INCIDENCE OF INSECT PESTS ON BLACKGRAM

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Abstract : This study has been undertaken to list out the insect pests of black gram in the field of village Dehar Kuriha of Kamrup district of Assam, India. The western part of Assam, known as lower Assam, is a marginalized low land area where paddy is the primary crop. The pulse variety, black gram (*Vigna mungo* L.) is also cultivated in a large area especially in the river bank of the Brahmaputra. This crop is infested by many insects in field from sowing to harvesting as well as in post harvesting period. A survey was carried out during kharif season from August, 2016 to November, 2016 to know the various insect pests which damage the crop. 15 species of insect pests have been recorded in all stages of the black gram in the field. Among them, aphid, *Aphis craccivora*, leaf hopper, *Empoasca kerri*, grass hoppers, *Attractomorpha crenulata* , bihar hairy caterpillar, *Spilosoma obliqua*, coreid bugs, *Riptortus pedestris*, and *Clavigralla gibbosa*, pentatomid bug *Nezara viridula*, pod boring weevil, *Apion clavipes*, white fly, *Bemicia tabaci*, leaf weber, *Omiodes indicata*, grey weevil, *Mylloceros undecimpustulatus*, blue butterfly, *Lampides boeticus*, pulse beetle, *Callosobruchus maculatus* were considered as serious defoliators and sucking pests. The pod borer complex included *Helicoverpa armigera* and *Maruca testulalis*. The population of all insect pests was more abundant on the crop during September to harvesting in November, 2016.

IndexTerms - Legume, black gram, crop, insect, pest, survey.

I. INTRODUCTION:

The black gram with soda is a special cuisine for the Assamese people and particularly in “Magh Bihu”; the people want to have a feast with duck meat and black gram dal. Black gram (*Vigna mungo* (L.))Hepper), locally known as “matimah’’, belongs to the family *leguminosae* and sub family *papilionaceae*. A high source of protein, phosphoric acid and ability to improve the soil by fixing atmospheric nitrogen, black gram becomes one of the most important pulse crops of Assam particularly in the region of Kamrup (Rural) district. Though there is an increase in area of cultivation and production of black gram in last decades, yet it is not sufficient to meet the demand of the people. The soil condition in Assam is not favorable to the pulse crops as well as the major problems known to limit the production is the incidence of insect-pests. Chhabra and Kooner (1985) found 54.3 per cent of losses caused by insect pest complex in urdbean.

The North East India including Assam is a hotspot of biodiversity but less accessible due to diverse ethnicity. The agro-climatic condition varies within a favorable range having high rainfall and low productivity which is very conducive for the growth and multiplication of insect pest. (N.S.Azad Thakur and D.M. Firake, 2015). As a result, the crops of this region are infested by a number of insects and damage the production to a large extent.

The black gram are attacked by various insect pests such as whitefly (*Bemisia tabaci*), jassid (*Empoasca* spp.), and green leaf hopper (*Nephotettix* spp.), grasshopper (*Atractomorpha* spp.), blister beetle (*Mylabris pustulata***)**, leaf Webber (*Grapholita critica*), grey weevil (*Myllocerus* spp.), tobacco caterpillar (*Spodoptera litura*), hairy caterpillar (*Spilosoma obliqua*), gram caterpillar (*Helicoverpa armigera***),** and epilachna beetle (*Epilachna* spp.) appeared as foliage feeders. Flower thrips (*Caliothrips* sp.) and leaf miner (*Chromatomyia horticola*) were classified as pollen feeder and tissue borer, respectively. Peak population was observed when the crop was at the full vegetative stage in the first week of October (*kharif*). Thrips incidence was recorded from flowering to pod filling stage (Chandra and Rajak, 2004).

Therefore, it is a challenge to the cultivators to manage the pest incidence to increase the production. Whatever method is applied to control or manage, a survey and monitoring in time of the insect pest always helps in effective management. It is also helpful in forecasting or giving warning to the farmer to apply any protection measure in time. But these types of practices are not sufficient from rural area of Kamrup district. So, the present work is an attempt to know the insect pests of black gram of this part of Assam, as the knowledge of pest in any agro-climatic condition is very essential for any management practices.

