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To study the population dynamics of major insect pests in black gram (*Vigna mungo* L. Hepper) in relation to weather parameter

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Abstract
The study of population dynamics of insect pest in blackgram was carried out during *kharif*- 2022 at research farm of Agriculture research station Badnapur. The crop grown on 100m² area. The crop was kept untreated till harvest. To record activities of major insect pest as well as their natural enemies. Weekly observation were recorded since from vegetative growth to till harvest the data generated was correleted with weather parameters using appropriate statistical analysis i.e. Pearson method.

Keywords: Black gram, screening, sucking pest, pod borer, defoliator

Introduction

Black gram *Vigna mungo* L. is the fourth most important pulse crop of India. It is leguminous crop of Asia and is commonly called as uradbean. Popularity of this pulse is mainly because of its superior nutritional quality and the crop can be grown in multiple cropping systems like mixed crop and intercrop apart from sole cropping due to its short duration. The pest complex caused avoidablelosseson various varieties of Urdbean ranging from 15.62 to 30.96% with an average of 24.03%. Among all the sucking pest white fly is a vector of Mungbam yellow mosaic virus (MYMV) only one can damaged up to 30 t 70%. Thus studies on, insect-pests attack during different stages of crop growth and their correlation with weather parameters provides significant information which could be further utilized for predicting the damage caused by the insects and to develop the forecast models which aids in development of pest management strategy. Therefore, keeping above facts in the view, present study was carried out in Kharif season to know the population dynamics of important insect-pests and their natural enemies and their relationship with weather parameters.

Materials and Methods

The research experiment was conducted at College of Agriculture, Badnapur during kharif -2023 in non-replicated data. The Local variety was sown in a100 m^2 area. The experiment was conducted under natural field conditions without application of insecticide and weedicide. Spacing between two rows 30cm and between two plants is 10 cm. To record the activities of natural enemies in blackgram ecosystem in relation to weather parameter. The population of natural enemies (lady bird beetle, chrysoperla carnea, predatory bug etc.) was recorded from ten randomly selected plants at weekly interval from seedling to harvest and population presented as per plant.

Results and Discussion

Seasonal incidence of major insect pest of black gram were recorded since from vegetative growth during 29th to 36th SMW inception of pest observed first in 31st SMW. The population of aphid recorded in the range of 7.7 to 9.0 aphid/ trifoliate leaves. The gradual increase was noticed from 31 SMW to 32 SMW and it was reached to peak in 33 SMW i.e. 9.0 aphid/trifoliate leaves. The fall in the

population was seen thereafter. The results of the present study correspond with earlier research carried out by Salunkhe, J. S. (2003) [11], The aphid population was observed in cowpea and it was raised at a rapid rate up until the last week of October. The activities of whiteflies noticed from 31st to 36th SMW though the population of whiteflies 1.3 to 2.0 / trifoliate leaves. It was reached to its peak in 33rd SMW (2.0/trifoliate leaves) and decline thereafter. According to earlier research by Kumar *et al*., (2004) [3], the highest whitefly populations on mungbeans and urdbeans occurred in the first two weeks of May and the second two weeks of September in the *Zaid* and *Kharif* crops, respectively. Mahendra and Bhairwa (2019) [6]. It was reported that the whitefly population on green gram it was peaked in the first week of September after being initially identified in the first week of August (32nd SMW).The results of the present study correspond with earlier research carried out by Jyotsana *et al.*,(2022) [2] Whitefly adult, *Bemisia tabaci* population was recorded on black gram by cage method initiating from 30th SMW to 39th SMW. Peak population of whitefly in both varieties, i.e., MH 479 (35.9 adults/cage) and UH 1 (47.6 adult/cage) was recorded in 31st SMW and it ranged from 12.9 (MH 479) to 47.6 adult/cage (UH 1). Whitefly infestation started at vegetative stage (30th SMW) and continued till harvesting of crop (39th SMW). Slight decrease (32nd, 33rd, 36th and 39th SMW) and increase (34th, 35th and 37th SMW) in whitefly population was observed in MH 479, while similar trend was observed for UH 1 except increasing trend in 36th SMW. The same trend was seen in the occurrence of thrips first it was recorded in the 31 SMW (1.2/ trifoliate leaves) gradual little increases was seen till 34 SMW (3.6/ trifoliate leaves) then after the population of thrips was decline. The results of the present study correspond with earlier research carried out by Kumawat *et al.,* (2019) [12], who reported that the thrips infestation occurred in the fourth week of August (35th SMW) with a mean population of 3.87 thrips/flower. The population slowly increased and reached its peak in the second week of September (37th SMW), with a mean of 5.20 thrips/ flower. The leafhopper population was noticed in 31st SMW (1.2 /trifoliate leaves) gradually increase was seen till 33rd SMW (1.8/ trifoliate leaves) the fall in the population seen thereafter. The present study supported by findings Jyotsana *et al.*,(2022) [2]. It was reported that Population of leafhopper nymphs, *Empoasca kerri* was observed in blackgram and it was almost negligible (0.1 nymph/3 leaves) in both the varieties during in 37th. The activities of *H. Armigera* was noticed in 32nd SMW (0.7 larvae/plant). It was reached to its peak in 36th SMW (1.4 larvae/plant) then after the population of *H. armigera* was declined. The present study supported by findings of Umbarkar *et al*., (2010) [13]. He was discovered that the gram pod borer, *H. armigera* population began to appear at the crops pod-formation stage with a population density of 0.34 larvae per plant during the 31st SMW. The pest population quickly increased during the 36th SMW reaching a peak density of 3.42 larvae/plants. The present study supported by findings Choudhary *et al*., (2020) [1] showed that in gram pod borer the population gradually increased and reached on its population was 1.2 larvae/ 5 plants and 1.4 larvae/ five plants, respectively in 36th SMW The same trend was seen in the occurrence of *M. vitrata* first it was recorded in SMW 31st (0.7 larvae/plant) it was gradually increase up to SMW 35th (1.2 larvae/plant) the fall in the larval population seen thereafter.

