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Natural Parasitism of Leaf Miner, *Chromatomyia horticola* (Goureau) (Diptera: Agromyzidae) on Vegetable Crops in Kashmir (India)

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Abstract: The present paper reports the occurrence of 7 hymenopteran parasitoids of Agromyzid leaf miner, *Chromatomyia horticola* (Gourear) (Diptera : Agromyzidae) from Kashmir (India). This is being the first report from this region. The various parasitoids recorded were 5 eulophids (*Chrysocharis horticola* Mani, *Diglyphus horticola* Khan, *Diglyphus* sp., *Pediobius indicus* Khan and *Euderus agromyzae*) and 2 braconids (*Opius* sp. and *Dacnusa* sp.). *Dacnusa* sp. is also a new parasitoid record of *C. horticola* for India. Some field observation have been made on the seasonal occurrence, distribution and percentage of parasitoids of *C. horticola* recorded in various vegetable crop fields in different areas and regions of Kashmir.

Key words: Hymenoptera · Parasitoids · *Chromatomyia horticola* · Eulophidae · Kashmir

INTRODUCTION

Agromyzid leaf miner, *Chromatomyia horticola* (Goureau) (=*Phytomyza horticola*) is a pest of economic importance on several vegetables in both the temperate and tropical regions [1]. It is more common in the Mediterean area and occurs widely throughout Asia [2]. The larvae of this species feed within the leaves of the host plant and this feeding can severely reduce yields and/or kills the plants at high fly density. In Kashmir Valley (India), *C. horticola* was earlier reported infesting some vegetable crops like, pea, kale, mustard, rape, turnip, radish and some ornamental flowering plants [3,4]. Many parasitoids are known to attack *C. horticola* in vegetable eco-systems in other parts of the world and some previous reports in this connection have been given by Mani [5], Khan [6], Chen *et al.* [7] Gencer [2,8] and Purwar *et al*., [9]. However, no published record has been found on the parasitoid complex of *C. horticola* on vegetable ecosystems in Kashmir. Thus the objective of this study was to determine parasitoids of *C. horticola* occurring in Kashmir (India).

MATERIALS AND METHODS

Field study was carried out during the year 2005-2006, in 5 districts of Kashmir Valley such as Baramullua, Badgam, Ganderbal, Srinagar and Pulwama, selecting two sites from each district. The sites visited for sample collection were: Sumbal and Sopore (Baramulla); Bugam and Narkarah (Budgam); Nunar and Kangan (Ganderbal); Idgah and Danderkah (Srinagar) and Hispora and Pampore (Pulwama). The miner fly infested leaves of vegetable plants such as *Brassica campestris*, *B. oleracea acephala*, *B.o. gongylodes*, *B. rapa*, *Pisum sativum*, *Alium cepa* and *Malva sylvestris* were collected. The weekly collection of samples was made during the moths from May to August, which is the period when the infestation of *C. horticola* occurs on vegetable crops fields in Kashmir [3,4]. In each sample, 100 infested leaves were randomly collected from each study site. The leaf samples were brought to the laboratory and kept in plastic culture container / rearing jars, covered with muslin cloth, till the emergence of adult flies or their parasitoids. The laboratory temperature was about 25-30°C and the relative humidity was between 60-70%. The emerged flies or parasitoids were collected from the containers and preserved in 70 % ethanol or as dry material. The parasitoid specimens were identified by the authors according to Mani [5], Khan [6] and Wharton *et al.* [10] and the number of specimens for each species was counted. The percentage of each parasitoid was estimated.

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RESULTS AND DISCUSSION

Frequent visits to vegetable-growing areas were conducted over the 2 years period of the survey, providing ample opportunity to make general field observations. *C. horticola* was recorded infesting 7 vegetable crops, *viz.* mustard (*Brassica campestris*), kale (*B. oleracea.* var. *acephala*), knoll-khol (*B. o.* var. *gongylodes*), turnip (*B. rapa*), pea (*Pisum sativum*), onion (*Alium cepa*) and malva (*Malva sylvestris*). Among these crops, malva and onion are 2 new host crop records of *Chromatomyia horticola* for Kashmir (India). In 2005, the surveys of these vegetable cop plants from May-August yielded 1004 adult of *C. horticola.* Like wise in 2006, 999 adults of *Chromatomyia horticola* were recovered.

Higher numbers of leaf miner adults emerged from leaves collected from *B. campestris* and *P. sativum*. During the two years of this investigation in the Valley, the infestations of *Chromatomyia horticola* were observed more serious during the month of May when limited control was exerted by parasitoids. As shown in Table 1, the monthly mean number of *Chromatomyia horticola* recovered in the months of May was much higher than that of total parasitoids. Tsumou *et al.* [11] have also reported *C. horticola* as a serious pest in slightly cool season (May) in Japan. The most severe infestation was observed on *B. campestris* and *P. sativum* in this investigation.

