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SEASONAL INCIDENCE AND DAMAGE INTENSITY OF LACE BUG, *COCHLOCHILA BULLITA* (STÅL) (HEMIPTERA: TINGIDAE) ON *TULSI, OCIMUM BASILICUM* L.

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Abstract: Present study envisages the result of studies conducted on seasonal incidence and damage intensity of lace bug, *Cochlochila bullita* (Stål) in natural field condition; experiments were conducted during 2014-15. The incidence of lace bug on *tulsi* commenced from the October, 2014 and continued till the month of January, 2015. Maximum bug population (43.2 insects per plant) was recorded during 52 standard week of December, 2014. All weather parameters except relative humidity (RH) at 07 hrs and 14 hrs had significant impact on lace bug population on *tulsi*. All these weather parameters together produced 86 per cent impact on lace bug population. Damage intensity caused due to infestation of *C. bullita* on the *tulsi* crop was also assessed by estimating the fresh herbage yield under protected and unprotected conditions. In protected plot yield was 5.4 tonnes/ ha whereas in unprotected plot yield obtained was 3.6 tonnes/ ha. Therefore, 33.33 per cent herbage yield loss was recorded in unprotected plot when compared with protected plot.
Keywords: Seasonal incidence, Damage intensity, weather parameters, *C. bullita, tulsi.*

1. Introduction

Among over 150 basil species belonging to the genus *Ocimum,* two most widely grown species for essential oil production are holy basil (*Ocimum sanctum* L.) and sweet basil (*Ocimum basilicum* L.). *Ocimum basilicum,* an erect highly branched aromatic perennial herb of family Lamiaceae is well known for its sweet basil oil and is widely distributed throughout India. This species is believed to be originated in India and some neighbouring countries. In the plains of north India, south India and Assam it may; however be grown as both *Kharif* and *Rabi* crops. In actual practice, about 30-35 Kg/ha oil, corresponding to 12-13 Kg of flower oil and 18-22 Kg of whole herb oil is obtained from this species (Panda, 2005). Main components of basil essential oil are linalool, camphor, 1, 8 cineole and germacren-D (Arabaci, 2004 and Daneshian, 2013). *Tulsi* hybrid is now being cultivated in about 2000 hectares of land in India (Balyan and Pushpangadan, 1988) as ayurvedic and medicinal plant.

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Its leaves, stem, shoots, flowers, seeds and roots have tremendous economic importance in epidemiology and industry. Its leaves have anthelminthic and anti-tussive effects. Seeds yield various essential oils, monoterpenes, sesquiterpenes and phenols which provides pleasant odour and flavours to the crop. *Tulsi* extract has fungicidal, insecticidal antibacterial, antifeedant and larvicidal activities (Sathe *et al.,* 2014).

However, *tulsi* crop is attacked by several sucking insect pests like lace bug *Cochlochila bullita* (Stål), whitefly *Aleurodicus dispersus* Russell, *Dialeurodes* sp. and aphid *Macrosiphum* sp. but *C. bullita* and *A. despersus* found throughout the year while aphid appeared occasionally in December-January (Sathe *et al.,* 2014). Among these pests, *C. bullita* caused severe damage. Besides these pests, basil plant is also attacked by other pests insects like leaf roller, lace bug, etc. (Panda, 2005). In Bihar, basil is grown in an area of about 32ha with an annual production rate of 3.20 tonnes/ha (Charan, 2013). The plant is attacked by various insect pests, among which lace bug, *Cochlochila bullita*, is a key pest limiting its production and productivity. It has been estimated that *C. bullita* causes approximately 27.8 per cent yield loss (Anonymous, 2012-13).

Adult lace bugs usually feed on tender shoots of the herb causing them to wilt and eventually die and in many instances, nymphs and adults feed, gregariously on the leaves, leaving tiny black spots of excrement on the upper surface of the leaves (Dhiman and Jain, 2010). *O. basilicum* plant is severely infested by the population of *C. bullita* at Saharanpur and causes drying and wilting of leaves resulting in ultimate death plants (Dhiman and Datta, 2013). According to Sajap and Peng (2010), adult *C. bullita* usually feed on tender shoots of the herbs causing them to wilt and eventually die. Nymphs are found on the under surface while the adults are on upper surface in colonies on the tender foliage and shoots. Leaves become discoloured and gradually dry up. Nymphs were observed on upper and lower leaf surfaces and reproductive structures, with foliar chlorosis evident on the upper surfaces and dark excrement on lower surfaces, severe feeding resulted in the death of plants.