The present study supported by findings Umbarkar *et al*., (2010) [13] recorded that the population of spotted pod borer, *M. vitrata* started occurred at pod formation stage of the green gram with average population 0.75 larvae per plant during 32nd SMW. and the larval population peak in succeeding week, was 3.81 larva/ plants in 34th SMW. The present study supported by findings of Jyotsana *et al.*,(2022) [2] He reported that the Spotted pod borer, *M. vitrata* commenced during 36th SMW (0.10 larvae/plant) in both genotypes of blackgram and continued till 38th and 39th SMW in MH 479 and UH 1, respectively. However, peak was observed in 36th (0.1 larvae/plant) in MH 479, while in 37th and 38th SMW (0.25 larvae/plant) in UH 1. The defoliator green semi looper observed during 31st SMW (2.4 larvae/plant) and little increases was seen till 33rd SMW .after that the population was declined but it was present till 36th SMW. The present study supported by findings Shanti and Singh (2018) [4]. The pest marked its first appearance in 29th SMW with number of 1.05 and 1.28 larvae/10 plants in the year 2016 and 2017 respectively the peak population was noticed (3.90 larvae/10 plants) on 33rd SMW in 2016 whereas it was maximum (4.26 larvae/10 plants) on 32nd SMW in the year 2017. The present study supported by findings of Jyotsana *et al.* (2022) [2] Semilooper larval population was 0.05 larvae per plant in both varieties of blackgram and was recorded during 32nd, 37th SMW.

Table 1: Population dynamics of major insect pests in blackgram

SMW	Sucking pests				Pod borer		Defoliator	Natural enemies	Weather parameter				
	Aphids\ trifoliate leaves	Whitefly\ trifoliate leaves	Thrips\ trifoliate leaves	Leafhopper\ trifoliate leaves	*H. armigera*	*M. vitrata*	Green Semilooper	LLB	Temperature (c)		Rainfall (mm)	RH (%)	
									Max	Min.		Morn.	Eve.
29	0	0	0	0	0	0	0	0	28	22	34.5	91	80
30	0	0	0	0	0	0	0	0	27.5	22	37.4	95	91
31	7.7	1.3	1.2	1.2	0	0	2.4	0.7	31	24	125.5	90.5	81
32	7.3	1.4	2.0	1.4	0.7	0.7	2.8	1.4	27	22.5	18.5	89	90
33	9.0	2.0	2.8	1.8	0.8	1.0	3.5	2.7	24.3	22.5	9.0	88	82.2
34	5.2	1.4	3.6	1.3	1.1	1.0	3.0	2.2	27.5	22	-	91	83
35	5.1	1.5	1.7	1.5	1.3	1.2	2.9	1.7	31	23.5	38.0	87	84
36	5.2	1.6	2.4	1.5	1.4	0.9	2.8	1.9	28	23	120.5	92	92

