



## RESEARCH ARTICLE

## Parasitism and hyper parasitism on *Pyrilla Perpusilla* Walker in sugarcane ecosystem

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**Abstract** The seasonal variation in parasitism on *Pyrilla perpusilla* Walker (Lophopidae: Homoptera) *in situ* by parasitoids were examined at fortnightly interval, from April to December 2004 (Plant crop) and 2005 (Ratoon crop) in sugarcane ecosystem. These fields were kept free from insecticidal applications. During, 2004 there was no parasitization in the month of April while  $3.7 \pm 0.2$  per cent nymphs were parasitized in May first fortnight. With the increase in *Pyrilla* population, rise in parasitization by *Epiricania melanoleuca* (Epiropyidae: Lepidoptera) started and reached its peak  $80.5 \pm 4.9$  per cent on nymphs in November second fortnight. Adult parasitization ( $6.2 \pm 0.5\%$ ) was noticed in May first fortnight and touched its peak at  $77.0 \pm 5.1$  per cent in November second fortnight. While during 2005 parasitization were observed at  $82.3 \pm 4.8$  per cent on nymphs and  $75.0 \pm 3.9$  per cent on adults in November second fortnight. The range of parasitization by *E. melanoleuca* on nymphs+ adults was  $5.0 \pm 0.4$  to  $78.8 \pm 5.0$  per cent and  $4.8 \pm 0.7$  to  $78.7 \pm 4.4$  per cent during 2004 and 2005, respectively. Significant negative correlation with maximum ( $r=-0.825$ ) and minimum ( $r=-0.800$ ) temperature and non significant positive correlation with Relative humidity ( $r=0.352$ ) and Rain fall

( $r=0.242$ ). Per cent parasitism by egg parasitoids (combined) viz., *Parachrysocharis javensis*, *Cheiloneurus pyrillae* and *Ooencyrtus pyrillae* varies from  $23.8 \pm 2.9$  to  $83.0 \pm 5.8$  per cent from the month of July to December based on egg mass but based on individual eggs it was  $9.6 \pm 2.1$  to  $78.2 \pm 5.2$  per cent. Highest parasitization was in the month of December. No hyper parasitoid recorded on egg of *E. melanoleuca*. The hyper parasitoid *Ecthodryinus* sp. ( $0.7 \pm 0.2$  to  $2.3 \pm 0.2$  per cent) and *Fusarium* sp. ( $0.4 \pm 0.1$  to  $6.8 \pm 2.3$  per cent) recorded on pupae of *E. melanoleuca* from September to November.

**Keywords** Egg parasitoid, *Epiricania melanoleuca*, Hyper parasitism, Parasitism, *Pyrilla perpusilla*

### Introduction

Insect-Pests are one of the most important limiting factors in obtaining high yield and high sugar recovery in sugarcane. Sucking insect-pest, *Pyrilla perpusilla* Walker (Hemiptera: Lophopidae) is the most destructive in subtropical India. Small as well as large range outbreaks of the sugarcane *Pyrilla* have been reported in different parts of India from time to time. *Pyrilla* epidemics have been recorded in Uttar Pradesh in the past in 1934-36, 1937-38, 1947-48, 1951-53, 1968-70, 1973-74, 1976-77, 1978-79, 1985-86, 1999 and 2007 (Pawar *et al* 2002, Anonymous 2007). The *Epiricania melanoleuca* Fletcher (Epiropyidae: Lepidoptera) is a potential ectoparasitoid successfully controls the sugarcane leaf hopper, *Pyrilla perpusilla* Walker through field colonization in many parts of the Indian subcontinent (Rajak, 2007). Fletcher (1939) recorded this parasitoid on *P. perpusilla* for the first time from India and has identified as *Epiropyrops melanoleuca* Fletcher. The genus *Epiropyrops* was transferred to *Epiricania* and the