II. RESEARCH METHODOLOGY:

Extensive cultivation of black gram is done throughout the bank of the river Brahmaputra from Rural Kamrup to Nalbari district. The local variety called “Saonia mah” is preferred mainly by the farmers. It is seen that some people cultivate black gram in paddy nursery field just before few days of transplantation of the rice plant. After the paddy is transplanted only the black gram remains and thereby a mixed cropping is done which help to fertilize the nursery field naturally by the roots of the black gram. Such type of plot was taken for our experiment where no artificial fertilizer, pesticide or irrigation was practiced for the crop growth. Recording of pest incidence and its collection was carried out during September to November, 2016 after two weeks of sowing. The experiment was laid out in randomized block design with three replications. The data were collected from three plots

at regular weekly interval in each Sunday of the week from 5 plants randomly per plot. Insect observations were done during 6 to 8 am when the insects remain less active. Some insects were collected by sweep net, some were handpicked and mainly visual counting was done for quantitative estimation. All the specimens were photographed by a Nikon camera. Identification was done by following some relevant keys comparing with illustrated instructions. The meteorological data were obtained from the state meteorological department. Quantitative estimation of the pests in different stages of crop growth was made from the data derived from field study. Species diversity was measured by Simpson index, abundance of insect pest species population was calculated by the sum of all available species in different plots and species richness was estimated by the variety of insect pest species in different plots.

Simpson diversity index (D) was calculated by the formula-

$$D=1-\frac{\sum n(n-1)}{N(N-1)}$$

The mean density was calculated by the formula-

Mean density $=\sum x_i*100/N$,

Where x_i = No. of insects in i^{th} sample and N= Total no.s of plants sampled.

Relative density was calculated by-

Relative density (RD) % = No. of individual of one species* 100/ total no.s of individual of all species.

The key insect pest was determined from the pests that are continuously present or that attack at the middle or end of the crop cycle having highest abundance. The relationship of the pest succession with atmospheric temperature and relative humidity was measured by Karl Pearson's co-efficient of correlation.

III. RESULTS AND DISCUSSION:

The local variety of black gram was sowed on 22nd August, 2016 and harvested on 25th November, 2016. The survey was started from 4th September of the 35th standard week of the year 2016. The results are presented in table-1, table-2, table-3, table-4, table-5 and table-6.

The list of pest found during the survey period is listed in table-1. All together 15 insect pests are found damaging the crop in different stages of its growth. The pests belong to 5 orders and 13 families. The orders are Orthoptera, Lepidoptera, Hemiptera, Diptera and Coleoptera. The families are Pyrgomorphidae, Arctiidae, Noctuidae, Aleyrodidae, Pyralidae, Aphididae, Cicadellidae, Bruchidae, Lycaenidae, Curculionidae, Apionidae, Pentatomidae and Coreidae. The order Orthoptera is represented by *Attractmorpha crenulata* (Fam. Pyrgomorphidae), order Lepidoptera is represented by Spilosoma *obliqua* (Fam. Arctiidae), *Maruca testulalis* (Fam.Noctuidae), *Helicoverpa armigera* (Fam. Noctuidae), *Lampides boeticus* (Fam. Lycaenidae) and *Omiodes indicata* (Fam. Pyralidae). The order Coleoptera is represented by *Callosobruchus maculatus* (Fam. Bruchidae) and *Apion clavipes* (Fam. Apionidae). The order Diptera is represented by *Bemicia tabaci* (Fam.Aleyrodidae). The order Hemiptera is represented by *Mylloceros undecimpustulatus* (Fam.Curculionidae), *Nezara viridula* (Fam. Pentatomidae), *Riptortus pedestris* (Fam.Coreidae), *Clavigralla gibbosa* (Fam.Coreidae), *Aphis craccivora* (Fam.Aphididae) and *Empoasca Kerri* (Fam. Cicadellidae).

Three important parts of a plant i.e. leaves, pods and flowers are damaged by these insects. The insects which damages on the leaves are *Attractmorpha crenulata, Spilosoma obliqua, Maruca testulalis, Lampides boeticus, Omiodes indicata, Empoasca kerri, Bemicia tabaci, Mylloceros undecimpustulatus* etc. The pod damaging insects are- *Maruca testulalis,Helicoverpa armigera, Callosobruchus maculatus, Lampides boeticus, Apion clavipes, Nezara viridula ,Riptortus pedestris and Clavigralla gibbosa. Apion clavipes, Aphis craccivora* and *Lampides boeticus* are the insects which damage the buds and the floral parts. Among the pod borers *Maruca testulalis* and *Apion clavipes* are the major pests. *M. testulalis* also acts as a leaf weber causing damage to the leaves besides the pod damaging activities. *A. clavipes* is found in the field throughout the survey period. The larva bore into the pod and completely feed on the seeds. Other pod sucking bug *R. pedestris* and *C. gibbosa* have a medium effect on the crop. *O. indicata*, the leaf weber feed on the green materials of the leaves and leaf curling occurs to accommodate the pest. It is one of the most damaging insects found in this crop. *A. clavipes, A. craccivora* and *L. boeticus* are the three important insects which damages floral parts to some extent.

