

Population Dynamics of Sugarcane Plant hopper *Pyrilla perpusilla* Walker (Lophopidae: Homoptera) and its Natural Enemies at District Mandi Baha-ud-din (Punjab)

MISHKAT ULLAH AND KHALID MAHMOOD

Pakistan Museum of Natural History, Garden Avenue, Islamabad
E-mail: mishkatullah@gmail.com; dkmahmood@msn.com

Abstract.- Population dynamics of sugarcane plant hopper *Pyrilla perpusilla* Walker (Homoptera: Lophopidae) and its natural enemies was investigated at district Mandi Baha-ud-din *i.e.* during 2003-04. Study revealed that there were two peaks of population of *P. perpusilla* during November 2003 (14 egg batches/leaf; 65 nymphs & 25 adults/leaf) and May 2004 (15 egg batches/leaf; 45 nymphs and 12 adults/leaf). Egg parasitoid *Parachrysocharis javensis* Crawford (Hymenoptera: Eulophidae) and nymphal-adult ectoparasitoid, *Epiricania melanoleuca* (Fletcher) (Lepidoptera: Epipyropidae) were observed in September 2003. Egg parasitism by *P. javensis* declined from mid of December 2003 (egg parasitism 52%) to March 2004 (egg parasitism 0%). *E. melanoleuca* hibernated from mid of December 2003 to first week of March 2004. Parasitism by these parasitoids *P. javensis* and *E. melanoleuca* was at peak (98% egg parasitism and 95% nymphal-adult parasitism, respectively) during September 2004.

Key words: *Pyrilla*, sugarcane, population dynamics, natural enemies of plant hopper.

INTRODUCTION

Sugarcane serves as a major source of raw material for production of white and brown sugar. It shares in value added of agriculture and GDP are 3.4 percent and 0.7 percent respectively. During the year 2004-05 total cultivated area under sugarcane crop was 966.4 thousand hectares which yielded 47.2 million tons of canes (GOP, 2005-2006). Sugarcane is damaged by a number of pests during its growth phase. Important pests are *Pyrilla*, borers (top and stem borer), termites and rodents. Sugarcane plant hopper *Pyrilla perpusilla* Walker (Homoptera: Lophopidae) is a widely distributed serious pest of sugarcane in the oriental region (Gupa and Ahmad, 1983). It has also been recorded on other crops such as *Pennisetum americanum*, *Sorghum* sp., *Triticum sativum* and *Zea mays* (Kumarasinghe and Wratten, 1996; Ganehiarachchi and Fernando, 2006).

P. perpusilla causes direct and indirect losses. Adult and nymph suck phloem sap from underside of leaves. Their feeding result in leaf wilting. Both

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adults and nymphs excrete honey dews on the foliage which lead to develop 'sooty mold'. Photosynthesis is reduced due to sooty mold development on the leaves. Thus sugarcane yield and quality is greatly affected (Butani, 1964). The damage caused by *P. perpusilla* has been reported upto 28% in the potential cane yield and 2-34% in sucrose content of sugarcane. *P. perpusilla* feeding also result in poor growth of sets formation which also causes difficulty in milling of affected canes (Kumarasinghe and Wratten, 1996). There is a need to check the population of this pest.

P. perpusilla is being attacked by twelve species of natural enemies in Pakistan (Mohyuddin, 1981). It was reported that 80% of *P. perpusilla* egg/population is killed by egg parasitoids and remaining 20% by complex of nymphal and adult parasitoids and predators (Chaudhary and Sharma, 1988).

The ectoparasitoid *Epiricania melanoleuca* (Fletcher) (Lepidoptera: Epipyropidae) has been reported as a successful bio-control agent of *Pyrilla* in Pakistan (Mohyuddin *et al.*, 1982). Its biology was described by Misra and Krishna (1986, 1987).

