J. Biol. Control, 23(4): 467–470, 2009 **Research Note**

Population fluctuations of Plassey borer, *Chilo tumidicostalis* Hampson and its parasitoid, *Cotesia flavipes* Cameron in sugarcane crop in Assam

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ABSTRACT*:* Seasonal incidence of Plassey borer, *Chilo tumidicostalis* Hampson, and its larval parasitoid, *Cotesia flavipes* Cameron, was studied at Shillogani, Nagaon, Assam, during 2006-07. Population of *C. tumidicostalis* first appeared in the early part of May and peaked in the second fortnight of September in both the cropping seasons. Later it showed a declining trend till harvest. The activity of *C. flavipes* commenced from the first fortnight of June in both the cropping seasons and continued till the end of November, 2006 and early part of December, 2007. The extent of natural parasitism by *C. flavipes* varied from 2.10 to 39.43 per cent in 2006 and 1.33 to 48.30 per cent in 2007. Maximum parasitism (39.43 and 48.30 per cent) occurred during the first fortnight of October, 2006 and the second fortnight of September, 2007 in the two study years. The parasitism increased with the increase in incidence of *C. tumidicostalis* larvae and fairly synchronized with the latter's maximum incidence. The extent of parasitism had significant positive correlations with the incidence of host larval population and relative humidity, but showed non-significant correlations with temperature, total rainfall and sunshine in both the cropping seasons.

KEY WORDS: *Chilo tumidicostalis, Cotesia flavipes*, parasitism, Plassey borer, sugarcane

Plassey borer, *Chilo tumidicostalis* Hampson, is a major constraint in sugarcane cultivation in the states of Bihar, Uttar Pradesh, Jharkhand, West Bengal, Assam, Nagaland and other northeastern states of India (Fletcher and Ghosh, 1919; Gupta and Avasthy, 1957; Khanna *et al*., 1957; Pandey *et al*., 2005). It is also reported from Bangladesh (Karim and Islam, 1977), Thailand (Suasa- ard *et al*., 2000), Nepal and Burma (David *et al*., 1986). The pest is widely distributed in sugarcane growing areas of Assam and causes extensive damage to the crop. The yield loss due to primary and secondary infestation has been estimated to a tune of 50-60 per cent in cane yield and 12.75-51.50 per cent in sugar in endemic areas of Assam (Anon., 1993). According to Gupta and Avasthy (1959), *C. tumidicostalis* multiplies actively from July to September, though its activity starts from mid-March and continues up to October in West Bengal. Rajmedhi (1992) and Borah and Sarma (1995) reported that the borer population was low at the beginning of the season and increased gradually to reach maximum in September in both Jorhat and Golaghat districts of Assam. A group of natural enemies of this pest has been reported (David *et al*., 1986). Among them, *Cotesia flavipes* Cameron is an important larval parasitoid causing overall parasitism as high as 40 per cent under natural conditions (Khanna *et al*., 1957; Gupta and Avasthy, 1959; Rajmedhi, 1992; Borah and Sarma, 1995; Rabha, 2002). Although seasonal incidence of *C. tumidicostalis* and its parasitoid, *C. flavipes* have been reported (Gupta and Avasthy, 1959; Rajmedhi, 1992; Borah and Sarma, 1995), their density dependence and the precise relationship of abiotic factors with the pest and its parasitoid have not been fully investigated. The present study was undertaken to elicit more information on these aspects in sugarcane ecosystem of Assam.

Field experiments were conducted on first year ratoon crop (ratooned on 9th January, 2006 and 16th January, 2007) [Variety-Co 6315] during 2006–07 at Field Trial Station (FTS), adjacent to Regional Agricultural Research Station (RARS), Shillongani, Nagaon. A plot of 0.4 ha was selected for the field observations. The crop was grown following the agronomical practices recommended for Assam (Anon., 2005). No pesticide was applied to the crop during the entire period of observations.

The larval population of *C. tumidicostalis* was observed at fortnightly intervals from the first fortnight of April in both the cropping seasons when the plants were three months old.