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insect was renamed as *Epiricania melanoleuca* Fletcher (Krampl & Dlabola, 1983). Biology of *E. melanoleuca* studied by Rajak, *et al.*(2006). It has been reported from Bangladesh, Pakistan, Sri Lanka, Burma, Indo-china, Thailand, Cambodia, Indonesia, Laos, Vietnam, Nepal, Afghanistan (Kumarasinghe and Wratten, 1996). Egg parasitoids are also very important for the management of *Pyrilla* as they reported to parasitize up to 100 per cent. The activity of parasite depends on its natural enemies if they are free from these they perform better. Therefore, the role of natural enemies for management of this pest needs to be explored. Estimation of field parasitization is the foremost step to quantify the natural field mortality for bio control programme. Although, studies on natural enemies of this pest exist, yet they are inadequate for this area to assess the suitability of parasitoids for its management. The present investigation on parasitism and hyper parasitism on *Pyrilla* attributes will provide vital information on actual field potential of the parasitoid and hyper parasitoids of this pest- a critical step in field releases programme.

**Materials and Methods**

Observation of the nymphal/adult parasitoids

To find out the seasonal variation in parasitization of *P. perpusilla* by parasitoids in nature, observations were recorded at fortnightly intervals at Kanpur area, from April to November 2004 (Plant crop) and 2005 (Ratoon crop) in three sugarcane fields. All the fields kept free from insecticidal application. Life stages of *Pyrilla* (nymphs and adults) and its parasitization were recorded from upper five leaves each of twenty randomly selected plants at three places from each field separately. The per cent parasitism and standard deviation

were calculated. Data recorded on per cent parasitism were correlated with the meteorological variables.

Observation of the egg parasitoids

Field collections of eggs of *Pyrilla* were made from July-December. The collected egg masses were kept in the small glass-jars, which covered with the muslin cloth, tied with rubber band. Per cent parasitization was recorded by individual egg and egg mass basis. Eggs of *Pyrilla* were counted after blowing the fluffy material lying over the egg-masses. The per cent parasitism and standard deviation were calculated

Observation of the hyper parasitoids

The life stages (egg, nymph and adult) of *E. melanoleuca* were collected from the field and kept separately in the glass tubes, which were covered with muslin cloth secured with rubber band. The emergence of hyper parasitoids was recorded. Careful observations made in the field also, to see predators of parasitoids. The per cent hyper parasitism and standard deviation were computed.

**Results and Discussion**

Nymphal / adult parasitism (*Epiricania melanoleuca*)

There was no parasitization in the month of April, 2004 while in the month of May first fortnight there were 3.7± 0.2, 2±0.5 and 5.0± 0.4 per cent parasitization observed on nymphs, adults and nymphs+adults, respectively by *E. melanoleuca* and it slowed down in the 1<sup>st</sup> fortnight of June. There was regular increase in the parasitization of nymphs and adults of

**Table 1.** Parasitism on *P. perpusilla* in situ by *Epiricania melanoleuca* Fletcher

Month	Fort night	Per cent parasitism					
		2004			2005		
		Nymph (Mean±SD)	Adult (Mean±SD)	Nymph+ Adult (Mean±SD)	Nymph (Mean±SD)	Adult (Mean±SD)	Nymph+ Adult (Mean±SD)
April	I	0.0	0.0	0.0	9.6±1.3	0.0	4.8±0.7
	II	0.0	0.0	0.0	11.7±1.3	0.0	5.8±0.7
May	I	3.7±0.2	6.2±0.5	5.0±0.4	3.5±0.3	3.4±0.2	3.5 ±0.3
	II	2.9±0.1	3.9±0.1	3.4±0.1	3.6±0.2	4.0±0.2	3.8±0.2
Jun	I	0.0	4.6±0.6	2.3±0.3	3.8±0.2	3.3±0.1	3.6±0.2
	II	3.7±0.2	0.0	1.8±0.1	5.3±0.4	0.0	2.7±0.2
Jul	I	5.9±0.5	4.1±0.7	5.0±0.6	10.9±1.2	3.3±0.1	7.1±0.7
	II	8.8±1.1	8.8±1.0	8.8±1.1	18.0±2.1	5.3±0.5	11.7±1.3
Aug	I	18.7±2.2	15.3±1.7	17.0±1.9	27.5±2.8	12.0±2.0	19.8±2.4
	II	24.9±3.8	17.5±1.2	21.8±2.5	32.4±3.9	19.1±2.1	25.8±3.0
Sep	I	31.3±4.2	24.5±3.4	27.9±3.8	36.2±4.2	29.7±3.4	33.0±3.8
	II	37.5±4.1	27.8±3.5	32.7±3.8	41.3±3.6	39.9±3.8	40.6±3.7
Oct	I	57.2±5.3	51.6±4.1	54.4±4.7	63.3±4.8	45.6±4.2	54.5±4.5
	II	64.7±5.8	60.7±4.8	62.7±5.3	71.1±4.6	63.8±4.3	67.5±4.5
Nov	I	72.8±4.6	73.3±5.2	73.1±4.9	76.9±3.9	72.8±4.1	74.8±4.0
	II	80.5±4.9	77.0±5.1	78.8±5.0	82.3±4.8	75.0±3.9	78.7±4.4

