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Research Article

EFFECT OF ABIOTIC FACTORS ON THE INCIDENCE OF MAJOR INSECT PESTS OF BLACKGRAM [*Vigna mungo* L. HEPPER]

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Abstract- Field experiments were conducted during *Kharif* season of 2013 and 2014. The pest population was recorded in blackgram field, aphids, jassid, whitefly, thrips and blister beetle and aphid population attained peak in the 1st week of September during 2013 and 2nd week of September during 2014; the jassids and white fly remained active throughout the growing stage and attained the peak in the 4th week of August and last week of August during both years; thrips infestation reached its peak in the last week of August; the blister beetle population reached its peak in the 1st week of September in 2013 and last week of August in 2014. The infestation of pods was maximum in the 2nd week of September during both the years. The mean density and relative density values were the maximum for aphid during 2013 and 2014. Abiotic factors like temperature, relative humidity, extent and distribution of rainfall, influenced the infestation and stabilization of various insect pests in blackgram.

Keywords- Abiotic factors, Mean density, Relative density, Blackgram, Pests

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Introduction

Pulses, the food legumes, have been grown by farmers since millennia providing nutritionally balanced food to the people of India [1] and many other countries in the world. The major pulse crops that have been domesticated and are under cultivation include chickpea, cowpea, greengram, blackgram, pigeonpea, faba bean, grass bean, horse gram, lablab bean, lentil, moth bean and pea. The total area and production in India under blackgram were 31 lakh hectares and 14 lakh tons, respectively, with the productivity of 451.61 kg/ hectares [2]; whereas, in Rajasthan total area and production under blackgram was 2.98 lakh hectares and 1.12 lakh tons with the productivity of 413.79 kg/ha [3]. The low productivity of blackgram both at national and state level is attributed to abiotic and biotic stresses. Among biotic stresses, insect pests often cause a serious threat to blackgram production by increasing cost of cultivation and impairing quality of the produce in many ways. The major insect pests of blackgram are aphids, *Aphis craccivora* Koch; jassids, *Empoasca kerri* Pruthi; white flies, *Bemisia tabaci* Gennadius, thrips belonging to genus *Megalurothrips* and *Caliothrips indicus* Bagnall; the plant bugs, *Riptortus pedestris* Fabricius, *Nezara viridula* L., *Plautia fimbriata* Fabricius and the pod bug, *Clavigralla gibbosa* Spinola, spotted pod borer, *Maruca vitrata* Geyer and field bean pod borer, *Adisura atkinsoni* Moore [4]. The present research undertaken to study their effects of weather parameters like temperature, relative humidity, extent and distribution of rainfall, etc. influenced the infestation and stabilization of various insect pests in blackgram. Therefore, attempts were made to find out the relationships between pests population and the climatological factors.

Materials and methods

The experiment was carried out during *Kharif* season of 2013 and 2014 in blackgram variety PU-31. The experimental site is situated at Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur. Weekly meterological data were obtained from the Meteorology Unit at the Instructional farm of the College. All the normal agronomic practices were followed for raising the crop. The experiment was replicated thrice in a randomized block design. The observation on sucking pests visual counting method was used to record the population of jassids, aphids, thrips and whiteflies on 5 randomly selected plants in each replicate. The total number of adults and nymphs of jassids, thrips and whiteflies were counted on the entire tagged plants; whereas, the aphids were counted from 5cm floral twigs. Aspirator was used to collect necessary sample insects for further identification. A hand-held magnifying lens (6 X) with LED illumination was used to count the insects in the field. The population of blister beetle was observed by visual count for 2 minutes during 9-11 a.m. from 5 plants per replication, selected at random; whereas, the incidence of pod borer complex was recorded in terms of mean pod damage by counting the total number of pods and the number of damaged pods at each picking per replicate. The data collected on various aspects were subjected to the statistical analysis. The population density of major insect pests of blackgram was recorded from plots of 25 sq. m size with three replications. Observations were recorded by random sampling using the sight count technique for estimating the population of insect pests. To quantify their abundance on blackgram plants the mean density and relative density values for the insect pests were estimated; besides, the diversity indices were computed.

Results and Discussion

The quantitative abundance of insect pests infesting blackgram revealed that aphids, *Aphis craccivora* (Koch); jassids, *Empoasca kerri* (Pruthi); white flies, *Bemisia tabaci* (Gennadius); thrips, *Megalurothrips sp.;* and blister beetle, *Mylabris pustulata* (Thunberg) were recorded under the prevailing agro-climatic conditions

Table-1 *Influence of abiotic factors on the incidence of major insect pests of blackgram during kharif, 2013*