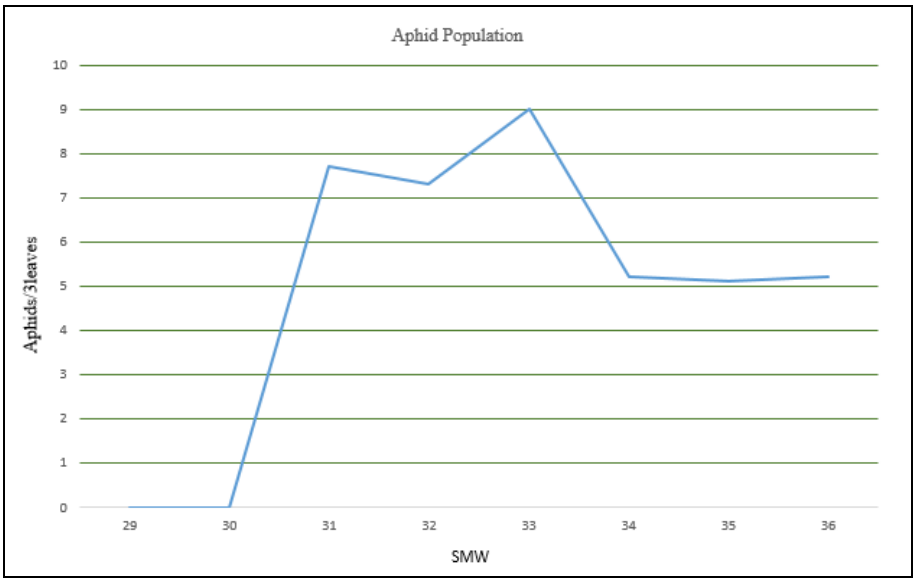

Fig 1: Population dynamics of aphid on blackgram

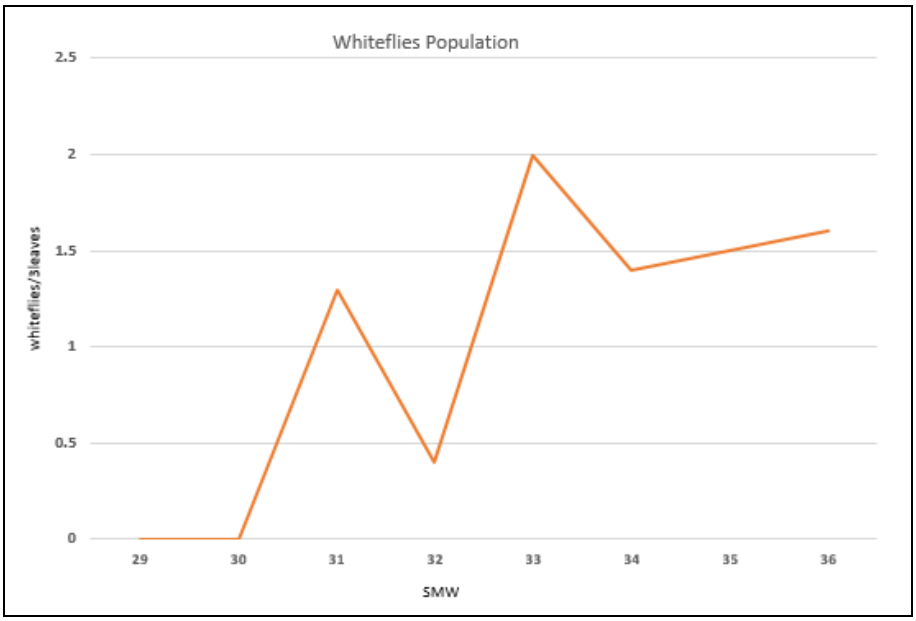

Fig 2: Population dynamics of whiteflies on blackgram

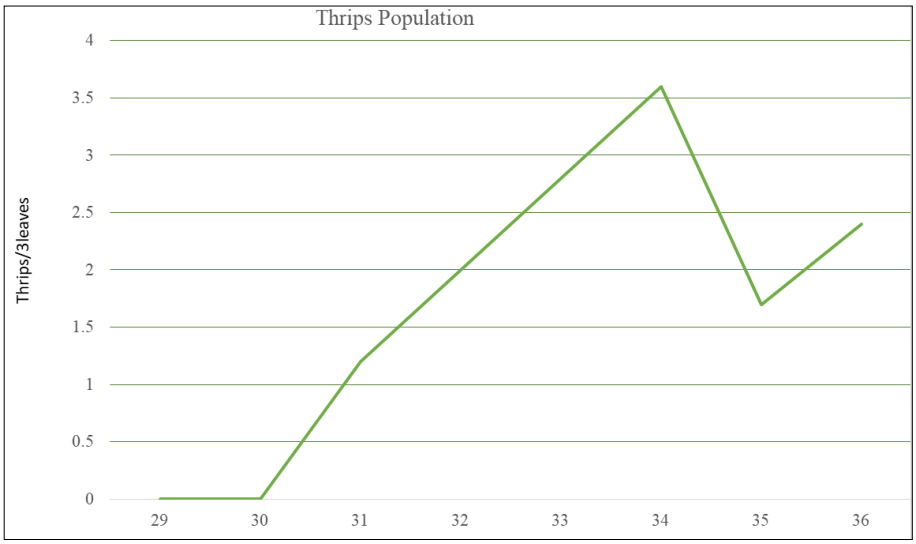

Fig 3: Population dynamics of thrips on blackgram

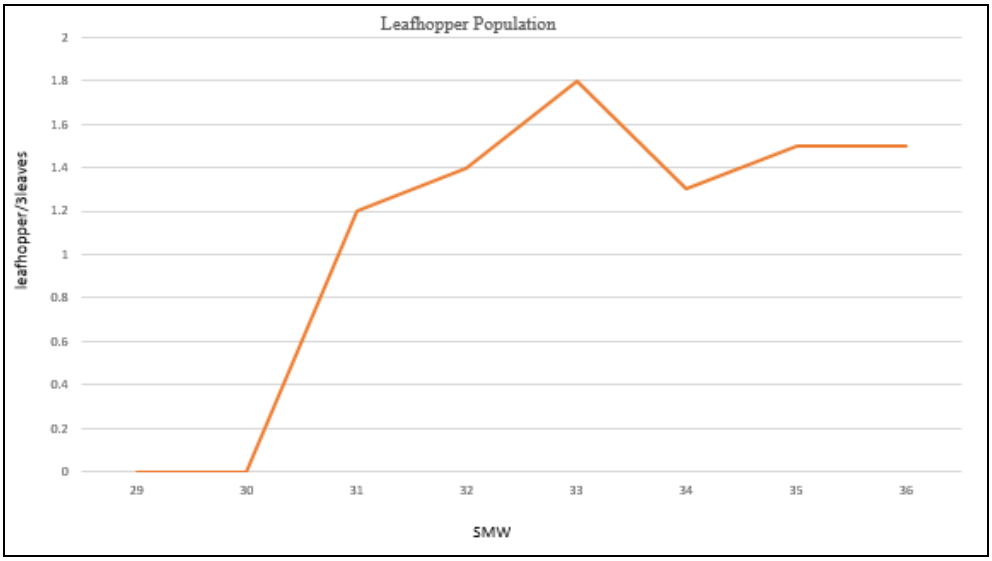

Fig 4: Population dynamics of leafhopper on blackgram

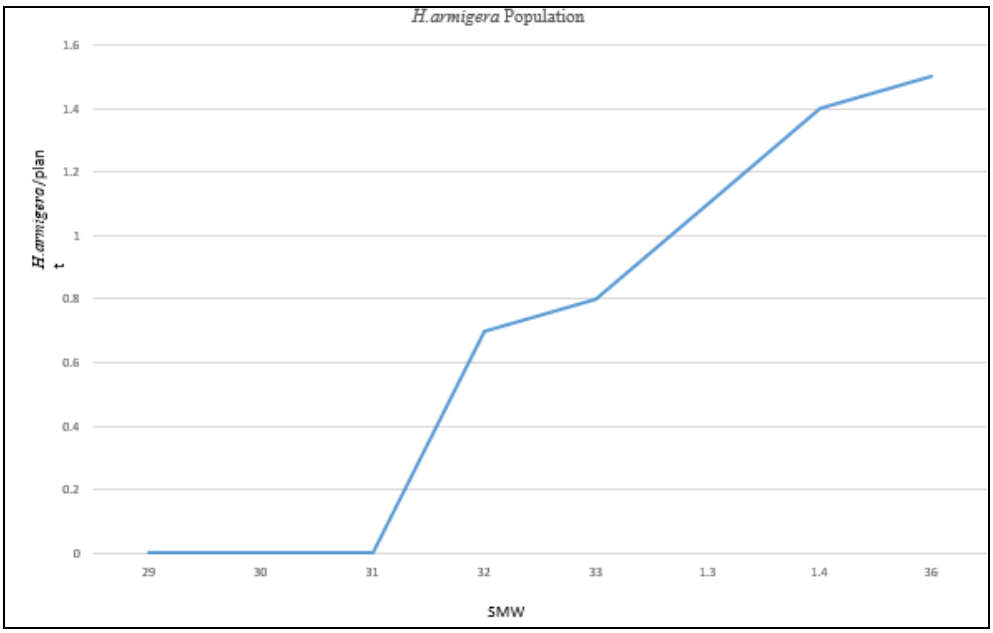

Fig 5: Population dynamics of *H. armigera* on blackgram

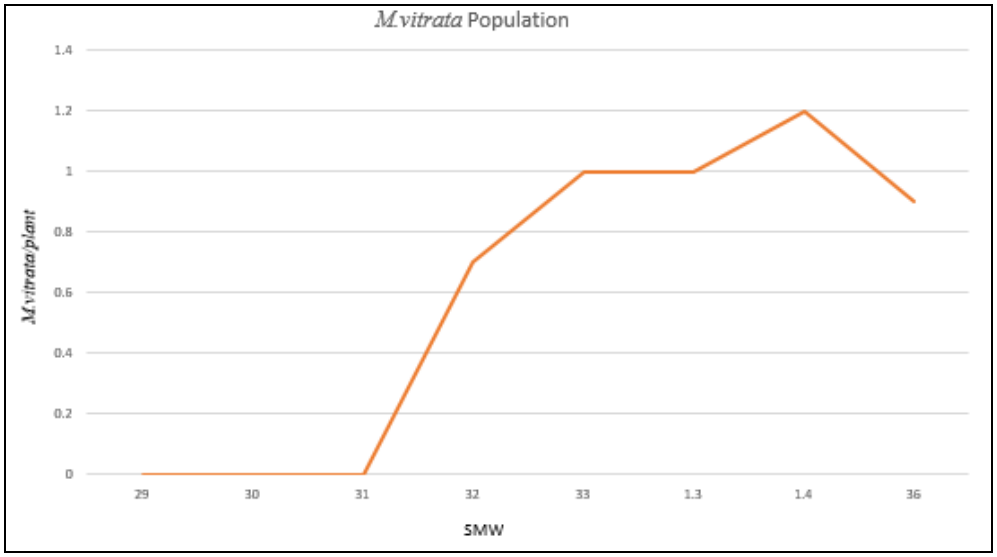

Fig 6: Population dynamics of *M. vitrata* on blackgram

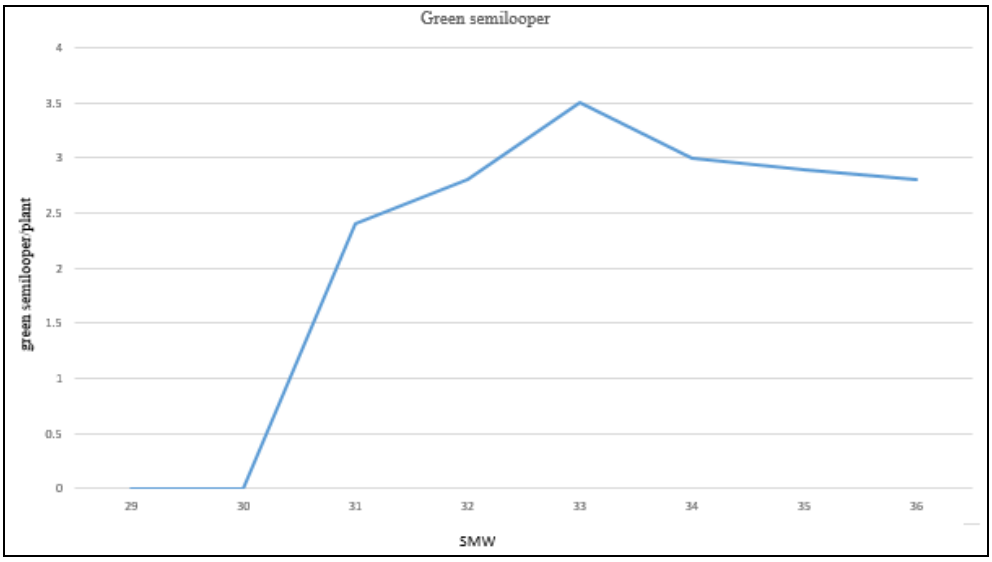

Fig 7: Population dynamics of Green semilooper on blackgram

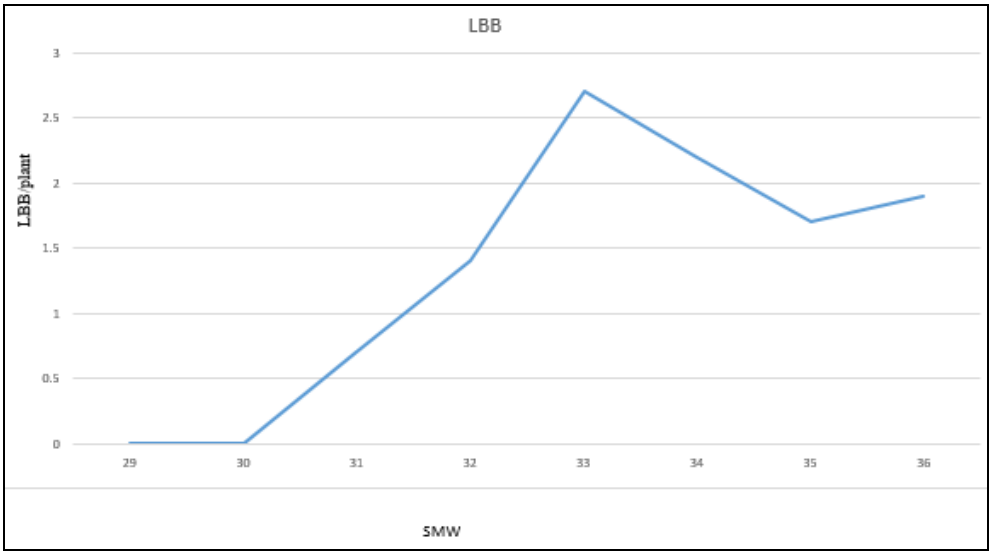

Fig 8: Population dynamics of LBB on blackgram

Table 2: Correlation coefficient between Aphid of blackgram with weather parameters.

Correlation coefficient					
Name of pest	Temperature		Humidity		Rainfall
	Max	Min	Morn	eve	
