



Population fluctuations of sugarcane woolly aphid, *Ceratovacuna lanigera* Zehntner (Homoptera: Aphididae), and its natural enemies in plant and ratoon sugarcane crops in Assam

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ABSTRACT: The seasonal incidence of sugarcane woolly aphid, *Ceratovacuna lanigera* Zehntner (Homoptera: Aphididae), and its natural enemies was studied at Instructional-Cum-Research (ICR) Farm, Assam Agricultural University (AAU), Jorhat and at Sugarcane Research Station (SRS), Buralikson, Golaghat during 2004-05. Out of five species of natural enemies recorded at ICR Farm, AAU, Jorhat, *Eupeodes confrater* (Wiedemann), *Chrysoperla carnea* (Stephens), *Coelophora biplagiata* (Mulsant) and *Dipta aphidivora* (Meyrick) had significant positive impact on sugarcane woolly aphid population, while non-significant negative correlation of aphid population was observed with the population of *Encarsia flavoscutellum* Zehntner. Multiple regression analysis of different natural enemies with the population of *C. lanigera* showed 89.0 per cent relationship with the aphid population. At SRS, Buralikson, Golaghat, the only observed natural enemy *D. aphidivora* showed significant positive impact on woolly aphid population.

KEY WORDS: *Ceratovacuna lanigera*, *Encarsia flavoscutellum*, population build up, predators, sugarcane

INTRODUCTION

A total of 212 insect and 76 non-insect pests have been recorded in India on sugarcane crop (David and Nandagopal, 1986). The major insect pests associated with sugarcane, particularly in Assam, are borers and sucking pests (Phukan, 1978). Among the sucking pests, sugarcane woolly aphid, *Ceratovacuna lanigera* Zehntner, mealy bug, *Saccharicoccus sacchari* Cockerell and leafhopper, *Pyrilla perpusilla* Walker are important of which, sugarcane woolly aphid is the most serious pest in North Eastern India. The insect was first reported from West Bengal in 1958 and later from other parts

of Northeast India (Basu and Banerjee, 1958). Since then, the insect has been observed to infest sugarcane crop regularly and it is considered as a major pest as it causes severe damage in different sugarcane fields of Assam. According to Ghosh (1974) and Phukan (1978), the aphid population is low in June in Nagaland and Assam, respectively. Gupta and Goswami (1995) reported that the aphid population was low in June, increased gradually to reach maximum in September in Assam and negligible in January.

The natural enemies like *Dipta aphidivora* (Meyrick) (Lepidoptera: Pyralidae), *Menochilus*

sexmaculatus (Fabricius), *Coccinella septempunctata* Linnaeus (Coleoptera: Coccinellidae), *Chrysoperla carnea* (Stephens) (Neuroptera: Chrysopidae), *Micromus* sp. and syrphids are recorded on woolly aphid in sugarcane ecosystem. Tripathi (1995) recorded *Antrocephalus* sp., *Aphelinus desantisi* Hayat, *Encarsia flavoscutellum* Zehntner and *Diaeretiella rapae* (M'Intosh) in Dimapur (Nagaland) parasitising *C. lanigera* on sugarcane. However, the pyralid predator *D. aphidivora* was reported to be more voracious and under congenial conditions, it completely devoured the pest population (Tripathi, 1992 and 1995).

Considering the paucity of information on the population fluctuation of woolly aphid and its natural enemies on ratoon and planted crop of sugarcane, the present study was undertaken in Assam.

MATERIALS AND METHODS

The field experiments were conducted in two locations, *viz.*, Instructional-Cum-Research (ICR) Farm, Assam Agricultural University (AAU), Jorhat, and Sugarcane Research Station (SRS), Buralikson, Golaghat, during 2004-2005. Out of 200 m² area of sugarcane in each location, a 500 sq. m. plot was selected in both the places. The experiment was carried out on first year ratoon crop (ratooned on 19th February, 2004) [Variety- Co Bln 9101 (Doria)] in Jorhat and on a newly planted crop (planted on 31st March, 2004) [Variety- Co Bln 9605 (Dhansiri)] in Golaghat. The agronomical practices were followed as per the recommended package of practices of the university. Both the plots were kept completely free from any insecticide or herbicidal sprays.

