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Short Communication

Influence of abiotic variables on the seasonal occurrence of pea leaf miner, *Chromatomyia horticola* (Goureau) afflicting damage to pea

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Pisum sativum L. is a cool-season leguminous crop that is the second most important legume crop of the world (Pawar *et al*., 2017). Due to its low fat but increased vitamin C, iron, ß-carotene, riboflavin, protein, fiber and thiamine content, its cultivation is in high demand (Devi *et al*., 2022). Additionally, by improving soil fertility through atmospheric nitrogen fixation, they make a substantial contribution to sustainable agriculture (Jolly *et al*., 2022). Pest insects are one of the principal biological factors limiting crop productivity. The major insect-pests attacking pea are thrips (*Caliothrips indicus* B.), pod borer complex comprising of pea pod borer (*Etiella zinckenella* Tr.), gram pod borer (*Helicoverpa armigera* Hub.) and blue butterfly (*Lampides boeticus* L.), leaf miner (*Chromatomyia horticola* G.) and stemfly (*Ophiomyia phaseoli* T.) (Mittal and Ujagir, 2005). Amongst these, *Chromatomyia horticola* (Goureau) is a major pest that regularly infests garden pea crop. The larval stage initiates damage by devouring leaf tissue. On the surface of the leaves, the feeding trails, also known as mines, are apparent as white or grey areas with an array of shapes, ranging from short linear tunnels to large chambers (Mahendran and Agnihotri, 2013). In cases of severe attacks, each leaf has mines embedded in it, and 86-93 per cent of the leaves are devastated (Atwal *et al*., 1969; Singh and Saravanan, 2008). The latter implications of feeding include reduction in transpiration and photosynthesis, which in turn reduces the amount of harvestable output (Choudhary, 2016). Use of synthetic insecticides is the most popular approach employed for eradicating the pest. Since the larva of leafminer cause damage while remaining unscathed within the epidermal layers, dependency on chemicals solely for controlling the pest is not sufficient. An effective approach of pest control that incorporates knowledge about peak period of pest occurrence along with chemical application can aid in control of the pest. According to Kaur *et al*., (2021) and Saha *et al.,* (2018) pest occurrence, growth and activity are primarily caused by ambient weather, either directly or indirectly, along with the crop. A significant relationship has been found between these parameters and the pest's seasonal incidence. Mondol and Kumar (2012) claim that while the population of pea leafminer reduced with rising relative humidity, it increased with rising maximum and lowest temperatures.

The seasonal fluctuations of the insect provide crucial information for the timely scheduling of control operations (Pazhanisamy and Hariprasad, 2014). Therefore, it's critical to comprehend how various weather factors, such as temperature and relative humidity, alter the dynamics of pest occurrence. By gathering this information, it is feasible to devise an efficient pest control strategy before the infestation exceeds the threshold level.

The present studies on "Influence of abiotic variables on the seasonal occurrence of pea leaf miner, *Chromatomyia horticola* (Goureau) afflicting damage to pea" were conducted in the Experimental farm of Department of Entomology, in rabi season of the year 2020-21 and 2021-22. Seeds of three pea varieties viz, Azad P-1, Him Palam Matar-1 and Pusa Pragati and 14 genotypes were sown in the field at a spacing of 60 x 7.5 cm in RBD with three replications each. All the seeds were procured from Department of Vegetable Science, Dr. YS Parmar University of Horticulture and Forestry, Nauni except Him Palam Matar-1 which was procured from CSK HPKV, Palampur. Insecticide application was avoided in the field trial. Weekly observations were recorded on 05 randomly selected plants. The average abundance of the pest was worked out by randomly selecting 05 leaflets from upper, middle and lower portion of the plants and counting the number of larvae and pupae. Based on the observations recorded mean larval and pupal

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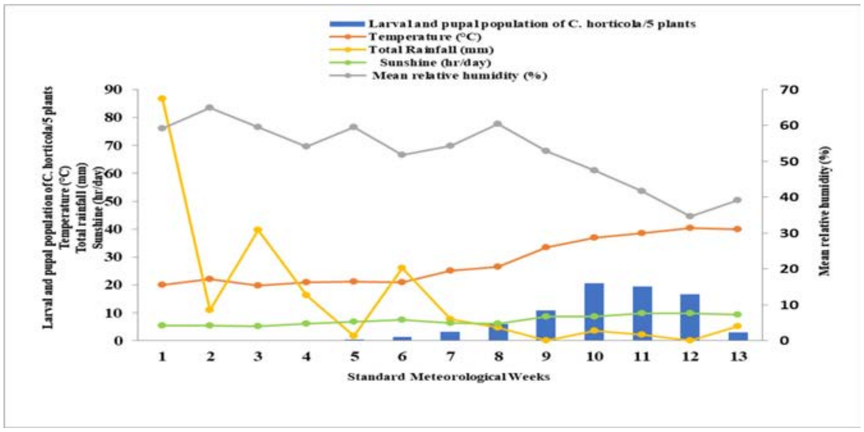

Fig. 1: Pooled population dynamics of *Chromatomyia horticola* (Goureau) in relation to different weather parameters in garden pea (pooled data)

population of *C. horticola* per 5 plants was worked out. The data on maximum and minimum temperature (°C), total rainfall (mm), mean relative humidity (%) and sunshine (hr/day) was collected from the University Meteorological Laboratory. The data so obtained was then correlated with the population of pea leafminer. The data was analyzed using IBM SPSS 22 X-86 software package.

