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Population dynamics of defoliating insect pests of mango in the coastal agroecosystem of Tamil Nadu

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ABSTRACT: Population dynamics of defoliating insect pests of mango was studied in the coastal agroecosystem of Tamil Nadu. Seven species of defoliating insect pests were recorded and among them, leaf webber, *Orthaga exvinacea* (Hamp.), leaf caterpillar, *Bombotelia jacosatrix* (Guen), shoot borer, *Chlumetia transversa* (Walk.) and leaf twisting weevil, *Apoderus tranquebaricus* (Fab.) were recorded with considerable leaf damage. The peak incidence of above pests *viz.,* leaf webber (3rd week of September), leaf caterpillar (2nd and 3rd week of December), shoot borer (3rd and 4th week of December) and leaf twisting weevil (3rd week of August). Incidence of leaf webber and leaf twisting weevil was positively correlated with maximum and minimum temperature whereas leaf caterpillar and shoot borer were negatively correlated. Rainfall and relative humidity had positively influenced all the selected pests whereas wind velocity showed negatively impact.

Keywords: Mango, population dynamics, defoliation, leaf webber, shoot borer, leaf twisting weevil, weather

INTRODUCTION

Mango (*Mangifera indica* L.) also known as the "King of fruits" is cultivated mainly in tropical and sub-tropical countries of the world. Among the countries, India contributes to 50 per cent of mango production in the world. India is one of the leading countries which export mango to many countries by fresh and also processed form in the money value 167.04 million USD **(**DGCI&S, 2018**).** The insect pests are the major constraints in mango production. More than 400 species of insect pests are associated with mango in the world (Butani, 1974). More than 180 species were reported in India (Tandon and Srivastava, 1982; Pena *et al*., 2002). Many defoliating pests infest more young trees and nurseries but in older trees level of damage and yield loss was less compared to other pests feeding on inflorescence and fruits. Among the defoliating pests of mango, leaf webber, *Orthaga exvinacea,* leaf caterpillar, *Bombotelia jacosatrix,* shoot borer, *Chlumetia transversa*, leaf roller, *Dudua aprobola* (Mey.), leaf miner, *Acrocercops syngramma* (Mey.), leaf and flower feeder, *Porthesia scintillans* (Walk.) and leaf twisting weevil, *Apoderus tranquebaricu* infest the trees in considerable level (Soumya *et al*., 2017). The leaf webber adult moths lay the eggs on the leaf surface, emerged out larvae start feeding on the new leaves and the later instars web the leaves and feed in the webbing, webbed leaves with excreta is the major identification. Leaf caterpillar causes heavy defoliation in tender leaves, early instars of shoot feed on tender leaf and borer into midribs later it bore into young shoots (Soumya *et al*., 2017). Adult beetles of leaf twisting weevils cause damages to the fresh leaves, cut the leaf and rolled from to tip to mid of the leaf and laid the egg inside the rolled leaves. Infestation of these pests was recorded throughout India but occurrence varied in different geographical conditions. To apply the proper management strategies understanding the incidence of pests is needed to predict the pest occurrence and timely action. In this view, the study was conducted to record the defoliating pest infestation in the orchard located near the Bay of Bengal.

MATERIALS AND METHODS

Study area

The survey was conducted in the mango trees in the University Orchard, Department of Horticulture, Annamalai University, Tamil Nadu, India from May 2018 to April 2019. The orchard is located at 11.2305° N, 79.4330° E and is 10 km from the Bay of Bengal.

