J. Natn. Sci. Foundation Sri Lanka 2000 28(3): 205-213

NATURAL ENEMIES OF SUGARCANE PLANTHOPPER *PYRILLA PERPUSILLA* WALKER (HOMOPTERA:LOPHOPIDAE) IN THE WET ZONE OF SRI LANKA.

G.A.S.M. GANEHIARACHCHI* and I.V.S. FERNANDO
Department of Zoology, University of Kelaniya, Kelaniya.

(Received: 22 March 2000 ; accepted: 08 December 2000)

Abstract: Sugarcane planthopper *Pyrilla perpusilla* is an important insect pest of sugarcane plantations in Sri Lanka. Although over thirty species of natural enemies have been recorded from sugarcane growing areas of the world, only nine species of natural enemies were found to attack the sugarcane planthopper in the wet zone of Sri Lanka. They comprised one egg parasitoid, six predatory arthropods, one bird species and one lizard species. The egg parasitoid in this study was identified as *Parachrysocharis javensis* (Girualt) (Hymenoptera:Eulophidae). Out of six predatory arthropods two were ants belonging to the genera *Camponotus* and *Diacamma*; another was a neuropteran of the genus *Brinckochrysa* and the fourth was a spider belonging to the genus *Tetragnatha*. The other two were an unidentified coccinelid beetle and a salticid spider. The mean percentage of egg clusters that were parasitized by *Parachrysocharis javensis* was 57.4% and the percentage of individual eggs parasitized ranged between 30 and 68 with a mean of 46.91 ±5.2%. The abundance of predatory arthropods and climatic factors affecting this are also discussed.

Keywords: Egg parasitoids, natural enemies, *Pyrilla perpusilla*, sugarcane pests.

INTRODUCTION

The sugarcane planthopper *Pyrilla perpusilla* Walker (Homoptera:Lophopidae) is a very destructive pest and is widely distributed in South East Asia. Both nymphs and adults suck sap from the leaves and most damage is caused by the nymphs. Feeding spots turn yellow and with the loss of sap the leaves wilt, retarding the growth of the plant. A sooty mould grows on the honeydew produced by these bugs and this further reduces photosynthesis. Both factors result in a significant loss of yeild in terms of sugar content. Various control measures have been proposed[1] but these have not been totally satisfactory.

P. perpusilla is a very important insect pest of sugarcane plantations in Sri Lanka. Heavy damage being observed on sugarcane in Udawalawe and Pelwatta areas in the Dry Zone. It was a major insect pest in the 1980-90 decade until the parasitoid *Epiricania melanoleuca* (Fletcher) (Lepidoptera:Epipyropidae) was introduced.

A search for the natural enemies of *P. perpusilla* was initiated in the early part of this century.[1] A perusal of literature reveals that a large number of natural

*Corresponding author

enemies including parasitoids, predators and microbial pathogens have been identified and described[2-12] in other countries. The most important egg parasitoids recorded in the literature are *Cheloneurus pyrillae*, *Proleuroceroides pyrillae*, *Parachrysocharis javensis* and *Tetrastichus gala*. *Epiricania melanoleuca* has been recorded as the most important nymphal and adult parasitoid. *Metarhizium anisopliae* and *Aspergillus flavus* have been recorded as virulent pathogenic fungi.

However, no study has recorded the natural enemies of *P. perpusilla* in Sri Lanka. In the present study, an attempt was made to identify the natural enemy complex attacking the various stages in the life cycle of this pest and their contribution to mortality of the pest.

METHODS AND MATERIALS

The experimental plot was located within the premises of University of Kelaniya at Dalugama in the Wet Zone of Sri Lanka. The single experimental plot was a 25mx35m rectangle. Cuttings of variety Co 775 obtained from the Sugarcane Research Institute (SRI) in Sri Lanka were planted 20cm apart with 1m between rows. After sprouting, the total number of plants in the plot was about 1100. Initially, fertilizers were applied according to SRI recommendations but no insecticides, herbicides or fungicides were applied during the study period (July 1993-May 1995). Watering was as recommended by the SRI. All plants were sequentially numbered.