Also the Figures 1 and 2 show that the mean number of adults of *Chromatomyia horticola* emerged during the

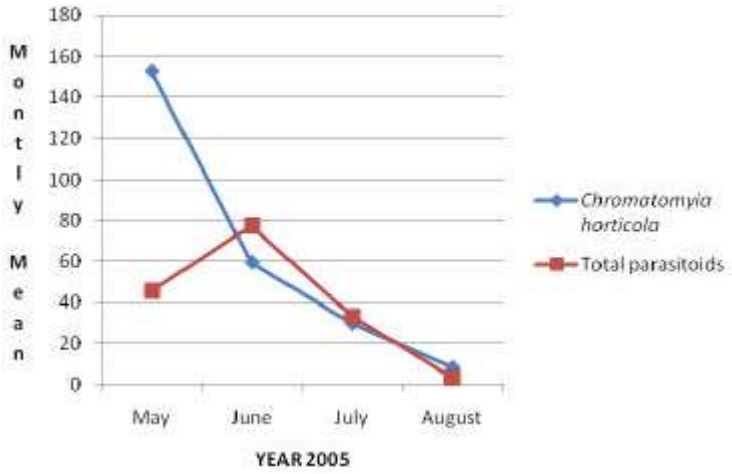

Fig. 1: Seasonal abundance of the leaf miner, *Chromatomyia horticola* and its parasitoids collected on various vegetable crops in Kashmir Valley from May to August 2005.

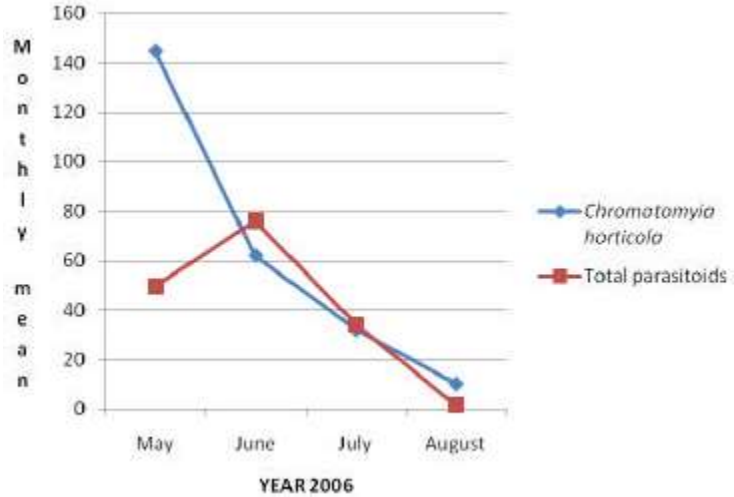

Fig. 1: Seasonal abundance of the leaf miner, *Chromatomyia horticola* and its parasitoids collected on various vegetable crops in Kashmir Valley from May to August 2006.

Table 1: Host-Crop-Complex of hymenopteran parasitoids of Chromatomyia horticola recorded during 2005-2006 survey in Kashmir (India)

Hymenopteran Parasitoid	Host Plants of C. horticola
Family 1. Braconidae	
Opius sp.	*B. campestris*
Dacnusa sp.	*B. campestris, P. sativum*
Family 2. Eulophidae	
Diglyphus horticola	*A. cepa B. campestris, B.O. acephala, B.O. gongylodes B. rapa, M. sylvestris, P. sativum*
Diglyphus sp.	*A. cepa, B. campestris, B.O. acephala, B.O. gongylodes, B. rapa, M. sylvestris, P. sativum*
Chrysocharis horticola	*A. cepa, B.O. acephala, B.O. gongylodes, P. sativum*
Pediobius indicus	*A. cepa, P. sativum, B.O. acephala*
Euderus agromyzae	*A. cepa, B. campestris, B.O. acephala, P. sativum*

Table 2: Weekly No. of miner fly, Chromatomyia horticola and its Hymenopteran parasitoids recorded on vegetable crops during 2005-2006 survey in Kashmir (India)

