Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

Journal of Entomology and Zoology Studies

E-ISSN: 2320-7078
P-ISSN: 2349-6800
www.entomoljournal.com
JEZS 2021; 9(6): 248-252

Received: 01-09-2021
Accepted: 03-10-2021

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Population dynamics of defoliator and sucking pests in black gram

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DOI: https://doi.org/10.22271/j.ento.2021.v9.i6d.8903

Abstract
Population dynamics of black gram defoliators *viz.*, leaf folder, *Omiodes indicata* (Fabricus), striped flea beetle, *Phyllotreta striolata* (Fabricus) and the sucking pest, bean aphids, *Aphis craccivora* (Koch) were studied in the entire crop growth period during *Kharif* 2020 and *Rabi* 2020 - 2021. The results exhibited the high peak of population of defoliator's population at 43rd Standard Week (SW) (91 larvae/ 50 plants) and 14th SW (76 larvae/ 50 plants), 43rd SW (210 beetles/ 50 plants) and 14th SW (197 beetles/ 50 plants) during *Kharif* 2020 and *Rabi* 2020 – 2021, respectively. The sucking pest reached a high peak at 45th SW (325 aphids/ 50 plant) and 16th SW (305 aphids/ 50 plant) during *Kharif* 2020 and *Rabi* 2020 – 2021. Impact of meteorological parameters on the population dynamics of black gram pests were studied and interpreted.

Keywords: population dynamics, defoliator, sucking pests, black gram

Introduction
Pulses are rich in proteins and it is the second important constituent of Indian diet after cereals (Justin *et al*., 2015) [5]. Black gram (*Vigna mungo* L. Hepper) is a short duration crop belonging to the family, Leguminaceae family and one of the most important pulse crop of India, cultivated over an area of 4.53 million hectares and a production of 2.08 million tonnes with a productivity of 459 kg/ ha. In Tamil Nadu, about 317.34 thousand tonnes of black gram were produced from an area of 405.32 thousand hectares with a productivity of 783 kg/ ha. In Puducherry, 290 tonnes of black gram produced from 470 hectares with an average productivity of 612 kg/ ha (INDIASTAT, 2019) [3].
More than 200 insect pests belonging to 48 families from the orders of Lepidoptera, Coleoptera, Thysanoptera, Diptera, Hemiptera, Hymenoptera, Isoptera, Orthoptera and 7 species of mites from the order Acarina were reported to inflict severe damage at different growth stages of black gram in different agro climatic conditions (Naik *et al*., 2019) [7].
These pests appear in different stages of crop growth with various climatic conditions and cause damages. The present investigation was carried out to know the Population dynamics of defoliators and a sucking pest in two seasons on black gram and their relationship with abiotic factors.

Materials and Methods
The population dynamics of defoliators and a sucking pest on black gram in relation to abiotic factors were studied by conducting two field experiments *viz*., field experiment I at Kunnathur, Thirupur, Tamil Nadu during *Kharif* 2020 and field experiment II at the Eastern farm of Pandit Jawaharlal Nehru College of Agriculture and Research Institute (PAJANCOA and RI), Karaikal, U. T. of Puducherry during *Rabi* 2020 - 2021. VBN (Bg) 8 black gram variety was sown in both the seasons with 30 x 10 cm spacing and the crop was raised successfully by adopting recommended agronomic practices as per the crop production guide 2020 of Tamil Nadu Agricultural University. For seasonal incidence, different insect-pests were recorded at weekly interval in ten randomly selected plants and at five different locations from germination to harvest.
The sucking pest was recorded by counting the number of nymphs and adults per leaf during morning hours between 8 and 10 am on randomly selected plants. For defoliators, leaf damage by the larvae was assessed based on the damaged leaves and number of beetle population also

was assessed. In order to find out the specific impact of meteorological parameters on defoliators and sucking pest, the data on sucking pests and larval population recorded in the experimental plot were correlated with maximum and minimum temperature, maximum and minimum relative humidity (RH), and rainfall during *Kharif* 2020 and *Rabi* 2020 – 2021. Weather data were obtained from the meteorological observatory of PAJANCOA and RI, Karaikal, U.T. of Puducherry.