Field counts of egg clusters were made once a week throughout the study period. Each plant was carefully examined for egg clusters of *P. perpusilla* beginning from the first plant of the first row upto the last plant of the last row. At each count, the number of eggs in each cluster was recorded for about a quarter of the clusters. The eggs were counted using a hand lens after removing the protective wax coating with a fine camel-hairbrush. Parasitized eggs were identified by their blackish colour as opposed to the white colour of the others. On each sampling day two randomly selected parasitized egg clusters were collected by clipping the leaves and the number of parasitized and unparasitized eggs in each cluster were recorded. Each cluster was then placed in a test tube plugged with cotton wool. The eggs were allowed to incubate at room temperature and the number of parasites emerging from each cluster was recorded. The number of parasitized eggs from which parasites failed to emerge was also recorded. The parasites were preserved in 70% alcohol and subsequently identified. While the egg clusters were being counted, different types of predators upon the different stages of *P. perpusilla* were also counted. This procedure was possible on account of the low population density of both host and predators. Arthropod predators were collected and preserved in 70% alcohol for identification. Five randomly selected adults and nymphs of *P. perpusilla* were collected on every sampling day and kept in a glass jar with a piece of sugarcane leaf in order to observe adult and nymphal parasitism.

Daily records were kept of maximum and minimum temperature, relative humidity and rainfall. The hypothesis that the abundance of *P. perpusilla* and its egg parasitoids is influenced by climate was tested using Pearson moment correlation analysis.

RESULTS

One species of egg parasitoid and eight species of predators were recorded during the period of study. No nymphal and adult parasitism was observed at any time during this study.

The egg parasitoid was identified as *Parachrysocharis javensis* (Girualt) (Hymenoptera:Eulophidae). This insect was earlier referred to as *Tetrastichus pyrillae* Crawford. It is a small (1mm in length) brown coloured wasp. Among the predators, four arthropods were identified to the genus level. They are *Camponotus* sp. (Hymenoptera: Formicidae), *Diacamma* sp. (Hymenoptera: Formicidae), *Brinckochrysa* sp. (Neuroptera: Chrysopidae) and *Tetragnatha* sp. (Arachnida: Tetragnathidae). In addition to these arthropod predators the common babbler *Turdoides affinis* and garden lizard *Calotes versicolor* were confirmed to prey on *P. perpusilla*. Also some unidentified coccinelid larvae and an unidentified salticid spider were recorded to feed on *P. perpusilla* nymphs.

There was a significant positive linear correlation ($r=0.965$; $p<0.001$) between the mean numbers of parasitized and total egg clusters (Figure 1 a and b). The mean range of egg cluster parasitism over the study period was 57.4±6%; in several months it exceeded 80% and in August 1993 it was around 100%. The number of parasitized eggs in a cluster ranged from 19 to 30 with a mean of 23.55±4.55. The maximum number of parasitized eggs in a cluster was 52 out of a total of 52 eggs and minimum number was 03 out of a total of 17. The mean number of eggs in a cluster and the mean number of parasitized eggs in a cluster are presented in figure 2. Parasitism due to the egg parasitoid ranged between 30 and 68% (Fig 3) with a mean of 46.91±5.2% during the period of study except in June and July 1995 when the percentages were ten and zero respectively. Mean percentage parasitoid emergence from parasitized eggs was 85.33%±14.63%.

Abundance of the arthropod predators, *Camponotus* sp., *Diacamma* sp., *Brinckochrysa* sp., *Tetragnatha* sp. and an unidentified salticid is shown in Figure 4. Among the predators *Camponotus* sp. was the most abundant. Adults built a silken shelter close to the *P. perpusilla* egg cluster, and as the first instar nymphs hatch, the ants emerged from the shelters to feed on them. Another ant, *Diacamma* sp., also fed on first and early second instar nymphs, as did *Brinckochrysa* sp.