Population buildup of aphid and natural enemies

The population data of *C. lanigera* and its different natural enemies were observed at fortnightly intervals. For the study, 40 sugarcane plants were randomly selected in each plot and all the selected canes were inspected for aphid infestation. Three woolly aphid infested leaves (one each from top, middle and bottom of the plant) from

each infested cane were selected for counting the aphid population with the help of sampling window (9 cm² area). From each selected leaf, three samples were drawn with the help of the sampling window. From the observed leaf the presence of larval and adult predators and parasitoids, if any, were inspected and recorded carefully from the whole leaf without making any disturbance. From the selected leaves, specially the presence of *D. aphidivora* and *E. flavoscutellum*, if any, were observed and recorded.

Simple correlations were done separately between the mean population of sugarcane woolly aphid and its natural enemies and correlation coefficients (*r*) were tested to examine the significance between the variables. Moreover, multiple regression analyses were done to know the impact of independent variables on the dependent variable and to assess the combined effect of various independent variables on the dependent variable.

RESULTS AND DISCUSSION

Population of natural enemies at ICR Farm, AAU, Jorhat

One parasitoid, *i. e.*, *E. flavoscutellum* and four species of predators, namely, *Eupeodes confrater* (Wiedemann), *C. carnea*, *Coelophara biplagiata* (Mulsant) and *D. aphidivora* were identified during the investigation in the sugarcane ecosystem of ICR Farm, AAU, Jorhat.

The data on the seasonal incidence of *C. lanigera* and its natural enemies are presented in Fig. 1. The incidence of *C. lanigera* was first observed in April 2004. It showed a steady increase and reached a peak (46.67 / window) in the second fortnight of September 2004. Similar observations on peak population of woolly aphid during September have been reported (Phukan, 1978; Gupta and Goswami, 1995; Rabindra *et al.*, 2002). The peak population during September could be due to the optimum temperature (24-32°C) prevailing during the month. Moreover, the population of *C. lanigera* was found to gradually decline from October 2004 onwards and the lowest population