The infestation of *C. bullita* was observed throughout the year. However, its incidence was highest during the months August to December, moderate from January to April and low from May to June. The pest hibernates in adult stage in scarcity of food and adverse (cold) conditions. Highest population 67.3 (range 60-72) was found in September (Sathe *et al*., 2014). Temperature and humidity both climatic factors influence the population built up and survivability of lace bug at Saharanpur (Jain and Dhiman, 2011). The lace bug preferred to live and feed on *O. basilicum* throughout the year except during autumn season. In winter,

few nymphs were seen in aggregation in the cavity of rolled leaves to avoid cold weather. Dhiman and Dutta (2013) reported that at Saharanpur the population of *C. bullita* infest the host plants during July to November and from April to May. The population built up started on *O. basilicum* during first week of April and attained peak in September – November. Damage intensity caused due to infestation of *C. bullita* on the *tulsi* crop was also assessed by estimating the fresh herbage yield under protected and unprotected conditions.

Keeping in view of the importance of lace bug, *C. bullita* there is needed to study its seasonal incidence and damage intensity to monitor and protect the basil crop from its damage. So far, information on these aspects is very scanty and scattered in India and abroad.

2. Materials and Methods

Seasonal incidence of lace bug, *Cochlochila bullita* (Stål) on *tulsi* host was studied under natural field condition. Experiment was laid out at the Herbal Garden, MAP & Betel vine, Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur, Bihar to assess the seasonal incidence and damage intensity of *C. bullita* during the year 2014-15. Meteorological observations with regard to ambient temperature (°C), relative humidity (%), rainfall (mm), prevailing at experimental field were recorded daily during the months of September 2014 to January 2015. The data so obtained were finally merged together to get average fortnightly temperature, relative humidity (RH) and rainfall, for the period under investigation.

With a view to determine fluctuations in the seasonal incidence of lace bug in North Bihar condition, a fixed plot survey was conducted at experimental field at HI-Tech Horticulture Garden, Dr. Rajendra Prasad Central Agricultural University, Pusa, (Samastipur), Bihar during 2014-15. For this purpose five plants of *tulsi*, variety *Kashmiri*, about one months old plants, were tagged. The inter- and intra-row spacing of *tulsi* crop was kept at 30 × 40 sq.cm, respectively. The crop was grown by adopting all the recommended agronomic practices uniformly.

The observation on pest activity was initiated to monitor the pest population at weekly intervals throughout the months from September 2014 to January 2015. The data so obtained were merged together to calculate mean weekly population. The number was recorded by counting them on five tagged plants of which 10 cm twigs and five leaves were selected for observation of insect count during morning hours before 9 AM. The data, so obtained, was finally used to work out the mean number of bugs (nymph and adult) per plant by using the following formula:

$$\text{Mean number of insects per plant} = \frac{n_1 + n_2 + n_3 + n_4 + n_5}{5}$$

Where,

n = number of individual per plant

The data on mean number of bugs (nymph and adult) were correlated with meteorological parameters recorded simultaneously.

After harvesting, the herbage yield was recorded and converted into tonnes per hectare. The per cent yield loss over unprotected plot was calculated by using following formula:

$$\text{Per cent loss in herbage yield} = \frac{Y2 - Y1}{Y2} \times 100$$

Whereas,

Y_2 = Yield in protected plot, Y_1= Yield in unprotected plot

3. Results and discussion

3.1. Seasonal incidence: Biotic and abiotic factors have a great role in influencing the population dynamics of any organism. Abiotic factors, *viz.* temperature, relative humidity (RH) and rainfall usually regulate population of any organism. The data pertaining to mean number of insect per plant has been presented in Table- 1, Fig. 1. The data presented in table clearly revealed that the pest population was initially observed in 40th standard week (1 Oct.-7 Oct.) 2014 and continued till the harvesting of the crop (4th standard week of January, 2015). The data clearly indicate that the pest's population was at its peak (43.2 insects per plant) during 52nd standard week (24 Dec.-31 Jan.) of 2014. The population started declining from 1st standard week of 2015 (1 Jan.-7 Jan. 2015) onwards and minimum bug population was recorded (0.2 insect per plant) during 4th standard week (22 Jan. -28 Jan. 2015). So far, the effect of the weather parameters on bug's population is concerned, the maximum population of lace bug (43.2 insects per plant) was recorded during 52nd standard week (24 Dec.-31 Jan.) of 2014 with corresponding weather parameters *i.e.*, maximum, minimum temperature (°C), relative humidity (%) at 07 and 14 hrs and rainfall (mm) were 15.3, 7.8; 91, 77 and 0.0 respectively. On the other hand minimum population of lace bug (0.2 insect per plant) was recorded during 40th standard week (1 Oct-7 Oct) of 2014. During this week, the weather parameters were 32.8, 23.6; 91, 62 and 36.2, respectively. The data clearly denotes that the bug population was maximum in December last week, 2014 and started declining from January, 2015 onwards. The present findings on the population fluctuation of lace bug on *tulsi* are in partial agreement with the results of Dhiman and Dutta (2013) who reported

that the population of *C. bullita* infest the host plants attained peak in September – November.