*Pyrilla* from July 1<sup>st</sup> fortnight at  $5.9 \pm 0.5$ ,  $4.1 \pm 0.7$  and  $5.0 \pm 0.6$  per cent on nymphs, adults and nymphs+adults, respectively. During 2005, parasitization on nymphs recorded in April up to  $11.7 \pm 1.3$  per cent. This year also parasitization slowed down during May and June and started to increase from July at  $10.9 \pm 1.2$ ,  $3.3 \pm 0.1$  and  $7.1 \pm 0.7$  per cent on nymphs, adults and nymphs+adults, respectively and reached at  $82.3 \pm 4.8$ ,  $75.0 \pm 3.9$  and  $78.7 \pm 4.4$  on nymphs, adults and nymphs+adults, respectively in the month of November. It is also obvious from the table 1 that nymphs were preferred over adults for parasitization. The *Pyrilla* population was completely checked by the nymphal and adult parasitoids in the fields. No parasitization was noticed in the month of April on adult. Almost similar trend observed in parasitization during both the years. The range of parasitization by *E. melanoleuca* on nymphs+ adults was  $5.0 \pm 0.4$  to  $78.8 \pm 5.0$  per cent and  $4.8 \pm 0.7$  to  $78.7 \pm 4.4$  per cent during 2004 and 2005, respectively.

The simple correlation between abiotic factors and parasitism (Pooled data) revealed that the parasitic activity exhibited significant negative correlation with maximum ( $r=-0.825$ ) and minimum ( $r=-0.800$ ) temperature and non significant positive correlation with Relative humidity ( $r=0.352$ ) and Rain fall ( $r=0.242$ ). The prevalence of *E. melanoleuca* on *Pyrilla* is well established fact (Kalra, 1973; Patel *et al.* 1993; Madan and Chaudhary, 1995 and Pandya, 1997). They also pointed out that high temperature and low relative humidity reduces parasitization. Rajak *et al.* (1987) reported outbreak of *Pyrilla* and its management during 1985. Tewari and Tanwar (2001) concluded that in India spectacular success achieved in the control of *Pyrilla* by *E. melanoleuca* both in tropical and subtropical regions. Hugar *et al.* (2002) reported that population of *Pyrilla* were noticed from June to December. The peak population was recorded during second fortnight of September while the activity of *E. melanoleuca* was in peak during the first fortnight of November. Pawar *et al.* (2002) reported *Pyrilla* out break during July to October in western Uttar Pradesh, the parasitization by *E. melanoleuca* was 33-62 per cent on nymphs in August that increased up to 100 per cent in October. The *Pyrilla* population was completely checked by the egg, nymphal and adult parasitoids in the fields up to November.

