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POPULATION DYNAMICS OF MAJOR INSECT PESTS OF BLACKGRAM

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ABSTRACT

A field trial was laid out to study the population dynamics of major sap sucking insect pests of blackgram when cultivated sole and when niger was intercropped as a barrier crop against blister beetles at the Instructional Farm, Rajasthan College of Agriculture, MPUAT, Udaipur during *kharif* 2012. The sucking pests began infesting the crop from the first week of August, 2012 and their numerical abundance peaked during September with 16.50 jassids per plant in sole blackgram and 17.25 jassids per plant when blackgram was farmscaped with niger; in a respective manner the numbers of whiteflies per plant were 26.50 and 24.75 on blackgram sole and blackgram with niger; 19.65 and 19.05 thrips per plant in blackgram sole and blackgram with niger and likewise, 43.50 and 37.0 aphids per plant, respectively during the last week of September, 2012. The maximum mean population of blister beetle was 2.75 per plant in the sole crop of blackgram and 2.50 per plant in blackgram with niger. The pod borer (*Maruca vitrata*) infestation was in traces. The mean density values were the maximum for aphids on blackgram during the crop season cultivated either sole or with niger as barrier crop for blister beetles. Among the abiotic factors of the environment onlyrelative humidity showed a significant positive correlation with the jassid population when blackgram was cultivated sole (+ 0.80) and with niger (+ 0.62).

Key words: jassids, whiteflies, aphids, blackgram, population dynamics

INTRODUCTION

Food legumes have been grown by farmers since millennia providing nutritionally balanced food to the people of India (Nene, 2006) and many other countries in the world. Pulses occupy a unique position in agriculture economy of our nation being the major source of proteins. The major pulse crops that have been domesticated and are under cultivation include blackgram, chickpea, cowpea, greengram, pigeon pea, faba bean, grass bean, horse gram, lablab bean, lentil, moth bean, pea and pigeon pea. The area covered under pulses in our country in 15.35 per cent of the total cropped area. Rajasthan, M.P, Haryana, Orissa, Maharashtra, and U.P, account for 83.77 per cent of total area under pulses. Pulses production in India in *kharif* season was 16.39 million tonnes as per data from 2011–2012; however, an estimated 32 million tonnes would be required by 2030 due to the increasing population (ICAR Vision, 2030).

MATERIALS AND METHODS

The investigation on, "*Population dynamics of major insect pests of blackgram*" was conducted at the Agronomy Farm, Rajasthan College of Agriculture, MPUAT, Udaipur during *kharif*, 2012. Blackgram, variety T–9 was sown in the field on July 11, 2012 in plots of size 5m x 3m. The row to row spacing was maintained at 30cm and plant to plant spacing was at 10cm. The meteorological data for different weather conditions prevailing during the period of experimentation were obtained from Meteorological Observatory, Agronomy Farm, Rajasthan College of Agriculture, MPUAT, Udaipur.

Sampling Techniques

Populations of different insect pests were recorded at weekly intervals from August first week onwards till crop maturity. Observations were recorded during early morning hours from 6 to 8 a.m., when most insects were less active. Appropriate sampling techniques adopted for estimating the population of different insect pests are given below:

(i) Sucking insect pest complex (Jassids, aphids, thrips and white flies): Visual counting method was used to record the population of jassids, aphids, thrips and white flies 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 (6x) with LED illumination was used to count the insects in the field.

(ii) Blister beetles: Population of blister beetles was observed by visual count for 2 minutes during 9–11 a.m. from 5 plants per replication, selected at random. The blister beetles were in significant numbers from the last week of August to end of September.

(iii) Pod borer: Pod borer infestation was recorded by counting the number of damaged and healthy pods per plant taken from 5 randomly selected plants. The observations were taken at each picking and then pooled for analysis; in all, three pickings could be taken.

Statistical Analysis

(i) Influence of abiotic factors of environment on pest populations: Observations on the prevailing abiotic conditions of the atmosphere will be recorded weekly from the Meteorological Observatory at the Agronomy Farm to work out the correlation coefficient between the pest/ natural enemy populations and the abiotic factors of the environment using standard statistical formulae (Fowler, *et al*., 1998).

(ii) Estimation of Mean and Relative Density :

$$\text{Mean density} = \frac{\sum Xi}{N} \times 100$$

Where

Xi = No of insects or natural enemies in i^{th} sample

N = Total numbers of plants sampled

Relative density (RD)

$$RD\% = \frac{\text{Number of individual of one species}}{\text{Total number of individual of all species}} \times 100$$

RESULTS AND DISCUSSION

The major insect pests recorded during August to September, 2012 were jassids, aphids, whiteflies and thrips among the sap sucking insect pests; while, among the flower feeding insects, blister beetle was the major menace whereas the pod borer infestation was in traces.