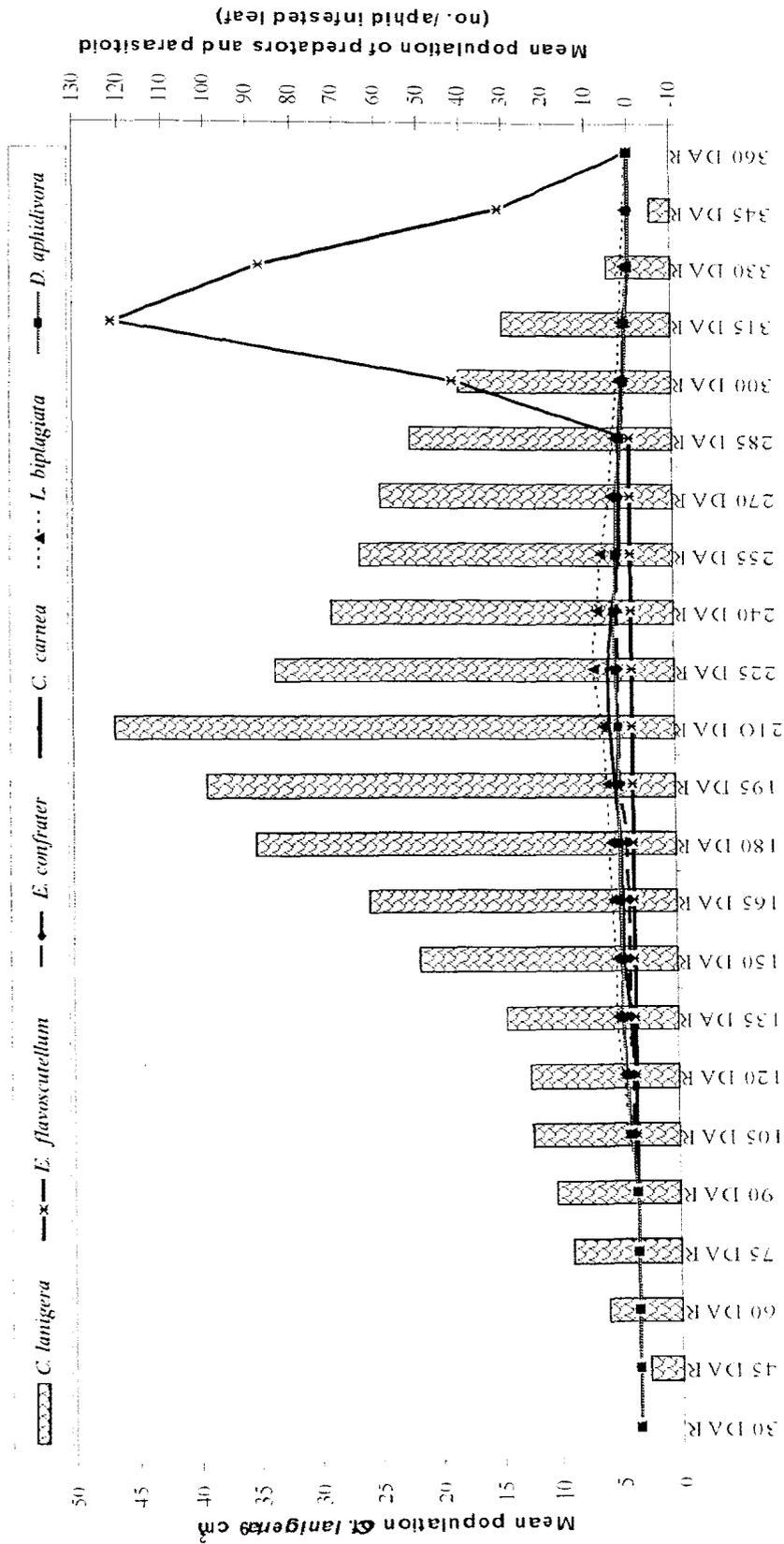


Fig. 1. Seasonal incidence of *C. lanigera* and its natural enemies in the sugarcane field at ICR Farm, AAU, Jorhat

(1.62 / window) was recorded during the second fortnight of January 2005. The aphid population completely disappeared from the field in January and drastic fall in aphid population might be due to fall in temperature from October 2004 to February 2005, which is similar to earlier observations made (Gupta and Goswami, 1995).

Population of *E. confrater* was observed as minimum (0.87 / aphid infested leaf) and maximum (3.16 / aphid infested leaf) in the first fortnight of June 2004 and in the first fortnight of October 2004, respectively. From October onward, the population gradually decreased and disappeared from the field in January 2005. This finding is in consonance with that of Cheng *et al.* (1992) who observed similar seasonal incidence of *E. confrater* on *C. lanigera* infested sugarcane ecosystem of Taiwan. Similarly, population of *C. carnea* was first observed in the first fortnight of July 2004 and it attained its maximum (5.60 / aphid infested leaf) in the first fortnight of October 2004 and minimum (0.81 / aphid infested leaf) in the second fortnight of December 2004. The predator completely disappeared from the field in January 2005. Population of *C. biplagiata* appeared in the first fortnight of June 2004 and attained its peak (8.92 / aphid infested leaf) in the first fortnight of October 2004. The lowest (0.95 / aphid infested leaf) population was observed in the second fortnight of January 2005. The predator disappeared completely from the field in February 2005. The presence of *D. aphidivora* on *C. lanigera* was first observed in the first fortnight of June 2004, showed a steady increase and reached a peak (4.03 / aphid infested leaf) in the second fortnight of October 2004 and attained its minimum (0.64 / aphid infested leaf) in the second

