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Population Dynamics of Citrus Butterfly, *Papilio demoleus* L. (Lepidoptera: Papilionidae) in Kinnow (*Citrus nobilis* × *Citrus deliciosa*) as Influenced by Abiotic Factors

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A B S T R A C T

The population dynamics studies were carried out in the orchard of CCS HAU, Hisar from April to November during 2016 on kinnow (*Citrus nobilis* × *Citrus deliciosa*). The citrus butterfly is one of the economically important pests whose larval forms cause serious damage by devouring large quantity of foliage of Rutaceae family with special preference towards both wild and cultivated species of citrus during the later stages of their development. Population density was determined on randomly selected five rows (10 plants each row) of kinnow at weekly interval and recorded on the basis of number of larvae per plant. The average larval population and leaf infestation percentage of citrus butterfly, *Papilio demoleus* L. was varied from 0 to 16.01 and 0-56.73/ five replicate in 16th to 47th standard meteorological weeks (SMW). The average temperature varied from 43.1^{0}C- 10.0^{0}C (maximum-minimum) whereas R.H 94-19% (morning-evening) and a rainfall of 2.8-93.5 mm during the experimental period. The peak activity of larval population was in 39th standard metrological week (16.01/ five replicate) when average temperature was minimum (35.0-23.8^{0}C) and relative humidity maximum (90-71%). The lowest average population of caterpillar i.e. 0 larva/5 replicates of kinnow was recorded in 18th, 20th, 21st and 24th to 28th SMW. The larval population of citrus butterfly were shows the significant positive correlation (r =0.556-0.455) with relative humidity (M-E) and significant negative correlation with maximum and minimum temperature (r = -0.544 and 0.254) whereas non-significant correlation with rainfall and sunshine hrs and same trend were follow in case of leaf infestation. The kinnow plants were more infested by *P. demoleus* during rainy season followed by summer. The study may be useful in the formulation of control strategy of this pest.

Introduction

Citrus is the largest cultivated group of fruits in the world, which includes mandarin, sweet orange, limes, lemons, tangerines and grape fruit. In the group of citrus plants, mandarin is the largest cultivated fruit in India and world, whereas sweet orange is the second largest growing species among the group of citrus fruits. Mandarin (*Citrus reticulata* Blanco) belongs to the family Rutaceae and is widely cultivated fruit plant in tropical and subtropical regions. It occupies premier position due to its high vitamin–C and juice content with pleasant aroma and flavour. In India, mandarin is mostly grown in

Maharashtra, Andhra Pradesh, Punjab and Haryana. Citrus is grown in an area of approximately 1055 (000'ha) in India and 19.8 (000'ha) in Haryana with an annual production of 12746 and 235.9 (000'MT) respectively, of fruits in Haryana, whereas, mandarin is grown in area of 429 (000'ha) and production of 4754 (000'MT) in India (Anonymous, 2016). Among the various factor of lower yield in India pest problem is one of the major constraints in the production of citrus.

All over in India, citrus plants are attacked by more than 250 insect pests alone at all stages of growth right from budding and seedlings in nurseries (Bhutani 1979). Out of these, 165 species are important in India causing an estimated loss of 30 per cent in yield (Pruthi and Mani, 1945). Among the various insect pests that attack citrus, the citrus butterfly, *Papilio demoleus* (Linnaeus) is a regular pest of nurseries, young seedlings and flush of full grown up trees. The caterpillars feed voraciously and cause extensive damage to nurseries and young seedlings leaving behind midribs only. Severe infestation results in defoliation of tree (Bhutani and Jotwani, 1975) and retarding plant growth and decreasing fruit yield. Keeping in view its economic importance, the study has been carried out for population dynamics of citrus butterfly, *P. demoleus* on kinnow.

Materials and Methods

The experiment on population dynamics was carried out during 2016 from April to November. This experiment was undertaken on citrus orchard in the Research Area of, Department of Horticulture, CCS HAU, Hisar. Population density was determined on randomly selected five rows (10 plants each row) of Kinnow at weekly interval and recorded on the basis of number of larvae and leaf infestation per plant. Correlation among abiotic factors (*i.e.* temperature, relative humidity, rainfall and sunshine hrs) and larval population were determined.

Results and Discussion

The population density was at the peak during August to October i.e. in rainy season. The maximum larval population and leaf infestation were recorded with an average of 16.01 and 56.73%/ five replicate of kinnow plant in the month of September (39th SMW) followed by 15.67 larvae/ 5 replicates in 40th SMW and minimum was observed in 18th, 20th, 21st and 24th-28th SMW i.e., 0 larvae/5 replicates.