S.M.W	Date and month	Abiotic factors			Mean population per five plants					
		Mean Atmospheric Temp (°C)	Mean R.H. (%)	Total Rainfall (mm)	Aphids	Jassids	White flies	Thrips	Blister beetle	Pod damage (%)/picking
31	July 30-Aug 5	26.10	84.90	63.60	---	5.33	3.00	---	---	---
32	Aug 6- Aug 12	26.55	82.10	85.20	---	13.33	7.67	---	---	---
33	Aug 13- Aug 19	26.80	81.80	25.60	5.00	16.67	9.67	6.00	---	---
34	Aug 20 – Aug 26	26.35	75.50	16.80	11.67	28.67	13.00	13.33	5.67	---
35	Aug 27-Sept 2	26.20	71.10	0.00	26.00	23.00	16.00	20.00	8.00	---
36	Sept 3-Sept 9	25.10	63.50	0.00	42.33	17.67	9.00	13.67	10.33	13.67
37	Sept 10- Sept 16	23.90	65.50	51.20	21.67	8.00	4.33	9.00	4.00	20.33
38	Sept 17- Sept 23	27.10	70.30	17.20	11.33	0.00	1.67	0.00	0.00	8.67
Seasonal mean [Mean Density (%)]					19.66 (23.70)	14.08 (21.46)	8.04 (10.72)	10.33 (16.50)	5.60 (9.30)	-
Relative Density (%)					30.65	29.26	16.71	16.10	7.27	-
Coefficient of correlation (r_1) between Mean Atmosphere Temperature and pest population					-0.58	0.39	0.11	0.11	0.32	-0.95
Coefficient of correlation (r_2) between Mean Relative Humidity and pest population					-0.82*	-0.20	-0.06	-0.35	-0.32	-0.88
Coefficient of correlation (r_3) between Total Rainfall and pest population					-0.43	-0.69	-0.49	-0.71	-0.88	0.63

* - Significant at 5% level of significance

Figure in parentheses are mean density (%) values

Table-2 *Influence of abiotic factors on the incidence of major insect pests of blackgram during kharif, 2014*

S.M.W	Date and month	Abiotic factors			Mean population per five plants					
		Mean Atmospheric Temp (°C)	Mean R.H. (%)	Total Rainfall (mm)	Aphids	Jassids	White flies	Thrips	Blister beetle	Pod damage (%)/picking
31	July 30-Aug 5	27.00	83.60	109.00	---	3.00	2.00	---	---	---
32	Aug 6- Aug 12	25.80	81.30	47.20	---	4.33	5.67	---	---	---
33	Aug 13- Aug 19	26.60	72.70	0.20	6.00	16.00	9. 33	6.67	---	---
34	Aug 20 – Aug 26	28.10	76.40	40.80	14.00	24.67	12.67	14.67	8.00	---
35	Aug 27-Sept 2	27.40	77.40	31.60	28.00	17.67	15.00	19.33	11.67	---
36	Sept 3-Sept 9	25.90	82.70	165.20	11.67	11.00	7.33	6.67	9.33	11.67
37	Sept 10- Sept 16	25.10	87.60	94.80	37.33	7.33	4.33	2.67	4.33	18.00
38	Sept 17- Sept 23	26.20	68.10	0.00	16.00	0.00	2.00	0.00	0.00	6.67
Seasonal mean Mean Density (%)					18.83 (25.11)	10.50 (16.00)	7.00 (9.72)	8.33 (13.34)	6.67 (11.11)	-
Relative Density (%)					34.31	25.51	14.88	15.18	10.12	-
Coefficient of correlation (r_1) between Mean Atmosphere Temperature and pest population					-0.34	0.69	0.62	0.86	0.59	-0.77
Coefficient of correlation (r_2) between Mean Relative Humidity and pest population					0.60	-0.72	-0.11	-0.51	-0.74	0.91
Coefficient of correlation (r_3) between Total Rainfall and pest population					-0.18	-0.47	-0.19	-0.43	-0.22	0.57

Figure in parentheses are mean density (%) values

of the region. Aphid infestation began in the 3rd week of August (33rd SMW) during both years with the peak in the 1st week of September (36th SMW) during 2013 and 2nd week of September (37th SMW) during 2014. From the observations taken during both years it could be noted that the aphid population was 1.13 times more in 2013 as compared to that during 2014, possibly because of the increase in total rainfall and enhanced relative humidity during 2014. The aphid population decreased due to more total rainfall (94.80mm) and relative humidity (87.60 per cent) at peak in the 37th SMW during 2014. The population of jassid commenced in the 1st week of August (31st SMW) during both years and remained active throughout the growing stage and reached to its peak in the 4th week of August (34th SMW) during both years. From the observations taken during both years it could be noted that the jassid population was 1.16 times more in 2013 as compared to that during 2014, possibly because of the increase in mean atmospheric temperature in 2014. Whitefly infestation began in the 1st week of August (31st SMW) during both years with the peak in the last week of August (35th SMW) during both years. It could be noted that the whitefly population was 1.07 times more in 2013 as compared to that during 2014. The thrips infestation initiated in the 3rd week of August (33rd SMW) and reached to its highest level in the last week of August (35th SMW) during both years. From the observations taken during both years it could be noted that the thrip population was 1.03 times more in 2013 as compared to that during 2014. The incidence of blister beetle in blackgram initiated in the 4th week of August (34th SMW) during both the years. The population increased gradually and reached to its peak in the 1st week of September (36th SMW) during 2013 and last week of August (35th SMW) during 2014. The blister beetle population was 1.12 times more in 2014 as compared to that during 2013. The infestation by pod borers began in the first week of September (36th SMW) and reached to its maximum in the 2nd week of September (37th SMW) during both years. From the observations taken during both years it could be noted that the infestation was 1.13 times more in 2013 as compared to that during 2014. These findings are in general agreement with those of Jain *et al.* (2013), Duraimurugan and Tyagi (2014), Singh and Singh (2014), Kumar and Kumar (2015) and Yadav *et al.* (2015) [5-9].

