

Natural Parasitism of Agromyzid Leaf Miner, *Chromatomyia horticola* (Goureau) (Diptera: Agromyzidae) on Field Pea

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Abstract: Observation have been made on the seasonal incidence and parasitization of agromyzid leafminer, *Chromatomyia horticola* (Goureau) in Pea crop fields at Pantnagar, Uttarakhand (India) during cropping season of the year 2009-10, 2010-11. The peak period of parasitization in both years was during 9th standard week constituted 71.69% and 68.87% of parasitization respectively. Occurrence of 3 hymenopteran parasitoids of Agromyzid leafminers were recorded viz., two eulophids (*Diglyphus horticola* Khan, *Diglyphus* sp.) and one braconid (*Opius* sp.). Weekly percent parasitization non-significantly influenced by the environmental factors.

Key words: Leafminers • Agromyzidae • Hymenoptera • Parasitoids • Eulophidae • *Diglyphus horticola* Khan • *Opius* sp

INTRODUCTION

Leafminers are insects whose larvae live and feed inside the leaves, consuming the mesophyll without damaging the leaf epidermis. Their feeding tracks (“mines”) are externally visible in leaves, as whitish or grey areas with variable shapes that range from narrow linear galleries to wide chambers. The leaf mining habit has been developed by a group of over 10,000 species of holometabolous insects, concentrated in four orders: Diptera, Coleoptera, Hymenoptera and Lepidoptera [1].

Agromyzid leafminer, *Chromatomyia horticola* (Goureau) is a highly polyphagous leafminer capable of inflicting severe damage to crops such as field and glasshouse grown vegetables and flowers. It was originated in South America and has spread to other continents where established populations are growing ever more. Due to its hiding nature and resistant development against insecticides makes control measures ineffective. At the same time, natural enemies playing major role in suppressing the leafmining insects in field level. Leafminers are in the phytophagous guild (group of organisms that consume the same resource in the similar manner), which has the greatest number of parasitoid species per host species and has the highest average rate of parasitoidism [2].

Over 40 species of parasitoids have been recovered worldwide from the leafminers [3]. Thus, the objective of this study was to determine seasonal incidence of Agromyzid leafminer, *Chromatomyia horticola* and its hymenopteran parasitoids on Field Pea at Pantnagar, Uttarakhand (India).

MATERIALS AND METHODS

Field surveys of leaf miners and their parasitoids on Field Pea have been made during Rabi season of 2009-10 and 2010-2011 at Crop Research Centre (CRC), G.B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand. Weekly, leafminer-infested leaves were randomly collected from the field were brought to the laboratory and placed in plastic bags/rearing jars covered with muslin cloth. Samples were maintained at room temperature (25-30°C) and numbers of emerged adult leafminers and parasitoids were recorded daily. All flies and wasps were kept separately in small vials containing 70% ethanol for identification. The weekly percent parasitism was calculated weekly basis according to Mills [4] and VanDrieche [5]. Weekly percent parasitization correlated with environmental factors viz. temperature (°C), relative humidity (RH) (%) and rainfall (mm) by using multi-variable regression analysis

$$\text{percent parasitism} = \frac{\text{no. of parasitoid adults emerged}}{\text{no. of host adult insects} + \text{no. of parasitoid adults}} \times 100$$

RESULTS AND DISCUSSION

Weekly Abundance and Parasitization: Weekly visits to pea growing field and rearing leafminer infested leaves over two cropping seasons provided plentiful opportunity to make a general observation and natural parasitization of pea leafminers.

In 2009-10, weekly field surveys of pea crop yielded 2997 adult of agromyzid leafminers and 2463 adult of parasitoids (Table 1) whereas, in 2010-11, 1485 adult of agromyzid leafminers and 1097 parasitoids were recorded (Table 2). In both the years, leafminer adults were recorded more than that of parasitoid adults.

During the two years of this investigation, the infestations of agromyzid leafminer were observed more during the 7th standard week (February, 12-18) when limited control was exerted by parasitoids (Fig 1 & 2). The number of leafminer adult emerged during 9th standard week (Feb 26 –Mar 04) was less as compared to the number of parasitoid adult emerged, where parasitoid showed considerable control over leafminers. As seen in Figure 3, natural weekly percent parasitization was observed peak during 9th standard week of February month accounting 71.69% and 68.87% during 2009-10 and 2010-11 respectively.

