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SEASONAL INCIDENCE OF INSECT PESTS AND PREDATORY FAUNA IN BLACK GRAM

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ABSTRACT

The succession and seasonal incidence of insect pests and predatory fauna in black gram were studied in a field experiment at the Agronomy farm, Anand Agricultural University, Anand during kharif 2019 and 2020. The results revealed nine species of insects (7 pests and 2 predators) from seedling to pod maturity stage. Besides, the peak incidence of whitefly, jassid, flower thrips, tobacco caterpillar, Bihar hairy caterpillar, and spiders were observed during 37th standard meteorological week (SMW); with spotted pod borer and coccinellids, maximum incidence was observed during 38th SMW, and the green stink bug during 35th SMW. Correlation coefficients revealed that tobacco caterpillar had a significant positive correlation with minimum temperature, morning RH and evening vapour pressure; and the incidence of spotted pod borer showed a significant negative correlation with bright sunshine hours and rainfall.

Key words: *Vigna mungo*, whitefly, flower thrips, jassid, tobacco caterpillar, Bihar hairy caterpillar, predators, weather factors, incidence, correlation coefficients

Black gram *Vigna mungo* is an important short duration pulse crop and India is the largest producer (Anonymous, 2020). Its productivity is limited by insect pests (Jat et al. 2017), with losses due to sucking pests, defoliators and pod borers ranging from 25.9-67.8% (Justin et al., 2015). Among the sucking pests, the whitefly, a potential vector of mung bean yellow mosaic virus causes a substantial loss of 30-70% (Duraimurugan and Tyagi, 2014). It is necessary to study the population dynamics of these pests along with their predators as has been done earlier (Prasad et al. 2005; Kumar and Singh, 2016; Mohapatra et al. 2018; Yadav et al. 2020). This study analyses the incidence of pests of black gram under middle Gujarat climatic conditions.

MATERIALS AND METHODS

The field experiment was conducted for two consecutive kharif seasons (2019 and 2020) at the Agronomy Farm, B A College of Agriculture, Anand Agricultural University, Anand. Variety T-9 was selected and sown in an area of 200 m^2 with a spacing of 45 cm row to row and 10 cm plant to plant. For observations on insect pests and predators, the plot was divided into six sectors, with 10 plants/ sector selected randomly. Observations were recorded at weekly intervals starting from one week after germination till crop maturity. All recommended agronomical practices were followed to raise the crop. Observations on the incidence of whitefly *Bemisia tabaci* (Gennadius) and jassid *Empoasca kerri* Singh-Pruthi were recorded from three leaves (upper, middle and lower)/ plant; thrips *Megalurothrips usitatus* Bagnall were counted from 10 flowers/ plant at the flowering stage; green stinkbugs *Nezara viridula* (L) were counted from 10 plants; for tobacco caterpillar *Spodoptera litura* (F) and Bihar hairy caterpillar *Spilarctia obliqua* (Wlk.) larvae/ plant were counted from one week after germination and continued till the removal of crop; and for spotted pod borer *Maruca vitrata* Geyer, it was similar to the above two larvae but was recorded from the initiation of flowering and continued till harvest. Similarly, the predators viz., spiders and coccinellids (grub and adult) i.e., *Coccinella transversalis* F were counted from germination till harvest. Weekly weather data was obtained from the Department of Meteorology, Anand Agricultural University, Anand. The correlation coefficients between the incidence of insect pests/ predators and weather factors were calculated.

RESULTS AND DISCUSSION

Table 1 provides the details of incidence of insect pests and their predators in black gram. These reveal the occurrence of *B. tabaci*, *E. kerri*, *S. litura* and *S. obliqua* at the seedling stage i.e., at 15 days after sowing (DAS); and these continued up to pod maturity; 25

DAS, *N. viridula* was observed from vegetative to pod formation stage, and it was followed by *M. usitatus*, first observed during flowering stage at 35 DAS and remained in the field up to pod formation (60 DAS); *M. vitrata* appeared with flowering stage and remained till pod maturity (80 DAS). The incidence of all these revealed that these can be categorized as major except for *N. viridula*. These observations corroborate with those of Duraimurugan and Tyagi (2014) and Yadav et al. (2015). The incidence of *B tabaci* commenced from 31st standard meteorological week (SMW) and persisted till 41st SMW, with peak (8.05 whitefly/ leaf) being during 37th SMW. Sneha et al. (2016), Singh et al. (2017) and Duraimurugan and Tyagi (2014) observed its peak incidence during 37th SMW. Correlation coefficient of its incidence with weather factors revealed that evapotranspiration (r= -0.587*) showed significant negative correlation while, bright sunshine (r= -0.371), rainfall (r= -0.221), wind speed (r= -0.174) and maximum temperature (r= -0.365) showed negative correlation; minimum temperature (r= 0.559), morning RH (r= 0.538), evening RH (r= 0.478), morning VP (r=0.333) and evening VP (r= 0.565) showed positive correlation. These results are corroborated by Singh and Kumar (2011), Patidar (2015) and Yadav et al. (2015).