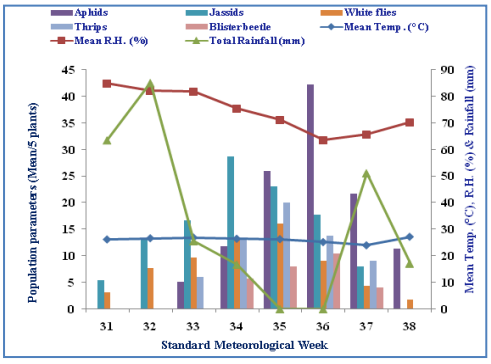

Fig-1 Influence of abiotic factors on the incidence of major insect pests of blackgram during *kharif* 2013

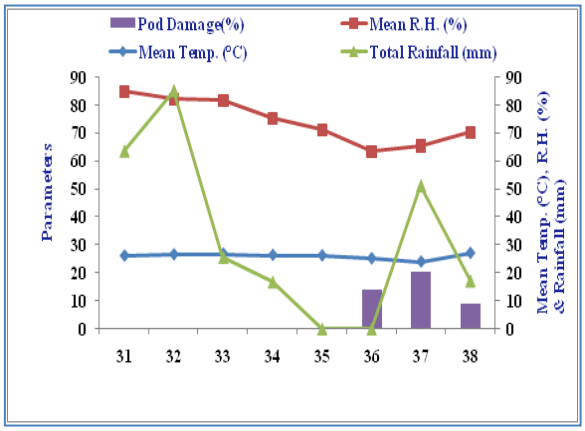

Fig-2 Infestation of pods by pod borers in blackgram during *kharif* 2013

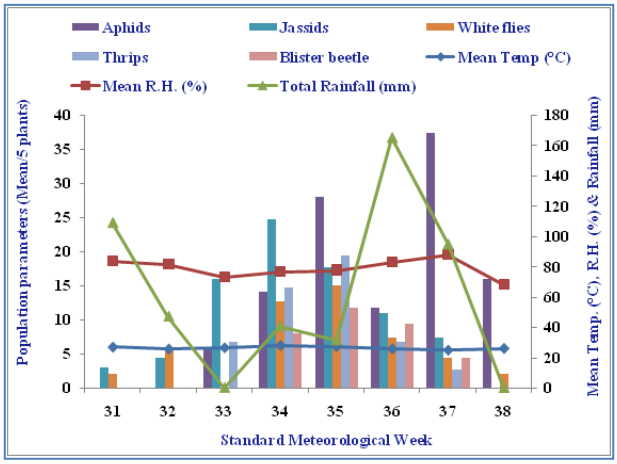

Fig-3 Influence of abiotic factors on the incidence of major insect pests of blackgram during *kharif* 2014

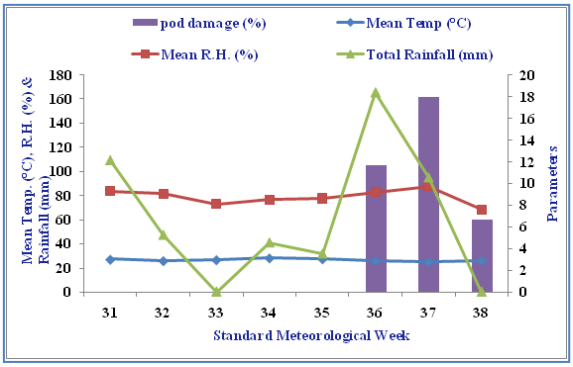

Fig-4 Infestation of pods by pod borers in blackgram during *kharif* 2014

Analyzing the pest population individually, it was observed that during both years the mean density values were the maximum for aphids and was followed by that for jassids and thrips. During the year 2013, comparing the abundance of major insect pests the relative density of aphid was relatively more followed by that for jassid and whitefly; whereas, during 2014 the maximum relative density was recorded for aphids followed by that for jassids and thrips. The Shannon Diversity Indices (1.51 and 1.52) were almost the same during the two years of study.

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Abbreviations
SMW = *Standard Meteorological Week*, ha = hectare, ^{0}C = Degree Celsius, sq. m= Square meter, LED =light-emitting diode
Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.

Conflict of Interest: None declared

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