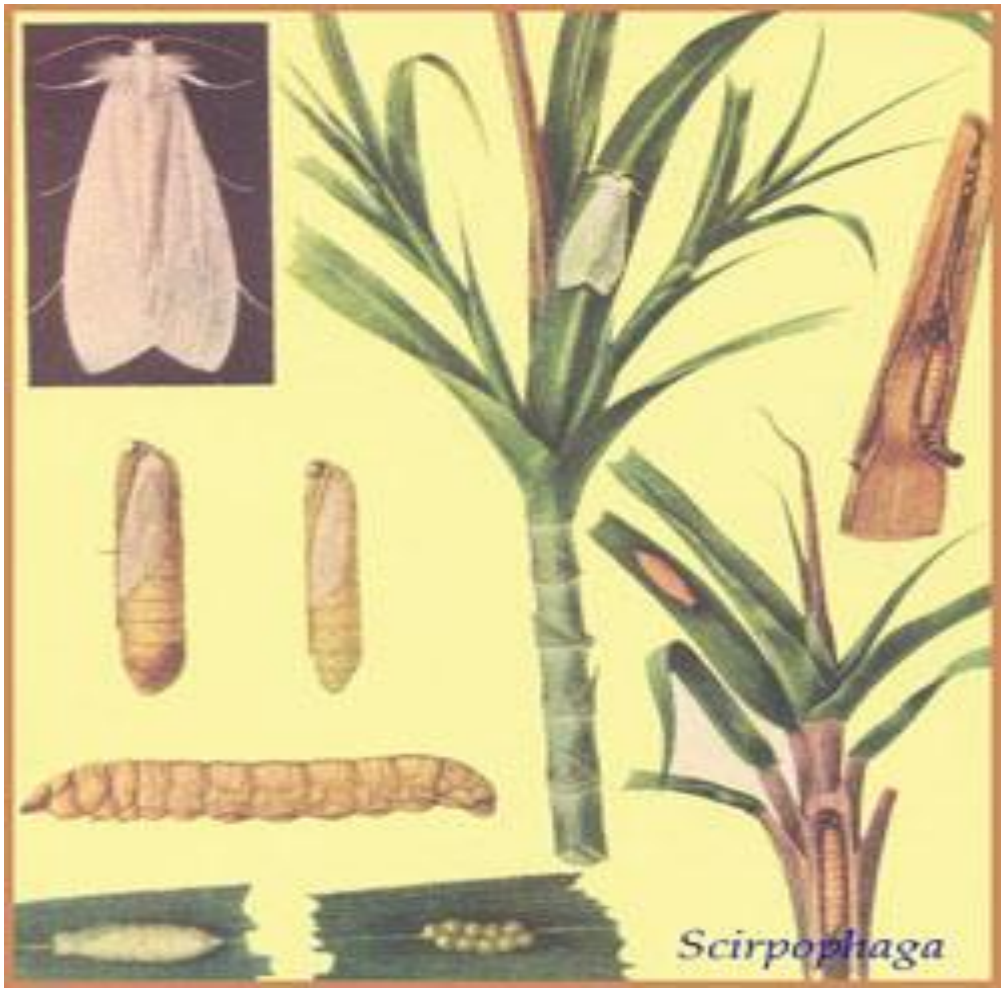
Production procedure of *Isotimajavensis*:

Field multiplication of host insect *Scirpophagaexcerptalis*:

In order to obtain sufficient number of eggs of *Scirpophagaexcerptalis* for field release, about 80 egg masses were removed with pieces of sugarcane leaves from the breeding cages and placed on five separate sugarcane clumps of situated 50 m apart in an experimental sugarcane field. These plants were also individually covered with meshed cages. Sufficient number of larvae and adults of sugarcane top shoot borer were introduced into the cage. After a significant increase of population, the nets of the cages were and provided to the *Isotimajavensis* and method require less attention from one 2X2 feet space.


Larvae of top shoot borer


Adult of top shoot borer



Laboratory rearing of *Isotimajavensis*:

Larvae which are ready to pupate are exposed to female parasitoids to obtain eggs and these eggs inoculated or transferred on individual larva or the larvae are exposed directly either in paper straw or infested tops of sugarcane for 24 hrs. and the emerging adults collected from the cages where the parasitized material is kept. But a method developed at Indian Institute of Sugarcane Research, Lucknow with some local modifications is now widely accepted and is detailed below.

Rectangular cages fitted with wire mesh on upper and two sides and sleeves and acrylic shutters on the remaining two sides *i.e.*, front and back are used. Four five cm wide wooden planks with 2.5 cm diameter holes 15 cm apart are fixed on the top of the cage. The bottom is provided with five iron rods (0.6 cm in diameter) to the upper planks. For each cage 20 wooden rods (70 cm length), each having 20 holes are used. The rods are inserted from the top holes to rest on the bottom iron rods. In this assembly, holes in wooden rods are available at every five cm distance. The bottom of the cage is lined with 2.5 cm thick sponge sheet which is moistened daily or on alternate days to provide 50-60% humidity.

For introducing larvae into cage, paper straws are cut into 2.5 cm long pieces and one side is plugged with cotton. From the open-end top borer larva is inserted in every straw piece. The larva spins a silken disc at the open end. Before introducing parasitoid adults' split raisins and saturated cotton swabs of honey water in ratio of 1:1 is provided for adult feeding. Twoto three-day old males and freshly emerged female wasps are introduced into the cage. The female parasitoid on finding the silk disc inserts its ovipositor to sting and paralyze the mature larva or pre-pupa of top borer and deposits its egg. The straw pieces containing parasitoidlarvae are removed every 24 to 48 hrs and fresh straw pieces containing top borer larvae are kept again in the same manner as described above.

For further development of parasitoids, the straws containing parasitized larvae are kept in adult emergence cages. The process is continued. The temperature inside the cage could vary from 26-30^{o}C. Seventy to eighty per cent of the parasitized top borer larvae give riseto adults in 17-39 days (eggs hatch in 2.1 days, larvae and pupae complete development in 4.5-9 days and 6-9 days, respectively). Each female can lay 6 to 10 eggs every day during its active oviposition period.

Field releases:

In the fields, the parasitoids are released after formation of emergence holes in the top borer attacked plants. For this purpose, 100 top bored canes or shoots are tagged to ascertain the initiation of emergence hole formation in the field. The release of *Isotimajavensis*is initiated only when the emergence hole formation in top bored plants is 3-5 days old. The releases are made during the morning hours of the day. The efficiency of *Isotimajavensis* under sub-tropical condition is limited because the parasite activity starts with the formation of emergence hole in borer affected plants by the time the borer has established, damaged the growing point and has thereby brought about the damage. Therefore, any increase in the level of parasitisation of parasitoid, when the third brood attack has affected the crop, is of no consequence. The release made in second brood that is previous to the third brood, which inflicts extreme damage, also did not help in keeping the borer activity at a low level. *Isotimajavensis*125 adults are released/ha thrice between July and august at weekly interval or in fields showing more than 10% infestation. Incidence of top borer is monitored starting from 45th day old crop and adult parasitoids are released, when necessary, by walking along rows and uniformly distributing them.

CONCLUSION

Isotimajavensis isan important larval parasitoid of sugarcane top borer *Scirpophagaexcerptalis* (Walker). The mass multiplication of these parasitoids we can do both field and laboratory conditions. This biocontrol agent is ecofriendly and effective without dependence on pesticides.

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