Larva and pupal population

Incidence of leaf miner was regularly observed during 2020-21 and 2021-22 in 17 pea genotypes. On clubbing the data of two years, during the initial weeks the population of leafminer was found to be very low, but gradually increased and rose to 0.50 larval and pupal population of *C. horticola*/5 plants during the 5th SMW i.e., first week of February. A gradual increasing trend up to 10th SMW was observed thereafter. The population dynamics of leafminer was significantly affected by various weather parameters which resulted in population decline up to 13 SMW (Fig. 1). Analysis of data revealed that the maximum population was observed in March compared to other months. Highest population of 20.50 larval and pupal population of *C. horticola*/5 plants was observed in the 10th SMW when the mean temperature, relative humidity, total rainfall and sunshine recorded were 36.91°C, 47.47 %, 3.50 mm and 8.55 hr/day, respectively (Fig. 1). The population declined further and reached lowest i.e., 2.87 larval and pupal population of *C. horticola*/5 plants during 13th SMW when the mean temperature, relative humidity, total rainfall and sunshine recorded were 39.98°C, 39.25 %, 5.25 mm and 9.30 hr/day, respectively (Fig. 1). The weather parameters played a significant role in altering population dynamics of the pest. With the decrease in relative humidity the population of leafminer was also observed to rise. According to the data, the leafminer population continued till start of April as observed by Khan *et al*., 2015. With the increase in weekly temperature, the activity of leafminer was also observed to increase which was evident with the gradual increase in occurrence of the pest from 1.39 larva and pupa/5 plants during 6th SMW to 20.50 larva and pupa/5 plants during 10th SMW. After this a decline in population was observed due to the maturity of crop that resulted in reduction in succulent leaves as reported by Manisha *et al.*, (2018).

Relationship of abiotic factors with population dynamics of C. horticola

Study of correlation factors revealed the existence of a significant positive relation between leafminer population and temperature in 2020-21 (r = 0.855**) and 2021-22 (r = 0.642**). In 2020-21, mean relative humidity was negatively significantly (r = -0.736**) correlated with leafminer population, however, during 2nd year of experimentation non-significant negative correlation (r = -0.331) with relative humidity was observed (Table 1). Amongst all the parameters only rainfall had a negative non-significant correlation with the leafminer population in both the years of experimentation (Table 1). Pooled correlation studies revealed that population of leafminer was significantly positively correlated with temperature (r = 0.815**) whereas, negative significant correlation was observed with relative humidity (r = -0.663**) (Table 1). This is in agreement with Mondol and Kumar (2012) and Manisha *et al*., (2018) who observed a similar correlation of leafminer population with relative humidity. A positive significant correlation of 0.773** was observed with respect to sunshine hours, however total rainfall was negatively correlated with the leafminer population (Table 1). The positive significant correlation of leafminer population with temperature as observed in the current study was found to be in unison with the findings of Singh and Saravanan, (2008), Jamal *et al.*, (2010) and Rizvi *et al.*, (2015). Similarly, Keval *et al.*, (2019) found a significant positive correlation of leafminer population with maximum (r=0.759**) and minimum temperature (r=0.672**), but a negative and non-significant relationship with morning relative humidity (r=-0.496) and evening relative humidity (r=-0.515) during 2016-17.

Hence, it can be concluded that the pooled peak incidence of leafminer during two years of experimentation i.e., 2020-21 and 2021-22 was observed during 10th SMW, i.e., 2nd week of March, when reduction in succulent parts of the plant was observed. The population dynamics of *Chromatomyia horticola* throughout the two years was positively correlated with increase in temperature and negatively correlated with relative humidity. Rainfall did not have a significant impact on pest occurrence. In order to escape the peak period of pest activity, cultivation of early season varieties can be considered as a good substitute to chemical control of the pest.

Table 1: Correlation of leaf miner *Chromatomyia horticola* with respect to weather parameters recorded during 2020-21 and 2021-22

Weather parameters	Correlation values (r)		
	2020-21	2021-22	Pooled
Temperature	0.855**	0.642**	0.815**
Mean relative humidity	-0.736**	-0.331	-0.663**
Total rainfall	-0.294	-0.338	-0.464
Sunshine	.0.849**	0.412	0.773**

*Significant at 5 per cent level of significance **Significant at 1 per cent level of significance

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