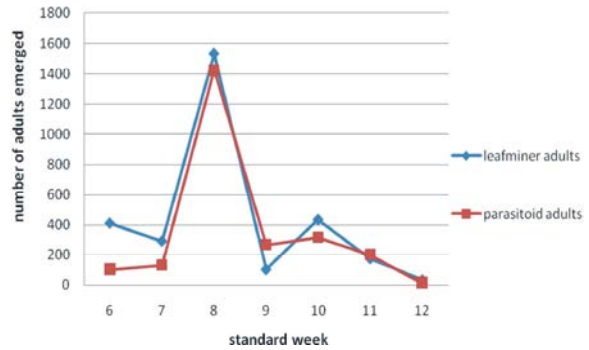


Fig. 1: Weekly abundance of the leaf miner and its parasitoids recorded on pea crop during 2009-10

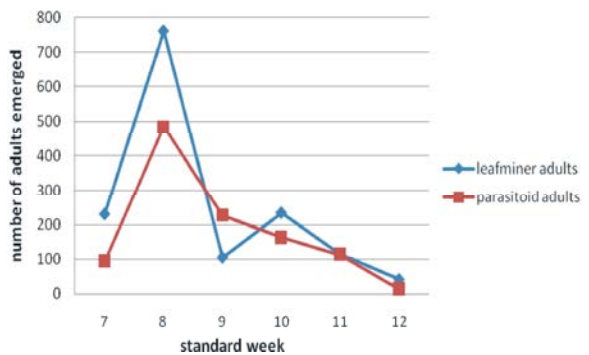


Fig. 2: Weekly abundance of the leaf miner and its parasitoids recorded on pea crop during 2010-11

During the course of investigation, three hymenopteran parasitoids viz., two eulophids (Eulophidae: Hymenoptera), *Diglyphus horticola* Khan,

Table 1: Seasonal incidence of agromyzid leafminers and its hymenopteran parasitoids recorded on pea crop during 2009-10

Serial Number	Meteorological standard Week	No. of leaves collected	No. of leaf miner adult emerged	No. of parasitoid adult emerged	% parasitization
1	06	640	413	103	19.96
2	07	440	293	133	31.22
3	08	2600	1536	1428	42.86
4	09	400	105	266	71.69
5	10	762	436	317	42.09
6	11	396	178	203	53.28
7	12	68	36	13	26.53
Total		5286	2997	2463	-

Table 2: Seasonal incidence of agromyzid leafminers and its hymenopteran parasitoids recorded on pea crop during 2010-11

Serial Number	Meteorological standard Week	No. of leaves collected	No. of leaf miner adult emerged	No. of parasitoid adult emerged	% parasitization
1	07	336	230	95	29.23
2	08	1200	760	484	38.90
3	09	336	105	227	68.37
4	10	474	234	163	41.05
5	11	245	115	114	49.78
6	12	54	41	14	25.45
Total		873	1485	1097	-

Table 3: Weekly percent parasitization and corresponding weekly mean temperature, RH and rainfall for the year 2009-10, 2010-11

Sl. No	standard week	% parasitization		Mean temperature (°C)		Mean RH (%)		Rainfall (mm)	
		2009-10	2010-11	2009-10	2010-11	2009-10	2010-11	2009-10	2010-11
1	06	19.96	-	16.1	16.85	74.5	69	32.2	10.8
2	07	31.22	29.23	15.95	17	72	73	0.0	19.4
3	08	42.86	38.90	17.25	15.7	67.5	69	0.0	000.0
4	09	71.69	68.37	20.45	16.45	70.5	69	0.0	4.8
5	10	42.09	41.05	20.6	18.3	64.5	63	0.2	2.4
6	11	53.28	49.78	21.8	21.2	61	61.5	0.0	000.0
7	12	26.53	25.45	24.95	22.9	60.5	55	0.0	000.0
Mean		41.09	42.13	19.58	18.34	65.01	69.5	4.628	5.342
Standard deviation (S.D)		17.53	15.51	3.32	2.69	5.44	12.13	12.15	7.329