Result and Discussion

The larvae of the leaf folder, *O. indicata* appeared first during 39th SW of September and had the highest peak at 43rd SW of October (91 larvae/ 50 plants) during *Kharif* 2020. During *Rabi* 2020 - 2021, the larval appearance started from 10th SW of March and reached the highest peak at 14th SW of April (76 larvae/ 50 plants). In both the season, larval population declined at reproductive stage at 45th SW of November during *Kharif* 2020 and 16th SW of April during *Rabi* 2020 – 2021 (Table 1 and 2).The correlation study showed a significant positive significance between *O. indicata* and minimum temperature (0.61) and non significant with maximum temperature (0.26). Non significant negative correlation was recorded with maximum (-0.44) and minimum RH (-0.33) and rainfall (-0.02) in *Kharif* 2020. During *Rabi* 2020 – 2021, non significant positive correlation was observed with maximum (0.31) minimum temperature (0.24), maximum RH (0.04), and rainfall (0.06). Non significant negative correlation was recorded with minimum RH (-0.54).The multiple linear regression analysis indicated that all the weather parameters were responsible for significant variation of 59 and 58 per cent on the incidence of larval population of leaf folder during *Kharif* 2020 and *Rabi* 2020 - 2021, respectively (Table 3) (Fig. 1 and 2).

Meena *et al*. (2018) [6] reported the incidence of leaf folder, *O. indicata* on soybean began during the last week of July and continued up to second week of October and peak incidence was observed in the last week of August (12.25 larvae/ 5 plants) in *Kharif* 2015 and in *Kharif* 2016, it began with mid-August and continued up to the second week of October and had the peak incidence during the third week of September (3.75 larvae/ 5 plants) at Udaipur. Jakkaray *et al*. (2020) [4] reported that the larval population of *O. indicata* exhibited positive correlation with maximum temperature, minimum temperature and rainfall, and negative correlation with minimum and maximum RH in *Kharif* 2019. During *Rabi* 2019-2020, positive correlation with maximum temperature, maximum RH, and negative correlation with minimum temperature and the minimum RH and rainfall. These findings are in consonance with the present findings of *Kharif* and *Rabi* season.

The incidence of the striped flea beetle, *P. striolata* appeared first at 39th SW of September and had the highest peak during 43rd SW of October with (210 beetles/ 50 plants) during *Kharif* 2020. During *Rabi* 2020 - 2021, the flea beetle appeared from 10th SW of March and showed the highest peak at 14th SW of April with (197 beetles/ 50 plants). In both the season population of beetle declined and reached its lowest level at crop harvest stage at 48th SW of November 2020 and in 19th SW of May 2021 (Table 1 and 2).The correlation study exhibited non significant positive correlation observed between *P. striolata* and maximum (0.45) and minimum temperature (0.31), minimum RH (0.04) and rainfall (0.31). Non significant negative correlation with maximum RH (-0.17) during *Kharif* 2020. During *Rabi*2020 - 2021, among all the weather parameters non significant positive correlation was observed with maximum (0.57) and minimum temperature (0.50) and rainfall (0.16). Non significant negative correlation was recorded with maximum (-0.15) and minimum RH (-0.47). The multiple linear regression analysis indicated that all the weather parameters had non significant variation of 45 and 47 per cent on beetle population during *Kharif* 2020 and *Rabi* 2020 - 2021, respectively (Table 3) (Fig. 1 and 2).

Prodhan *et al.* (2008) [9] stated high infestation of flea beetle, *P. striolata* was observed in black gram during the Mid-August and September during 2007 at Bangladesh. Hossain *et al*. (2012) [2] stated that highest peak infestation of striped flea beetle, *P. striolata* was observed in the months of February, April and May with a per cent leaf damage of 7.67, 10.33 and 13.60 per cent with different dates of sowing and a high positive correlation with maximum temperature and rainfall in green gram during *Kharif* 2009 at Bangladesh. This result is in consonance with the present findings of *Kharif* and *Rabi* seasonal incidence.