Aphid	-0.112^{NS}	0.157^{NS}	-0.721*	-0.452^{NS}	0.187^{NS}

** significant at 1%, * significant at 5%.

Table No 2 finding concluded that the population of aphid was correlated with weather parameter temperature minimum (r =0.157) and rainfall (r = 0.187) had positive impact on aphid population but it was non-significant. Whereas temperature maximum (r = - 0.112) and relative humidity evening (r = - 0.45s2) had negative impact on aphid population and non-significant. The relative humidity at morning (r = -0.721) was helpful significantly for the suppression of the aphid population.

Kumar *et al*., (2018) [4] The present study supported by findings of the correlation matrix showed a significant positive correlation between maximum temperature (r =0.535) and aphid infestation. However, there was a significant negative correlation with average relative humidity (r =-0.820) and total rainfall (r =-0.513), while non-significant negatively correlated with minimum temperature (r = -0.386). Findings of present investigation are in conformity with earlier work carried out by Sharma *et al.* (2019) [6] observed that the aphid population showed negative significant correlation with rainfall.

Table 3: Correlation coefficient between whiteflies of blackgram with weather parameters.

Correlation coefficient					
Name of pest	Temperature		Humidity		Rainfall
	Max	Min	Morning	evening	
White fly	-0.115^{NS}	0.106^{NS}	-0.731*	-0.398^{NS}	0.166^{NS}

**Significant at 1%, *significant at 5%.

The data presented in table 3 was related to correlation coefficient between weather parameters. The population of whitefly indicated that the Tmax (r = -0.115) and relative humidity (r = -0.398) had negative impact on white fly it was statistically non-significant. Tmin (r = 0.106) and rainfall (r = 0.166) had positive impact i.e. Congenial for the growth of whitefly but it was statistically non-significant. The relative humidity at morning (r = -0.731) showed negative impact on white fly population and it was statistically significant.

Findings of present investigation are in conformity with earlier work carried out Kumar *et al*. (2018) [4] showed that the significant negative correlations were exhibited between mean population of whitefly and rainfall (r =-0.85, r =-0.65 and r =0.76) whereas non-significant positive correlation between mean population of whitefly.

Findings of present investigation are in conformity with earlier work carried out Jyotsana *et al.*, (2022) [2] Significant and negative correlation of *B. tabaci* adult population was found with rainfall (r = -0.682*). Whereas it showed non-significant and negative correlation with minimum temperature, relative humidity (morning and evening) and wind speed, while positive and non-significant correlation was observed with maximum temperature and sunshine hours.