One of the most important characters of the parasitoid is its ability to exploit all the biotypes of *P. perpusilla* in different climatic regions. The female moth of *E. melanoleuca* lay 400-800 eggs. Its larvae feed through the *P. perpusilla* cuticle and suck its body fluids (Common, 1990). *E. melanoleuca* larval feeding also develops parasitic castration in both sexes of *Pyrilla* (Gupta, 1940). Short life cycle, higher rate of reproduction and tremendous searching ability for their host increase its effectiveness as a useful bio-control agent (Chaudhary and Sherma, 1988; Seneviratne and Kumarasinghe, 2002).

Parachrysocharis javensis Girault (Hymenoptera: Eulophidae) was previously known as *Tetrastichus pyrillae* Chrawford (Kumarasinghe and Wratten, 1996). It is an important egg parasitoid of *P. perpusilla* in Pakistan (Mohyuddin *et al.*, 1982; Rahim, 1989). A high level of *P. javensis* parasitism was recorded among higher population densities of *P. perpusilla* population at Faisalabad and low at Mardan and Peshawar (Rahim, 1986). It was also observed that field releases of egg parasitoid of *P. javensis* resulted in 16% increase in egg parasitism of *P. perpusilla* at Karnal (India) (Isaac, 1946).

The present study was carried out to find the population dynamics of *Pyrilla perpusilla* and parasitism by its natural enemies *viz.* egg parasitoid *P. javensis* and nymphal-adult parasitoid *E. melanoleuca*. This study would help to formulate low input Integrated Pest Management (IPM) strategies on the basis of fluctuation in population dynamics of *Pyrilla* and parasitism by its natural enemies.

MATERIALS AND METHODS

Data were collected during daily field visits under "Bio-control based Sugarcane Integrated Pest Management Project (2003-2004) at Distt. Mandi Baha-ud-din (Punjab)".

Average per leaf populations of *P. perpusilla* eggs batches, nymphs and adults were assessed from randomly selecting ten leaves from sugarcane field and average egg batches per leaf were worked out by following formula.

Average egg batches or individuals per leaf =

$$\frac{\text{Total No. of egg batches or individuals on ten leaves}}{10}$$

Percentage of parasitism by *P. javensis* was assessed by selection of ten sugarcane leaves at random. Parasitized and un-parasitized eggs were differentiated on the bases of color. Un-parasitized eggs were creamy white and parasitized eggs were dark brown to black in color. Percent parasitism was then calculated.

Percent of egg batches parasitism =

$$\frac{\text{No. of parasitised egg batches}}{\text{Total No. of egg batches}} \times 100$$

The percent parasitism of *E. melanoleuca* was assessed by selection of ten sugarcane leaves at random throughout active season of *P. perpusilla* infestation. Parasitized nymphs and adults were differentiated by presence of white cottony cushion on back and on pleural abdominal region, respectively.

Percent nymph and adult parasitism =

$$\frac{\text{No. of parasitised nymph and adult}}{\text{Total no. of nymph and adult}} \times 100$$

Data were analyzed and graphs were prepared in Microsoft Office.

RESULTS AND DISCUSSION

The original host of *Pyrilla perpusilla* is not known however, it has been recorded feeding and reproducing on wide range of host plants other than sugarcane (Kumarasinghe and Wratten, 1996). In district Mandi Baha-ud-din, it has been recorded on sugarcane, sorghum, maize, millet, wheat, oat, barley and rice. Highest egg batches density of *P. perpusilla* was observed during Nov. 2003 (14 egg batches / leaf) and May 2004 (15 egg batches / leaf) on sugarcane. *Pyrilla* usually preferred to lay egg batches on underside of the leaves along the mid rib,

from Mar-Sep 2003-04. However, during November 2003, *Pyrilla* deposited egg masses inside the leaf

