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SEASONAL INCIDENCE OF SERPENTINE LEAF MINER, *Liriomyza trifolii* AND INFLUENCE OF WEATHER PARAMETERS ON ITS INCIDENCE IN DIFFERENT SOWINGS OF CASTOR CUTIVARS

V. Shilpakala and T. Murali Krishna
Department of Entomology, S.V Agricultural College, Tirupati

Abstract: A field experiment was conducted to study the seasonal incidence of serpentine leaf miner, *Liriomyza trifolii* in three different sowings (28-06-2013, 13-07-2013 and 28-07-2013) in two cultivars *viz*., Haritha and PCH-111 during *kharif*, 2013. The incidence of leaf miner was recorded as number of fresh mines per plant. More infestation of leaf miner was noticed in Haritha than PCH-111. Maximum incidence was noticed in 38th, 39th and 40th standard weeks. Correlation studies revealed that sunshine hours and rainfall are the key factors. Mutilple regression analysis showed that effect of combination of weather parameters *viz*., maximum temperature, minimum temperature, rainfall, sunshine hours, wind velocity, morning relative humidity and evening relative humidity was not less than 50 per cent.
Keywords: Castor, Serpentine leaf miner, correlation, Regression analysis.

Introduction

Castor (*Ricinus communis* L.) is an important non-edible oilseed crop and is grown especially in arid and semi arid regions. Castor crop plays an important role in the agricultural economy of the earning substantial foreign exchange through export of castor beans and oils. India's export of castor oil and its derivatives is 4.3 lakh tonnes which account for Rs.3193.7 crores per annum in 2012-13. Andhra Pradesh occupies third position in the country in terms of area and production i.e., 2.42 lakh hectares and 1.05 lakh tonnes with the productivity of 214.9 kg ha^{-1} in 2011-2012.

Castor crop suffers from many biotic stresses. So far, 100 insect pests are recorded on castor. In recent times Serpentine leaf miner causes severe damage to castor foliage it cause damage to more than 50 per cent lamina when highly infested (Anjani *et al*., 2010). Information on the incidence of different pests of castor at different growth stages of the crop and its relation with weather parameters, will help to forewarn the cultivars to resort to preventive measures against such pest in time.

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Materials and methods

The experiment was conducted at Dryland farm, S.V Agricultural College, Tirupati during *kharif*, 2013. Two popular genotypes were selected for the experiment *viz*., Haritha and PCH-111. The seed material was obtained from Regional Agicultural Research Station, Palem, Mahabubnagar district AP. The studies were carried out in a randomized design with three dates of sowing *viz.*, IstDOS-June second fortnight (28-06-2013), IInd DOS-July first fortnight (13-07-2013) and IIIrd DOS- July second fortnight (28-07-2013).

The serpentine leaf miner incidence was recorded by taking the number of fresh mines from 3 leaves per plant on 5 randomly selected plants in each cultivar at weekly intervals from 15 days after germination(DAG) till the harvest. Three leaves were selected viz., one leaf from top (excluding two top most leaves), one from middle canopy and one from bottom (leaving one or two bottom most leaves) on main stem.

Results and discussion

Infestation of serpentine leaf miner: leaf miner infestation on two cultivars viz., Haritha and PCH-111 was significantly different in all three dates of sowing viz., June second fortnight (28-06-2013), July first fortnight (13-07-2013) and July second fortnight (28-07-2013). Observations were recorded starting from 15 DAG. In general the infestation was seen in all the leaves up to 36 DAG, later with the growth of canopy, number of infested leaves were reduced but number of leaf mines were found to be increased in aleaf. Of both the cultivars, Haritha was more preferred by serpentine leaf miner. The crop was harvested 20 weeks after sowing.

First date of sowing (28-06-2013): In Haritha, the first infestation was observed 15 DAG 2.2 leaf mines/plant and reached its peak (36.4 leaf mines/plant) by 92 DAG. Thereafter, the infestation reduced to 19.64 leaf mines/plant at 120 DAG as the crop growth progressed. In PCH-111 the initial occurrence of leaf mines was observed 15 DAG 2 leaf mines/plant and reached its peak (26.9 leaf mines/plant) by 99 DAG. Thereafter, the infestation reduced to 14.34 leaf mines/plant at 120 DAG as the crop growth progressed.

Second date of sowing (13-07-2013): In Haritha, the infestation was first observed 15 DAG with 3.1 leaf mines/plant and reached its peak (32.6 leaf mines/plant) by 85 DAG. Thereafter, the infestation reduced to 9.4 leaf mines/plant at 120 DAG as the crop growth progressed. In case of PCH-111, the initial occurrence of leaf mines was observed 15 DAG 4.2 leaf mines/plant and reached its peak (27.5 leaf mines/plant) by 85 DAG. Thereafter, the

infestation reduced to 12.02 leaf mines/plant at 120 DAG as the crop growth progressed (Table 1).