The activity of *E. kerri* commenced from 32nd SMW and continued till 41st SMW, with a peak population of 7.76 jassids/ leaf during 37th SMW. Sneha et al. (2016) and Sarode et al. (2003) also observed similar incidence. Correlation coefficients of its incidence with weather factors revealed that evapotranspiration (r= -0.492), rainfall (r= -0.334), wind speed (r= -0.287) and maximum temperature (r= -0.222) showed negative relationship; however, bright sun shine (r= 0.247), minimum temperature (r= 0.510), morning RH (r= 0.445), evening RH (r= 0.359), morning VP (r= 0.264) and evening VP (r= 0.479) showed a positive one. These results agree with those of Kundu et al. (2021), and are contrary with those of Mohapatra et al. (2018). Thrips incidence was observed from 35th SMW to 40th SMW, with a peak of (9.31 thrips/ flower) during 37th SMW. These results are in accordance with Kumar and Singh (2016) and Sujatha and Bharpoda (2017). Correlation coefficients showed that evapotranspiration (r= -0.435), bright sun shine (r= -0.142), rainfall (r= -0.494), wind speed (r= -0.434) and maximum temperature (r= -0.059) showed negative relationship with its incidence; and minimum temperature (r= 0.437), morning RH (r= 0.333), evening RH (r= 0.247), morning VP (r=0.216) and evening VP (r= 0.400) showed a positive one. Kumar and Singh (2016) also noticed that morning and evening RH showed a non-significant positive correlation; while Sujatha and Bharpoda (2017) observed that rainfall and wind speed were negatively associated, and minimum temperature positively correlated. The incidence of *N. viridula* commenced from 32nd SMW and through 40th SMW, with peak being at 35th SMW, agreeing with the results of Sujatha and Bharpoda (2017). Correlation coefficients revealed that evapotranspiration (r= -0.451), bright sun shine (r= -0.322), rainfall (r= -0.119), wind speed (r= -0.049) and maximum temperature (r= -0.411) showed negative association; while minimum temperature (r= 0.494), morning RH (r= 0.570), evening RH (r= 0.462), morning VP (r=0.322) and evening VP (r= 0.525) showed a positive one. Sujatha and Bharpoda (2017) concluded that minimum temperature, morning VP and evening VP had a positive relationship.

The initial incidence of tobacco caterpillar started from 31st SMW and remained till 40th SMW which ranged from 0.77 to 0.66 larvae/ plant (Table 1). The activity considerably increased from 32nd SMW with peak (4.58 larvae/ plant) during 37th SMW. Yadav et al. (2015) and Kumar et al. (2007) reported that its incidence occurred 2 weeks after germination and attained peak during the 6th week after germination. Sneha et al. (2016) also reported a peak incidence during 38th SMW in black gram. The correlation coefficient between incidence and weather factors indicate that evapotranspiration (r= -0.651*) had significant negative association. In contrast, minimum temperature (r= 0.585*), morning RH (r= 0.619*) and evening VP (r= 0.56*) had a significant positive correlation Kurly and Singh (2021) observed that leaf-eating caterpillar showed a significant positive correlation with minimum temperature and rainfall had a negative and non-significant impact. Mohapatra et al. (2018) reported that the *S. litura* population is positively correlated with temperature and RH.

With *S. obliqua* activity was first noticed from 31st SMW and persisted till 41st SMW and increased from 33rd SMW and attained a peak (11.67 larvae/ plant) in 37th SMW. The present finding is in agreement with that of Sujayanand et al. (2019) on pigeonpea at Uttar Pradesh. The present findings are in agreement with Mohapatra et al. (2018); Patel et al. (2020) and Sujatha and Bharpoda (2017). Correlation coefficients revealed that evapotranspiration (r= -0.518), bright sun shine (r= -0.333), rainfall (r= -0.240), wind speed (r= -0.211) and maximum temperature (r= -0.280) showed negative correlation; while minimum temperature (r= 0.512), morning RH (r= 0.478), evening RH (r= 0.438),

morning VP (r=0.300) and evening VP (r= 0.525) showed positive correlation Kurly and Singh (2021) and Berani et al. (2017) observed a positive correlation with minimum temperature and morning and evening RH but a negative correlation with rainfall.

The incidence of spotted pod borer commenced from 35th SMW and sustained up to 41st SMW, with peak population of during 38th SMW. Patel and Borad (2016) and Sneha et al. (2016) reported its peak activity during 37th and 38th SMW.

Correlation coefficients revealed that bright sun shine (r= -0.695*) and rainfall (r= -0.666*) showed a significant negative correlation. Sneha et al. (2016) reported that evening RH and rainfall are negatively associated. Sravani et al. (2015) observed that the pest showed a positive association with both maximum and minimum temperature.