The distribution of the insect pests in the crop field is included in the table-2. The first survey was carried out on 4th September, 2016 and in this survey only *A.crenulata, A.clavipes and L. boeticus* made its presence in the field. Most of the pests appeared in the field from 39th standard week. Out of the 15 pests *Apion clavipes* were found from 35th week to harvesting of the crop.

A.clavipes has the highest abundance of 409 having a mean density of 227.22 and relative density of 18.50(Table-3). Considering the period of distribution, abundance, mean density and relative density *A.clavipes* can be regarded as the key pest. Of all the 5 orders present in the field the Hemipterans have the highest percentage of occurence followed by Coleopterans (Table-4). The Simpson diversity index is more or less same in all the surveyed plots which state that the diversity of the insect pest in all the plots are similar. All the 15 insect pests are found in the three surveyed plots. The coefficient of correlation was worked out between the number of insect pests and abiotic factors like temperature and relative humidity. No significant correlation was found with mean relative humidity, however with mean temperature *M. testulalis*, *L. boeticus*, and *A. clavipes* showed significant positive correlation and *C. maculatus* and *C.gibbosa* showed negative significant correlation (Table-6).

Several other workers also investigated the insect pest of black gram and found similar trends in diversity and succession of the pests. Reddy, in 2009 investigated the insect pests feeding on black gram and found that12 species of insect pests were causing considerable loss to the crop.

In 20015, C. Gailce Leo Justin, P. Anandhi and D. Jawahar worked on Cataloguing, screening and assessing the effect of sowing time on the incidence of black gram pests under dryland condition to catalogue the different insect pests occurring in black gram at Agricultural Research Station Farm, Tamil Nadu Agricultural University. All together 11 species of insect pests were found damaging on black gram crop during the experimental period and majority of them were sucking pests followed by borers and defoliators. The medium numbered pests found were sucking pest, aphids, *A. craccivora*, leafhopper, *E. kerri* and thrips, *Thrips tabaci* Lind. Low level of infestation found were of whitefly,*B. tabaci*, green bug, *Nezara viridula* (L.) and ash weevil, *Mylloceru*s *undecimpustulatus* (Faust) during the study period. The high numbered and found as destructive were the tobacco caterpillar, *S. litura* and gram pod borer, *H. armigera*. The occurrence of other insect pests viz. sphingid caterpillar, blue butterfly and blister beetle was low or nil for the three years.

S.K. Yadav, Meena Agnihotri and R. S. Bisht in 2015 studied the seasonal incidence of insect-pests of black gram, *Vigna mungo* (Linn.) and its correlation with abiotic factors and found that biotic and abiotic factors limit the productivity of blackgram including insect pests like leafhopper, *Empoasca kerri*, white fly, *Bemisia tabaci*, tobacco caterpillar, *Spodoptera litura*, semilooper, *Trichoplusia ni* and bihar hairy caterpillar, *Spilosoma obliqua*.The high population of 3.49 whiteflies/leaf was observed during 39th standard week. Kumar, M. and Singh, P.S. (2016), studied about the population dynamics of major insect pests of black gram (*Vigna mungo* (L) Hepper, in relation to weather parameters. The experiment was conducted during the kharif season of 2014. He found that population dynamics of major insect pests of black gram highly affected by weather parameters like temperatures (max. and min.), humidity, rainfall, sunshine hours etc. The result revealed that the highest population of whiteflies 8.07 adult/cage/plant and Hassid 1.43 nymph and adult/cage/plant was recorded during 37th standard week. The population of white fly and Jassids showed non-significant negative correlation with max. and min. temperature and sunshine hours while significant positive correlation showed with total rainfall and minimum humidity. The highest population of spotted pod borer 2.13 larvae per plant was recorded during 38th standard week and flower thrips, 3.47 nymph and adult/10 flowers was recorded during 37th standard week. Jat S.K., Lekha and Rana B.S. in 2017 studied the effect of Abiotic Factors on the Incidence of Major Insect Pests of Blackgram [*Vigna mungo* L. Hepper] and found the quantitative abundance of insect pests infesting blackgram which 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 .Field experiments were conducted during Kharif season of 2013 and 2014. 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 black gram. Thus the findings of this investigation are in conformity with some other related experiments.

