J. Biol. Control, 22(1): 185-188, 2008

Research Note

Effect of host density and host-parasitoid ratio on parasitization of *Pyrilla perpusilla* (Walker) by *Epiricania melanoleuca* (Fletcher)

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ABSTRACT: **Laboratory and field studies were carried out on the influence of host-parasitoid ratio on parasitism of *Pyrilla perpusilla* (Walker) (Homoptera: Lophopidae) by *Epiricania melanoleuca* (Fletcher) (Lepidoptera: Epipyropidae). Enhanced parasitism was observed with increased host-parasitoid ratio from 48.1 per cent at 1: 1 to 84.9% at 1: 4 ratios. Enhanced pupation was also observed with increase in the host-parasitoid ratio (46.1 to 79.6%). The host-parasitoid ratio of 1: 4 at 5 pyrilla per leaf was found optimum for mass multiplication of *E. melanoleuca* in laboratory conditions. Under field condition non-significant effect of life stages (nymphs 80.0 and adults 77.8%) of pyrilla was noticed on their parasitization by *E. melanoleuca*. In field conditions also, enhanced parasitization was noticed with increase in host-parasitoid ratios from 1: 1 to 1: 7, but 1: 3-1: 5 ratio at a host density of 5 pyrilla per leaf resulted in better increase in field parasitism.**

KEY WORDS: *Epiricania melanoleuca*, host density, host-parasitoid ratio, parasitization, pupation, *Pyrilla perpusilla*

The sugarcane leafhopper, *Pyrilla perpusilla* (Walker) (Homoptera: Lophopidae), is one of the major insect pests and has been recorded from many parts of India, Pakistan, Bangladesh, Burma, Sri Lanka, Thailand and Indonesia. In India, it is a key pest in Uttar Pradesh, Haryana, Punjab, Bihar, Rajasthan, Maharashtra, Andhra Pradesh and Gujarat (Avasthy, 1973; Seneviratne and Kumarsinghe, 2002). Pyrilla causes 31.6 and 34.2% reduction in sugarcane yield and sucrose, respectively. It also creates havoc with sugar content, purity in juice and recovery of jaggery by 2-5, 5-12 and 2.2-2.5 units, respectively, in India (Tewari *et al.*, 1987). The ecto parasitoid, *Epiricania melanoleuca* (Fletcher) (Lepidoptera: Epipyropidae), has been successfully used for the control of the sugarcane leaf hopper through field releases in many parts of the Indian subcontinent (Pawar *et al.*, 2002; Rajak, 2006, 2007). Systematic studies on host-parasitoid ratio would enable us to find out the optimum ratio for mass multiplication in the laboratory and field colonization of *E. melanoleuca* against pyrilla. Hence, the present laboratory and field investigations were carried out at the Department of Entomology and Insectary, C. S. Azad University

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Laboratory studies

The parasitoid larvae were released in glass jars (20x15cm) with 10 cut cane leaves at varying ratios and population densities of the host (1.0, 2.0, 3.0, 4.0, 5.0 and 6.0 pyrilla adults per cane leaf). The ratio of host and parasitoid was maintained at 1: 1, 1: 2, 1: 3 and 1: 4 and these were replicated thrice. To provide enough food to pyrilla, the leaves were changed every fifth day. In the center of the jars, a 5 cm petri dish with absorbent cotton soaked in 2.5% each of sugar and protinules was provided. This diet was changed after every third day. The open end of the glass jars was covered with muslin cloth and secured with a rubber band. The rearing was done in the laboratory at a mean temperature of 27±2°C and relative humidity of 70±5%. Parasitism and pupation was recorded at 10th and 25th day of release, respectively.

Field studies

The experiment was conducted in the field by placing a 10x3ft nylon-net cage on 8-month-old canes having 20 leaves in each cage. In each cage, 100 nymphs and 100 adults of pyrilla were released separately (5 individuals per leaf). Thereafter, parasitoid eggs ready to hatch were released @ 125, 250, 375, 500, 625, 750 and 875 eggs per cage. The hatchability of eggs for all the ratios was considered as 80 per cent. The host-parasitoid ratios 1: 1, 1: 2, 1: 3, 1: 4, 1: 5, 1: 6 and 1: 7 were maintained in each replication. After 10 days of release of the parasitoid, 30 nymphs and 30 adults of pyrilla were examined for parasitism.

The data presented in Table 1 showed enhanced parasitization with the increased ratio of parasitoid. It varied from 48.1% at 1: 1 ratio at 84.9% in 1: 4 ratio. It was observed that there was significant difference between population densities varying from 1.0 to 5.0 pyrilla per leaf. The parasitization in these densities varied from 48.3 to 82.2%. There was no significant difference in % parasitism between population densities of 5.0 and 6.0 pyrilla per leaf (82.2 to 85.4%). At a host-parasitoid ratio of 1: 4, it was observed that parasitization in the population density of 1.0 pyrilla

Table 1. Effect of host density and host-parasitoid ratio on parasitization of *Pyrilla* by *E. melanoleuca* in the laboratory