Five samples, each with 10 stools, were selected randomly from different parts of the field for the study. All the selected canes were inspected for borer infestation. Ten borer infested canes (two canes from each sample) were selected for direct counting of larvae. At the time of sampling of host population, 25-100 larvae of *C. tumidicostalis* (depending upon the density of the host larvae) were collected on every sampling day to determine the level of parasitism. The larvae so collected at each sampling date were brought to the laboratory and reared on sugarcane internodes in groups of ten in ventilated transparent plastic boxes (20 x 10 x 8 cm) until the emergence of either parasitoid cocoons or adults of *C. tumidicostalis*. The data recorded on per cent parasitism were correlated with host population and the meteorological parameters such as maximum and minimum temperature, relative humidity, total rainfall and sunshine. The data were subjected to multiple regression analysis as per Gomez and Gomez (1983).

The data on fortnightly population of *C. tumidicostalis* and its parasitoid, *C. flavipes* during 2006 and 2007 are presented in Figure 1. The population of *C. tumidicostalis* was first observed in the early part of May in both the population declined gradually, but continued till harvest of the crop (December) in both the cropping seasons. The declining phase of the borer population might be due to the fall in temperature and relative humidity from October onwards, which is similar to earlier observations (Rajmedhi, 1992; Borah and Sarma, 1995). Afterwards, the population declined gradually, but continued till harvest of the crop (December) in both the cropping seasons. The declining phase of the borer population might be due to the fall in temperature and relative humidity from October onwards, which is similar to earlier observations (Rajmedhi, 1992; Borah and Sarma, 1995).

The larval parasitism by *C. flavipes* was first recorded after the appearance of its host from the first fortnight of June in both the years. The parasitoid activity was 2.63 per cent and 1.49 per cent when the larval density of *C. tumidicostalis* was 3.30 larvae/plant and 7.80 larvae/plant in 2006 and 2007, respectively. The initial parasitism level was low in both the years, but increased gradually from August and the maximum parasitism was recorded during the first half of October, 2006 (39.42 per cent) and the second half of September, 2007 (48.30 per cent), respectively. The corresponding host larval population density was 41.30 larvae/plant and 47.50 larvae/plant in 2006 and 2007, respectively. Thereafter, the extent of parasitism gradually declined and reached 2.10 and 1.33 per cent corresponding with the host larval population of 16.60 larvae/plant and 12.50 larvae/plant during the second fortnight of November, 2006 and the first fortnight of December 2007. The activity of the parasitoid ceased by the end of November, 2006 and mid-December, 2007 possibly due to the hibernation of the host. Gupta and Avasthy (1959) reported 16-35 per cent and Rajmedhi (1992) reported 13.52–37.20 per cent parasitism by *C. flavipes* during August–October in West Bengal and Assam, respectively. A similar trend was also obtained by Rabha (2002) from Nagaland who reported a parasitism range of 5.30-40.23 per cent. Borah and Sarma

