



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* (Goureau) (Diptera: Agromyzidae) for the first time from Kashmir (India). The various parasitoids recorded are 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.

Keywords: 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 (Spencer, 1973). It is more common in the Mediterranean area and occurs widely throughout Asia (Gencer, 2005). The larvae of this species feed within the leaves of the host plant and this feeding can severely reduce yield and/or kill the plant 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 (Zaka-ur-rab, 1981 and Bhagat *et al.*, 1989). Many parasitoids are known to attack *C. horticola* in vegetable ecosystem in other parts of the world and some previous reports in this connection have been given by Mani (1971), Khan (1985), Chen *et al.* (2003) Gencer (2004 & 2005) and Purwar *et al.* (2003). However, no published record has been found on the parasitoid complex of *C. horticola* on vegetable ecosystem 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 viz., Baramullua, Badgam, Ganderbal, Srinagar and Pulwama, selecting two sites from each district. The sites visited for sample collection were: Sumbal & Sopore (Baramulla); Bugam & Narkarah (Budgam); Nunar & Kangan (Ganderbal); Idgah & Danderkah (Srinagar) and Hispora & Pampore (Pulwama). The miner fly infested leaves of vegetable plants; *Brassica campestris*, *B. oleracea acephala*, *B. o. gongylodes*, *B. rapa*, *Pisum sativum*, *Alium cepa* and *Malva sylvestris* were collected. The sampling was repeated weekly from May to August, which is the period when the infestation of *C. horticola* occurs on vegetable crops in Kashmir (Zaka-ur-rab, 1981 and Bhagat *et al.*, 1989). 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 maintained at about 25-30 °C with relative humidity of 60-70%. The emerged flies or parasitoids were collected from the containers and preserved in 70 % ethanol or as dry material. The identification of parasitoid specimens was carried by using work of Mani (1971), Hyat (1985), Khan (1985) and Wharton *et al.* (1997). Number of specimens for each species was counted and percentage of each parasitoid was estimated.

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 (*Allium 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 survey of these vegetable crop plants from May-August yielded 1004 adult specimens 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.* (2008) have also reported *C. horticola* as a serious pest in slightly cooler season (May) in Japan.

Also the figures 1 & 2 show that the mean number of adult *Chromatomyia horticola* emerged during the months of June and July were less as compared to the total monthly mean number of

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. horticola*. 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 the first report from Kashmir. *Dacnusa* Sp. is also a new record of parasitoid of *C. horticola* for India. The summary of parasitoids of *Chromatomyia horticola* recovered from various vegetable crops is provided in table 1. As seen in table 1 & 2, 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* in this region. Purwar *et al.* (2003) have also reported *D. horticola* as the dominant parasitoid 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. Also the table 1 and figures 1 & 2 show that the mean number of adult *Chromatomyia horticola* emerged during the months of June and July in both years, 2005 and 2006 were 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.* (2008) 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.

Table-1: Weekly No. of miner fly, *Chromatomyia horticola* and its Hymenopteran parasitoids recorded on vegetable crops during 2005-2006 survey in Kashmir (India)

Month/ week	No. of miner fly (<i>C. horticola</i>) emerged		No. of parasitoids emerged by rearing of miner fly infested leaves															
	2005	2006	Dacnusa Sp.		Opilus Sp.		D. horticola		Diglyphus Sp.		Chrysocharis horticola		P. indicus		E. agrorumyzae		Total Parasitoids	
			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	12	17	10	6	-	-	2	-	2	1	-	31	27	
III	191	170	6	2	21	36	15	19	6	8	3	4	-	-	2	56	75	
IV	123	141	6	4	33	25	23	18	9	8	7	6	4	2	2	88	66	
Mean	152.75	144.75	4.25	2	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	20	25	13	10	9	11	8	5	96	97	
II	56	80	2	5	3	28	19	18	11	9	9	7	7	7	6	79	70	
III	68	54	1	2	1	19	30	28	9	10	11	18	6	6	4	76	86	
IV	40	44	-	3	1	23	13	12	10	7	8	6	3	3	5	58	52	
Mean	59.75	62.25	2.25	4	3	25.75	24.75	23	10.75	9	9.25	10.5	6	6	5	77.25	76.25	

