The Pharma Innovation

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Seasonal incidence of citrus leaf miner (*Phyllocnistis citrella* Stainton) on acid lime (*Citrus aurantifolia* Swingle) and it's correlation with different abiotic factors

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Abstract
The field experiment was conducted at Pt. Kishori Lal Shukla College of Horticulture and Research Station, Instructional farm, Bharregaon, Rajnandgaon, Indira Gandhi Krishi Vishwavidyalaya, Raipur (Chhattisgarh) during *Mrig Bahar* (June – December) 2021. The studies revealed that the first incidence of citrus leaf miner was observed in the first week of July (27th SMW) and attended peak (41.23% damaged leaves) during the last week of August 2021 (35th SMW). The correlation studies revealed that minimum temperature (r = 0.552), morning relative humidity (r = 0.610), evening relative humidity (r = 0.592), average relative humidity (r = 0.618), average temperature (r = 0.450), rainfall (r = 0.487) had significant positive correlation, while the remaining weather parameters were not found to be significantly correlated with citrus leaf miner infestation.

Introduction

Acid lime (*Citrus aurantifolia* Swingle) belongs to family Rutaceae and originated in India. It is commercially grown in tropical and subtropical regions of India (Chadha, 2010) [5]. It is a good source of Vitamin- C (62.90 mg/100 ml), Vitamin- B1, Vitamin -B2 and minerals like Calcium (90 mg /100 ml), Phosphorus (20 mg/100 ml) and Iron (0.3 mg/100 ml) (Abhilash *et al.,* 2018) [2].

The cultivated area and production of acid lime in India is 3397 thousand MT from 296 thousand hectares (Anonymous, 2019-20) [3] and acid lime is second largest important citrus crop according to area and production. In India, acid lime fruits crops are mainly grown in Andhra Pradesh, Maharashtra, Punjab, Madhya Pradesh and Gujarat (Anonymous, 2018) [1]. The area of acid lime and lemon in Chhattisgarh is 12.100 thousand hectares and production are 102.217 thousand MT. Similarly, area of sweet orange /Kinnow Mandarin is 0.023 thousand hectares and production 0.806 thousand MT (Anonymous, 2021) [4].

Around 42 insect species are found in the North-Eastern region, assuming major and minor pest status in the mandarin for aggravation as citrus decline (Hore *et al.,* 2004) [6]. Citrus leaf miners (*Phyllocnistis citrella* Stainton) and lemon butterflies (*Papilo demoleus* Linnaeus) were among the most common. The citrus trunk borer (*Anoplophora versteegi* Ritzema) can destroy an entire tree. Sucking pests such as aphids (*Toxoptera citricida* Kirkaldy) are important vectors; blackfly (*Aleurocanthus woglumi* Ashby), mealy bug (*Planococcus citri* Risso) and psylla (*Diaphorina citri* Kuwayama) were causing severe citrus decline (Sreedevi, 2010) [13]. In Maharashtra, 14 species have been reported, with 8 of these species having the most significant importance (Lad *et al.*, 2010) [8]. Citrus leaf miner larvae reduce the growth of citrus nurseries and young plants (Raga *et al.*, 2001) [10]. Almost all citrus orchards were found to be damaged by the insect attack to some degree or another. Citrus leaf miner indirect damage can be significant at times. The larvae's mining of immature foliage can decrease growth rates and yield, and mined surfaces can act as sites for the spread of diseases like citrus canker, *Xanthomonas citri*. Citrus leaf miner is a significant pest of rapidly growing young or pruned trees in the absence of citrus canker. Citrus canker, on the other hand, is a major pest of both immature and older trees when it is present (Lukasz, 2011) [9].