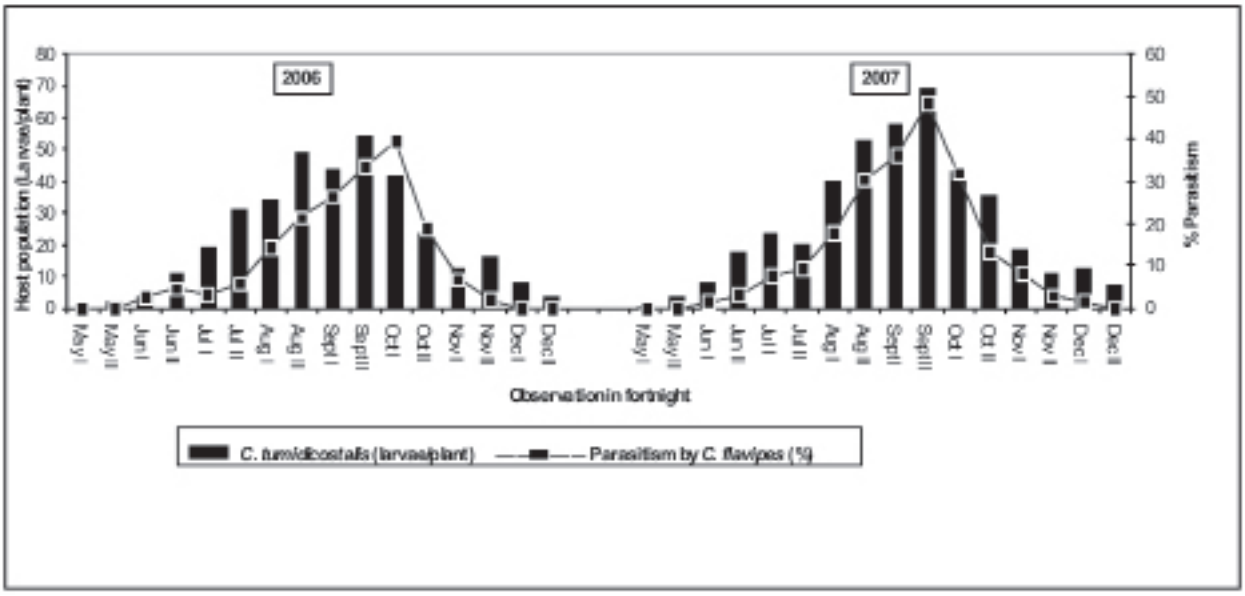

Fig. 1. Seasonal incidence of *C. tumidicostalis* and its parasitoid, *C. flavipes* in ratoon sugarcane

Table 1. Correlation co-efficients of *C. tumidicostalis*, larval parasitism by *C. flavipes* and abiotic factors

Correlation matrix	Crop season	Temperature ^{0}c Max.	Min.	R. H. (%)	Rainfall (mm)	Sunshine (hrs)
C. tumidicostalis	2006	0.518*	0.020	0.693*	0.105	0.247
	2007	0.369	0.105	0.740*	0.291	0.204
C. flavipes	2006	0.351	0.121	0.788*	0.471	0.327
	2007	0.394	0.439	0.689*	0.318	-0.284

* Significant at P = 0.05

(1995) also noticed 31.72 per cent parasitism during first fortnight October.

The extent of parasitism by *C. flavipes* showed significant positive correlation (r=0.861 in 2006 and r=0.914 in 2007, P=0.05) with the host population. Influence of *C. flavipes* on the host population was established by regression equations, $Y = -1.95 + 0.62X$; $R^2 = 0.741$ in 2006; $Y = -3.35 + 0.68X$; $R^2 = 0.835$ in 2007 and $Y = -2.70 + 0.70X$; $R^2 = 0.790$ (pooled over two years). Simple correlation analysis between abiotic factors and the extent of parasitism revealed a significant positive relationship with relative humidity and non- significant relationship with other abiotic factors in both the years (Table 1). Multiple regression studies on data pooled over two years ($Y=- 225.78 + 0.05X_1 + 0.23X_2 + 3.31X_3 – 0.61X_4 + 0.36X_5$) indicated combined influence of abiotic factors on parasitism by *C. flavipes* to an extent of 78.10 per cent. Correlation The population of *C. tumidicostalis* exhibited significant positive correlation with relative humidity and maximum temperature in the first cropping season (2006) while in the second cropping season (2007), significant positive relationship was observed with relative humidity (Table 1). The multiple regression studies of the data pooled over two years ($Y=-158.07+0.83X_1+0.12X_2+2.97X_3–0.42X_4+0.78X_5$) indicated strong combined influence of abiotic factors on the pest population with co-efficient of multiple determination (R^2) of 81.36 per cent.