fortnight of December 2004 and disappeared completely in January 2005. Potentiality of predation of *D. aphidivora* against *C. lanigera* was observed by Tripathi (1992), Rabindra *et al.* (2002) and Tripathi and Jadhav (2004) from India and by Arakaki (1992) from Japan. As regards *E. flavoscutellum*, the population first appeared in first fortnight of December 2004 and reached its maximum (121.20 / aphid infested leaf) in the second fortnight of December 2004. However, population declined gradually and the minimum (30.90 / aphid infested leaf) population was observed in the second fortnight of January 2005. There was no parasitoid activity after January 2005.

Correlation and multiple regression analyses involving population of *C. lanigera* and different natural enemies (Table 1) showed significant positive correlation of aphid population with the population of *E. confrater*, *C. carnea*, *C. biplagiata* and *D. aphidivora* while non-significant negative correlation was observed with *E. flavoscutellum*. Multiple regression analysis revealed that 89.00 per cent variation in population (Y) of *C. lanigera* was influenced by the combined effect of different natural enemies observed at the sugarcane ecosystem of ICR Farm.

Population of natural enemies of SRS, Buralikson, Golaghat

Only *D. aphidivora* was found in the sugarcane ecosystem of SRS, Buralikson.

Data on the population of *C. lanigera* and *D. aphidivora* at fortnightly intervals are presented in Figure 2. Population of *C. lanigera* first appeared in the second fortnight of May 2004 and attained

Table 1. Correlation and multiple regression between SWA and its natural enemies at ICR Farm

Correlation matrix	<i>E. flavoscutellum</i> (X ₁)	<i>E. confrater</i> (X ₂)	<i>C. carnea</i> (X ₃)	<i>C. biplagiata</i> (X ₄)	<i>D. aphidivora</i> (X ₅)
SWA population (r)	-0.2539NS	0.8905**	0.9358**	0.8926**	0.8678**
Regression equation: $Y = -11.284 + 0.137X_1 + 0.638X_2 + 16.872X_3 - 4.008X_4 + 9.219X_5$; $R^2 = 0.89$					
Observations were taken at fortnightly interval; NS = non significant * P = Significant at P = 0.05; ** P = Significant at P = 0.01; DAR = days after ratooning (date of ratooning was 19 th February, 2004)					

