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Natural parasitism of the rice skipper, *Parnara guttata* (Bremer and Grey) (Lepidoptera: Hesperiidae) infesting paddy at Anantnag, Kashmir

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ABSTRACT: ***Parnara guttata*** **(Bremer & Grey) was found to support the population of three different larval parasitoids, namely,** ***Apanteles*** **sp., an ichneumonid, a tachinid and one pupal parasitoid,** ***Brachymeria*** **sp. in paddy fields at Regional Rice Research Station, Khudwani, Anantnag, from July to October during Kharif 2003 & 2004. Total host parasitisation was averaged as 41.83 and 44.43 per cent during 2003 and 2004 respectively, and showed non-significant positive correlation (0.22 and 0.13) with the availability of host, during both the years. Among the parasitic community studied, average parasitism by** ***Apanteles*** **sp. was found maximum in nature (23.26 and 24.7), followed by tachinid (8.7 and 8.38),** ***Brachymeria*** **sp. (7.33 and 8.1) and ichneumonid (2.55 and 2.63 per cent) during the corresponding years. Pattern of parasitism for individual parasitoid species was worked out in detail along with possible reasons of dynamic similarity and changes in their population.**

KEY WORDS: Anantnag, *Apanteles* sp., *Brachymeria* sp., ichneumonid, paddy, parasitism, *Parnara guttata*, tachinid

INTRODUCTION

Although *Parnara guttata* (Bremer and Grey) is considered as a minor pest of paddy, in case of severe infestation occurring at young transplanted seedling to ear formation stage, the plants are reported to become weak and fail to recover. The grain quality has also been reported to be reduced with uneven maturation (Susan 1976). Pang (1987) reported the yield loss / 100 hills from 3.3 to 31.8 per cent in China. Jana *et* al. (1994), however, indicated little or no consequence on crop yield in West Bengal.

Sufficient information is available largely from China and Japan on the parasitic community of *P. guttata* and their bio-regulatory potentials in natural rice ecosystem (Zhao 1986; Zhang 1986; Liu 1987; Huo and Wang 1991; Matsumura 1992; Hirai *et al.*, 2001). Important parasitic fauna reported from China and Japan comprises egg parasitoids (*Trichogramma parnarae, T. shaanxiensis* and *Telenomus* spp.); larval parasitoids (*Apanteles baoris, A. ruficrus, Charops bicolor, C. brachypterum, Pediobius inexpectatus* and a tachinid fly, *Argyrophylax apta*) and pupal parasitoids (*Pediobius* spp.). Two braconid larval

parasitoids, namely, *Rhysipolis meditator* and *R. parnarae*, are also reported from Vietnam (Belokobyl and Kon 1988).

Although some larval and pupal parasitoids have been reported to be associated with *Parnara mathias* from India (Hussain and Agarwal 1982; Narendran 1986; Sathe and Bhoje 2000; Basit and Saikia 2006), no information, however, is available till date, on the parasitic fauna of *P. guttata*.

Studies on natural parasitism of *P. guttata* in rice ecosystem conducted for the first time in Kashmir valley revealed the host insect supporting three different larval (*Apanteles* sp., an ichneumonid and a tachnid fly) and one pupal (*Brachymeria* sp.) parasitoid species. The latter has been proposed and communicated as a new species by the authors. The details are presented in this paper.

MATERIALS AND METHODS

The present study was conducted in a totally pesticide free area of Regional Rice Research Station, Khudwani, Anantnag, during *kharif*-2003 and 2004. Fortnightly collections of healthy and parasitized larvae (3rd to mature stage) and pupae of *P. guttata* were made from an area of approximately 1.0 hectare. Pupal cocoons of ichneumonid and tachinids were also taken into account whenever observed during the survey. Individual larva / pupa along with leaves of host plant was kept separately in glass test tubes (15.0x2.5mm) plugged with cotton wool and stored in a thermostat BOD, maintained at 27.0 ± 1.0°C and 65 ± 5 per cent R.H. Immature active larvae were supplied with fresh paddy leaves as per requirement. Necessary hygienic condition was also provided during the experiment. The tubes were examined regularly for the emergence of parasitoids which were killed after 2-3 days by exposing them to cotton soaked fumes of ethyl acetate and preserved in 70% alcohol for further taxonomic identification. Larvae / pupae displaying failure of emergence were dissected under a stereoscopic binocular microscope for examination of parasitoids' presence.

