

IN THE NAME OF ALLAH WHO IS REHMAN AND RAHEEM

**Possibility of Biocontrol of sugarcane top borer
with *Rhaconotus scirpophagae***

By

Rana Masood Ahmad

RATED: BEST PAPER IN AGRICULTURE OF 48TH CONVETION

AUTHORS



DAMAGE BY SUGARCANE TOP BORER

The attack of top borer on crop starts right from early tillering stage and goes up to maturity.



DAMAGE ON SUGARCANE CROP

- Top and stem borers damage the crop up to 20% to 30% (Ali and Shah, 1990)

BORERS DAMAGE 2008

In District Kasur During 2008 – 2009 the incidence of top borer alone was up to 47% in several fields.



TOP BORER IN INDIA

Reduction in yield 51%

Reduction in sugar contents up to 2.0 units

Pandey et al., 1997 & Madan et al., 1999.

METHODS OF CONTROL

To offset the damage done by the top borer, generally two methods are used

1. Chemical control
2. Biological control

CHEMICAL CONTROL

- Spray over the infested crop
or
- Flood the infested crop

* Eggs are not accessible to chemicals

Because:

*Egg mass of Top borer is on the underside of the leaf

*Eggs are tightly covered with hairs

Top borer larvae on hatching make mines in leaves very quickly and move into shoots. In the top shoots they are fully protected inside



Egg mass of Top borer



Hatching egg mass of top borer

- Newly hatched larvae hide themselves in shoots
- Grown up larvae make tunnels
- They are fully protected from being hit by chemicals



When the crop is young, larva live in root portion. There they are fully safe from the effects of spray of insecticide



Possibly because of these reasons the chemical control is not providing satisfactory results

BIOLOGICAL CONTROL

In Pakistan at present *Trichogramma chilonis* and *Chrysoperla carnea* are being used for sugarcane borers



Trichogramma chilonis

- Trichogramma chilonis cannot parasitize the tightly covered eggs
- It parasitizes uncovered a few eggs that are present on the outer margins of egg mass



Chrysoperla Carnea

- Chrysoperla larvae are not interested for feeding on hair covered eggs
- Newly hatched larvae move quickly in to shoots, therefore a few larvae are preyed upon



- In the stem tunnels the top borer larvae are not accessible to Chrysoperla



BIOLOGICAL CONTROL

These facts show that neither Trichogramma nor Chrysoperla can control top borer as desired by the cane growers

BIOLOGICAL CONTROL OF TOP BORER

- Since the top borer larvae remain hidden in stem tunnels during their development period, we need such parasitoids which can destroy these stages in stem tunnels



LIST OF TOP BORER PARASITOIDS

- *Bracon chinensis* Cam.
 - *Chelonus*
 - *Goniozus indicus* Ashmead
 - *Goryphis nursei*
 - *Isotima javensis* Rohw.
 - *Rhaconotus scirpophagae*
 - *Stenobracon deesae*
- (Carl,1962; Beg and Khan, 1982; Mohyudin,1981)

RHACONOTUS SCIRPOPHAGAE

Rhaconotus scirpophagae is one of the parasitoids which kills top borer larvae in stem tunnels



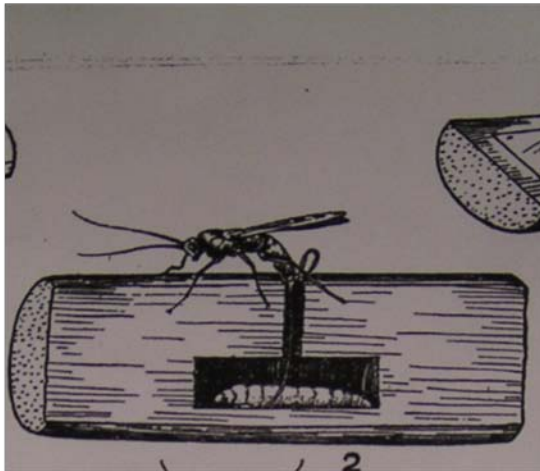
HOLE IN THE STEM

- Top borer larva makes an hole in the stem before pupation. This hole is for the emergence of top borer adult (moth). *Rhaconotus* uses this hole to find the top borer larvae.