The occurrence of the bean aphids, *A. craccivora* appeared first at 41st SW of October and had its highest peak at 45th SW of November (325 aphids/ 50 plant) during *Kharif* 2020. During *Rabi* 2020 - 2021, population of aphids appeared from the 12th SW of March and reached its highest peak at 16th SW of April with (305 aphids/ 50 plants). In both the seasons, aphid population had a decline at crop harvest at 48th SW of November 2020 and 19th SW of May 2021(Table 1 and 2). The correlation study showed that significant positive correlation observed with maximum temperature (0.69), and non-significant with maximum (0.21) and minimum RH (0.24) and rainfall (0.43). Non-significant negative correlation was observed in minimum temperature (-0.22) during *Kharif* 2020. During *Rabi* 2020 - 2021, significant positive correlation was observed with maximum (0.74) and minimum temperature (0.73) and non-significant with minimum relative humidity (0.21) and rainfall (0.52). Significant negative correlation with maximum relative humidity (-0.62) was recorded. The Multiple linear regression analysis exhibited the significant variation of 82 and 77 per cent on population incidence of aphids with all the weather parameters during *Kharif* 2020 and *Rabi* 2020 - 2021 (Table 3) (Fig. 1 and 2).

Yadav *et al*. (2015) [10] reported that the aphid population in cowpea started from 1stWeek After Sowing (WAS) (41st SW) (October) and the population increased continuously up to 8th WAS (48th SW) (December) with a peak level of (3.4 aphid index/ plant) and the peak activity of aphids was seen from 7th week to 10th WAS (November to December). Parmar *et al*. (2018) [8] reported that incidence of aphid in cowpea started from 2nd week of March (11th SW) and population increased continuously upto the 5th week of April (22nd SW) with a peak level of 3.82 aphid index/ plant at 20th SW, coinciding with peak stage of pod formation and population of aphids exhibited positive correlation with maximum temperature, sunshine hours and RH, and negative correlation with minimum temperature and wind speed in Junagadh during 2016. Gehlot and Prajapat (2021) [1] reported that population of aphid on green gram had positive correlation with minimum and maximum temperature, minimum and maximum RH and negative correlation with rainfall in *Kharif* 2019. These findings are in consonance with the present findings of *Kharif* and *Rabi* season.

Table 1: Population dynamics of defoliator and sucking pests on black gram during *Kharif* 2020

Standard Week (SW)	Leaf folder, *O. indicata*/ 50 plants	Striped flea beetle, *P. striolata*/ 50 plants	Bean aphids, *A. craccivora*/ 50 plants	Temperature (^{0}C)		R.H (%)		Rain Fall (mm.)
Kharif 2020				Max.	Min.	Max.	Min.	
38	0	0	0	30.11	25.11	76.50	48.77	0.00
39	12	28	0	30.14	25.14	89.15	52.51	0.00
40	28	95	0	31.32	24.82	78.43	59.79	2.54
41	40	148	22	30.86	25.54	79.34	59.12	7.11
42	68	205	96	30.68	25.51	80.31	60.22	4.54
43	91	210	151	30.36	25.21	72.28	43.11	0.00
44	61	180	200	35.04	26.11	74.38	47.17	0.00
45	32	161	325	34.68	24.29	89.16	69.18	12.86
46	10	148	244	33.75	23.68	82	55.12	1.06
47	6	129	155	29.5	24.25	86.18	61.12	6.31
48	0	56	89	28.58	22.5	76.36	58.84	1.89

Table 2: Population dynamics of defoliator and sucking pests on black gram during *Rabi* 2020 – 2021