Table 4: Regression analysis

Dependant variable	Independent variables	F-value (at 5% level of significance)		R ² value	
		2009-10	2010-11	2009-10	2010-11
Weekly percent parasitization	Temperature, RH and Rainfall	0.683ns	0.411ns	0.406	0.381
	Temperature	0.289ns	0.562ns	0.055	0.123
	RH	0.102ns	0.288ns	0.020	0.067
	Rainfall	1.971ns	0.195ns	0.283	0.047

ns- Non significant

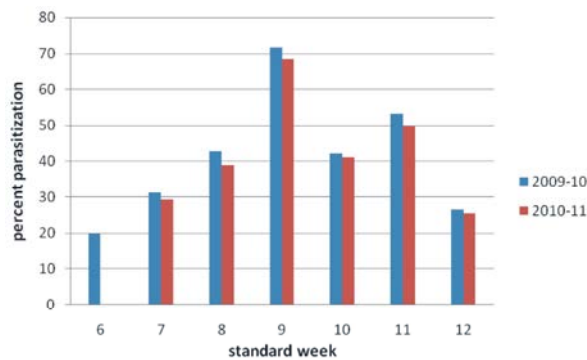


Fig. 3: Natural weekly percent parasitization of agromyzid leaf miner, *Chromatomyia horticola* during 2009-10, 2010-11

Diglyphus sp and one braconid (Braconidae: Hymenoptera), *Opius* sp. were recorded on leafminers.

Jensen *et al.* [6] recorded 50% parasitization by most abundant parasitoids, *Chrysocharis ainsliei* Crawford, *Halticoptera patellana* (Dalman) and *Diglyphus begini* (Ashmead) on leafminer parasitoids on Alfalfa in California.

Trumble and Nakakihara [7] recorded 90% parasitization by two most common parasitoids viz., *Diglyphus* sp and *Halticoptera circulus* on *Liriomyza* species infesting Celery in California.

Gratton and Welter [8] recorded 74% of parasitization by two eulophids, *Diglyphus spp* and *Neochrysocharis arizonensis* together on leaf miners, *Liriomyza helianthi* spencer and *Calycomyza platyptera* (Thomson).

Bhat and Bhagat (2009) [9] have also reported 63.10% and 63.77% of parasitization by two eulophids (*Diglyphus horticola* Khan and *Diglyphus* sp) together during 2005 and 2006 respectively on the *Chromatomyia horticola* on vegetable crops viz. mustard (*Brassica campestris*), kale (*B. oleracea* var. *acephala*), knoll-khol (*B. oleracea* var. *gongylodes*), turnip (*B. rapa*), pea (*Pisum sativum*), onion (*Alium cepa*) and malva (*Malva sylvestris*) in Kashmir (India).

Statistical Analysis: Statistical analysis was made to study the correlation between observed weekly percent parasitization and environmental factors viz., temperature, RH and rainfall. Table 3 shows the weekly percent parasitization and corresponding weekly mean temperature, RH and rainfall for the year 2009-10 and 2010-11.

The data were subjected to multi variable regression analysis by taking weekly percent parasitization as a dependent variable and environmental factors as independent variables.

- Regression equation for the year 2009-10:

$$Y_1 = 2.878X_1 + 2.425X_2 - 1.043X_3 - 173.418$$

- Regression equation for the year 2010-11:

$$Y_2 = 3.313X_1 + 3.524X_2 - 2.013X_3 - 239.880$$

where, Y_1, Y_2 = weekly percent parasitization, X_1 = mean temperature, X_2 = mean RH, X_3 = rainfall.

Perusal of these equations reveals that during 2009-10 for every increase of one unit of mean temperature and RH, weekly percent parasitization increased by 2.878 and 2.425 units respectively. Likewise, in 2010-11, every increase of one unit of mean temperature and RH, weekly percent parasitization increased by 3.313 and 3.524 units respectively. Whereas, in both the years (2009-10, 2010-11) every increase of one unit of rainfall, weekly percent parasitization decreased by 1.043 and 2.013 units respectively.

Table 4 shows that environmental factors non-significantly influenced the weekly percent parasitization in both the years. However, 40.6% (0.406) and 38.1% (0.381) of variation in the weekly percent parasitization caused by environmental factors during 2009-10 and 2010-11 respectively based on R^2 value. In case of individual factors, variation caused by temperature (5.5%, 12.3%), RH (2.0%, 6.7%) on weekly percent parasitization was less during 2009-10 as compared to 2010-11 whereas variation caused by rainfall (28.3%, 4.7%) was more during 2009-10 than 2010-11.

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