



Biology of stem borer, *Euzophera perticella* (Lepidoptera: Pyralidae) and association of endoparasitoid *Pristomerus euzopherae* (Hymenoptera: Ichneumonidae) in grafted and ratoon brinjal crop

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ABSTRACT

The present study envisages the bionomics of brinjal stem borer, *Euzophera perticella* on eggplant and occurrence of its prominent endoparasitoid, *Pristomerus euzopherae* under Varanasi, Uttar Pradesh condition. Affected plants can easily be visualized by their appearance as light yellow in colour, completely drooped, withered and wilted with stunted growth, reduced plant vigour, lowered fruit bearing capacity and detected in patches across the plot. Damage is more severe in near maturing, ratoon and grafted brinjal crop. Its incidence was observed from the second fortnight of February onwards (13.5% stem damage) which increased gradually with 29.75, 51.5, 76.5 and 89.7% stem damage during March, April, May and June, respectively and where almost all the plants were affected by this borer during July. Oviposition, incubation, larval and pupal periods of *E. perticella* ranged from 4-11, 3-9, 29-47 and 7-14 days, respectively, whereas adult longevity were 4-8 days for male and 5-13 days for females. An Ichneumonid endoparasitoid, *Pristomerus euzopherae* was recorded associated with this stem borer. Incidence of this parasitoid was noted during second fortnight of April (1.91% parasitization) with highest parasitization (12.48%) during July followed by June (7.73%).

Key words: Brinjal, *Euzophera perticella*, Parasitoid, *Pristomerus euzopherae*, Stem damage

Brinjal stem borer *Euzophera perticella* Ragonot (Lepidoptera: Pyralidae) is an oligophagous insect pest found mostly in the Indian subcontinent. The first infestation of this pest in eggplant was reported from Hyderabad by Rizvi and Sanyal (1977). It feeds mainly on brinjal but sometimes on other solanaceous plants, viz. tomato, potato and chilli. It is generally considered as a minor pest of eggplant (Swamy and Satpathy 2007, Rai *et al.* 2014) but occasionally its infestation is reported to be severe (Yadav and Kumawat 2013, Anonymous, 2014). In India, viz. Tiruchirapalli district of Tamil Nadu (David *et al.* 2001) and parts of West Bengal it is considered as a major pest (Anonymous 2006). Literature on biology, seasonal incidence and periodical damage of the *E. perticella* on eggplant and its potential parasitoid(s) are very scanty; hence, detailed investigation on bionomics and damage of the this borer pest along with its important parasitoid(s) was undertaken.

MATERIALS AND METHODS

Occurrence of *E. perticella* was recorded at monthly

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intervals in the field throughout the year (August - July) during 2015-16 and 2016-17 on eggplant at experimental farm of ICAR-Indian Institute of Vegetable Research (25°12' N, 82°52' E), Varanasi, Uttar Pradesh, India. Randomly selected fifteen plants were observed at monthly intervals from August onwards when the plants were one month old till July of the next year. The stems of the plants were striped open longitudinally with a sharp knife to expose and count the larvae inside, if any, and also to observe the occurrence of larval tunnel(s) inside stem. Per cent stem damage was calculated by the following formula –

$$\text{Plant damage (\%)} = \frac{\text{Number of damaged plants}}{\text{Total number of plants}} \times 100$$

The biology of *E. perticella* was studied under laboratory conditions at 28 ± 2°C temperature, 70–80 % relative humidity and a photoperiod of 13:11 (L:D) hour. Initial culture of stem borer, *E. perticella* was maintained by collecting the infested plants of eggplant containing different developmental stages of the borer. Infested stems were placed in plastic jars (15 cm diameter and 19.2 cm height) and reared on their natural host for further multiplication of the pest. The observations on oviposition were recorded by introducing pairs of newly emerged moths in wire screen cages (210 cm × 60 cm × 80 cm) with four months old eggplants grown on plastic pots filled with clay loam soil

with recommended doses of fertilizers and manures. The larvae were reared in Petri dishes (Himedia, 10 cm diameter and 4 cm height) with mature stems of eggplant. Pupae were segregated and placed in cages for adult emergence. All the biological parameters were recorded and statistically analyzed using SAS version 9.3. To record the occurrence of parasitoid, if any, twenty field collected larvae were kept separately in each petri dish (9 cm diameter) at fortnightly intervals along with their natural host (brinjal stem). Emergence of parasitoid was recorded and accordingly their nature (solitary or gregarious) was determined and per cent parasitization was calculated by the following formula –

$$\text{Parasitization (\%)} = \frac{\text{Number of parasitized larvae}}{\text{Total number of larvae}} \times 100$$

The parasitoids were collected and preserved at 70% ethanol and sent to National Pusa Collection, Division of Entomology, Indian Agricultural Research Institute, New Delhi for taxonomic identification.