Survey on seasonal incidence of defoliating insect pests of mango

The survey was conducted on twenty randomly selected mango trees in four directions of the orchard, the selected trees were examined for pest incidence in the weekly interval and kept unsprayed during the entire study period. Incidence of leaf webber observed on four branches from all four directions in each tree and the number of leaf webs on the selected branches was counted and the mean number of leaf webs per tree was calculated. The number of twisted leaves in selected

Table 1. Incidence defoliating insect pests on mango during May 2018 to April 2019

Month	Standard week	Leaf webber (mean number of larvae/ twig)	Leaf caterpillar (mean number of larvae/ twig)	Shoot borer (mean number of larvae/ twig)	Leaf twisting weevil (mean number of twisted leaves/ branch)	Maximum temperature (°c)	Minimum temperature (°c)	Rainfall (mm)	Relative humidity (%)	Wind velocity (kmh)
May	19	2.3	0	0	6.5	36.3	26.8	0	81	6.5
	20	3.2	0	0	4.25	36.2	26.4	0	79	7.1
	21	2.5	0	0	0.0	35.8	26	0	80	3.6
	22	3.2	0	0	0.0	38	27.4	0	78	6.6
June	23	2.5	0	0	0.0	37	22.4	40.6	81	5.2
	24	2.8	0	0	0.5	36.9	26.1	32.7	80	6.3
	25	4.1	0	0	0.5	36.5	25.9	0	79	7
	26	3.2	0	0	14.2	36.7	25.6	9.2	80	5.7
July	27	3.4	0	0	21.0	35.4	24.8	34.8	84	6.9
	28	5.2	0	0	22.6	35.1	26.4	0	83	4.7
	29	5.7	0	0	28.8	36.1	26.2	4	80	2.9
	30	4.6	0	0	25.4	36.7	25.9	15.8	82	5.6
	31	5.8	0	0	23.4	36.3	25	20.4	84	4.6
August	32	4.6	0.2	0	28.5	35.2	25.1	28.4	95	5
	33	5.6	0.2	0	30.2	35.4	25.6	10.2	81	5.3
	34	6.2	0.4	0	31.4	35.1	25.3	12.4	85	5.6
	35	6.5	0.5	0	29.4	33.8	24.2	132.6	89	3.6
September	36	10.25	0.7	0	26.7	35	25	0	84	7.4
	37	12.45	0.4	0	28.4	35.2	25.7	0.4	86	7.6
	38	13.4	0.5	0.2	24.22	34	25.2	18.8	86	4
	39	12.2	0.8	0.2	21.5	33.3	24.9	2.9	88	7
October	40	10.2	1.1	0.5	23.4	30.5	24.7	157.8	97	4.4
	41	10.42	1.5	0.5	25.0	33.6	25.2	3.8	87	5.2
	42	8.50	1.5	0.7	15.6	31.4	24.6	52.8	91	4
	43	9.56	1.7	0.9	12.4	29.8	23.9	86.2	89	5.3
	44	6.5	1.5	0.9	2.5	29.3	24	84.4	88	2.9
November	45	5.5	1.7	1.2	3.0	29.6	24.4	38.6	89	6.1
	46	5.2	1.9	1.25	4.10	30.8	23.9	62	83	5.1
	47	4.8	2.1	1.3	2.6	29	24.1	117	94	3.4
	48	4.8	2.2	1.35	3.51	29.4	22.2	14.5	88	6.3
December	49	5.2	2.8	1.9	4.1	29.6	22.6	43.4	92	5.8
	50	2.1	3.3	2.5	2.6	29.5	22.5	0	89	4
	51	2.4	3.3	2.6	3.21	28.8	21.8	31.4	87	3.8
	52	3.1	3.2	2.6	3.4	28.7	25	7.8	88	5
January	1	0.8	3.1	2.4	2.6	27.8	19.5	0	86	8.1
	2	0.9	1.5	1.8	2.1	28.3	19.3	0	89	8.4
	3	0.6	0.8	0.5	0.0	28.4	19.5	0	87	6.3
	4	0.8	0.2	0	0.0	29.4	20.8	2.5	87	7.6
	5	0.4	0	0	0.0	29.3	21.3	0	88	8.4
February	6	1.5	0	0	0.0	30.7	22.6	0	90	6.2
	7	2.1	0	0	0.0	31.2	22.4	0	86	8.6
	8	4.2	0	0	0.0	31.7	21.7	0	89	8.8
	9	3.2	0	0	0.0	33.2	22.8	0	88	7.9
March	10	4.1	0	0	14.5	35.4	24.2	0	86	7.9
	11	4.0	0	0	7.8	33.6	22.1	0	85	8.2
	12	3.5	0	0	12.2	34.1	23.2	0	91	8.4
	13	3.5	0	0	15.6	34.7	22.5	0	89	9.1
April	14	4.3	0	0	14.6	35.2	24.1	0	87	9
	15	4.1	0	0	11.45	35.8	24.4	0	87	9.2
	16	4.2	0	0	14	36.4	26.1	0	82	8.2
	17	4.5	0	0	15.5	36.2	25.8	0	85	7.1
	18	5.2	0	0	10.23	38.2	26	6.5	80	7