Infestation of sap sucking insect pests: Observations recorded from blackgram that was either left untreated with free access to natural insect pest infestation or farmscaped with niger as a barrier crop for blister beetles, wherein no pesticide applications were made (Tables 1 and 2), indicated a significant infestation by jassids, whiteflies, thrips and aphids that began from 2nd week of August, 2012 (*i.e*., 28 days after sowing). The initial mean population of jassids was 11.25 per plant in blackgram sole and 10.0 per plant when blackgram was farmscaped with niger. The mean population at peak period of infestation for jassids on the sole crop of blackgram was 16.50 per plant and 17.25 per plant when blackgram was grown with niger (mid–September, 2012). Likewise, whiteflies had a mean population of 6.25 per plant in unprotected blackgram sole and 2.25 per plant in blackgram with niger as barrier crop. The maximum mean population of whiteflies was 26.50 per plant on blackgram sole and 24.75 per plant on blackgram cultivated with niger during the first week of September, 2012. The appearance of thrips also became significant on blackgram from 2nd week of August with a mean population of 5.25 per plant in unprotected blackgram and 4.95 per plant in the blackgram with niger treatment. The peak mean population of thrips of 19.65 per plant was recorded during first week of September in sole unprotected crop of blackgram and almost the same with 19.05 per plant in blackgram with niger. The initial mean population of aphids was of 5.50 per plant in unprotected crops and 7.75 per plant in blackgram with niger. The peak mean population of aphids happened to be 43.50 per plant and 37.0 per plant, respectively during the last week of September. A comparison made for the reduction in pest numbers due to intercropping with niger indicated 13.48, 10.58, 9.65 and 6.76 per cent reduction in the seasonal mean population of whiteflies, aphids, jassids and thrips, respectively. Probably, incessant rains especially during the later part of the monsoon season (September) caused a natural reduction in the aphid population and the associated coccinellids. Among the abiotic factors of the environment only relative humidity showed a significant positive correlation with the jassid population when blackgram was cultivated sole (+ 0.80) and with niger (+ 0.62).

Blister beetle infestation: Blister beetles started infesting blackgram buds and flowers from the first week of September onwards with initial mean population of 1.75 per plant in unprotected blackgram and 1.25 per plant in blackgram protected with niger as a physical barrier for blister beetles. The maximum mean population of blister beetle was 2.75 per plant in unprotected crop and 2.50 per plant when blackgram had niger. The difference in the numerical abundance of blister beetle on sole blackgram and blackgram with niger was only marginal.

Pod borer infestation: The pod borer (*Maruca vitrata*) infestation was in traces and the maximum mean population recorded was 1.75 per plant in sole blackgram and 1.50 per plant in blackgram with niger. In the plots treated with insecticides at vegetative stage or reproductive stage or both, pod borer incidence was not noticed.

From the recent literature it can be noted that in field studies the major insect pests recorded on greengram (*Vigna radiata*) and blackgram (*Vigna mungo*) were *Madurasia obscurella, Luperodes spp.*, *Aphis craccivora*, *Bemisia tabaci*, *Megalurothrips distalis*, *Caliothrips indicus*, *Cydia ptychora*, *Maruca testulalis* and

Table 1. Mean population of pestiferous insects of unprotected blackgram during *kharif* 2012

S. No.	Dates of observation *Kharif*, 2012	Mean Atm. Temperature (°C)	Mean Rel. Humidity (%)	Total Rainfall (mm)	Mean insect pest numbers per plant					
					Jassids	Whiteflies	Thrips	Aphids	Blister beetles	Pod borer
1.	11–Aug	26.50	76.00	55.60	11.25	6.25	5.25	5.50	0	0
2.	18–Aug	24.00	80.50	67.70	12.00	5.25	4.95	4.75	0	0
3.	25–Aug	26.00	75.10	16.40	8.00	6.75	12.15	10.50	0	0
4.	1–Sep	26.50	79.60	60.60	9.50	25.75	12.60	17.00	0	0
5.	8–Sep	26.20	83.40	167.40	11.80	26.50	19.65	24.00	1.75	1.25
6.	15–Sep	25.50	84.90	93.40	16.50	21.75	18.15	34.25	1.75	1.75
7.	22–Sep	26.10	73.70	0.40	9.25	22.5	18.3	43.50	2.75	1.00
	Seasonal means	25.83	79.03	461.50	11.19	16.39	13.01	19.93	0.89	0.57
Coefficient of correlation (r) for population and atm. temperature					–0.36	0.42	0.35	0.23	NA	NA
Coefficient of correlation (r) for population and relative humidity					0.80*	0.40	0.29	0.09	NA	NA
Coefficient of correlation (r) for population and total rainfall					0.55	0.40	0.28	–0.03	NA	NA
Mean Density (%)					55.93	81.96	65.04	99.64	4.46	2.86
Relative Density (%)					18.05	26.45	20.99	32.15	1.44	0.92

Note: NA = Not Applicable; * refers to “t” test being significant for correlation coefficient values a P = 0.05