Table 4: Correlation coefficient between Thrips of blackgram s with weather parameters.

Name of pest	Correlation coefficient				
	Temperature		Humidity		Rainfall
	Max	Min	Morning	Evening	
Thrips	-0.257^{NS}	-0.152^{NS}	-0.578^{NS}	-0.355^{NS}	-0.040^{NS}

**significant at 1%, *significant at 5%.

The data included in table 4. revealed that population of thrips correlated with weather parameter. Tmax (r = -0.257), Tmin (r = - 0.152) and relative humidity morning (r = -0.578) and relative humidity at evening (r = -0.355) and rainfall (r = -0.040) had negatively impact on the population of trips and it was non-significant.

According to research by Vijayalakshmi *et al*., (2017) [14], the thrips population correlated negatively with morning and evening RH and positively correleted with maximum and minimum rainfall and sunshine hours, respectively.

The results of the current analysis are parallel with earlier work done by Sarkar *et al*. (2019) [10] Whitefly, *Bemisia tabaci*, and thrips, *Scirtothrips dorsalis* population demonstrated positive correlations with weather conditions, including maximum temperature. While the thrips were unaffected by the rain, the whiteflies' activity helped by it.

Table 5: Correlation coefficient between leafhopper of blackgram with weather parameters.

Name of pest	Correlation coefficient				
	Temperature		Humidity		Rainfall
	Max	Min	Morning	Evening	
Leafhopper	-0.086^{NS}	0.114^{NS}	-0.745*	-0.384^{NS}	0.163^{NS}

** significant at 1%, * significant at 5%.

The data given in table 5 indicated that the correlation coefficient of leafhopper population with weather parameter. The Tmax (r = -0.086) relative humidity at evening (r = -0.384) had negative impact on leafhopper population but no significant. Relative humidity at morning (r = -0.745) showed significant negative impact. The Tmin (r = 0.114) and rainfall (r = 0.163) it was Congenial to growth of leafhopper population but statistically non-significant.

Findings of present investigation are in conformity with earlier work carried out by Jyotsana *et al.*, (2022) [2] All the weather parameters showed non-significant correlation with *E. kerri* nymphs. Leafhopper nymph showed positive and non-significant correlation with maximum temperature. while negative and non-significant with minimum temperature, relative humidity (morning and evening), and rainfall.

Table 6: Correlation coefficient between green semilooper of blackgram with weather parameters

Name of pest	Correlation coefficient				
	Temperature		Humidity		Rainfall
	Max	Min	Morning	Evening	
Green semilooper	-0.091^{NS}	0.078^{NS}	-0.736*	-0.410^{NS}	0.121^{NS}

**significant at 1%, *significant at 5%.

Table 6 content exhibit the positively non-significant correlation between Tmin (r =0.078) and rainfall (r =0.121) while relative humidity at morning (r = -0.736) showed negative impact but statistically significant. But Tmax (r = -0.091) and relative humidity at evening (r= -0.410) had negative impact on green semi looper and it was non-significant.

The current study's findings corroborate previous research by Jyotsana *et al.* (2022) [2] larvae showed negative and non-significant correlation with relative humidity (morning and evening), wind speed and rainfall, while positive and non-significant association with temperature (Max. and Min.).

Table 7: Correlation coefficient between *H. armigera* of blackgram with weather parameters.

Name of pest	Correlation coefficient				
	Temperature		Humidity		Rainfall
	Max	Min	Morning	Evening	
H. armigera	-0.063^{NS}	-0.056^{NS}	-0.565^{NS}	-0.124^{NS}	0.038^{NS}

**significant at 1%, *significant at 5%.

Table 7 presented that the larval population of *H. armigera* and there correlation with weather parameter. The Tmax (r = - 0.063), Tmin (r = -0.056), relative humidity at morning (r = -0.565) RH evening (r = -0.124) had negative impact but non-significant. Whereas the rainfall (r = 0.038) was congenial to growth of *H. armigera* but it was non-significant.

Findings of present investigation are in conformity with earlier work carried out by Umbarkar *et al*., (2010) [13] observed that the rainfall and larval population showed positive correlation coefficient but it was non-significant.