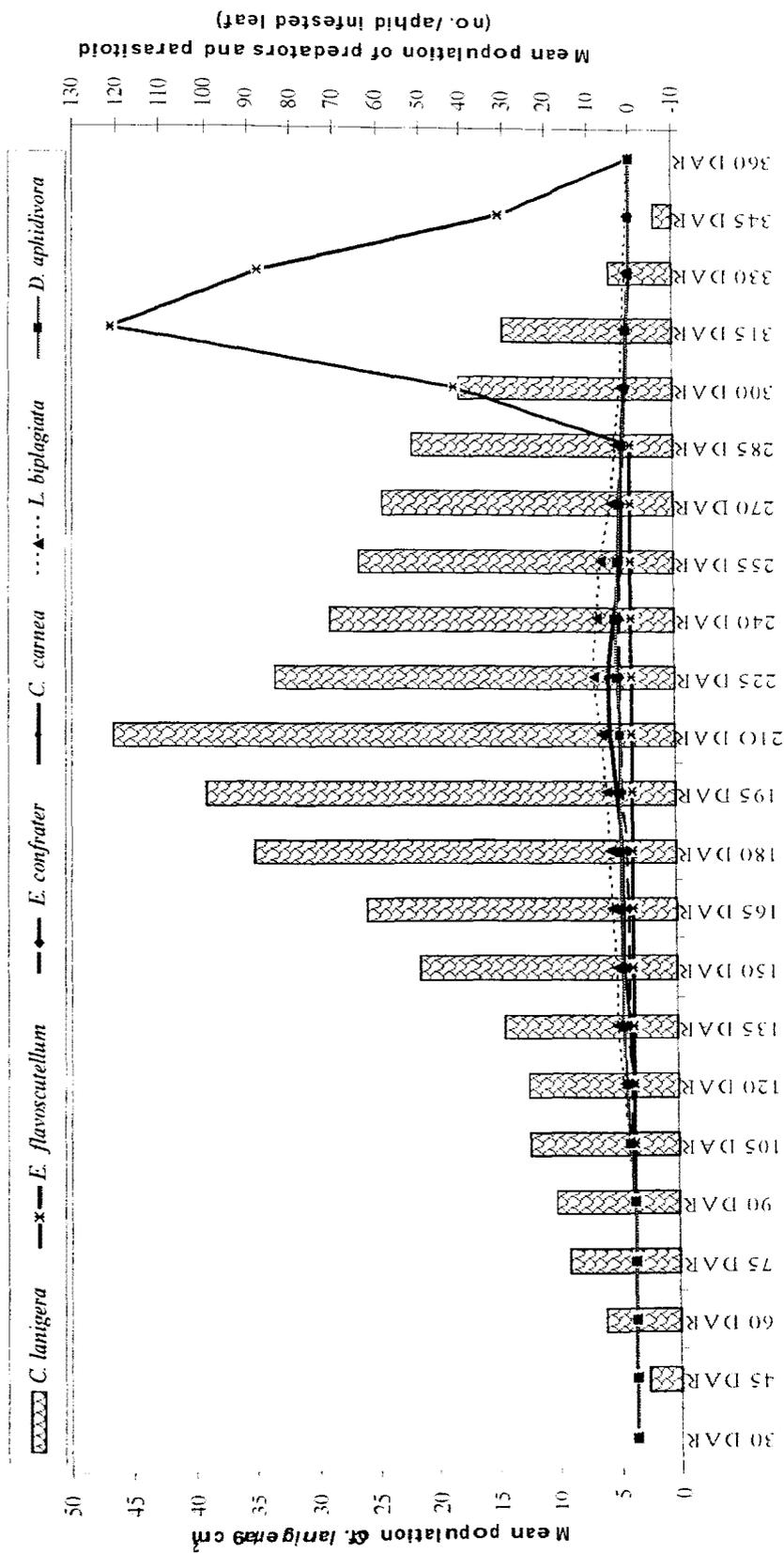


Fig 2. Seasonal incidence of *C. lanigera* and *D. aphidivora* at SRS, Buralikson, Golaghat

maximum (28.73 / window) in the second fortnight of September 2004. However, population declined gradually and was lowest (1.60 / window) in the first fortnight of January 2005 and completely disappeared from the field in the second fortnight of January 2005. As regards *D. aphidivora*, population was first noticed (0.17 / aphid infested leaf) in the first fortnight of July 2004, reached its peak (1.32 / aphid infested leaf) in the second fortnight of October 2004 and disappeared completely from the field in January 2005. Significant positive correlation was evident between the populations of *D. aphidivora* and *C. lanigera* ($r = 0.8082^{**}$; $P = 0.01$) and regression equation obtained $Y = -16.07 + 26.18x$; $R^2 = 0.65$ showed that *C. lanigera* population was influenced by *D. aphidivora*.

ACKNOWLEDGEMENTS

The authors are grateful to the Project Director, Project Directorate of Biological Control (PDBC), Bangalore for helping in the identification of *Eupeodes confrater* (Wiedemann). The authors are also indebted to Dr. A. Basit, Principal Investigator, All India Co-ordinated Research Project (AICRP) on Biological Control, Assam Agricultural University (AAU), Jorhat, for his help during the course of the investigation.

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(Received: 21.08.2006; Revised: 21.05.2007; Accepted: 01.06.2007)