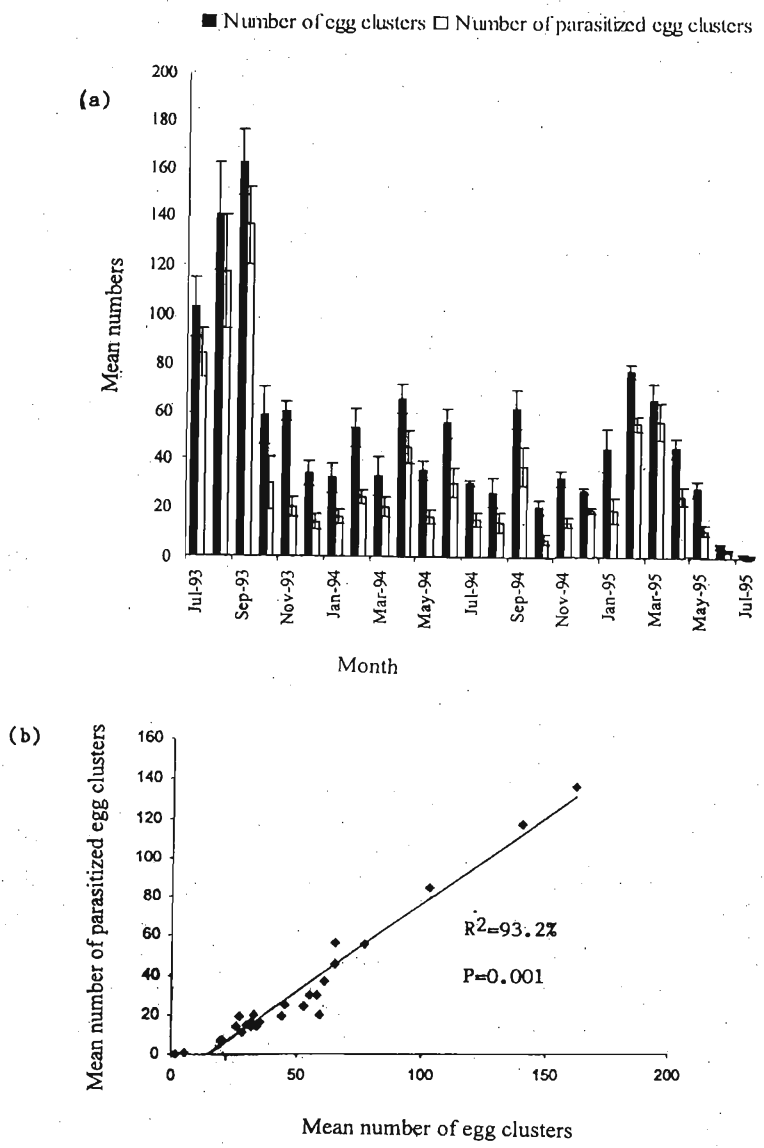

Figure 1: (a) Relationship between the mean number of egg clusters/sampling occasion/month and the mean percentage parasitized egg cluster/ sampling occasion per month.

(b) Correlation between mean number of egg clusters/sampling occasion/month and mean percentage parasitism/sampling occasion/month.

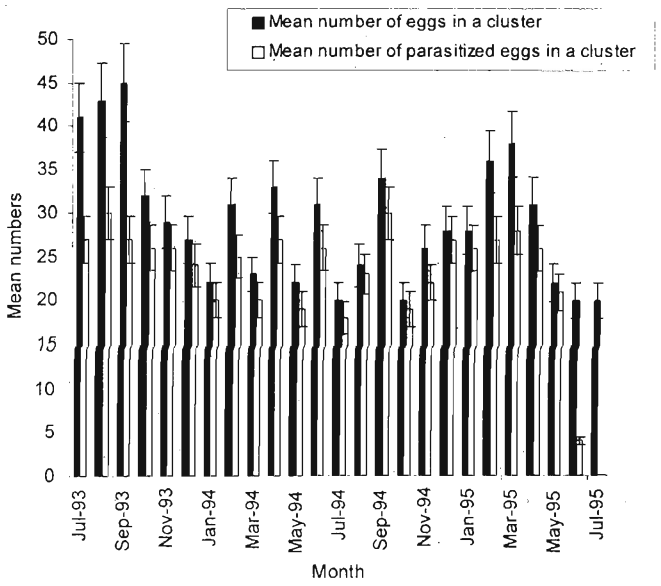

Figure 2: Relationship between the mean number of eggs in a cluster/ sampling occasion/month and mean number of parasitized eggs/ sampling occasion/month