Third date of sowing (28-07-2013): In Haritha, the first infestation was observed 15 DAG with 4.8 leaf mines/plant and reached its peak (36.1 leaf mines/plant) by 71 DAG. Thereafter, the infestation reduced to 7 leaf mines/plant at 120 DAG as the crop growth progressed. In case of PCH-111, the initial occurrence of leaf mines was observed 15 DAG 4.8 leaf mines/plant and reached its peak level (26.6 leaf mines/plant) by 71 DAG. Thereafter, the infestation reduced to 8.34 leaf mines/plant at 120 DAG as the crop growth progressed. In all the dates of sowing the infestation of leaf miner was more in 38^{th}, 39^{th} and 40^{th} standard weeks.

Influence of weather parameters on leaf miner infestation:

In Haritha, The correlation studies with the abiotic factors in first sowing revealed that significant positive correlation existed between leaf miner infestation and sunshine hours and morning relative humidity while non-significant positive correlation with the maximum temperature, whereas minimum temperature, rainfall, wind velocity and evening relative humidity exhibited no-significant negative correlation. In case of next two sowings maximum temperature, minimum temperature, sunshine hours, wind velocity and morning relative humidity has non-significant positive correlation with the pest infestation whereas, rainfall and evening relative humidity showed non-significant negative correlation (Table 2). Whereas in PCH-111, study of the influence of weather parameters on incidence of leaf miners in first two sowings revealed that maximum temperature, sunshine hours, wind velocity and relative humidity has non-significant positive correlation whereas minimum temperature, rainfall and evening relative humidity exhibited non-significant negative correlation with the leaf miner infestation. In case of July second fortnight sown crop sown crop non-significant positive correlation existed between maximum temperature, minimum temperature, sunshine hours, wind velocity and leaf miner infestation while rainfall, morning and evening relative humidity showed non-significant negative correlation.

Based on regression models:

In the cultivar, Haritha the variability in number of leaf mines sown in June second fortnight sown crop was best explained by the multiple regression model (Y=2.292-0.374max temp+0.161min temp-0.005 RF+0.248 SSH+0.006 WV+0.063 mor RH+0.022 eve RH) that could explain the relation up to 64.9 per cent whereas the forward selection model could predict the pest infestation to an extent of 56 per cent. Similarly, fluctuations in the

infestation level in July second fortnight sown crop sown crop due to weather parameters was best explained by multiple regression model (Y=1.172-0.361max temp+0.235min temp -0.003 RF +0 .205 SSH-0.079WV+0.046mor RH + 0.031eve RH) that could explain the relation to an extent of 72.6 per cent whereas the forward selection model (Y= -3.591+0.091eve RH) could predict the leaf miner infestation to an extent of 55.1 percent. In case of July second fortnight sown crop multiple regression model (Y=-20.756-0.102 max temp+0.486min temp-0.005RF+0.204 SSH + 0.008 WV + 0.077 mor RH +0.113 eve RH) could predict the infestation to an extent of 80.9 per cent whereas, forward selection model could explain up to 74.9 per cent of leaf miner infestation (Table 3).

In PCH-111, The variability in number of leaf mines sown in June second fortnight sown crop was best explained by the multiple regression model (Y=94.124 -2.282 max temp-1.095min temp+0.014 RF+2.152 SSH+0.485 WV+0.629 mor RH-0.793 eve RH) that could explain the relation up to 83.6 per cent whereas the forward selection model could predict the infestation to an extent of 72.8 per cent. Similarly, fluctuations in the infestation level in July second fortnight sown crop sown crop due to weather parameters was best explained by multiple regression model(Y=2.292-0.374 max temp+ 0.161min temp -0.005 RF+0.248 SSH+0.006 WV+0.063 mor RH+ 0.022 eve RH) that could explain the relation to an extent of 63.2 per cent whereas the forward selection model could predict the infestation to an extent of 61.8 percent. In case of July second fortnight sown crop sown crop multiple regression model(Y=-116.541+ 2.253min temp+1.573SSH +0.575WV+0.705 mor RH) could predict the infestation to an extent of 56 per cent whereas, forward selection model could explain up to 52.3 per cent of leaf miner infestation (Table 4).

The results are in agreement with the findings of Durairaj (2007) who reported that a positive association with maximum temperature, minimum temperature and sunshine hours while negative association with relative humidity, rain fall and rainy days. Similar results were obtained by Bagmare *et al*., (1995) and Reddy and Kumar (2005). The present findings are in contrary with Chaudhuri and Senapati (2004) who reported leaf miner incidence was positively correlated with rainfall and average relative humidity.