The current study's findings corroborate previous research by Umbarkar *et al*., (2010) [13] showed that among the weather parameters, minimum temperature (r= -0.557) and evening relative humidity (r =-0.583) exhibited highly significant negative correlation with the gram pod borer population, rest of the weather parameters were non significantly correlated with the pest population.

Table 8: Correlation coefficient between *M. vitrata* of blackgram with weather parameters.

Correlation coefficient					
Name of pest	Temperature		Humidity		Rainfall
	Max	Min	Morning	Evening	
M. vitrata	-0.170^{NS}	-0.102^{NS}	-0.687*	-0.246^{NS}	-0.135^{NS}

**significant at 1%, *significant at 5%.

Table no 8 revealed that correlation between *M. vitrata* and it's relation to weather parameter the relative humidity at morning (r = -0.687) had negative impact on *M. vitrata* but it was significant. Tmax (r = -0.170), Tmin (r = -0.102) RH evening r = -0.246) and rainfall (r = -0.135) had adversely effect on growth of *M. vitrata* and statistically non-significant.

Findings of present investigation are in conformity with earlier work carried out by Pal *et al*., (2021) [9] recorded that the population of spotted pod borer showed positive significant correlation with relative humidity (r = 0.71). The population of *M. vitrata* showed non-significant correlation with minimum temperature, and rainfall at 5 percent level of significance.

The current study's findings corroborate previous research by Jyotsana *et al.*, (2022) [2] Larval population of *M. vitrata* showed correlation was non-significant positive (maximum temperature, morning relative humidity and sunshine) and negative (minimum temperature, evening relative humidity and rainfall) for other factors.

To record the activities of natural enemies in blackgram ecosystem in relation to weather parameter

The study of population dynamics of insect pest in blackgram was carried out during *kharif* 2022 at research farm of Agriculture research station Badnapur. The crop grown on 100m² area. The crop was kept untreated till harvest recorded activities of major insect pest as well as their natural enemies weekly observation were recorded since from vegetative growth to till harvest the data generated was correlation with weather parameter using appropriate statistical analysis that is Pearson method.

The natural enemies activities were recorded with the occurrence of sucking pest.ie ladybird beetle was noticed during SMW 31 (0.7/ plant) and it was at its peak in SMW 33rd (2.7/plant) The he peak of ladybird beetle coincided with the highest population of aphid, thrips, whiteflies, leafhopper as well as the pod borer.

The present study correspond with earlier research carried out by Jyotsana *et al.* (2022) [2]. Data collected regarding the population dynamics of natural enemies indicated that coccinellids was the major natural enemies during the period of study (Fig. 8). Population of coccinellids commenced in 30th SMW and remained till 39th SMW. Peak population of coccinellids (0.25 adult/plant) was recorded during 31st SMW (MH 479), 31st and 33rd SMW (UH 1).However, population ranged between 0.05 to 0.25 adults per plant in both varieties.

Table 9: Correlation coefficient between ladybird beetle of blackgram gram with weather parameters.

Correlation coefficient					
Name of natural enemies	Temperature		Humidity		Rainfall
	Max	Min	Morning	Evening	
LBB	-0.309^{NS}	-0.103^{NS}	-0.670*	-0.356^{NS}	-0.054^{NS}

**significant at 1%, *significant at 5%.

Tabular feature of the table 9 disclosed that the Tmax (r = -0.309), Tmin (r = -0.103), Rainfall (r = -0.054) RH at evening (r = -0.356) had adversely effect on the growth of the LBB and statistically non-significant. Whereas the RH at morning (r = -0.0670) had significant impact on population of LBB but it was negative.

The present findings corroborate previous research by Muhammad *et al*., (2016) [8] revealed that syrphids and *chrysoperla* had a significant positive correlation with *A. gossypii* and *T. orichalcea*, respectively. Likewise, spiders and lady beetles had significant positive relationship with *B. tabaci*, *N. inconspicuous* and *Empoasca spp.* Furthermore, temperature had a significant positive correlation with *B. tabaci*, *N. inconspicuous* and *Empoasca* spp., suggested increased in temperature also increased their population.

The results of the present study correspond with earlier research carried out by Jyotsana *et al.*,(2022) [2] Coccinellid population showed positive and non-significant correlation with temperature (minimum and maximum), evening relative humidity, wind speed and sunshine, while positive and non-significant with morning relative humidity and rainfall.

Conclusion

Population dynamics of sucking pests and their correlation with weather parameters from 29th to 36th SMW, Aphid, white fly, leaf hopper, green semilooper, *M. vatrata* and LBB had negative significant correlation with relative humidity at morning.

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