Standard week (SW)	Leaf folder, *O. indicata*/ 50 plants	Striped flea beetle, *P. striolata*/ 50 plants	Bean aphids, *A. craccivora*/ 50 plants	Temperature (^{0}C)		R.H (%)		Rain Fall (mm.)
Rabi 2020 –2021				Max.	Min.	Max.	Min.	
09	0	0	0	31.14	20.16	92.86	57.00	0.00
10	13	22	0	31.87	23.16	89.29	60.43	0.00
11	24	51	0	32.26	22.23	90.57	58.86	0.00
12	38	82	38	32.41	23.00	89.43	60.57	0.00
13	51	148	81	34.77	25.46	90.00	54.00	0.00
14	76	197	183	36.36	25.89	88.43	54.71	0.00
15	48	134	267	34.43	25.40	90.00	61.43	2.30
16	26	98	305	35.27	26.03	86.71	61.00	0.36
17	16	69	252	35.86	26.81	82.57	60.14	0.00
18	10	52	192	35.69	25.96	88.43	60.00	1.36
19	0	41	70	35.77	26.79	87.86	62.29	0.43

Table 3: Correlation and multiple linear regression between meteorological parameters and population of defoliators and sucking pests during *Kharif* 2020 and *Rabi* 2020 – 2021

Insects	Temperature (^{0}C)		RH (%)		Rainfall (mm)
	Max.	Min.	Max.	Min.	
	Kharif 2020				
O. indicata	0.26	0.61*	-0.44	-0.33	-0.02
	$Y=-63.87+1.21X_1+13.02X_2-2.43X_3-1.49X_4+4.30X_5$				
P. striolata	0.45	0.31	-0.17	0.04	0.31
	$Y=65.17+10.49X_1+9.16X_2-5.04X_3-2.34X_4+11.79X_5$				
A. craccivora	0.69*	-0.22	0.21	0.24	0.43
	$Y=1207.87+36.22X_1-69.54X_2+1.72X_3-12.95X_4+23.74X_5$				
Rabi 2020 – 2021					
O. indicata	0.31	0.24	0.04	-0.54	0.06
	$Y=-17.74+1.01X_1+9.00X_2-1.65X_3-1.58X_4+3.77X_5$				
P. striolata	0.57	0.50	-0.15	-0.47	0.16
	$Y=326.18+5.33X_1+7.01X_2-4.58X_3-4.56X_4+11.23X_5$				
A. craccivora	0.74*	0.73*	-0.62*	0.21	0.52
	$Y=1196.35+38.88X_1-65.49X_2+1.59X_3-15.79X_4+25.93X_5$				

* Significance at 5 per cent level

X_1-Maximum temperature (^{0}C) X_2-Minimum temperature (^{0}C) X_3- Maximum Relative Humidity (%) X_4- Minimum Relative Humidity (%) X_5-Rainfall (mm)