branches counted, the mean number of leaf twists per branch was calculated for leaf twisting weevil. The larvae were counted on twigs of selected branches and expressed as the number of larvae per twig for mango leaf caterpillar, shoot borer and hairy caterpillar. The incidence of the above pests was plotted in Randomized Block Design (RBD). The weather information was collected from the Meteorological observation unit, Department of Agronomy, Annamalai University which is located within the 340 m radius of the study area.

RESULTS AND DISCUSSION

Defoliating pests of mango in the study area

The surveys resulted in documenting seven species of defoliating pests *viz.,* leaf webber, *O.exvinacea,* leaf caterpillar, *B. jacosatrix,* shoot borer, *C. transversa* and leaf twisting weevil, *A. tranquebaricus,* Semi-looper, *Achaea janata* and two unidentified species of hairy caterpillars. The above first four were recorded causing considerable leaf damage.

Seasonal incidence of mango leaf webber, *O. exvinacea* (Noctuidae: Lepidoptera)

Incidence of mango leaf webber, *O. exvinacea* (Fig.1) was recorded almost throughout the year but the peak incidence was recorded during 38th SMW, higher level of incidence (9.56 to 13.4 webs per tree) was recorded from 36th to 43rd SMW. The high decline in incidence was recorded during January and the increasing trend was from July (Table.1). Similarly, Kannan and Rao (2006) also recorded the peak incidence during September to October and also observed a gradual increase from July and declining in leaf webber population during January. Kasar *et al.,* (2017) also observed the above trend. The correlation between leaf webber and weather parameters revealed minimum temperature (0.425**) and rainfall (0.322*) had a significant positive correlation, maximum temperature (0.145^{NS}) and relative humidity (0.175^{NS}) had non-significant positive correlation whereas wind velocity negatively correlated with wind velocity (-0.285*) (Table 2). Kannan and Rao (2006) reported the positive correlation of leaf webber with minimum temperature and relative humidity. The difference in month of peak incidence of leaf webber observed from different states *viz.,* Bharath Babu (2001) reported that February-April as peak incidence months in Odissa, Srivastava *et al.* (1982) recorded October-November in Uttar Pradesh. The difference in the peak activity of leaf webber from the different regions may be because of the weather condition of the particular study area.

Seasonal incidence of mango leaf caterpillar, *B. jacosatrix* (Noctuidae: Lepidoptera)

The initial incidence of mango leaf caterpillar *B. jacosatrix* (Fig.2) (0.2 larvae/twig) recorded from 32nd SMW gradual increase recorded and reached the peak at 50th and 51st SMW (3.3 larvae/twig), the gradual decreasing recorded thereafter and there was no incidence observed from 5th to 31st SMW (Table.1). The infestation of mango leaf caterpillars has coincided with new leaves production in mango orchards. Soumya *et al.* (2017) reported the two peak activities of leaf caterpillar *viz.,* May and November but in the current study location single peak incidence was recorded the difference may be because of weather differences in the specific locations. A significant positive correlation was recorded with rainfall (0.300*) and relative humidity (0.423**) whereas a negative correlation was recorded with maximum temperature (-0.744**), minimum temperature (-0.368**), wind velocity (-0.363*) (Table.2).