**Table 3.** Hyper parasitism on *Epiricania melanoleuca* Fletcher

Month of observation	Natural enemy	Nature of Association	Stage of host	Per cent parasitization (Mean±SD)	Locality
July	-	-	-	-	-
August	-	-	-	-	-
September	<i>Ecthodryinus</i> sp.	Hyper parasitization	Cocoon	0.2-1.2 (0.7±0.2)	Kakardahi
	<i>Fusarium</i> sp.	Fungal parasitization	Cocoon	0.1-0.6 (0.4±0.1)	Kakardahi
October	<i>Ecthodryinus</i> sp.	Hyper parasitization	Cocoon	0.4-4.1 (2.8±1.2)	Kakardahi
	<i>Fusarium</i> sp.	Fungal Pathogenic	Cocoon	3.8-7.0 (5.6±1.1)	Hazipur patara
November	<i>Ecthodryinus</i> sp.	Hyper parasitization	Cocoon	0.3-3.6 (2.3±0.2)	Ghatampur
	<i>Fusarium</i> sp.	Fungal pathogenic	Cocoon	3.6-9.4 (6.8±2.3)	Bunthara

No hyper parasitoids noticed on eggs of *E. melanoleuca*

**Table 2.** Parasitism on egg of *Pyrilla perpusilla* Walker in situ

Month	Number examined		Per cent parasitization	
	Egg Masses	Eggs	Egg Mass basis (Mean±SD)	Egg basis (Individual) (Mean±SD)
July	31	1085	23.8±2.9	9.6±2.1
August	73	2486	36.2±4.6	18.2±4.3
September	95	3420	52.1±3.3	34.8±2.9
October	120	3960	58.6±5.3	41.2±4.8
November	110	3630	72.8±4.7	62.6±5.1
December	30	930	83.0±5.8	78.2±5.2

#### Egg Parasitism (Egg parasitoids)

The Table 2 reveals combined parasitism by *Parachrysocharis javensis*, *Cheiloneurus pyrillae* and *Ooencyrtus pyrillae* on the egg of *Pyrilla* based on egg mass was  $23.8 \pm 2.9$  to  $83.0 \pm 5.8$  per cent from the month of July to December, respectively while on the basis of individual egg, the per cent parasitization varies between  $9.6 \pm 2.1$  to  $78.2 \pm 5.2$  per cent during same period. There was increasing trend in parasitization from July to December. There was no egg mass available in the month of January. It was also concluded that in an egg mass all the eggs not get parasitized. Yadav (1983) reported parasitization of egg up to 97.6 per cent. Singh *et al.* (2000) reported parasitization of egg by egg parasitoids. Rajak and Varma (2001) recorded (17.0-79.8 per cent) parasitisation of egg of *Pyrilla* by egg parasitoids.

#### Hyper parasitoids of *E. melanoleuca*

From the field collected cocoons of *E. melanoleuca*, hyper parasitoid, *Ecthodryinus* sp. found in the range of 0.2 to 1.2 ( $0.7 \pm 0.2$ ), 0.4 to 4.1 ( $2.8 \pm 1.2$ ) and 0.3 to 3.6 ( $2.3 \pm 0.2$ ) per cent during September, October and November, respectively from villages- Kakardahi & Ghatampur. The *Fusarium* sp. was also recorded on pupae from September to November in the range of 0.1-0.6 ( $0.4 \pm 0.1$ ) to 3.6-9.4 ( $6.8 \pm 2.3$ ) per cent from villages- Kakardahi, Hazipur, patara and Bunthara (Table 3). No hyper parasitoids recorded on egg of *E. melanoleuca*. Jadhav and Varma (1988), Brar (1978) and Pandya (1998) were also reported *Ecthodryinus* sp. from Maharashtra, Punjab and Gujrat, respectively.

It was concluded that the nymphal/adult parasitoid and egg parasitoids are essential biotic component that contribute to the natural regulation of *Pyrilla* population in existing agro-ecosystem of Kanpur. It proved again that conservation of natural parasitoids, augmentation through field releases and not using chemical insecticides are the eco-friendly and most economical *Pyrilla* management tools. The study advocates that for the redistribution of *E. melanoleuca* only egg masses should be used to prevent the spread of the hyper parasitoid because cocoons were found parasitized by hyper parasitoids. Hence forth, the present investigations warrant more attention towards the conservation of these parasitoids as well as to explore the bio control potential of promising parasitoids and also to findout the way to mitigate the problem of hyper parasitoids. Moreover, *Ecthodryinus* sp. is not much important because of low level of hyper parasitism but careful watch is required.

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