

Studies of Leaf Miner (*Phyllocnistis citrella* Stainton) in Relation to Temperature and Relative Humidity in Kanpur, India



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Abstract

Citrus leaf miner (*Phyllocnistis citrella* Stainton), a native of subtropical and tropical Asia is a serious pest of citrus. It belongs family Gracillariidae and order Lepidoptera. Its adults are minute moths with a 4mm wing spread. They have silvery iridescent scales on the forewings, with several black spot on each wing. The hind wing and body are white with long scales extending from hind wing. Larvae of leaf miner makes serpentine mines on the ventral side of the leaf. Larvae pupate on the margin of the leaf. Adults generally are too minute to be easily noticed and are active diurnally and in the evening. Population of the leaf miner is correlated with the temperature and relative humidity. The average incidence was found positively. Correlated with maximum temperature, minimum temperature and relative humidity.

Keywords: Correlation, Leaf Miner, Population, Abiotic Factors.

Introduction

Abiotic factors like Temperature, Relative humidity, Rainfall, etc. affects the distribution, colonisation, survival, abundance, behaviour, fitness and life history of insects. It is well known that excess of weather fundamentals limit the geographic range of insect population, either imparting mortality or depriving them from food. Temperature can be sole factor for initiating dormancy in insects. (Danks, 2002).

Citrus leaf miner rely on flushing shoots for reproduction and development. So many studies have been revealed connection of different weather factors with incidence and intensity of leaf miner (*Phyllocnistis citrella* Stainton), [Lepidoptera : Gracillariidae). This association has been mostly followed on citrus species.

Aim of the Study

Citrus are an important fruit crops and rich source of vitamin C. The aim of this investigation was to study the population dynamics, distribution, biotic and abiotic factors affect the population activity. So we can make a systematic plan for the management.

Review of Literature

Tomberlin and benbow (2015) studied International dimensions and frontiers of abiotic factors on leaf miner. Kirchenka and Kenis (2016) using botinacals garden to asses factors influencing the colonization of exotic woody plants by phyllophagous insects. Ellis (2018) and CABI (2018) reported that leaf miner, galler and fungi are serious plant papasites .pitin *et.al* (2018) reported leaf miner and stem mines in citrus plants at England. Arshad *et.al* conducted research trial on leaf miner and its parasitoids in Sargadha of Pakistan. They identified parasitoids of *P.Citrella* an important pest of citrus

Materials and Methods

Incidence and intensity of the leaf miner were recorded on citrus leaf at weekly interval. Five branches were tagged in four directions i.e. east, west, north and south. Population of leaf miner were observed at per lines of Atwal and Singh (1990). In order to study the effect of Maximum Temperature (x_1), Minimum Temperature (x_2) and Relative Humidity (x_3) on the percentage damage of leaves (y_1), and population of insect (y_2) multiple regression analysis was worked out in which the partial regression coefficients (i) of y on x_1 (b_1), (ii) of y on x_2 (b_2) and (iii) of y on x_3 (b_3) along with the multiple correlation coefficients were estimated by the standard

methodology given by Statisticians. The multiple regression equation fitted to the data was:

$$y = a + b_1x_1 + b_2x_2 + b_3 x_3$$

multiple correlation coefficient (R) :

$$R = \sqrt{\frac{SS \text{ (Regression)}}{\text{Total SS}}}$$

Results and Discussion

Citrus leaf miner is a tiny moth that lays eggs in the lower surface of leaf from which larvae hatches and make burrows into the leaf. This larvae attacking the young growth flush and causing leaves to twist and curl. This damage is easily identified by the miner that the larvae produce in the leaves. Older trees can

be usually sustain damage, but young trees can be severely affected. Similar results have been found by Wilson (1991) and Malika (2010).

Adults of the leaf miner was 2.5 mm long, Silvery, white in colour. Females can be lay upto 50 eggs. After 6-10 days larvae hatch and have only four larval instar. As they being feeding, the larvae excrete their faces into the mine forming visible trail. After completion of the feeding in one leaf, they enter near the edge of the leaf causing the leaf margin to fold over. Hall (2007) and Shama (2008) also studied population dynamics of leaf miner and observed the intensity and infestation. Pupation was found in a fold on the edge of the leaf. The pupal stage lasts 6-8 days.