Materials and Methods

The seasonal incidence was recorded from 3 randomly selected plants from each replication. The infested leaves due to citrus leaf miner along with total leaves were counted at weekly intervals from 5 terminal shoots, each of 15 cm length from each plant. Mean percent of citrus leaf miner infestation was computed by the following formula-

$$\text{Percent of citrus leaf miner infestation} = \frac{\text{Leaf miner infested leaves per 15 cm tender shoots}}{\text{Total no.of leaves per 15 cm tender shoots}} \times 100$$

The weekly meteorological data on temperature, relative humidity, rainfall, sunshine hours and wind velocity were also recorded on *Mrig Bahar* (June – December) season from the meteorological observatory located at KVK, Surgi, Rajnandgaon (C.G.). The data obtained was correlated with various abiotic factors and correlation coefficient was worked out as suggested by Snedecor and Cochran, 1967. The graphical representation was applied to depict the seasonal incidence of the citrus leaf miner.

Results and Discussion

The seasonal activity of citrus leaf miner was initially detected (10.2% damaged leaves) in the first week of July (27th SMW) and the pest remained active until the last week of December (52nd SMW). When a new flush of the plant emerges, the insect population increases gradually. The average seasonal activity of citrus leaf miner in terms of leaf infestation was in the range from 4.13 to 41.23 % damaged leaves during the study period. The incidence continuously increased up to the last week of August (35th SMW) and reached its peak (41.23% damaged leaves). The weather conditions prevailed during this period were maximum (29.76 ℃), minimum (24.61 ℃) and average (27.19 ℃) temperatures, morning (92.14%), evening (70.57%) and average (81.36%) relative humidity, Rainfall (33.69 mm) and sunshine hours (4.03 hrs.). Thereafter, the infestation gradually decreased from the first week of September (36th SMW) and reached to lowest (4.13% damaged leaves) during first week of December (49th SMW).

Krishna *et al*., (2021) observed the highest level of leaf miner infestation (53.2%) in the first week of August (32nd SMW) and gradually reduced (30.7%) during first week of December (49th SMW). Although, Kumbhar *et al*., (2021) was observed maximum leaf infestation (46.13%) in the first week of August, 2019 (31st SMW) with minimum leaf infestation (1.24%) during fourth week of May, 2019 (22nd SMW). Rathod *et al*., (2020) observed the highest level of citrus leaf miner infestation in the third week of September (39th SMW).

Correlation co-efficient was worked out between the citrus leaf miner infestation and weather factors *viz.,* temperature (maximum, minimum and average), relative humidy (morning, evening and average), rainfall, sunshine hour. Citrus leaf miner infestation was found to have a significant positive correlation with minimum temperature (r = 0.552), morning relative humidity (r = 0.610), evening relative humidity (r = 0.592), average relative humidity (r = 0.618), average temperature (r = 0.450), rainfall (r = 0.487), while the remaining weather parameters were not found to be significantly correlated with citrus leaf miner infestation (Table 1).