Table-1: Continued

Month/ week	No. of miner fly (<i>C. horticola</i>) emerged		No. of parasitoids emerged by rearing of miner fly infested leaves															
			Dacnusa Sp.		Opilus Sp.		D. horticola		Diglyphus Sp.		Chrysocharis horticola		P. indicus		E. agromyzae		Total Parasitoids	
	2005	2006	2005	2006	2005	2006	2005	2006	2005	2006	2005	2006	2005	2006	2005	2006	2005	2006
July																		
I	36	39	-	-	-	-	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	-	-	-	-	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-2: Percentage emergence of parasitoids from *Chromatomyia horticola* during 2005-2006 survey in Kashmir

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

Table-3: Host-Crop Complex of hymenopteran parasitoids of *Chromatomyia horticola* recorded during 2005-2006 survey in Kashmir (India)

Hymenopteran Parasitoid	Host Plants of <i>C. horticola</i>
Family 1. Braconidae	
<i>Opius</i> Sp.	<i>B. campestris</i>
<i>Dacnusa</i> Sp.	<i>B. campestris</i> , <i>P. sativum</i>
Family 2. Eulophidae	
<i>Diglyphus horticola</i>	<i>A. cepa</i> , <i>B. campestris</i> , <i>B. o. acephala</i> , <i>B. o. gongylodes</i> , <i>B. rapa</i> , <i>M. sylvestris</i> , <i>P. sativum</i>
<i>Diglyphus</i> Sp.	<i>A. cepa</i> , <i>B. campestris</i> , <i>B. o. acephala</i> , <i>B. o. gongylodes</i> , <i>B. rapa</i> , <i>M. sylvestris</i> , <i>P. sativum</i>
<i>Chrysocharis horticola</i>	<i>A. cepa</i> , <i>B. o. Acephala</i> , <i>B. o. gongylodes</i> , <i>P. sativum</i>
<i>Pediobius indicus</i> Khan	<i>A. cepa</i> , <i>P. sativum</i> , <i>B. o. acephala</i>
<i>Euderus agromyzae</i>	<i>A. cepa</i> , <i>B. campestris</i> , <i>B. o. acephala</i> , <i>P. sativum</i>

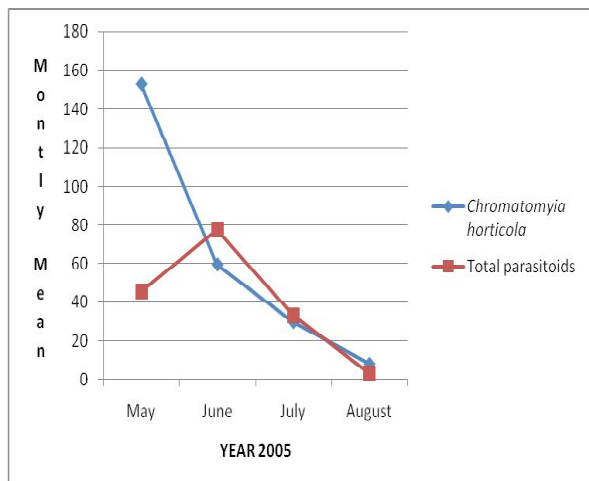


Fig. 1: Seasonal abundance of the leaf miner, *Chromatomyia horticola* and its parasitoids collected on various vegetable crops in Kashmir Valley from May to August 2005.