The activity of coccinellids commenced during 33rd SMW and remained up to 40th SMW (Table 1), with a peak observed during 38th SMW. Yadav et al. (2015) and Sujatha and Bharpoda (2017) reported that the peak occurence was during the 37th SMW. Correlation indicated that evapotranspiration (r= -0.339), bright sun shine (r= -0.236), rainfall (r= -0.221), wind speed (r= -0.309) had negative association whereas maximum temperature (r= -0.507), minimum temperature (r= 0.489), morning RH (r= 0.454) and evening RH (r= 0.299), morning VP (r=0.545) and evening VP (r= 0.571) had positive association. These findings are in close proximity with those of Sravani et al. (2015) on RH.

Similarly, the activity of spiders commenced during 33rd SMW with a peak during 37th SMW. Swathi et al. (2018) reported a peak in black gram during the

Table 1. Population dynamics of insect pests and their predators in black gram (kharif, 2019, 2020)

SMW	Incidence of insect pests							No. of predators/ plant	
	Whitefly/ leaf	Jassid/ leaf	Flower thrips/ flower	Green stink bug/ plant	Leaf eating caterpillar larvae/ plant	Bihar hairy caterpillar larvae/ plant	Spotted pod borer larvae/ plant	Coccinellids (grub + adult)	Spider
30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
31	0.91	1.33	0.00	0.00	0.77	1.02	0.00	0.00	0.00
32	2.72	2.45	0.00	0.13	1.93	2.80	0.00	0.16	0.03
33	3.71	3.11	0.00	0.26	2.57	5.00	0.00	0.23	0.13
34	4.57	3.67	2.69	0.29	3.80	6.10	0.92	0.37	0.21
35	5.69	4.88	6.15	0.51	4.05	9.76	3.14	0.46	0.13
36	7.40	7.59	9.01	0.33	4.58	10.54	4.00	0.52	0.22
37	7.43	7.76	9.31	0.38	4.02	10.91	6.10	0.60	0.21
38	6.29	6.09	7.23	0.27	3.02	8.84	4.28	0.56	0.19
39	4.21	4.37	5.25	0.17	2.60	3.38	4.24	0.26	0.12
40	1.34	2.82	1.31	0.05	0.66	1.26	3.80	0.07	0.04
41	0.00	0.00	0.00	0.00	0.00	0.97	1.03	0.00	0.00

Correlation coefficients

Weather parameters	Whitefly	Jassid	Flower thrips	Green stink bug	Leaf eating caterpillar	Bihar hairy caterpillar	Spotted pod borer	Predators	
								Coccinellids (grub and adult)	Spider
Evapotranspiration, mm (EP)	-0.587*	-0.492	-0.435	-0.451	-0.651*	-0.518	0.264	-0.339	-0.340
Bright Sunshine, h/ day (BSS)	-0.371	0.247	-0.142	-0.322	-0.445	-0.333	-0.695*	-0.236	-0.131
Rainfall, mm (RF)	-0.221	-0.334	-0.494	-0.119	-0.117	-0.240	-0.666*	-0.221	-0.148
Wind Speed, km/ h (WS)	-0.174	-0.287	-0.434	-0.049	-0.002	-0.211	0.274	-0.309	-0.435
Maximum Temperature, °C (MaxT)	-0.365	-0.222	-0.059	-0.411	-0.512	-0.280	0.104	0.507	0.443
Minimum Temperature, °C (MinT)	0.559	0.510	0.437	0.494	0.585*	0.512	0.019	0.489	0.466
Morning Relative Humidity, % (RH1)	0.538	0.445	0.333	0.570	0.619*	0.478	-0.138	0.454	0.461
Evening relative humidity, % (RH2)	0.478	0.359	0.247	0.462	0.549	0.438	-0.113	0.299	0.260
Morning vapour pressure, mm in Hg (VP1)	0.333	0.264	0.216	0.322	0.381	0.300	0.044	0.545	0.483
Evening vapour pressure, mm in Hg (VP2)	0.565	0.479	0.400	0.525	0.596*	0.525	0.123	0.571	0.482

* Significant at p=0.05; SMW= Standard Meteorological week

50th SMW. Correlation coefficients indicated that evapotranspiration (r= -0.340), bright sun shine (r= -0.131), rainfall (r= -0.148), wind speed (r= -0.435) showed negative correlation whereas maximum temperature (r= 0.443), minimum temperature (r= 0.466), morning RH (r= 0.461) and evening RH (r= 0.260), morning VP (r= 0.483) and evening VP (r= 0.482) had positive association. These findings are in agreement with those of Bharathimeena et al. (2008).

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AUTHOR CONTRIBUTION STATEMENT

All authors equally contributed.

CONFLICT OF INTEREST

No conflict of interest.

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