sheath of sugarcane and cracks under the barks of

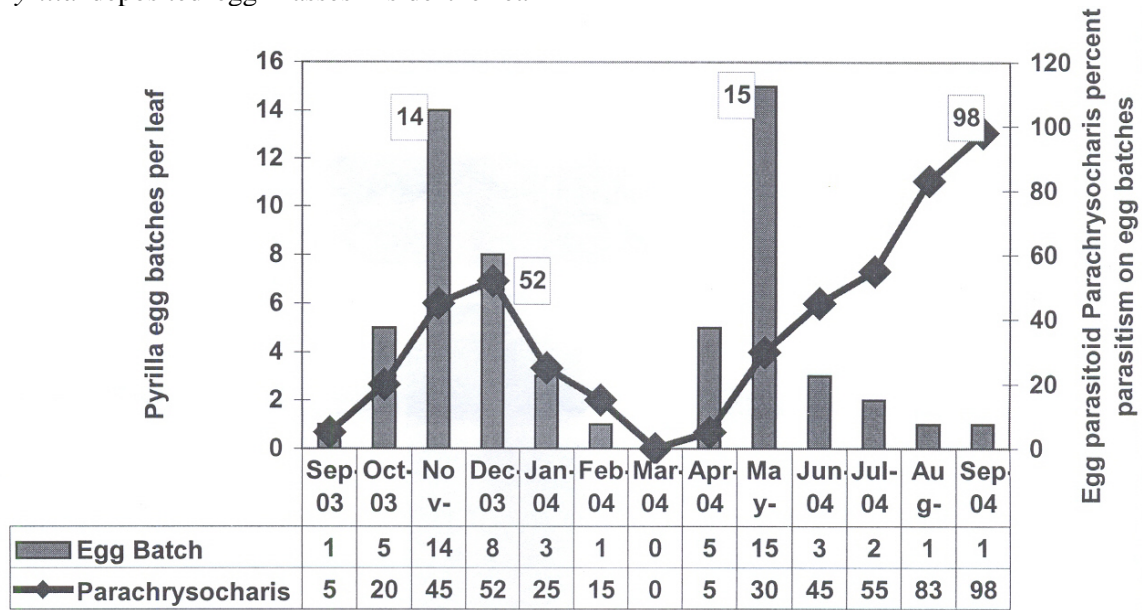


Fig. 1. *Pyrilla* egg density and percent parasitism of egg parasitoid *Parachrysocharis javensis* at Mandi Bahaud-Din during 2003-2004.

Acacia orolinca (Keekar), *Melia* sp. (Bakain), *Dalbergia sisso* (Tahli) and *Salmalia malabarica* (Sumbal) trees adjoining to heavily infested fields. These observations were in conformity with Wajih and Hamid (1993). In this way *Pyrilla* adults protect their egg batches from adverse environmental conditions and enemies. Adults females died after completion of egg laying. Therefore, during Nov-Dec 2003, percent egg parasitism was 52%, which tend to reduce from January 2004 (25%) to March 2004 (0%) in the absence of fresh eggs.

Over wintered eggs and nymphs of *P. perpusilla* become adults in April 2004 and an acceleration in eggs density deposition was observed in May 2004 (15 egg batches/leaf). An inverse relation is noticed between decrease in egg laying and increase in egg parasitism during May 2004 (15 egg batches/leaf with 30% egg parasitism) to September 2004 (01 egg batch/leaf with 98% egg parasitism) (Fig. 1).

During April 2003, *P. perpusilla* nymphs and adults were observed only in few patches. It reproduced rapidly so that intensity of attack became severe (65 nymph/leaf and 25 adults/leaf) in