ACTION OF RHACONOTUS

- Rhaconotus female Inserts her ovipositor through this hole
- Locates the top borer larva
- It paralyzes the top borer larva
- It places eggs on paralyzed larva



Egg laying behavior of Rhaconotus

- In field condition it inserts its ovipositor through the hole, paralyzes the larva, then places eggs on or close to the paralyzed larva



Rhaconotus acts in the same way



RHACONOTUS LARVAE

- Rhaconotus eggs hatch and start feeding on body of the paralyzed larva



Parasitized top borer larva in tunnel



PARASITOID COCOONS

- After completing larval development , it forms cocoons on the body of top borer or nearby



RHACONOTUS COCOON

Parasitoid adult emerges from this cocoon and starts its life activities



RHACONOTUS SCIRPOPHAGA

- For the use of this parasitoid in the biological control of top borer, technique of its rearing and biology were studied



1. MATERIAL AND METHODS

Facilities of Biological control Laboratory of Brothers Sugar Mills Ltd. at Chunian district kasur were used for work on rearing and biology of Rhaconotus scirpophagae



Biology of *R. scirpophagae*

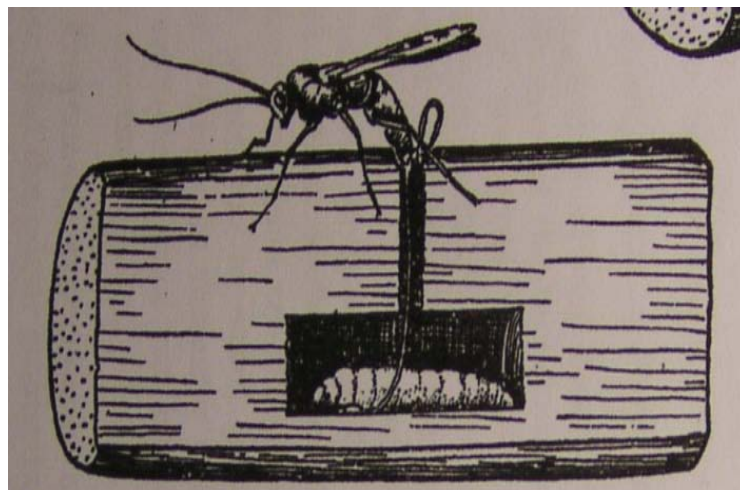
Adults of *R. scirpophagae* were obtained by keeping field collected parasitized larvae of top borer in glass jars. The jars were placed in a room maintained at $29 \pm 1^\circ\text{C}$ and $60 \pm 5\%$ Relative humidity.

Emerged adults were fed on dilute honey and transferred into a cage containing matured larvae in sugarcane stem pieces



Biology of *R. scirpophagae*

- Mating in adults started 2 – 3 days after emergence
- Mated females moved over the stem pieces, inserted their ovipositor through small holes, stung and paralyze the larvae
- Paralysis was permanent



Biology of R.scirpophagae

- Larvae fed for 5-7 days
- Pupation occurred in cocoons
- Pupal period was 6-8 days



Biology of R. Scirpophagae

- Male longevity 10-14 days
- Female longevity 12-18 days
- Fecundity of females 186 eggs

Biology of R. scirpophagae

- Number of top borer larvae paralyzed 61%
- Number of top borer larvae with eggs 15%

Biology of Rhaconotus

Number of eggs laid per female Hatchability (based on 150 eggs)	185 average 87.2%
Larval period(based on 118)in days	5-7 (6.4)
Pupal period of 97 pupae (days)	6 – 8 (7.7)
Male longevity (50 adults)	10 – 14 (12 .7)
Female longevity (50)	12 – 18 (16)
Number of larvae paralyzed per female	61
Number of eggs laid/per female	185
28 $\pm$ 2 degree centigrade and Relative humidity 65 $\pm$ 5%	

DEVELOPMENT PERIOD

Rhaconotus

- 11 – 13 days



- It complete 4 generations in 60 days

Top borer

- 50 – 60 days



- As against one generation in 60 days

DISCUSSION

It is very clear from the figures shown in table-1 that *R. scirpophagae* possesses several positive points which strongly indicate that it is an effective parasitoid of top borer. These positive points are:

- It is gregarious ecto-parasitoid
- It can locate the top borer larvae even in the tunnel
- it stings its host through the silk webbing at the mouth of the larval tunnel
- It lays several eggs on/close to one larva. Most of them develop to adult stage
- Its females paralyze the larvae permanently even when no egg is laid. Thus the top borer is disabled to do further damage to the cane
- Its fecundity is fairly good as a female can lay more than 185 eggs in her life time
- Its development period from egg to adult is short- much less than 1/4 of the development period of top borer. Thus it can multiply very quickly as compared with its host

CONCLUSIONS

Above mentioned points show that it is a promising biocontrol agent. Its augmentation at the start of the season may prove effective in preventing the damage caused by top borer at tillering stage of sugarcane crop

THE END