Fig.1 Population of citrus butterfly with abiotic factors

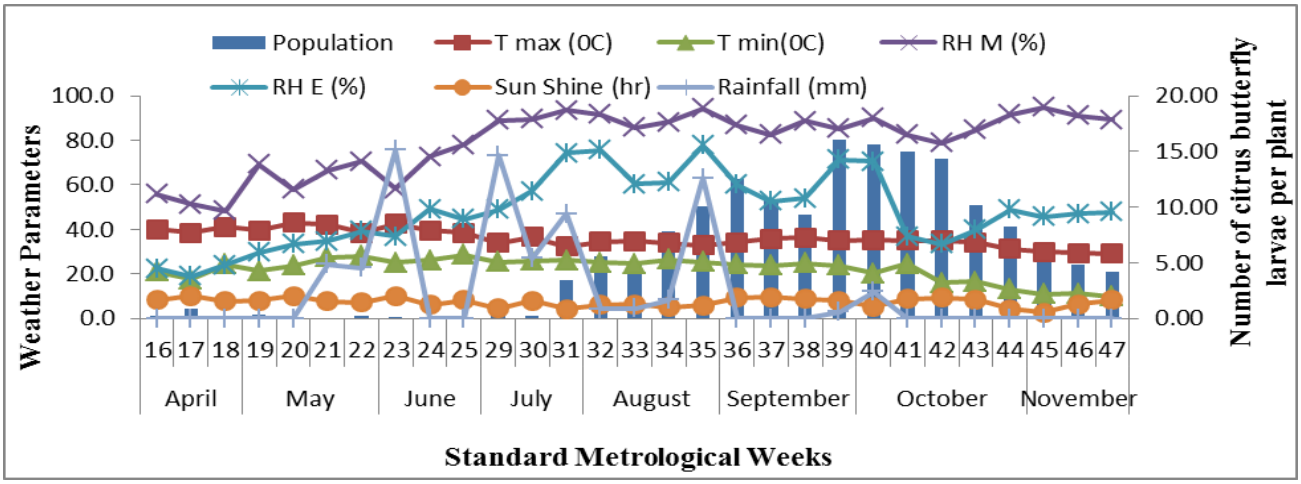

Table.1 Population dynamics of citrus butterfly, *Papilio demoleus* on Kinnow mandarin in 2016

Month	SMW	2016	
		Mean larval population/ plant*	Mean leaf infestation/ plant (%)*
April	16	0.25	3.91
	17	0.85	5.00
	18	0.00	0.00
May	19	0.39	4.54
	20	0.00	0.00
	21	0.00	0.00
	22	0.21	3.65
June	23	0.15	1.89
	24	0.00	0.00
	25	0.00	0.00
July	29	0.63	4.67
	30	0.29	3.75
	31	3.43	9.84
August	32	5.57	17.00
	33	5.16	16.37
	34	7.84	24.56
	35	10.11	32.89
September	36	12.57	43.70
	37	10.69	35.64
	38	9.28	34.00
	39	16.01	56.73
October	40	15.67	54.50
	41	15.00	50.00
	42	14.30	44.10
	43	10.19	32.04
	44	8.23	29.00
November	45	6.00	18.58
	46	4.88	14.06
	47	4.20	14.00

SMW- Standard Meteorological Week, *mean of five replicates and each replication having 10 plants

The population density declined gradually till the end of October. The first appearance of *P. demoleus* was observed 0.25 larvae and 3.91% leaf infestation on 16th SMW when average temperature (maxi.-mini.) was 40-21^{0}C and RH (M-E) varied from 56-23 per cent (Table 1). Correlation coefficient of larval population and leaf infestation with relative humidity (M-E) were found positive (r =0.556-0.455 and 0.536-0.447) which showed that increase in RH (%) then increase the larval population (Figure 1).

The negative correlation was found with temperature (max.-min.) i.e. r = -0.544 to -0.254 and -0.514 to -0.230, respectively.

Whereas negative and non-significant correlation was found with rainfall, and sunshine (hrs) (r= -0.236, -0.019 and -0.227, 0.003), respectively. Almost similar observations were reported by Sunita (2003), Reddy and Kumar (2005), Haldhar, *et al.*, (2010) and Gaikwad *et al.*, (2011) on kinnow which is in conformity with the present studies.

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