Conclusion

More infestation of leaf miner was noticed in Haritha than PCH-111. Maximum incidence was noticed in 38^{th}, 39^{th} and 40^{th} standard weeks. Correlation studies revealed that sunshine hours and rainfall are the key factors. Mutilple regression analysis showed that effect of combination of weather parameters *viz*., maximum temperature, minimum temperature,

rainfall, sunshine hours, wind velocity, morning relative humidity and evening relative humidity was not less than 50 per cent.

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Table 1. Seasonal incidence of Serpentine leaf miner, *Liriomyza trifloii* on castor during *kharif*, 2013

DAG	Mean number of leaf mines per plant					
	Haritha			PCH-111		
	June second fortnight(D_1)	July first fortnight (D_2)	Julysecond fortnight(D_3)	June second fortnight(D_1)	June first fortnight (D_2)	Julysecond fortnight(D_3)
15	2.20	3.10	4.80	2.0	4.2	4.8
22	5.60	7.50	5.14	5.7	12.6	5.2
29	8.10	12.6	9.38	8.5	9.5	12.6
36	12.4	14.02	15.5	16.6	10.6	15.3
43	16.7	16.7	17.3	12.4	14.02	14.42

50	17.5	19.5	21.1	10.6	16.7	13.01
57	18.93	18.2	23.9	17.8	15.6	18.98
64	23.9	15.6	28.9	18.2	13.24	22.34
71	20.04	25.5	36.1	16.02	19.4	26.6
78	19.01	28.7	34.2	14.7	23.04	22.4
85	31.2	32.6	32.4	19.01	27.5	14.6
92	36.4	30.02	26.0	22.66	22.31	15.43
99	26.4	20.06	21.0	26.9	18.04	14.64
106	21.1	16.04	16.0	21.1	15.6	12.31
113	17.8	12.02	12.0	17.04	14.4	10.6
120	19.64	9.40	7.00	14.34	12.02	8.34

Table.2 Correlations between weather parameters and infestation of serpentine leafminer on castor during *kharif*, 2013

Weather parameters	**Correlation coefficients (r)**					
	Haritha			**PCH-111**		
	D_1	**D_2**	**D_3**	**D_1**	**D_2**	**D_3**
Maximum temperature	0.163	0.242	0.268	0.347	0.236	0.433
Minimum temperature	-0.314	0.059	0.238	-0.189	-0.010	0.320
Rainfall	-0.043	-0.056	-0.055	-0.141	-0.124	-0.198
Sunshine hours	0.608*	0.349	0.227	0.762**	0.450	0.379
Wind velocity	-0.078	0.173	0.240	0.259	0.257	0.419
Relative humidity (morning)	0.530*	0.288	0.156	0.332	0.294	-0.079
Relative humidity (evening)	-0.179	-0.370	-0.337	-0.184	-0.098	-0.381

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

Table 3. Regression models developed for infestation of serpentine leaf miner inthree dates of sowing in Haritha

DOS	**Model**	**Regression equation**	**R^2**
D_1	Full model	Y=2.292-0.374 max temp+0.161min temp-0.005 RF+0.248 SSH + 0.006 WV+ 0.063 mor RH+0.022 eve RH	0.649
	Forward selection	Y= 16.121-0.493 max temp+ 0.341 SSH	0.560
D_2	Full model	Y=1.172-0.361max temp +0.235min temp -0.003 RF+ 0.205 SSH-0.079 WV+ 0.046 mor RH + 0.031eve RH	0.726
	Forward selection	Y= -3.591+0.091eve RH	0.551
D_3	Full model	Y=-20.756-0.102 max temp+0.486 min temp-0.005 RF+0.204 SSH+0.008WV+0.077mor RH+0.113eve RH	0.802
	Forward selection	Y= -18.088 + 0.310 min temp+0.204 SSH+ 0.060 mor RH+0.102eve RH	0.749

Table 4. Regression models developed for infestation of leaf miner in three dates of sowing in PCH-111 of castor

DOS	**Model**	**Regression equation**	**R^2**
D_1	Full model	Y=94.124-2.282max temp-1.095min temp+0.014 RF +2.152 SSH +0.485WV+0.629 mor RH-0.793eve RH	0.836
	Forward selection	Y= -32.234+2.107 SSH+0.504WV+0.425mor RH	0.728
D_2	Full model	Y=2.292-0.374 max temp+ 0.161min temp -0.005 RF+0.248 SSH +0.006 WV+0.063 mor RH+ 0.022 eve RH	0.632
	Forward selection	Y=-122.748+2.573min temp+1.522 SSH+0.536 WV+0.768 eve RH	0.618
D_3	Full model	Y=-90.475-1.701max temp+3.463 min temp-0.008 RF+1.791 SSH +0.574WV+1.01mor RH-0.390eve RH	0.560
	Forward selection	Y=-116.541+ 2.253min temp +1.573SSH+0.575 WV+ 0.705 mor RH	0.523

(DOS-Date of Sowing)