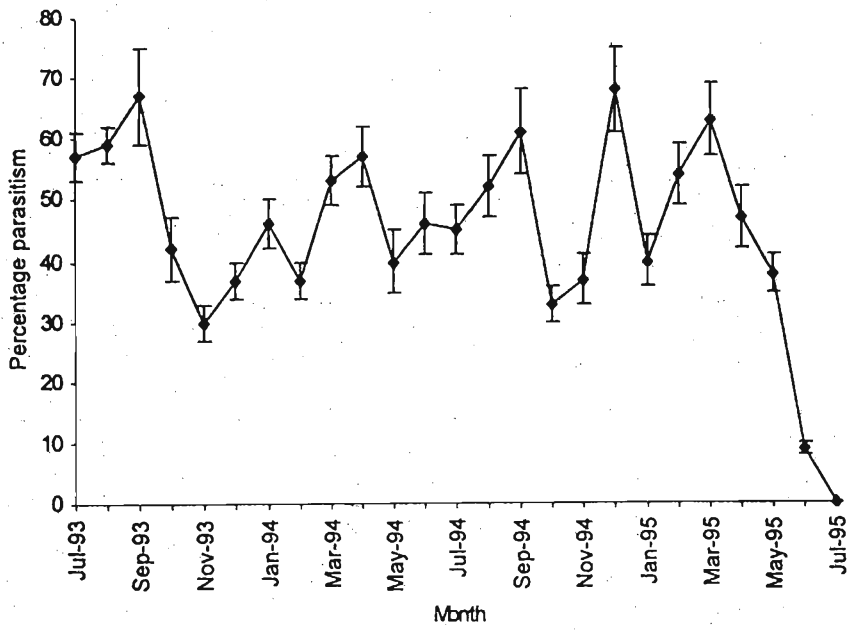

Figure 3: Monthly variation of percentage parasitism of eggs

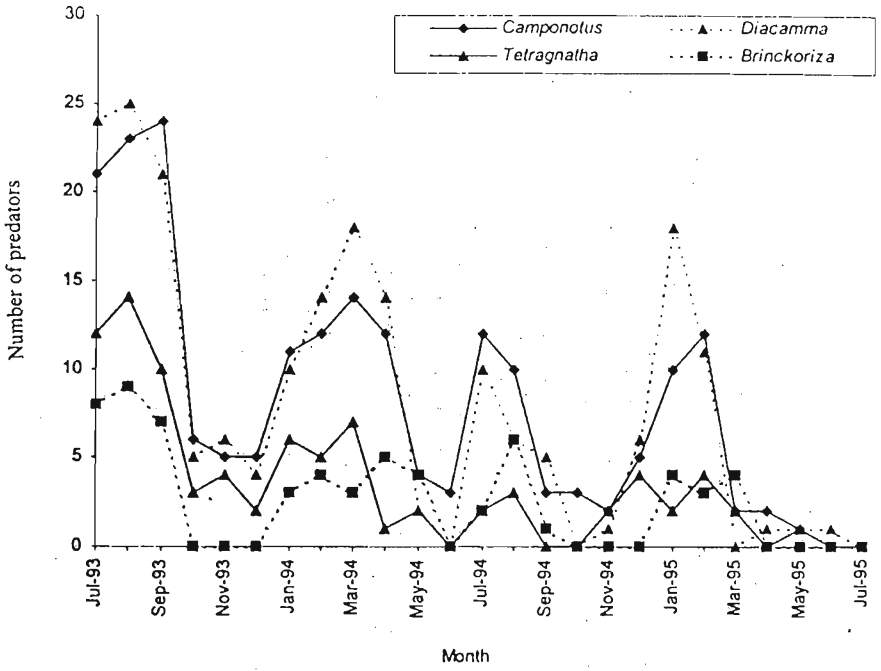

Figure 4: Variation of relative abundance of predator species

The correlation of percentage parasitism with climatic factors is given in table 1. Percentage parasitism was negatively correlated with the rainfall and humidity, but it was positively correlated with the minimum and maximum temperature.