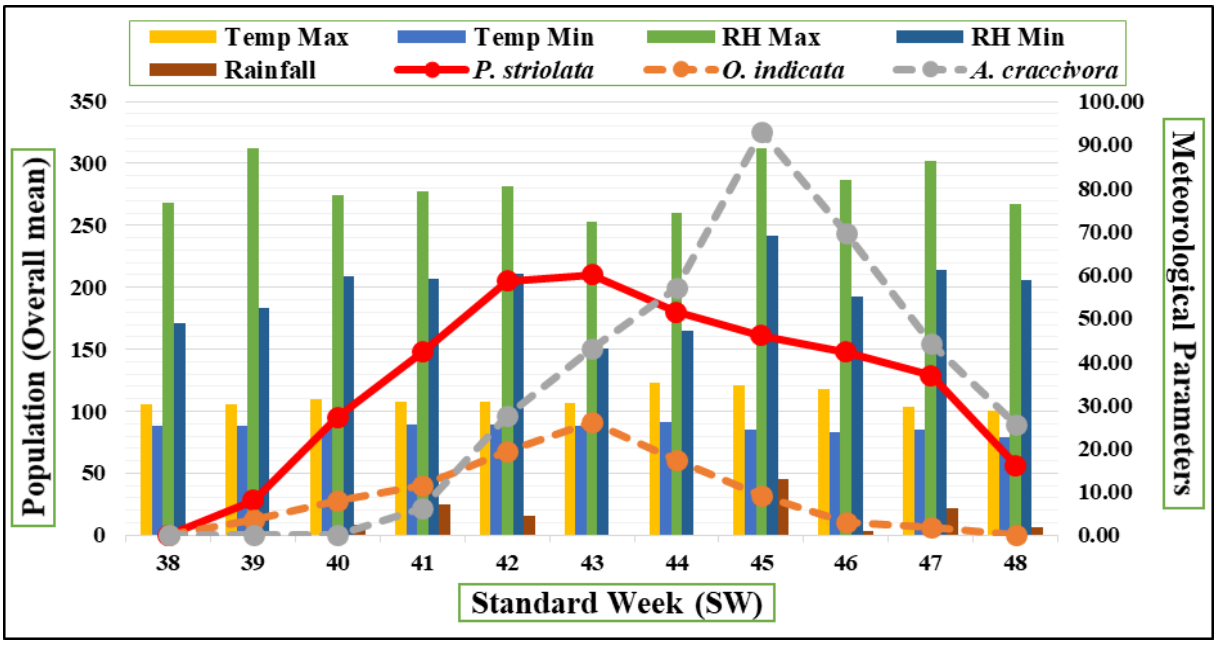

Fig 1: Seasonal incidence of defoliators and sucking pest in black gram during *Kharif* 2020 on the basis of meteorological parameters

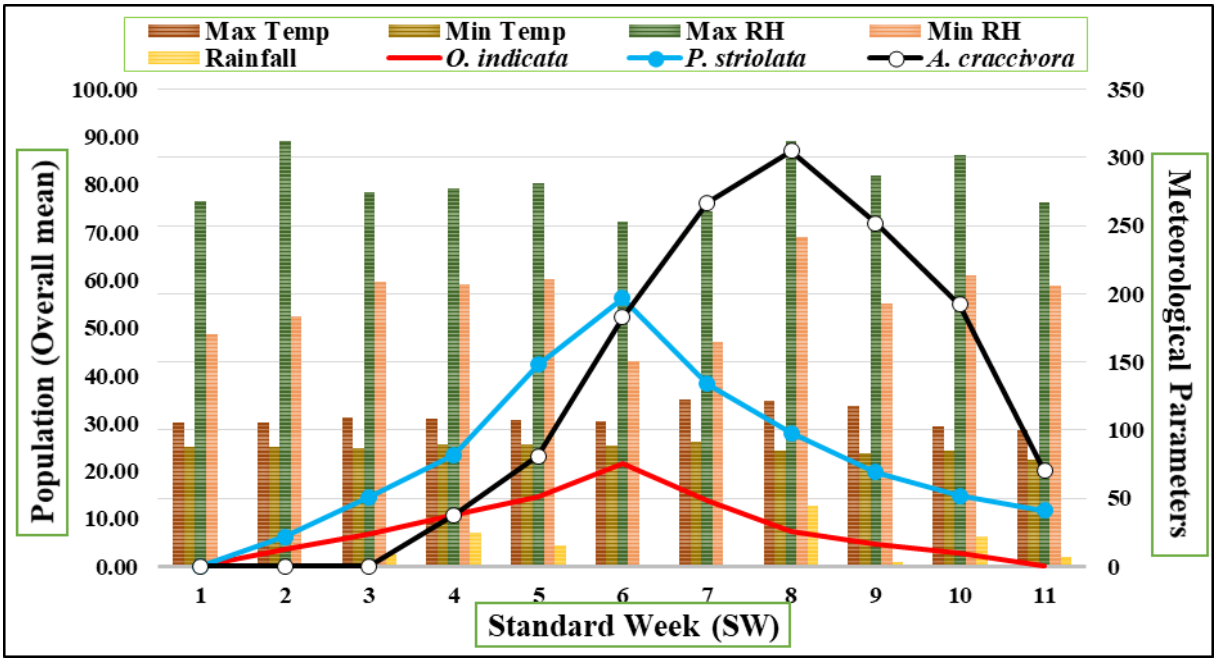

Fig 2: Seasonal incidence of defoliators and sucking pest in black gram during *Rabi* 2020 - 2021 on the basis of meteorological parameters

Acknowledgement

I express my sincere thanks to Dr. P. Saravanane, Associate Professor of Agronomy who had helped me a lot to conduct the field trial in the Eastern farm of the campus.

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