Table-1: List of insect pests in black gram-2016

Sl. No.	Common name	Scientific name	Family	Nature of damage	Status of damage
1	Grass hoppers	*Attractomorpha crenulata*	Pyrgomorphidae	Leaves	Medium
2	Bihar hairy caterpillar	*Spilosoma obliqua*	Arctiidae	Leaves	Medium
3	Pod borer	*Maruca testulalis*	Noctuidae	Leaves, pods	High
4	Pod borer	*Helicoverpa armigera*	Noctuidae	Leaves, pods	Low
5	Pulse beetle	*Callosobruchus maculatus*	Bruchidae	Pods	Low
6	Blue butterfly	*Lampides boeticus*	Lycaenidae	Flowers, pods	Medium
7	Grey weevil	*Mylloceros undecimpustulatus*	Curculionidae	Leaves	Low
8	Leaf weber	*Omiodes indicata*	Pyralidae	Leaves	High
9	White fly	*Bemicia tabaci*	Aleyrodidae	Leaves	Low
10	Pod boring weevil	*Apion clavipes*	Apionidae	Buds, flowers and pods	High
11	Pentatomid bug	*Nezara viridula*	Pentatomidae	Pods	Very low
12	Pod sucking bugs	*Riptortus pedestris*	Coreidae	Pods	Medium
13	Pod sucking bugs	*Clavigralla gibbosa*	Coreidae	Pods	Medium
14	Aphid	*Aphis craccivora*	Aphididae	Leaves, stems, floral parts	Low
15	Leaf hopper	*Empoasca kerri*	Cicadellidae	Leaves	Low

Table-2: Mean number of pest population from weekly observation-2016

Sl. No.	Name of the pests	Mean No. of pest population											
		SW-35	SW-36	SW-37	SW-38	SW-39	SW-40	SW-41	SW-42	SW-43	SW-44	SW-45	SW-46
		4th Sept.	11th Sept.	18th Sept.	25th Sept.	2nd Oct.	9th Oct.	16th Oct.	23rd Oct.	30th Oct.	6th Nov.	13th Nov.	20th Nov.
1	*Attractomorpha crenulata*	0.2	1.73	1.73	1.93	2.8	2.26	1.13	1.13	-	-	0.73	0.6
2	*Callosobruchus maculatus*	-	-	-	0.06	0.13	0.06	0.06	0.13	0.2	0.2	0.13	0.33
3	*Spilosoma obliqua*	-	-	-	2.46	2.93	2.73	1.46	-	-	0.6	0.93	0.53
4	*Helicoverpa armigera*	-	-	-	-	-	o.33	0.46	0.53	0.73	-	-	0.2
5	*Maruca testulalis*	-	0.4	0.33	0.13	0.26	0.4	0.2	0.13	0.2	-	-	-
6	*Lampides boeticus*	0.46	0.53	0.6	0.73	1.06	0.8	0.8	-	-	0.46	-	0.33
7	*Mylloceros undecimpustulatus*	-	-	-	-	0.13	0.4	0.33	0.26	-	0.2	-	-
8	*Omiodes indicata*	-	0.13	0.26	1.26	1.53	0.73	0.4	0.6	0.4	-	-	-
9	*Bemicia tabaci*	-	1.00	2.86	3.13	2.26	2.2	0.8	0.86	0.33	0.4	0.26	0.13
10	*Apion clavipes*	1.8	1.93	1.93	3.03	4.80	3.4	3.13	1.73	1.33	1.6	1.46	0.8
11	*Nezara viridula*	-	0.2	0.33	0.33	0.6	0.46	0.33	0.26	0.33	0.26	0.26	0.13
12	*Riptortus pedestris*	-	-	0.8	1.00	2.2	1.73	1.6	1.46	0.93	0.87	0.46	0.4
13	*Clavigralla gibbosa*	-	-	-	-	-	0.26	0.53	1.13	1.4	1.53	1.66	0.73
14	*Aphis craccivora*	-	-	3.4	4.86	6.47	1.4	3.4	-	-	2.6	1.53	-
15	*Empoasca kerri*	-	1.4	1.8	2.2	3.13	2.06	2.6	1.8	-	1.00	0.2	0.13

SW- Standard Week

Table-3: Distribution of insect pests in different plots in black gram cultivation with species density and abundance- 2016