			No. of parastioids emerged by rearing of miner fly infested leaves															
	No. of miner fly (*C. horticola*) emerged		*Dacnusa* sp.		*Opius* sp.		*D. horticola*		*Diglyphus* sp.		*Chrysocharis horticola*		*P. indicus*		*E. agromyzae*		Total parastioids	
Month / week	2005	2006	2005	2006	2005	2006	2005	2006	2005	2006	2005	2006	2005	2006	2005	2006	2005	2006
May																		
I week	162	143	-	-	-	-	4	3	3	1	-	-	-	-	-	-	7	4
II week	135	125	5	2	1	-	12	17	10	6	2	-	-	2	1	-	31	27
III	191	170	6	2	5	4	21	36	15	19	6	8	3	4	-	2	56	75
IV	123	141	6	4	6	3	33	25	23	18	9	8	7	6	4	2	88	66
Mean	152.75	144.75	4.25	2	3	1.75	17.5	20.25	12.75	11	4.25	4	2.5	3	1.25	1	45.5	49.75
June																		
I	75	71	6	6	7	1	33	39	20	25	13	10	9	11	8	5	96	97
II	56	80	2	5	3	3	28	22	19	18	11	9	9	7	7	6	79	70
III	68	54	1	2	1	3	19	21	30	28	9	10	11	18	6	4	76	86
IV	40	44	-	3	1	1	23	17	13	12	10	7	8	6	3	5	58	52
Mean	59.75	62.25	2.25	4	3	2	25.75	24.75	23	20.75	10.75	9	9.25	10.5	6	5	77.25	76.25
July																		
I	36	39	-	2	-	-	13	18	17	15	12	9	4	7	5	6	51	55
II	25	34	-	-	-	-	15	18	12	11	9	11	3	4	5	3	44	47
III	28	32	-	-	-	-	11	9	9	10	8	6	2	-	1	2	30	27
IV	31	24	-	-	-	-	5	2	1	2	-	2	-	3	2	-	8	9
Mean	30	32.25	-	0.5	-	-	11	10	9.75	7.75	7.25	7	2.25	4.25	3.25	2.25	33.25	34.5
August																		
I	15	19	-	-	-	-	4	4	2	3	1	-	-	-	-	-	7	7
II	9	10	-	-	-	-	4	-	3	-	-	-	-	-	-	-	7	-
III	7	6	-	-		-	5	1	-	1	-	-	-	-	-	-	-	-
IV	3	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mean	8.5	10.5	-	-	-	-	3.25	1.25	1.25	1	0.25	-	-	-	-	-	3.5	1.75

Table 3: Percentage of emergence of parasitoids from Chromatomyia horticola during 2005-2006 survey in Kashmir

	Number of individuals		% age of parasitoids	
Parasitoid species	2005	2006	2005	2006
Opius sp.	24	15	3.72	2.47
Dacnusa sp.	26	24	4.03	3.95
Diglyphus horticola	230	225	35.66	37.06
Diglyphus sp.	177	162	27.44	26.69
Chrysocharis. horticola	90	80	13.95	13.18
Pediobius indicus	56	68	8.68	11.20
Euderus agromyzae	42	33	6.51	5.44
Total parasitoids	645	607		

months of June and July was less as compared to the total monthly mean number parasitoids recovered. However, the monthly mean of *Chromatomyia horticola* in the months of May was much higher than that of total parasitoids.

During the course of this investigation, a total of 7 hymenopteran parasitoid species were recorded on the leaf miner, *C. hortcola*. These included 5 eulophids, *Chrysocharis horticola* Mani, *Diglyphus horticola* Khan, *Diglyphus* sp., *Pediobius indicus* Khan, *Euderus agromyzae* and two braconids, *Opius* sp. and *Dacnusa* sp. The parasitism of *C. horticola* by the afore-mentioned parasitoids is being the first report from this region. Also, *Dacnusa* sp. is a new record of parasitoid of *C. horticola* for India. The summary of parasitoids of *Chromatomyia horticola* recovered on various vegetable crops is provided in Table 1. As seen in Table 2 and 3, a total of 645 parasitoids were recovered in 2005, out of which *D. horticola* and *Diglyphus* sp. together were 407 (230+177) forming 63.10 % (35.66 % + 27.44 %) of the total parasitoids. Likewise in 2006, a total of 607 parasitoids were recovered out of which, these two parasitoids together were 387 (225+162) forming 63.77% (37.06 %+ 26.68%) of the total parasitoid collection. So, *D. horticola* and *Diglyphus* sp. were recorded as the most common parasitoids of *C. horticola* in Kashmir (India) and hence considered to be the most important natural enemies of the *Chromatomyia horticola* during this region. Purwar *et al.* [9] have also reported *D. horticola* as the dominant parasitoids of *C. horticola* on *P. sativum* in Himachal Pradesh (India).

As depicted from the Table 2, *Opius* sp. and *Dacnusa* sp. were recorded to be the least common parasitoids of *C. horticola* in both the years of study in Kashmir (Table 2). Also the Table 1 and Figures 1 and 2 show that the mean number of adults of *Chromatomyia horticola* emerged during the months of June and July in both years, 2005 and 2006 was less as compared to the total monthly mean number parasitoids recovered. The parasitoids of *C. horticola* remained active in the field mostly from May to July but the highest activity of these parasitoids was witnessed during the month of June when most number of the parasitoids were recorded (329 out of 645 (51%) in June 2005 and 305 out of 607 (50%) in June (2006). This study is in agreement with Tsumou *et al.,* [11] who have also witnessed the months of June and July as the period of highest activity of the parasitoids of *Chromatomyia horticola* on pea in Japan.

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