RESULTS AND DISCUSSION

Recently for the last couple of years its serious infestation was recorded in and around the experimental farm of the Institute on eggplant (*Solanum melongena*) particularly during summer seasons (February–July). Damage was more serious in near maturing brinjal crop, ratoon brinjal as well as grafted brinjal maintained at the experimental plots of the Institute. During June–July, cent percent plants were affected by this borer pest which led to discontinuation of the old crops and re-sow the new crop. Several local farmers visiting the Institute also reported about the same problem. Initially infested plants became light yellow in colour with stunted growth and detected in patches across the plot. Later on the infested plants were completely drooped, withered and wilted with stunted growth, reduced plant vigour and lowered fruit bearing capacity. Larvae of stem borer, *E. perticella* damaged the stem portion of the eggplant by feeding the pith portion thereby reducing the translocation activity of the plants. The affected plants as visualized by their drooping nature were uprooted and brought to the biocontrol laboratory. Close observations revealed that prominent larval galleries/tunnels filled with frassy excreta were observed inside the stem and its underneath. Number of larval tunnels were varied from 3-11 per plant with an average of 7.92 ± 0.69 tunnels/plant. Larval feeding tunnel length varied from 8.4 – 21.3 cm with an average of 12.8 cm. On critical examination, it was found that most of the larvae (84.61%) exhibited positive geotropic movement i.e., moving from stem towards root region, except few (15.39%) following reverse direction. Movement of the larvae was clearly visualized by comparing the diameter of the feeding tunnel. Pupation was generally inside the stem with brown coloured fibrous cocoon. Adult exit points were quite often adjacent to the branch or any weak or injured point on the stem. A single exit point was often used by many borer larvae by interconnecting their feeding tunnel.

Field incidence of the stem borer was observed from second fortnight of February with 13.5% stem damage and gradually increased coinciding with increase in atmospheric temperature during summer months. The stem damage during March, April, May and June were 29.75, 51.5, 76.5 and 89.7%, respectively. Almost all the plants were affected by this borer during July. The lower temperature restricts its normal growth and development resulting as was evident from no incidence of this borer pest during November to first fortnight of February, i.e. winter at Varanasi (Fig 1). In another study it was confirmed that infestation of stem borer was seen usually in the later stage of crop (Anonymous 2008). In contrast, Sathe *et al.* (2016) reported that infestation of eggplant stem borer, *E. perticella* occurred during October to March under Kolhapur region of Maharashtra, India. Satpathy *et al.* (2006) documented that during the first sampling (July), 15-34% plants were infested, whereas during the second sampling in August the severity of damage increased and the mean plant infestation was 49.45% indicating three fold increases in infestation during one month.

The neonate larvae of *E. perticella* were light yellowish green in colour. There were four larval instars. Larval period ranged from 29 to 47 days with mean duration of 38.40 days. The third instar larvae were whitish in colour with blackish hairs on its body, whereas fourth instar larvae were bigger in size (14.5–19.25 mm in length) with brown sclerotized head capsule, sparsely clothed with white minute hairs and brown spotted dorsal area and clearly segmented

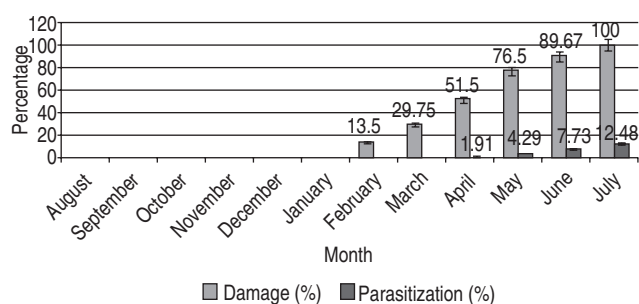


Fig 1 Seasonal incidence of *E. perticella* and its parasitoid on brinjal at Varanasi, Uttar Pradesh.