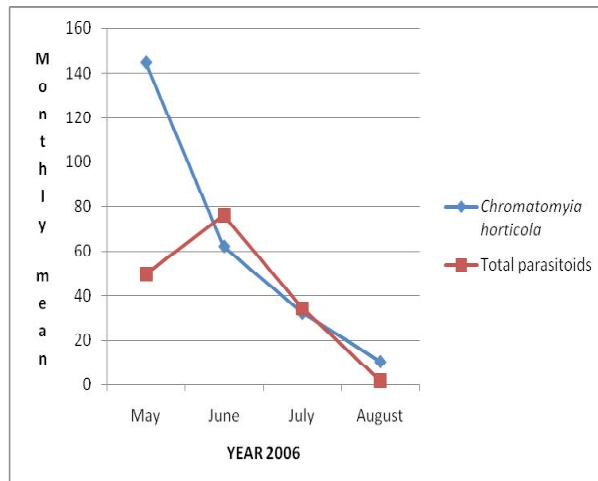


Fig. 2: Seasonal abundance of the leaf miner, *Chromatomyia horticola* and its parasitoids collected on various vegetable crops in Kashmir Valley from May to August 2006.

References

- Bhagat, K. C., Masoodi, M. A., Bhat, O. K. and Koul, V. K. 1989. Kale, *Brassica oleracea* var. *acephala* DC, a new host plant of *Chromatomyia horticola* Goureau from Kashmir. *Journal of Insect Science* 2 (2): 173-174.
- Chen, X., Lang, F., Xu, Z., He, J. and Ma, Y. 2003. The occurrences of leaf miners and their parasitoids on vegetables and weed in Hangzhou Area, Southeast China. *Biological Control* 48:515–527.
- Gencer, L. 2004: A Study on the Chalcidoid (Hymenoptera: Chalcidoidea) Parasitoids of Leaf miners (Diptera: Agromyzidae) in Ankara Province. *Turkish Journal of Zoology* 28:119-122.
- Gencer, L. 2005. Chalcidoid parasitoids of *Chromatomyia horticola* (Gour.) (Dip. Agromyzidae) in Sivas Province, Turkey, *Journal of pest Science* 78:41-43.
- Hyat, M. 1985. Family Eulophidae, In: Subba Rao, B.R. and Hyat, M. (eds.). *The Chalcidoidea (Insecta: Hymenoptera) of India and adjacent countries part-1 Review of families and keys to families and genera.* *Oriental Insects* 20: 1-430.
- Khan, M. A. 1985. New descriptions of eulophid parasites (Hymenoptera: Eulophidae) of agromyzidae in India. *Journal of Bombay Natural History Society* 82(1): 149-159.
- Mani, M.S. (1971): Some chalcidoid parasites (Hymenoptera) of leaf-mining Agromyzidae (Diptera) from India. *Journal of Natural History* 5:591-598.
- Purwar, J. P., Mall, P. and Mittal, V. 2003. Hymenopterous parasitoids associated with the pea leafminer, *Chromatomyia horticola* Goureau, on pea. *Pest Management and Economic Zoology* 11 (1):89-91.
- Spencer, K.A. 1973. *Agromyzidae (Diptera) of economic importance.* UK: The Pitman Press.
- Tsutomu, S., Makoto, D., Haruki, K., Shuji, K., Yohsuke, T. and Keitaro, S. 2008. Seasonal abundance of hymenopteran parasitoids of the leafminer *Chromatomyia horticola* (Diptera: Agromyzidae) and the impact of insecticide applications on parasitoids in garden pea field. *Applied Entomology and Zoology* 43 (4): 617-624.
- Wharton, R. A., Marsh, P. M. & Sharkey, M. J. 1997. *Manual of the new world genera of the family Braconidae (Hymenoptera).* Washington, D. C: Special Publication. of the International. Society of Hymenopterists 1: 1-439.
- Zaka-ur-Rab, M. 1981. Studies on Agromyzidae (Diptera) of Kashmir, India, some interesting palaeartic species. *Bulletino del Laboratorio di Entomologia agraria, (Filippo Silvestri)*, 38: 133-137.