The findings of the current experiment on the correlation between weather parameters and citrus leaf miner infestation were consistent with those of Wagh, T. A., (2016) [15], who also found a highly significant positive correlation with minimum temperature, morning relative humidity, evening relative humidity, and sunshine hours, but a highly significant negative correlation with rainfall.
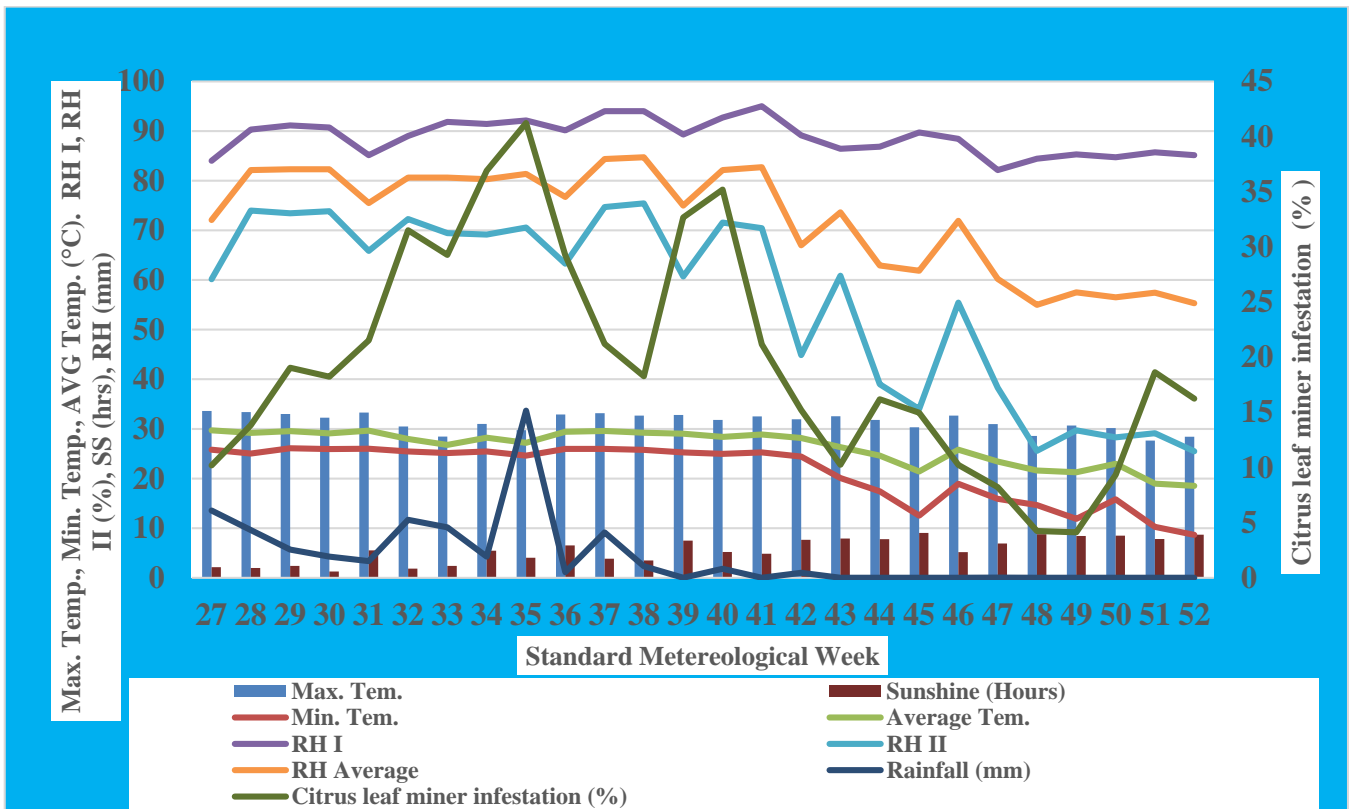

Fig 1: Seasonal incidence of citrus leaf miner on acid lime at Rajnandgaon during *Mrig Bahar* 2021

Table 1: Correlation (r) and regression (b_{yx}) coefficient of meteorological parameters on citrus leaf miner on acid lime

Meteorological parameters	Citrus leaf miner	
	r	b_{yx}
Maximum Temperature (°C)	-0.013	-
Minimum Temperature (°C)	0.552**	0.962
Average Temperature (°C)	0.450*	1.288
Morning RH (%)	0.610**	1.761
Evening RH (%)	0.592**	0.328
Average RH (%)	0.618**	0.597
Sunshine (Hrs.)	-0.346	-
Rainfall (mm)	0.487*	0.676

* Significant at 5 %, ** Significant at 1 %

Conclusion

The seasonal activity of citrus leaf miner was initially detected (10.2% damaged leaves) in the first week of July (27th SMW) and the pest remained active until the last week of December (52nd SMW). When a new flush of the plant emerges, the insect population increases gradually. The average seasonal activity of citrus leaf miner in terms of leaf infestation was in the range from 4.13 to 41.23 % damaged leaves during the study period. The incidence continuously increased up to the last week of August (35th SMW) and reached its peak (41.23% damaged leaves).

The correlation studies revealed that minimum temperature (r = 0.552), morning relative humidity (r = 0.610), evening relative humidity (r = 0.592), average relative humidity (r = 0.618), average temperature (r = 0.450), rainfall (r = 0.487) had significant positive correlation, while the remaining weather parameters were not found to be significantly correlated with citrus leaf miner infestation.

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