Table 1 Biological events in life-cycle of *E. perticella* on eggplant under laboratory conditions

Biological parameters	Minimum	Maximum	Mean* ± SD
Fecundity (Nos.)	111	256	179.10 ± 37.94
Egg viability (%)	79	90	83.90 ± 3.98
Oviposition period (days)	4	11	7.45 ± 2.14
Incubation period (days)	3	9	6.35 ± 1.96
Total larval period (days)	29	47	38.40 ± 6.74
Pupal duration (days)	7	14	10.10 ± 2.44
Adult longevity (days)			
Male	4	8	6.08 ± 1.39
Female	5	13	8.68 ± 2.79

SD= Standard Deviation; *Means are based on ten replications

body. Pupation took place mostly in feeding galleries inside the stems or sometime in cracks and crevices in the soil. The obtect pupae were light brown in colour with spindle shaped fibrous cocoon. The pupal period ranged from 7 to 14 days, with an average of 10.10 days (Table 1). Adult was medium sized moth whose forewings were pale straw yellow with prominent dentate vertical black lines beyond middle of the wing and hindwings were whitish in colour. Adult longevity varied from 4 to 13 days. The adult female survived longer (average 8.68 days) than the male (6.08 days). Mating took place mostly during night hours and gravid females laid eggs singly on the young leaves, petioles and tender stems. Freshly laid eggs were oval in shape, light yellowish colour which turned to yellowish brown before hatching. The oviposition period ranged from 4 to 11 days. Egg viability ranged from 79-90% with average 83.90%, whereas incubation period varied from 3-9 days. The insect is active from February to October and hibernates as larva in the stem of old plant from November to February under Varanasi condition. Swamy *et al.* (2006) reported that the incubation period ranged from 3-10 days, moths emerged in 6-8 days and insect completes its total life cycle in 35-75 days.

During the course of study, a larval endoparasitoid was recovered from *E. perticella* was sent to National Pusa Collection, Indian Agricultural Research Institute, New Delhi for its taxonomic identification. The specimen was identified as *Pristomerus euzopherae* Viereck (Hymenoptera: Ichneumonidae). The adult female is 7.5 to 8 mm long (excluding ovipositor). The body is pale yellow with mandibular apices, claws, antennal flagellum and bases of all gastral segments black, mesothorax with three black patches. Head and thorax punctuate, gastral segment I and II aciculate. Wings are hyaline, all veins and stigma are dark. Antenna was extending to almost apex of post petiole. Fore and mid legs are pale yellow, hind legs with black patches, hind femur with a distinct spine.

The parasitization by *P. euzopherae* was recorded first during the second fortnight of April when only 1.91% *E. perticella* larvae were parasitized. From April onwards, rate of parasitization gradually increased and the highest parasitization (12.48%) was recorded during July followed by June (7.73%) (Fig 1). The present study reported here is the first comprehensive report of *P. euzopherae* as an endoparasitoid of brinjal stem borer, *E. perticella* which has become a serious pest in near maturing and ratoon brinjal in and around Varanasi. The adult female parasitoid began to oviposit from the first day onwards. In the act of oviposition, the female arched her abdomen to penetrate its ovipositor into the host larvae residing inside the stem for egg laying. The lifespan of *P. euzopherae* females ranged from 7.5-13.75 days with an average of 10.63 days under laboratory conditions. According to Jiménez *et al.* (2000), the first generation of *P. spinator* females (F_1), a parasite of the potato tuber moth (*Phthorimaea operculella*), had a

mean lifespan of 33.5 days and second generation females (F_2) lived 10 days less than F_1 . From the present study, It is evident that under Eastern Uttar Pradesh condition, stem borer may cause severe damage to eggplant particularly ratoon brinjal, grafted brinjal as well as in the later part of crop growth stages. Occasionally stem borer is reported to be a severe pest in this subcontinent (Akhtar and Khawaja 1973, Anonymous 2014). We aim to conduct detailed studies on the bio-ecology and mass rearing of this ichneumonid parasitoid for integrated management practices for this nefarious borer pest with special emphasis on biological control.

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