Table 2. Mean population of pestiferous insects of blackgram with niger as barrier crop during *kharif* 2012

S. No.	Dates of observation *Kharif*, 2012	Mean Atm. Temperature (°C)	Mean Rel. Humidity (%)	Total Rainfall (mm)	Mean insect pest numbers per plant					
					Jassids	Whiteflies	Thrips	Aphids	Blister beetles	Pod borer
1.	11–Aug	26.50	76.00	55.60	10.00	2.25	4.95	7.75	0	0
2.	18–Aug	24.00	80.50	67.70	8.00	3.00	3.90	4.50	0	0
3.	25–Aug	26.00	75.10	16.40	9.25	6.25	10.65	10.25	0	0
4.	1–Sep	26.50	79.60	60.60	8.25	20.75	10.50	13.00	0	0
5.	8–Sep	26.20	83.40	167.40	10.00	24.75	19.05	20.25	1.25	1.25
6.	15–Sep	25.50	84.90	93.40	17.25	23.25	17.25	32.00	1.75	1.50
7.	22–Sep	26.10	73.70	0.40	8.00	19.00	18.60	37.00	2.50	1.00
	Seasonal means (Percent reduction)	25.83	79.03	461.50 (9.65)	10.11 (13.48)	14.18 (6.76)	12.13 (10.58)	17.82	0.79	0.54
Coefficient of correlation (r) for population and atm. temperature					–0.03	0.34	0.35	0.22	NA	NA
Coefficient of correlation (r) for population and relative humidity					0.62	0.51	0.25	0.09	NA	NA
Coefficient of correlation (r) for population and total rainfall					0.35	0.45	0.27	–0.03	NA	NA
Mean Density (%)					50.54	70.89	60.64	89.11	3.93	2.68
Relative Density (%)					18.19	25.52	21.83	32.08	1.41	0.96

Note: NA = Not Applicable; * refers to "t" test being significant for correlation coefficient values a P = 0.05
Figures in parentheses depict the percent reduction in pest numbers over control when crop was protected using niger as barrier crop

Helicoverpa armigera (Sahoo and Patnaik, 1994). The key pod borers on both greengram and blackgram include the lepidopteran caterpillars – the spotted pod borer, *Maruca testulalis* (Geyer) [*Maruca vitrata*] and the spiny pod borer, *Etiella zinckenella* Tretsche; however, the blue butterflies, *Lampides boeticus* Linnaeus and *Catechrysops cnejus* Fabricius; the gram caterpillar, *Helicoverpa armigera* (Hubner) have also been reported among the major pests. Sharanabasappa (2004) reported the pest status of the seed weevil, *Apion ampulum* from North Karnataka. In greengram, Uthamasamy (2005) observed leaf miner, flea beetle, aphids, thrips, mites and whitefly as pests in the early season of January sown crop; with *Aphis craccivora* attaining the key pest status. Earlier, Swaminathan *et al.* (2007) observed that among sap sucking insects the more common were aphids, especially black bean 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* spp., *Nezara viridula* L., *Plautia lumbriata* and the pod bug, *Clavigralla* spp. It was also noted that greengram cultivated in the vicinity of pigeon pea was heavily infested and rather preferred by the pigeon pea pod bug, *Clavigralla* species. Blister beetles (*Mylabris phalerata* and *M. pustulata*) have attained pest status quite recently. Form the southern states of India, Soundararajan and Chitra (2012) of late have recorded whitefly (*Bemisia tabaci*), leaf hopper (*Empoasca kerri*), defoliator (*Madurasia obscurella*), spotted pod borer (*Maruca vitrata*), pea butterfly (*Lampides boeticus*) and gram pod borer (*Helicoverpa armigera*) to be the major pests of blackgram. Patil and Nithya Chandran (2012) noted that pestilence activity of the seed weevil, *Apion amplum* (Faust) (Apionidae: Coleoptera) gained a major pest status on greengram and blackgram and was maximum when the crop was sown in first fortnight of July (4.57 and 4.70 weevils/ plant) as compared to that when sown in second fortnight of July.

Density Estimates for Insect Pests: During the present study, the mean density values estimated for the sucking insect pest complex revealed that aphids had the maximum mean density on blackgram during the crop season whether blackgram was cultivated sole (99.64%) or with niger as barrier crop for blister beetles (89.11%). However, the mean density values for whiteflies on blackgram followed that of aphids closely and were 82 and 71 per cent, respectively, when the crop was cultivated sole and with niger. The mean density for blister beetles in the sole crop of blackgram (4.46%) was relatively more than that when blackgram was cultivated with niger (3.93%). A comparison of the populations of the different sucking insect pests infesting blackgram by computing the relative density indicated that aphids were relatively denser in terms of numerical abundance followed by whiteflies, thrips and jassids. The blister beetle and pod borer incidence showed the lowest relative density.

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