Kumar (2013) also found that there was a peak population lace bug 63.8 in 2011 and 71.2 in 2012 per plant during August and September. The present results are more or less in conformity with the findings of other workers (Jain and Dhiman, 2011; Sathe *et al*., 2014).

3.2. Correlation coefficient: The correlation analysis between weather parameters and the mean number of insects has been summarized in Table 2. The data revealed that all the weather parameters, under study, except the relative humidity (RH) at 07 hrs and 14 hrs highly influenced the insect population. The correlation coefficient (*r*) was computed as -0.92, 0.87 and -0.53 for maximum, minimum temperatures, and rainfall, respectively. The relative humidity recorded (r = -0.07) at 07 hrs and (r = 0.41) at 14 hrs showed non-significant effect on lace bug population. The weather parameters were found to contribute around 86.0 per cent impact on *Cochlochila bullita* population when acted together (R^2 = 0.86).

The population density of *C. bullita* at any location is the result of complex interaction of many abiotic and biological factors. The interaction between lace bug population and prevailing weather condition as obtained in present investigation provided a good support to the earlier findings (Sathe *et al*. 2014; Kumar, 2013; Jain and Dhiman, 2011; Dhiman and Dutta, 2013). The result of present study will be helpful in the developing a forecasting model for *C. bullita* population on *tulsi*.

3.3. Damage intensity on *tulsi* crop due to infestation by *C. bullita* was also assessed by comparing the yield of fresh herbage in treated and untreated plots. In the treated plot, prophenophos 50EC @ 1 ml/lit were sprayed at fortnightly interval. In treated plot yield was 5.4 tonnes/ ha whereas in untreated plot yield obtained 3.6 tonnes/ ha. This indicates that there was about 33.33 per cent herbage yield loss in untreated plot when compared with treated plot. The yield loss of *tulsi* herbage due to infestation of lace bug, *C. bullita* has been earlier estimated approximately 27.8 per cent (Anonymous, 2012-13).

CONCLUSION

The *tulsi* lace bug, *Cochlochila bullita* (Stål) (Tingidae: Hemiptera) has been recognized as the key pest of *tuls*i. It is a pest of *tulsi* and limiting the production and productivity, posing serious threat to *tulsi* crop.The incidence of lace bug on *tulsi* commenced from the October 2014 and continued its activity till the month of January 2015. The maximum number of population (43.2 insects per plant) during fourth standard week of December 2014 was

recorded with corresponding weather parameters *i.e.*, maximum, minimum temperature (°C), relative humidity (%) at 07 and 14 hrs and rainfall (mm) were 15.3, 7.8 , 91, 77 and 0.0, respectively. These weather parameters were found to be congenial for the population build-up of *tulsi* lace bug. The lace bug population started declining gradually from January. All the weather parameters except relative humidity at 07 hrs and 14 hrs had significant impact on lace bug population on *tulsi*. All these weather parameters combinedly produced 86 per cent impact on lace bug population. In treated plot, yield was 5.4 tonnes / ha., whereas, in untreated plot the yield was 3.6 tonnes/ ha. which estimates 33.33 per cent herbage yield loss in untreated plot when compared with treated plot.

References

[1] Anonymous (2012-13). Assessment of crop loss by the major pests. *Annual Report of All India Co-ordinated Research Project on Medicinal and Aromatic Plants and Betel vine*, TNAU, Coimbatore, 294 pp.

[2] Arabaci, O. (2004). The effect of nitrogen fertilization and different plant densities on some agronomic and technologic characteristic of *Ocimum basilicum*. *J. Argon*. **3**: 255-262.

[3] Balyan, S.S. and Pushpangardan, P. (1988). A study on the taxonomic status and geographic distribution of the *Ocimum. Patai. Journal*, **10**: 13-19.

[4] Charan, C. (2013). Production of herbal and medicinal plant: An innovative effort towards sustainable development (A case study of Bihar). *Global J. Manag. Business Studies,* **3**(2): 145-152.