Sl. No.	Insect pest species	Order	Plot-I	Plot-II	Plot-III	Richness	Abundance	Mean Density	Relative Density
1	*Attractomorpha crenulata*	Orthoptera	71	73	70	3	214	118.89	9.68
2	*Spilosoma obliqua*	Lepidoptera	66	63	46	3	175	97.22	7.91
3	*Maruca testulalis*	Lepidoptera	11	13	7	3	31	17.22	1.40
4	*Helicoverpa armigera*	Lepidoptera	15	13	6	3	34	18.89	1.54
5	*Callosobruchus maculatus*	Coleoptera	11	6	3	3	20	11.11	0.90
6	*Lampides boeticus*	Lepidoptera	39	32	16	3	87	48.33	3.93
7	*Mylloceros undecimpustulatus*	Hemiptera	8	5	7	3	20	11.11	0.90
8	*Omiodes indicata*	Lepidoptera	32	22	26	3	80	44.44	3.62
9	*Bemicia tabaci*	Diptera	78	63	72	3	213	118.33	9.63
10	*Apion clavipes*	Coleoptera	141	119	149	3	409	227.22	18.50
11	*Nezara viridula*	Hemiptera	20	17	11	3	48	26.67	2.17

12	*Riptortus pedestris*	Hemiptera	61	63	49	3	173	96.11	7.82
13	*Clavigralla gibbosa*	Hemiptera	35	31	43	3	109	60.56	4.93
14	*Aphis craccivora*	Hemiptera	127	127	101	3	355	197.22	16.06
15	*Empoasca kerri*	Hemiptera	82	82	79	3	243	135.00	10.99

Table-4: Species richness, abundance, relative abundance and diversity of insect pests of black gram cultivation – 2016

Study plots	Rich ness (S)	Abunda nce (N)	Relative abundance (RA)	Lepidop tera %	Coleop tera %	Orthoptera %	Hemip tera %	Diptera %	Diversity index
Plot-I	15	797	36.05	20.45	19.07	8.91	41.78	9.79	0.73
Plot-II	15	729	32.97	19.62	17.15	10.01	44.58	8.64	0.72
Plot-II	15	685	30.98	14.74	22.19	10.22	42.34	10.51	0.73

Table-5: Temperature and Relative humidity during the study period-2016. (Time: From 6am to 8pm)

Sl.No.	Std.Week	Date	Temperature (^{0}C)			Relative Humidity (%)		
			Maximum	Minimum	Mean	Max.	Min.	Mean
1	35	04-09-16	31	27	29.0	94	72	83.0
2	36	11-09-16	31	27	29.0	89	77	83.0
3	37	18-09-16	30	26	28.0	92	78	85.0
4	38	25-09-16	30	26	28.0	95	80	87.5
5	39	02-10-16	32	26	29.0	96	76	86.0
6	40	09-10-16	29	26	27.5	94	83	88.5
7	41	16-10-16	30	24	27.0	95	75	85.0
8	42	23-10-16	27	20	23.5	94	69	81.5
9	43	30-10-16	27	23	25.0	98	76	87.0
10	44	06-11-16	28	23	25.5	91	58	74.5
11	45	13-11-16	25	21	23.0	95	77	86.0
12	46	20-11-16	21	15	18.0	96	80	88.0

Table-6: Correlation Co-efficient of succession of insect pests with Mean Temperature and Mean Relative humidity:

Sl.No.	Name of the pests	Correlation coefficient with Mean Temperature	Correlation coefficient with Mean Relative Humidity
1	*Attractomorpha crenulata*	0.47	0.42
2	*Spilosoma obliqua*	0.28	0.41
3	*Maruca testulalis*	0.56*	0.31
4	*Helicoverpa armigera*	-0.30	0.21
5	*Callosobruchus maculatus*	-0.84*	-0.001
6	*Lampides boeticus*	0.61*	0.15
7	*Mylloceros undecimpustulatus*	0.09	-0.15
8	*Omiodes indicata*	0.40	0.37
9	*Bemicia tabaci*	0.51	0.34
10	*Apion clavipes*	0.63*	0.25
11	*Nezara viridula*	0.30	-0.28
12	*Riptortus pedestris*	0.17	0.17
13	*Clavigralla gibbosa*	-0.63*	-0.34
14	*Aphis craccivora*	0.44	0.08
15	*Empoasca kerri*	0.51	0.O8

*Significant at p= 0.05

IV.CONCLUSION:

The experiment was done on a field which was covered by paddy from all sides and the crop was cultivated in mixed cropping pattern in paddy nursery field maintaining a gap of 60 days from the date of sowing paddy seeds. The succession and diversity of

the insect pests are similar with other parts of the country. *A.clavipes* is the important pest found throughout the survey period in all the plants and in each plot of the field.

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