

Short communication

Studies on seasonal population dynamics of the citrus leaf miner, *Phyllocnistis citrella* stainton (Lepidoptera: Gracillariidae) on kinnow in submontaneous region of Punjab

RAKESH KUMAR SHARMA and YOGESH KHOKHAR

*Dr D R Bhumbla Regional Research Station for Kandi Area (PAU, Ludhiana),
BallowalSaunkhri, Dist-S.B.S.Nagar - 144521 Punjab India*

Corresponding author : E-mail: rksharma@pau.edu

Citrus fruit production has emerged as the third largest food Industry in the country, which is playing an important role in gaining the economy of country. In Punjab during 2018 total area under Citrus fruit crops is 55.62 thousand hectares with total production of 1240808 MT and average yield of 39490kg. (Anon, 2018). Weather parameters not only affect the growth and development of Kinnow (Gaur *et al.* 2012), but also provide favourable condition for incidence of pest and diseases. The citrus leaf miner, *Phyllocnistis citrella* Stainton (Lepidoptera: Gracillariidae), is a potentially serious pest of citrus and it occurs all over the country causing low to medium level of infestation.

The leaf miner creates its incidence on the young developing leaves. A newly hatched larva immediately start feeding on epidermal tissues of the tender leaves by creating serpentine mines by shearing the plant tissue. These mines are shining silvery due to the entrapped air. The mature larvae settle down in enlargements of galleries near the leaf margin. By the time, they spin cocoons for pupation, the leaves get twisted or folded over. It pupates in the leaf margin, resulting in leaf deformation, partial leaf chlorosis, necrosis, and some leaf dropping, respectively. This adversely affects the photosynthetic activities of the plant that result in poor plant health, low fruit quality and reduction in yield. Many studies have been conducted to evaluate incidence of citrus leaf miner on citrus (Lad *et al.*, 2010; Chhetry *et al.*, 2012)

Information regarding the seasonal incidence and population dynamics is an important tool for developing pest management strategies against this pest. Periods of no incidence, initiation of incidence, low incidence, peak incidence etc. carry important meaning for deciding the time for adoption of management tactics. Many studies have been conducted to study the incidence of leaf miner in relation with different weather parameters (Ali and Ali, 2018; Patel *et al.* 2000). Therefore, an observation on the seasonal incidence of citrus leaf miner around the year was recorded to assess the critical time of the pest incidence to adopt management practices. With this view, correlations between pest incidence and the weather parameters i.e. temperature, humidity, rainfall and rainy days, have been worked out. This information would

also be useful to inform the citrus growers for the expected incidence based on the ecological conditions and to adopt the management practices in time.

The seasonal incidence of *P. citrella*, were studied at Regional research station, Ballowal saun Khari, Punjab during January 2016 to August 2018. The weekly data were pooled month-wise on the randomly selected ten kinnow trees where single plant represented as a replication. From each tree, four shoots from four sides of the tree were taken. Larval counts were made from 10 cm apical portion of 4 terminal shoots/plant. Meteorological data on the relative humidity, rainfall, minimum and maximum temperature were obtained from the Meteorology observatory at Dr D R Bhumbla Regional Research Station Ballowal Saunkhri, during the period of study. The monthly larval counts were then correlated with weather parameters.

Incidence of citrus leaf miner on kinnow

The larval population started building up on citrus shoots from February onwards to November during both the years (Table 1). The population of leaf miner started increasing thereafter and a significant increase was recorded in the month of April with mean larval population of 10.6 per 10 cm terminal shoot with mean maximum and minimum temperature (°C), rainfall (mm) and relative humidity of 36.5°C, 20.2°C, 5.8 mm and 45.7 per cent respectively. The first peak population (mean larval population of 15.4 per 10 cm terminal shoot) of citrus leaf miner was recorded in the month of May with mean maximum and minimum temperature of 38.5 and 23.5 (°C) respectively. The highest build-up of *P. Citrella* population might be with high temperature due to low humidity coupled which is conducive for the same. However, population of citrus leaf miner tended to dwindle from June to August and it was low during July. Thereafter, the larval population started increasing and reached at its second peak of the year in the month of September (mean larval population of 15.4 per 10cm terminal shoot) at mean maximum and minimum temperature, rainfall and temperature and relative humidity of 33.6°C, 23.3°C, 100.95 mm and 81 per cent respectively (Table 1). It is clear that the trend of leaf miner infestation remained same during next two years (2017 and 2018). The environmental

Table 1: Overall incidence of citrus leaf miner on kinnow and weather parameters during 2016-18

Year	2016					2017					2018				
	Months	Larval population	T _{max} (°C)	T _{min} (°C)	Rainfall (mm)	Average RH (%)	Larval population	T _{max} (°C)	T _{min} (°C)	Rainfall (mm)	Average RH (%)	Larval population	T _{max} (°C)	T _{min} (°C)	Rainfall (mm)
	January	0	19.3	6.9	16.8	78.8	0.0	19.0	7.0	128.0	75.2	0.0	18.6	5.1	10.7
	February	1.4	24.7	9.4	12.8	66.3	0.9	23.2	9.4	3.6	67.8	1.8	23.6	9.0	37.4
	March	3.8	29.0	14.7	43.6	59.8	4.6	27.6	12.7	34.5	62.0	4.8	29.4	14.1	18.7
	April	10.6	36.5	20.2	5.8	45.7	12.3	36.1	18.9	27.7	46.4	11.2	34.7	19.1	14.3
	May	15.4	38.5	23.5	40.9	45.6	16.2	38.4	23.8	46.2	46.4	16.8	38.6	23.2	32.9
	June	5.9	37.3	25.5	112.9	64.2	4.6	35.4	24.0	148.3	66.3	4.8	36.3	24.8	250.6
	July	3.4	33.6	25.6	137.6	81.3	4.9	34.2	25.0	242.3	78.9	5.2	33.0	25.2	337.7
	August	6.7	32.9	24.7	313.8	83.8	8.2	33.0	25.1	299.0	84.5	15.2	32.7	24.9	231.4
	September	13.6	33.6	23.3	109.5	81.0	14.7	33.3	22.0	197.4	80.0				
	October	8.8	32.4	18.1	1.6	65.2	7.4	32.6	17.2	0.0	71.1				
	November	3.2	28.0	11.3	0.0	59.1	3.3	25.3	10.7	0.0	70.8				
	December	1.2	23.3	7.6	6.6	69.5	0	21.6	7.4	34.4	73.9				