An up-to-date record, period wise, for each year was duly maintained regarding sample size, kinds and number of emerged parasitoids per host larva / pupa. The present analysis is based on a total sample size (N) of 558 and 597 larvae and pupae, for 2003 and 2004, respectively. Percentage of larval parasitism on fortnightly basis was worked out from the number of larvae and pupae collected during that period (n_1). The percentage of pupal parasitism, however, was determined from n_1 minus number of larvae found parasitized during that period. Year wise representation of each species was worked out by averaging per cent parasitism of the entire *kharif* season. Student's t-test was carried out after transformation to arcsine values. Co-efficient of correlation between host and per cent parasitism was established with untransformed values.

RESULTS AND DISCUSSION

Moderate occurrence of *Parnara guttata* was first noticed from late June to early July, but without any case of parasitism during *kharif*-2003 and 2004. Larval parasitism was first observed during the 3rd week of July, which continued till late October. Pupal parasitism, however, began during early August and followed after larval parasitism during both the years. Total larval parasitism was 34.5 and 36.33 per cent during 2003 and 2004, respectively. In each case, larval parasitism was first found to increase till September, but declined thereafter. Pupal parasitism, however, maintained an upward trend (Table 1). Among the parasitic community studied, *Apanteles* sp. was found to be more dominant than others. It was found parasitizing late fourth instar larvae, whereas ichneumonids and tachinid flies selected early third and final instars, respectively. *Brachymeria* sp. parasitised pupae only. Average parasitism recorded by *Apanteles* sp. was 23.26 and 24.7 per cent during *kharif* 2003 and 2004, respectively. Pattern of parasitism by larval and pupal parasitoids during the entire *kharif* season is depicted in Figure 1. Differences in per cent parasitism of individual parasitoid species both on fortnightly as well as average basis of both years were non-significant in each case. However, per

cent parasitization for the parameters observed except for *Brachymeria* sp. and tachinid sp. was found positively correlated with host availability during both the years (Table 2), which indicated a density-dependent relationship.

Maximum parasitization by *Apanteles* sp. was found due to its dominance over other larval and pupal species by virtue of its high population density, achieved as a result of displaying superparasitism in the host larvae. This

Table 1. Level of parasitism in *Parnara guttata* on rice during *kharif* 2003 and 2004

Period of observation	% Larval parasitism						% Pupal parasitism	
	Apanteles sp.		Ichneumonid		Tachinid		*Brachymeria* sp.	
	Kharif 2003	*Kharif* 2004	*Kharif* 2003	*Kharif* 2004	*Kharif* 2003	*Kharif* 2004	*Kharif* 2003	*Kharif* 2004
July 1st-2nd week	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
July 3rd-4th week	6.82	3.85	2.27	1.92	4.54	3.85	0.0	0.0
Aug 1st- 2nd week	8.22	10.00	2.74	2.5	5.48	5.00	1.64	1.51
Aug 3rd- 4th week	17.24	19.42	3.45	3.9	5.17	5.82	3.49	2.7
Sep1st- 2nd week	34.9	38.23	4.65	4.41	7.75	8.82	7.35	6.06
Sep3rd- 4th week	50.00	52.5	3.95	5.00	10.53	12.5	11.11	16.66
Oct 1st- 2nd week	38.33	37.7	3.33	3.28	16.66	13.11	16.00	17.86
Oct 3rd- 4th week	30.55	35.89	00	00	19.44	17.95	19.04	20.00

Table 2. Percent parasitism between years and correlation between parasitism and host availability

Parasitoid species	Student's t-test†	Coefficient of correlation†† 2003	2004
Apanteles sp.	0.93 NS	+0.35 NS	+0.31 NS
Ichneumonid	0.21 NS	+0.84 Sig.**	+0.77 Sig.*
Tachinid	0.48 NS	-0.09 NS	-0.08 NS
Total larval parasitism	0.91 NS	+0.3 NS	+0.27 NS
Brachymeria sp.	0.63 NS	-0.46 NS	-0.8 Sig.*
Total parasitism	1.19 NS	+0.22 NS	+0.13 NS
Average parasitism†††	1.76 NS	- -	