The present study confirms the potential of *C. flavipes* in the natural regulation of *C. tumidicostalis* in sugarcane ecosystem of Assam. During recent years, extensive work on augmentative releases of this parasitoid has been done against shoot borer, *Chilo infuscatellus* Snellen, stalk borer, *Chilo auricilius* Dudgeon and Gurdaspur borer, *Acigona steniellus* (Hampson) and encouraging results have been obtained in Punjab, India (Shenhmar and Brar, 1996; Brar, 2000). In this context, more attention is needed towards the conservation and augmentative releases of *C. flavipes* for effective management of *C. tumidicostalis* in Assam and other parts of Northeast India.

RFFERENCES

Anonymous, 1993. *Annual Report*. Sugarcane Research Station, Assam Agricultural University, Buralikson, Golaghat, Assam, India.

Anonymous, 2005. *Package of practices for kharif crops of Assam*. Assam Agricultural University, Jorhat, pp. 47-49.

Borah, B. K. and Sarma, K. K. 1995. Seasonal incidence of plassey borer, *Chilo tumidicostalis* Hampson in ratoon sugarcane. *Plant Health*, **1**: 29-33.

Brar, K. S. 2000. Biological control of insect pests of field crops. *One Day Seminar on Biocontrol of Pests.* Indian Society for the Advancement of Insect Science, Punjab Agricultural University, Ludhiana, pp.4-6.

David, H., Easwaramoorthy, S. and Jayanthi, R. 1986. *Sugarcane Entomology in India*. Sugarcane Breeding Institute (ICAR), Coimbatore, pp.170-174.

Fletcher, T. B. and Ghosh, C. C. 1919. Borers in sugarcane, rice, etc. *Report of the Proceedings of the Third Entomological Meeting*, *Pusa,* **1**: 380-389.

Gomez, K. A. and Gomez, A. A. 1983. *Statistical Procedures for Agricultural Research*. John Wiley and Sons, New York.

Gupta, B. D. and Avasthy, P. N. 1957. An epidemic of stem borer, *Chilo tumidicostalis* Hampson. *Newsletter of Indian Institute of Sugarcane Research, Lucknow,* **3**: 4.

Gupta, B. D. and Avasthy, P. N. 1959. Biology and control of the stem borer, *Chilo tumidicostalis* Hampson. *Proceedings of International Society of Sugarcane Cane Technologists,* **10**: 886-901.

Karim, M. A. and Islam, M. N. 1977. Stem borers of sugarcane in Bangladesh. *Proceedings of 22nd*

Annual Scientific Conference, Bangladesh Association for Advancement of Science: 29-30.

Khanna, K. L., Nigam, L. N. and Puri, V. D. 1957. *Chilo tumidicostalis* Hampson, a serious stem borer pest of sugarcane in Bihar. *Proceedings of Indian Academy of Sciences* (B), **46**: 75-95.

Pandey, K. P., Vinay Kumar, M. N. and Singh, D. N. 2005. Occurrence of Plassey borer, *Chilo tumidicostalis* Hampson in eastern U.P. *Indian Sugarcane,* **54**: 857-858.

Rabha, D. C. 2002. Natural parasitisation of sugarcane Plassey borer, *Chilo tumidicostalis* Hampson by *Cotesia flavipes* Cameron. *Insect Environment*, **8**: 117.

Rajmedhi, J. 1992. *Biology of sugarcane Plassey borer,* Chilo tumidicostalis *Hampson (Pyralidae: Lepidoptera)*. M.Sc. (Agri) Thesis, Assam Agricultural University, Jorhat.

Shenhmar, M. and Brar, K. S. 1996. Efficacy of two strains of *Cotesia flavipes* Cameron on the control of sugarcane borer. *Indian Sugar*, **45**: 877-879.

Suasaard, W. and Ailsopp, P. G. 2000. *Chilo tumidicostalis* Hampson (Pyralidae: Lepidoptera) and its natural enemies in Thailand, pp. 10-16. In: *Sugarcane Pest Management in the New Millennium*. *Proceedings of 4th Sugarcane Entomology Workshop, International Society of Sugarcane Technologists*. Khon Kaen. Thailand. 7-10 February, 2000.

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