Seasonal incidence of mango shoot borer, *C. transversa* (Noctuidae: Lepidoptera)

The incidence of shoot borer *C. transversa* (Fig.3) was observed from 38th SMW and reached the peak (2.6 larvae/ twig) at 51st and 52nd SMW (Table.1). The defoliation caused by larva was observed on tender leaves only. Many earlier findings reported *C. transversa* as a serious pest of the mango nursery (Kushwaha *et al.,* 1964; Bagle and Prasad,1980) and newly emerged flushes on older trees (Kirpal and Shant, 1985). Though the incidence of *C. transversa was* recorded from the 3rd week of September to the 3rd week of January, the peak was during December (1.9–2.6 larvae/twig). This finding is supported by the results of Abraham and Devi (1998). Other workers reported the activity in different months *viz.,* August to December, at Jammu (Kirpal and Shant, 1985), July to October at Rajasthan (Kushwaha *et al.,* 1964) from the above earlier reports could be inferred that the weather parameters of selected locations may play the important roles in incidence. The maximum temperature (-0.735**), minimum temperature (-0.429**), wind velocity (-0.279*) negatively correlated with the incidence of mango shoot borer whereas rainfall (0.191^{NS}) and relative humidity (0.356**) was positively correlated (Table.2).

Seasonal incidence of mango leaf twisting weevil, *A. tranquebaricus*

The fluctuation was observed in the incidence of leaf twisting weevil, *A. tranquebaricus* (Fig.4) the high number of twisted leaves recorded (21.0 to 31.4 twisted leaves/ branch) during 27th to 41st SMW (Table 1). The

Table 2. Correlation of mango defolating insect pests with weather parameters

Weather parameter	Correlation coefficient (r)			
	Leaf webber	Leaf caterpillar	Shoot borer	Leaf twisting weevil
Maximum temperature	0.145^{NS}	-0.744**	-0.735**	0.427**
Minimum temperature	0.425**	-0.368**	-0.429**	0.473**
Rainfall	0.322*	0.300*	0.191^{NS}	0.130^{NS}
Relative humidity	0.175^{NS}	0.423**	0.356**	0.030^{NS}
\ind velocity	-0.285*	-0.363**	-0.279*	-0.218^{NS}

*Significant at 0.05%, ** -Significant at 0.01% level of probability, ^{NS}- Non Significant

Fig.1. Leaf webber, *Orthaga exvinacea*

Fig.2. Leaf caterpillar, *Bombotelia jacosatrix*

Fig.3. Shoot borer, *Chlumetia transversa*

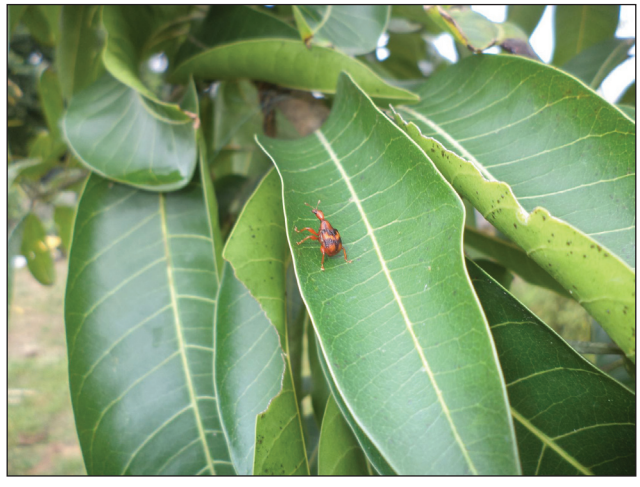

Fig.4.Leaf twisting weevil, *Apoderus tranquebaricus*

leaf twisting weevil positively correlated with maximum temperature (0.427**), minimum temperature (0.473**), rainfall (0.130^{NS}) and relative humidity (0.030^{NS}) whereas negatively correlated with wind velocity (-0.218^{NS}) (Table.2). The leaf damage was recorded almost throughout the year, but the peak was from July to the end of October, this might be due availability of new shoots during the period. The incidence drastically reduced in January and the absence of pest was recorded from January 3rd week to April last week. Similarly, Manjunath and Umamaheshwari (2018) recorded the peak incidence during September and the least incidence during January.

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