Leaf Miner Larvae

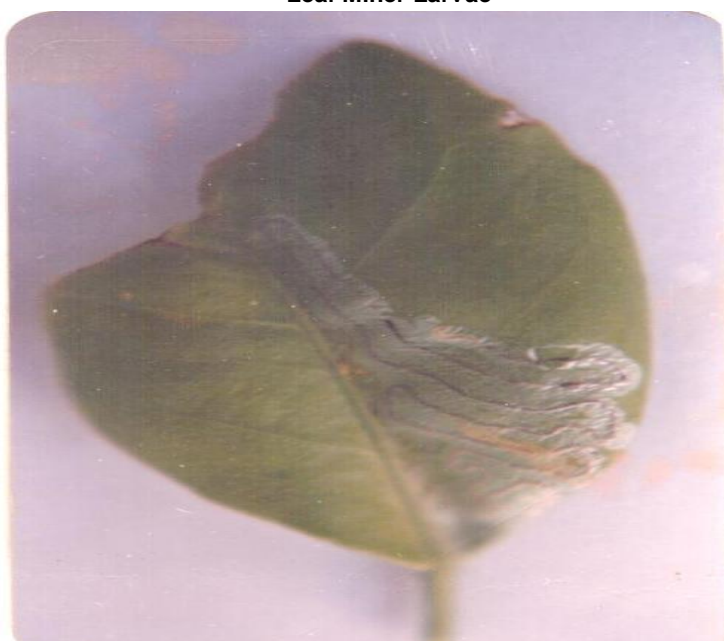


Table 1: Correlation of Incidence of Citrus leaf miner with temperature and Relative Humidity

2015

Explanatory variables	Correlation coefficient with Y	Partial Regression Coefficient (byx)	S.E. of byx	t-value
X ₁ : Max. Temp.	0.170	0.205	0.490	0.419
X ₂ : Min. Temp.	0.302	0.090	0.358	0.250
X ₃ : R.H.	0.317	0.213	0.166	1.287
	D.F. = 34			D.F.= 32

N = 34, Residual variance = 57.380
 R = 0.377 R² = 0.142 F_(3, 32) = 1.77

Multiple Regression Equation

$$Y = 18.816 + 0.205X_1 + 0.0896X_2 + 0.213X_3$$

Table 2: Correlation of Incidence of Citrus leaf miner with temperature and Relative Humidity

2016

Explanatory variables	Correlation coefficient with Y	Partial Regression Coefficient (byx)	S.E. of byx	t-value
X ₁ : Max. Temp.	-0.086	-0.177	0.287	-0.616
X ₂ : Min. Temp.	0.076	-0.012	0.282	-0.942
X ₃ : R.H.	0.226	0.194	0.163	1.175
	D.F. = 34			D.F.= 32

N = 36, Residual variance = 87.670
 R = 0.258 R² = 0.066 F_(3, 32) = 0.75

Multiple Regression Equation

$$Y = 33.589 - 0.177X_1 - 0.012X_2 + 0.194X_3$$

Conclusion

In the correlation of incidence of citrus leaf miner with Temperature and Relative Humidity data were presented in Table 1 and 2 and indicated that incidence of Citrus leaf miner by multiple regression analysis. The average incidence was found positively correlated with Maximum Temperature, Minimum Temperature and Relative Humidity but it was found non significant at 5 per cent level of significance during both years of these investigations. Mustafa *et al.* also found similar results in Pakistan district. In the partial regression coefficient incidence were found to be non-significant and positively correlated during 2015 but it was negatively correlated with Maximum and Minimum Temperature during 2016 (Wilson 1991). The multiple correlation coefficient was found $R = 0.377$ and 0.258 during 2015 and 2016, respectively. It was non-significant at 5 per cent level of significance. This indicates that the dependent variables average incidence was not jointly correlated with Maximum Temperature, Minimum Temperature and Relative Humidity. Ahmad *et al.* (2013) carried out experiment on relationship of citrus leaf miner population correlated with biotic factors and found similar results. Diez *et al.* (2006) and Heppner (2019) conducted research trial on citrus plants and studied population of leaf miner (*P. citrella* Stan.) in Florida and found positive and significant results.

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