November 2003. Therefore, nymphal-adult ectoparasitoid *E. melanoleuca* parasitism could not synchronize with *Pyrilla* population up to Nov-Dec. 2003 (65 nymphs & 25 adults / leaf with 20% nymphal-adult parasitism). *E. melanoleuca* individuals went into hibernation during mid December 2003 to 1st week of Mar 2004. Adult females died after completion of laying eggs and hence no adult was recorded during January 2004 to mid March 2004. Over-wintering nymph migrated to wheat crop after harvesting of sugarcane and preferred to remain in wheat crop upto its harvesting (till mid of April 2004). These overwintered nymphs became adults by the end of April and migrated back to spring and ratoon crop of sugarcane and started to lay eggs. The rate of eggs hatching was high due to lower rate of egg parasitism (30%) during May 2004. This resulted in second flare up of *Pyrilla* nymphal-adult population (45 nymph and 12 adults/leaf with 12% nymphal-adult parasitism). Later on, a decreasing trend in *Pyrilla* population was observed which remained upto September 2004. This decreasing trend was inversely proportionate with *E. melanoleuca* percent

parasitism from Jun 2004 (42 nymph and 3 adults per leaf with 15% nymphal-adult parasitism) to September 2004 (6 nymph and 6 adult / leaf with 95% parasitism) (Fig. 2).

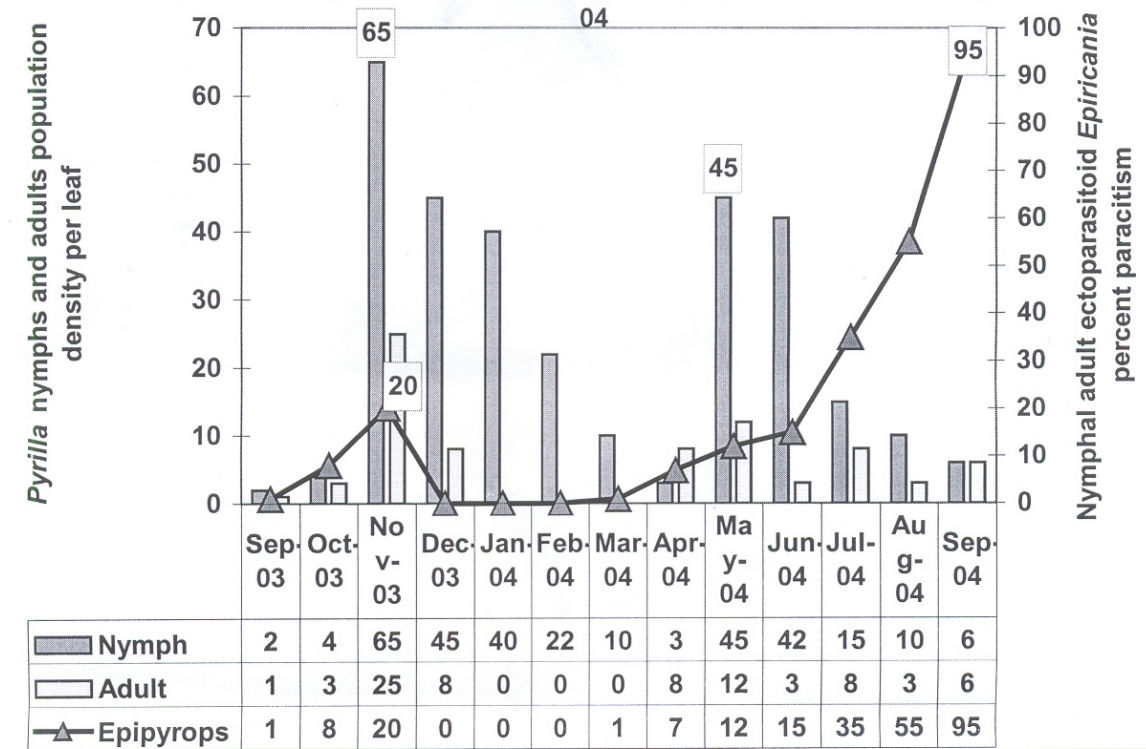


Fig. 2. Population dynamics of *Pyrilla perpusilla* Walker and its ectoparasitoid *Epiricania melanoleuca* at Mandi Baha-ud-Din during 2003-2004.

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