[5] Daneshian, M. (2013). Evaluation of Basil (*Ocimum basilicum* L.)- essential oil content and yield under different plant densities and nitrogen levels. *Journal of Medicinal Plants and By-Products*, **2**: 159-162.

[6] Dhiman, S.C. and Jain, S. (2010). Seasonal occurrence and damage of *Eusarcocoris capitatus,* a pest of *Ocimum sanctum. Ann. Plant Protec. Sci.* **18**: 498-499.

[7] Dhiman, S.C. and Datta, O. (2013). Seasonal occurrence of *Cochlochila bullita*: A serious pest of *Ocimum basilicum. Ann. Pl. Protec. Sci.* **21** (1): 176-223.

[8] Jain, S. and Dhiman, S. C. (2011). Some observations on the early biological stages of *Eusarcocoris capitatus* Distant, A pest of holy *Tuls* (*Ocimum sanctum* L.). *Uttar Pradesh J. Zool.* **30**: 159-164.

[9] Kumar, A. (2013). The lace bug *Cochlochila bullita* (Stal), a destructive pest of *Ocimum sanctum* in Jharkhand, India. *Phytoparasitica*, DOI 10.1007/S 12600-013-0359-0.

[10] Panda, H. (2005). *Aromatic Plants Cultivation, Processing and Uses*. *Asia Pacific Business Press Inc*, ISBN: 8178330571.

[11] Sajap, A.S. and Peng, T.L. (2010). The lace bug *Cochlochila bullita* (Stål) (Heteroptera: Tingidae), a potential pest of *Orthosiphon stamineus,* Bentham (Lamiales: Lamiaceae) in Malaysia. *Insecta Mundi*, **136**: 1-5.

[12] Sathe, T. V., Sathe, N. T., Ghodake, D. and Sathe, A. (2014). Sucking insect pests and medicinal value of *Tulsi* (*Ocimum sanctum* L.). *Indian J. Appl. Res.* **4(3): ISSN - 2249-555X.**

Table 1: Seasonal incidence of *tulsi* lace bug, *Cochlochila bullita* (Stål)) in relation to weather parameters

Period of observation	Standard week	Mean no. of insect/plant	Temperature (°C)		Relative humidity (%)		Rainfall (mm)
			Max.	Min.	7hrs	14hrs	
17-Sep	38	0	33.0	24.8	92	71	48.4
24-Sep	39	0	32.2	24.5	91	65	18.8
1-Oct	40	0.2	32.8	23.6	91	62	36.2
8-Oct	41	0.8	33.0	24.1	91	65	7.2
15-Oct	42	1.5	30.1	19.3	91	52	38.2
22- Oct	43	2.7	30.5	19.6	90	53	0.0
29- Oct	44	3.1	30.0	18.3	91	53	0.0
5- Nov	45	5.4	30.7	17.0	89	45	0.0
12- Nov	46	11.9	28.5	13.2	84	35	0.0
19- Nov	47	15	27.7	11.6	86	34	0.0
26- Nov	48	21.2	26.0	11.7	88	55	0.0
3-Dec	49	25.8	20.6	13.6	94	76	0.0
10- Dec	50	29.1	21.6	12.0	91	67	4.2
17- Dec	51	39.6	20.9	8.5	92	61	0.0
24- Dec	52	43.2	15.3	7.8	91	77	0.0
1-Jan	1	35.2	21.0	12.1	86	72	7.7
8- Jan	2	27.9	18.1	8.7	88	73	0.0
15- Jan	3	24.6	16.2	7.1	90	71	0.0
22- Jan	4	20.1	21.6	9.5	90	58	0.0

Table 2: Correlation coefficient and regression equation between weather parameters (X) and mean number of insects per plant (Y)

Weather parameters	Correlation coefficient (r)	Regression coefficient (b)
Maximum temperature (°C) (X_1)	-0.92**	1.08
Minimum temperature (°C) (X_2)	0.87**	-2.67
R.H 7 hrs (%) (X_3)	-0.07NS	-0.32
R.H 14 hrs (%) (X_4)	0.42NS	0.69
Rainfall (mm) (X_5)	-0.53*	-0.93

Multiple regression equation:

$$\mathbf{Y = 16.68 + 1.08(X_1) - 2.67(X_2) - 0.32(X_3) + 0.69(X_4) - 0.93(X_5)}$$

Coefficient of determination (R^2) = 0.86

**Significant at P 1%

*Significant at P 5 %

NS =Non-significant

Fig. 1 : Seasonal incidence of tulsi lace bug, Cochlochila bullita (Stal.) in relation to weather parameters