Table 2: Relationship between the *P. citrella* population and weather factors on kinnow

Step-wise regression equations	R ²
$Y = -14.45 + 0.68 T_{max}$	0.624**
$Y = -18.89 + 0.99X_1 - 0.28X_2 T_{min}$	0.684
$Y = -26.12 + 1.49X_1 T_{max} - 0.83X_2 T_{min} + 0.017 \text{ Rainfall}$	0.692
$Y = -44.97 + 2.15X_1 T_{max} - 1.38X_2 T_{min} + 0.0121X_3 \text{ Rain} + 0.11X_4 \text{ RH}$	0.701
ant at P=0.01, NS= not significant.	
**Signific	

temperature and relative humidity of spring and autumn influenced the incidence of citrus leaf miner resulting in higher pest population and plant damage but the low environmental temperature in the winter months and excessive rainfall in the monsoon season adversely affected the pest in Bangladesh (Rahman *et al.*, 2005), however, the moderate environmental conditions of spring and autumn were, therefore, the most favourable periods for *P. citrella* which was similar to the present findings.

Under Punjab conditions, Sharma *et al.*, (2006) showed that citrus leaf miner had two peaks of infestation i.e. first during April-May and again during August-September which corroborate the findings of present studies. High population densities of *P. citrella* are usually recorded in spring and summer due to greater availability of new shoots.

Effect of weather parameters on the seasonal abundance of citrus leaf miner

The mean maximum temperature showed (0.624**) highly significant but positive relationships with leaf miner population. However, other climatic factors positively but non-significantly related with the leaf miner population build up in different months (Table 2). The observations are line with the findings of Patel and Patel (2001) who observed that the incidence of leaf miner had positive correlation with minimum temperature and rainfall in Gujarat and Doaa *et al.*, (2016) also reported that the population dynamics of *P. citrella* had positive correlation and regression with maximum and minimum temperature.

Based on the obtained results, it can be concluded that the population dynamics of *P. citrella* throughout the two years in the sumontaneous region of Punjab was higher in summer than in autumn seasons. It started in February and reached population peak on May and September and then started to decline. Climatic conditions were found to be the important factors in determining the intensity of *P. citrella* incidence.

ACKNOWLEDGEMENT

The authors are grateful to Dr. D. R. Sharma, Retd Professor Entomology, Punjab Agricultural University, Ludhiana for guiding in the above experiment from time to time. The authors are grateful to Director, RRS Ballawal Saunkhri for providing necessary facilities.

REFERENCES

- Anonymous. (2018). Package of practices for cultivation of fruit crops. Punjab Agricultural University, Ludhiana
- Chhetry, M., Gupta, R., Tara, J.S. and Pathania, P.C. (2012). Seasonal abundance of citrus leaf miner *Phyllocnistis citrella* Stainton (Lepidoptera: gracillariidae) from Jammu and Kashmir. *J. Insect Sci.*, 25: 144-149
- Doaa, S., Farghaly, Asmaa. Z., El-Sharkawy, Afaf. A.A., Gamal, A.M and Halima, M.I. (2016). Studies on biotic, abiotic factors and seasonal population dynamics on the citrus leafminer, *Phyllocnistis citrella* Stainton (Lepidoptera: Gracillariidae) in Middle Egypt. *Middle East J. Appl. Sci.*, 18: 59-69
- Gaur, R.B., Sharma, R.N. and Kaur, M.K. (2012). Impact of meteorological variables on postbloom fruit dropping in kinnow mandarin. *J. Agrometeorol.*, 14(1): 91-94.
- Lad, D.L., Patil, S.G. and More, S.A. (2010). Seasonal incidence of *Phyllocnistis citrell* stainton on Nagpur mandarin. *Int. J. Plant Prot.*, 3: 77-79
- Patel, G. P. and Patel, J. R. (2001). Population dynamics of *Phyllocnistis citrella* on citrus in middle Gujarat. *Ind. J. Ent.*, 63: 41-48.
- Patel, G.P., Shekh, A.M. and Patel, J.R. (2000). Effect of temperature on preimaginal development of *Phyllocnistis Citre* Stainton on Kagzilime. *J. Agrometeorol.*, 2(2): 147-152.
- Rahman, H., Islam, K. S. and Jahan, M. (2005). Seasonal incidence and extent of damage caused by citrus leaf miner, *Phyllocnistis citrella* Stainton infesting lemon. *Pak. J. Sci. Indus Res.*, 48: 422-25.
- Sharma, D. R., Singh, Sandeep. and Arora, P. K. (2006). Population dynamics and management of citrus leaf miner, *Phyllocnistis citrella* Stainton on Kinnow mandarin.. *Nat Sem Integ Prod Post Harvest Mgmt Trop Fruit* held at Bidhan Chandra Krishi Viswavidyalaya, Mohanpur Nadia, West Bengal. 44pp