Host -parasitoid ratio	Per cent parasitism at various host densities (per jar with10 cut cane leaves)						Mean
	10	20	30	40	50	60	
1: 1	23.3 (28.86)	35.0 (36.27)	43.3 (41.15)	56.7 (48.85)	61.3 (51.53)	68.9 (56.11)	48.1 (43.91)
1: 2	40.0 (39.23)	56.7 (48.85)	68.9 (56.11)	80.8 (64.01)	83.3 (65.88)	86.1 (68.11)	69.3 (56.35)
1: 3	60.0 (50.77)	70.0 (56.79)	76.7 (61.14)	88.3 (70.00)	90.0 (71.56)	91.7 (73.26)	79.5 (63.08)
1: 4	70.0 (56.79)	78.3 (62.24)	81.1 (64.23)	90.8 (72.34)	94.0 (75.82)	95.0 (77.08)	84.9 (67.13)
Mean	48.3 (44.03)	60.0 (50.77)	67.5 (55.24)	79.2 (62.87)	82.2 (65.05)	85.4 (67.54)	Mean
Factors		SEM±			LSD (P = 0.01)		
Host-parasitoid ratio (A)		0.76			2.06		
Host density (B)		0.93			2.52		
Interaction (A x B)		1.86			5.04		

Figures in parentheses are arcsine-transformed values

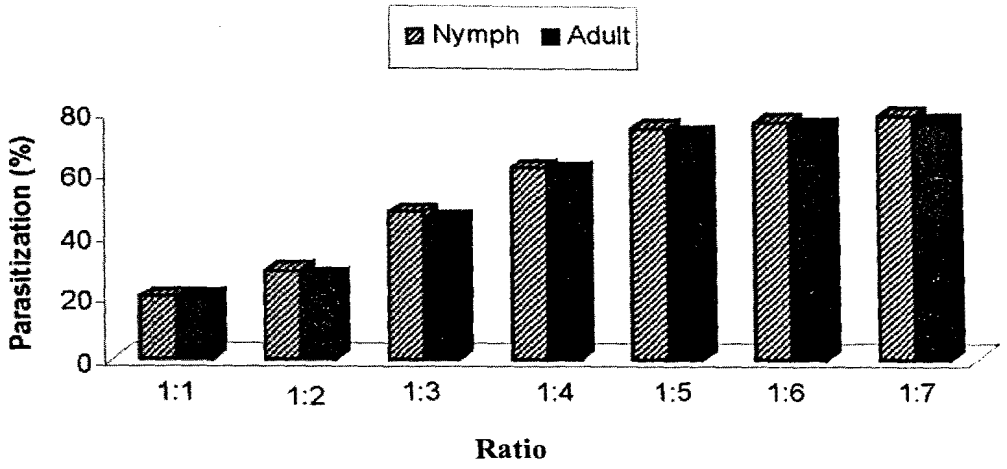

Fig. 1. Parasitization of pyrilla with different ratios of *E. melanoleuca* under field

per leaf was significantly lower than all other ratios. It indicates that increasing host densities at different host-parasitoid ratios enhanced parasitism significantly.

There was also a significant increase in pupation with increase in the host-parasitoid ratio. The pupation varied from 46.1 to 79.6% at different ratios of host and parasitoid. There was a regular increase in the per cent pupation with rise in density of pyrilla up to 5.0 pyrilla per leaf. Pupation at host-parasitoid ratio 1: 1 was significantly different from ratio 1:4 at all the population densities. When the density of pyrilla rose to 6.0, there was a reduction in the per cent pupation of *E. melanoleuca*. This was probably due to overcrowding in the glass jars. It resulted in the mortality of pyrilla as also parasitoid. At host–parasitoid ratio 1: 4 and 5 pyrilla per leaf, the maximum increase in parasitism and pupation was observed in laboratory condition. Earlier, Madan and Chaudhary (1993a) reported that a host: parasitoid ratio of 1: 3 at 27.5 to 30.0°C with 50 to 90% relative humidity was the most suitable combination for the mass multiplication of *E. melanoleuca* in the laboratory.

In field cage studies, parasitism of nymphs ranged from 20.0 to 80.0% at different host-parasitoid ratios (Fig. 1). Under field conditions, non-significant effect of life stages (80.0% of nymphs and 77.8% of adults) of pyrilla was noticed on their parasitism by *E. melanoleuca*. Parasitism in the host parasitoid ratios of 1: 1 and 1: 2 was similar. Similarly, non-significant differences were observed in per cent parasitism among the host parasitoid ratios of 1: 5-1: 7. In case of adults also, the host parasitoid ratios of 1:1 and 1:2 showed 20.0 and 26.7% parasitism and were on par. The host-parasitoid ratios of 1:5-1: 7 showed parasitism of 73.3-77.8% and were on par, but significantly different from other ratios. Therefore, considering its increased rate of parasitism, the ratio 1: 3 to 1: 5 of host-parasitoid may be used for the effective control of pyrilla at a population density of 5 nymphs / adults per leaf in field conditions. Singh and Dayal (1975) reported effective control of pyrilla under field conditions when the host-parasitoid ratio reached the level of 1: 3.5. Madan and Chaudhary (1993b) also reported a ratio of 1: 2-1: 4 for field release and effective management of pyrilla.

It is concluded from the present study that a host-parasitoid ratio of 1: 3-1: 5 at 5 nymphs / adults per leaf was most effective for field colonization. There was no significant effect of life stages on the

parasitism of pyrilla. A host-parasitoid ratio of 1: 4 at 5 pyrilla per leaf was suitable for the mass multiplication of *E. melanoleuca* in the laboratory.

ACKNOWLEDGEMENTS

The author is grateful to Dean, College of Agriculture; Head, Department of Entomology and Head, Legume section, C.S.A.U.A. and T., Kanpur, for guidance and providing facilities during the course of investigations.

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(Received: 03.07.2007; Revised: 20.08.2007; Accepted: 14.09.2007)