† $t > _{0.05}$; d.f.=7; †† $t < _{0.05}$; d.f.=6, ††† $t > 0.05$, d.f.= 4

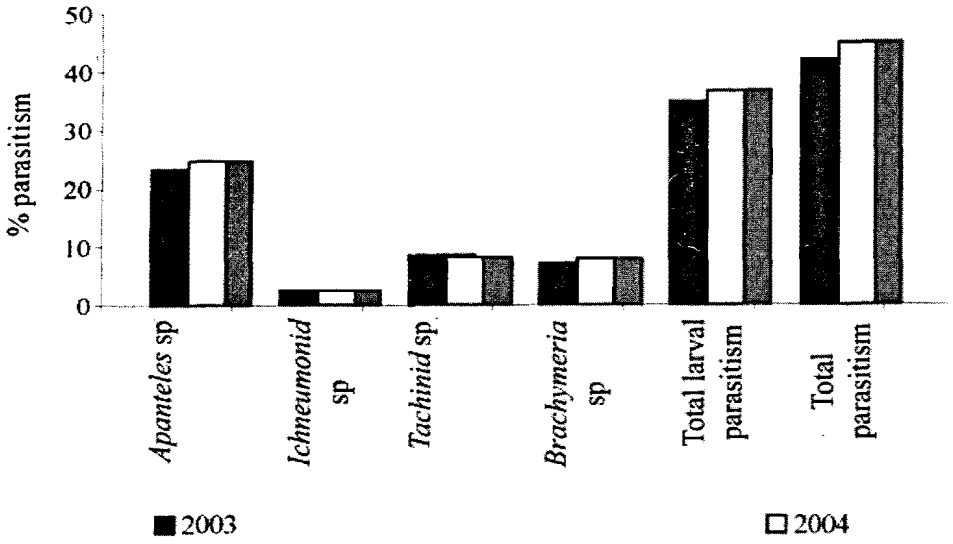

Fig. 1. Average parasitism *in Parnara guttata* during *kharif* 2003 and 2004

phenomenon enhanced the population of *Apanteles* sp. several fold at every generation, which eventually marginalized the role of other parasitoid species. However, sharp decline in larval parasitism by *Apanteles* sp. during October was found to be caused by gradually increased level of hyper parasitism by the pteromalid parasitoid, *Trichomalopsis apanteloctena* Crawford, recorded for the first time by Ahmad and Zaki (2004) from Kashmir valley. Similar observations have also been made by Belokobyl and Kon (1988) and Zhang (1986). However, this decline in larval parasitism was found to be compensated to some extent by relatively increased parasitism both by tachinid species and *Brachymeria* sp. as a result of comparatively relaxed interspecific competition (Table 1). Increased level of parasitism by tachinid species during October was also marked by several instances of multiparasitism along with *Apanteles* sp., as well as occasional practice of superparasitism too. The ichneumonid species, however, displayed comparatively meager role towards larval parasitization because of its sparse population during both the years.

The present study revealed almost a uniform pattern of parasitism in *P. guttata* during both the years, as also indicated by its non-significant difference through Student's t-test (Table 2). Negative correlation however, both for *Brachymeria* sp. and tachinid sp. as observed during both the years reflected slow build up of above mentioned parasitoids and hence increased parasitism during late stage of the crop when the pest population had already declined. Nevertheless, cumulative parasitization as worked out for both the years provided testimony of the remarkable bioregulatory potentials of the studied parasitoids. Sufficient level of natural parasitism in *P. guttata*, however, in Kashmir owes greatly to pesticide-free paddy cultivation in Kashmir valley so far, that augurs well both for future as well as existing rice eco-system. Some other cultural practices like cultivation of both early and late maturing rice varieties, staggered harvesting, field storage of straw residue for 1-2 months, avoidance of trash burning, etc. contribute enough towards conservation of the above mentioned natural enemies causing their frequent occurrence and hence substantial level of host parasitism. This well-balanced ecosystem offers a great potential for organic rice cultivation in the valley, which needs to be promoted by sensitizing the farming community.

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