Table 1: Correlation of percentage parasitism

	Rainfall	Humidity	Minimum temperature	Maximum temperature
% Parasitism	-0.04	-0.62	0.42	0.42
	(< 0.01)	(<0.05)	(<0.05)	(<0.05)

DISCUSSION

Although Kumarasinghe and Wratten (1996)[13] have listed 32 species of parasitoids, predators and pathogens of *P. perpusilla* occurring in sugarcane growing countries of the South East Asian region, only one egg parasitoid, six predatory arthropods, one species of bird and one species of lizard were recorded in the present study.

Two virulent pathogenic fungi *Metarhizium anisopliae* and *Paeciliomyces lilacinus*, which cause heavy seasonal mortality in *P. perpusilla* recorded in sugarcane fields in Udawalawe, were not observed at Kelaniya. A lepidopteran parasitoid, *Epiricania melanoleuca* introduced to Sri Lanka from Pakistan has successfully controlled *P. perpusilla* infestations in Udawalawe and Sevangala[13], but this parasitoid was not present at Kelaniya. Reasons for the absence of both fungi and the lepidopteran parasitoid in Kelaniya are obscure.

The egg parasitoid observed in this study was *Parachrysocharis javensis* Girualt (Hymenoptera:Eulophidae), well known as a parasitoid of *P. perpusilla*. In our work this was the most important biological control agent of *P. perpusilla* owing to its high rate of parasitism. The overall parasitism rate of individual eggs was 46.91± 5.2%; whereas Kumarasinghe and Ranasinghe[14] have found that *P. javensis* parasitism was below 20% in the Sevanagala area. The lower level is probably due to the practice of burning the trash after harvest, which reduces the parasitoid population.

The maximum number of parasitized eggs in a cluster observed was 52 out of a total of 52 eggs and the minimum number was 03 out of a total of 17. However, it is uncertain if all the 52 host eggs were parasitized by the same parasitoid. Although the minimum number of eggs in a cluster was 3 , it is unlikely that this figure represents the minimum fecundity of a parasitoid female. It is more probable that a female having discharged the bulk of its eggs in another cluster laid the remaining eggs of its full complement as a second cluster accounting for the low figure.

Predictably, egg cluster parasitism was positively correlated with the number of clusters present in the field. Frequently all the eggs in an egg cluster were parasitized when the number of eggs in the cluster was low, but there was no correlation between the number of eggs in a cluster and the number parasitized.

The percentage parasitism by *P. javensis* showed a positive correlation with the daily minimum and maximum temperature since the population density is high during such warmer periods. When the population density was high, the number of egg clusters found in the field was also high and this increases the chance of parasitoids finding egg clusters. Percentage parasitism has a negative correlation with rainfall and humidity. It is possible that heavy rainfall can adversly affect oviposition of *P. perpusilla* and dislodge egg clusters. Therefore the lowered percentage parasitism by *P. javensis* may be due to either or both reasons.

Predators confirmed in this study (i.e *Camponotus, Diacamma, Brinckochrysa, Tetragnatha*, unidentified coccinelid and salticid, *Turtoides affinis* and *Calotes versicolor)* have not been previously reported from any sugarcane growing areas of Sri Lanka as predators of *P. perpusilla* even though they are likely to be present.

Among the predators, *Camponotus* sp was the most abundant. Mani[7] had recorded this predator in sugarcane plantations in India but he stated that these ants feed on honeydew produced by *P. perpusilla* implying a symbiotic relationship. However, from the present study it was clearly evident that *Camponotus* was not a symbiont but a predator of the first instar of *P. perpusilla*.

Predatory lacewing *Brinckochrysa scelestes* which has not been previously recorded from Sri Lanka has been widely reported as preying upon all stages of the pest in India and Pakistan.[3,9,15,16] It has been observed that this chrysopid predator remained active all year round and when food was scarce it became cannibalistic. However, in this study it was observed that this predator feeds on only first and second instars of the pest.

The abundance of predators like *Camponotus*, *Diacamma*, *Brinckochrysa* and *Tetragnatha* was affected by heavy rainfall, as this affected the abundance of early instar nymphs of the pest which are the food of the predators.

The present investigation confirms that the most important natural enemy of *Pyrilla perpusilla* is *Parachrysocharis javensis*. Its combined action with those of other predators, recorded in this study keeps *P. perpusilla* populations in the Wet Zone under control.

Acknowledgement

This study was funded by a grant (No. R.P 1/7/92/05) from the University of Kelaniya. We thank Dr. Anura Wijesekara, Dr. N.C Kumarasinghe and Lakshman Weeratunga for their help in identifying egg parasitoid and other arthropod predators.

References

1. Butani D.K. (1964). Sugarcane leafhopper *Pyrilla perpusilla* Walker- a review. *Indian Sugarcane Journal* **9**: 60-75

2. Bose B.B. (1939). On *Epipyrops melanoleuca* Fletcher on *Pyrilla* species. *Indian Journal of Entomology* **1** (3): 93

3. Chaudhaury J.P. & Sharma S.K. (1988). Biological control of *Pyrilla* using parasites and predators. In: Biological Technology for Sugarcane Pest Management (Eds. H. David & S. Easwaramoorthy) pp 186-206., India Sugarcane Breeding Institute, Coimbatore.

4. Garg A.K. & Sethi G.R. (1982). Parasitization of *Pyrilla perpusilla* Walker by *Epipyrops melanoleuca* Fletcher. *Indian Journal of Entomology* **44**: 92-97

5. Gupta B.D (1940). On Epipyrops- a parasite on the nymphs and adults of sugarcane leafhopper (*Pyrilla* sp) *Current Science* **9**: 132-133

6. Khan M.R. & Shafee S.A. (1979). Taxonomic studies on some Indian eulophid parasites (Hymenoptera:Eulophidae). *Journal of Bombay Natural History Society* **76**: 324-334

7. Mani M.S. (1939). Description of new and record of some known chalcidoid and other hymenopterous parasites from India. *Indian Journal of Entomology* **1** (1): 69-99

8. Narayan E.S. & Kundanlal P. (1953). Studies on chalcid egg parasites of *Pyrilla* spp. occuring in Delhi. Part I Bionomics of *Tetrastichus pyrillae* Crawford *Ageniaspis pyrillae* Mani and *Cheiloneurus pyrillae* Mani. *Indian Journal of Entomology* **15**: 173-179

9. Rahim A. & Hashmi A.A. (1984). Biological control of *Pyrilla perpusilla* Walker in Singh, Pakistan. International Pest Control Sept-Oct 1984, 124-126

10. Rhaman K.A. (1941) Parasites of the insect pests of sugarcane in Punjab. *Indian Journal of Agricultural Sciences* **11**: 119-128

11. Singh P.B. & Verma A. (1993). Some observations on the biology of *Richarsidrynus pyrillae*, nymphal parasitoid of sugarcane leafhopper *Pyrilla perpusilla*. *Annals of Plant Protection Science* **1** (1): 43-44

12. Subba Rao B.R. (1957). The biology and bionomics of *Lestodrynus pyrillae* Kieff (Dryinidae: Hymenoptera) a nymphal parasite of *Pyrilla perpusilla* Walker and note on its role in the control of *Pyrilla*. *Journal of the Bombay Natural History Society* **54**: 741-749

13. Kumarasinghe N.C. & Wratten S.D. (1996). Sugarcane lophopid planthopper *Pyrilla perpusilla* (Homoptera:Lophopidae) - a review of its biology, pest status and control. *Bulletin of Entomological Research* **86**: 485-498

14. Kumarasinghe N.C. & Ranasinghe M.H.S.K. (1988). Effect of environmental factors on populations of the sugarcane leafhopper *Pyrilla perpusilla singhalensis*. *Proceedings of the 44th annual sessions of the Sri Lanka Association for Advancement of Sciences* 1988, 70

15. Nasir M.M. (1947). Biology of *Chrysopa scelestis* (*Brinckochrysa scelestis*) Banks. *Indian Journal of Entomology* **9**: 177

16. Rahman K.A. (1940). Important insect predators of India. *Proceedings of the Indian Academy of Sciences* B. 12. 47-74