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POPULATION DYNAMICS OF MAJOR INSECT PESTS OF MUNG BEAN [*VIGNA RADIATA* (L.) WILCZEK] AND CORRELATION WITH ABIOTIC FACTORS UNDER TERAI AGROCLIMATIC ZONE OF WEST BENGAL

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ABSTRACT

Field experiments were carried out during the year 2012-13. The pest population recorded in mung bean field were aphids, whitefly, thrips and its highest population were observed during 2nd week of Feb to 1st week of Mar (14.0 per 10 cm shoot tip, 1.68 per compound leaf and 4.37 per flower, respectively) during first season. Whereas, highest population of aphids, whitefly and thrips were observed during 2nd week of April with 14.18 per 10 cm shoot tip, 2.0 per compound leaf and 6.89 per flower, respectively during second season. The predatory coccinellid population also coincides with incidence of sucking pest population. The highest coccinellid predators were observed during 2nd week of Feb (7.38) and 1st week of April (14.18) per plant, respectively during first and second seasons. The Sucking pest *viz.*, Aphid, thrips, whitefly and its predatory coccinellid populations exhibited highly significant positive correlation with maximum temperature (r= 0.78,0.78,0.79,0.78) and significant negative correlation with evening relative humidity (r= -0.51,-0.51,-0.57, -0.53) and rainfall (-0.41,-0.41,-0.45,-0.45), respectively during first season. Same trend was observed in the second season also. Spotted pod borer population exhibited highly significant positive correlation with minimum temperature (r= 0.79, 0.77) and Significant negative correlation with maximum temperature (r= -0.46,-0.34), respectively during first and second seasons.

INTRODUCTION

Mung bean, *Vigna radiata* (Linn.)Wilczek (Family: Leguminosae, Subfamily: Papilionaceae) is the third most important pulse crop after chick pea and red gram in India (Ved *et al.*,2008). In India, mungbean is grown in 2.92 million ha, with a 1.42 million tonnes production with a productivity of 486 kg per ha (Dixit, 2005). Mungbean yields are greatly depressed by a complex of biotic and abiotic factors of which insect pests are the most important. The major constraint responsible for poor yields is the wide array of insect pests, which attack the plants from seedling to maturity. About 65 species of insects (Siddappaji *et al.,* 1979) has been recorded on mungbean. About half a dozen insect species are of major importance (Vyas, 1978). In India, quantitative avoidable losses (7-35%) caused by insect pest complex, both in mung bean and urd bean vary with different agro-climatic conditions (Hamad and Dubey,1983) . The annual yield loss due to the insect pests has been estimated at about 30 per cent in mung bean and urd bean. Duraimurugan and Tyagi (2014) reported that the avoidable losses due to pest complex on mungbean ranged from 27.03 to 38.06% with an average of 32.97%.

The perusal of pertinent literature indicate that there is paucity of information on the succession of insect pests on mung bean in relation to climatic factors except the work of Nene, 1972; Murugesan and Chelliah, 1978. A meagre amount of work has been done on seasonal incidence of the insect pests and their predatory fauna associated with this crop. The effect of abiotic factors on the incidence of insect pests provide suitable know how about the congenial weather conditions for development of insect pests, thus immensely helpful in formulating the management strategy against them. Very little information is available on impact of meteorological factor on the population dynamics of insect pest of mung bean under terai region of West Bengal condition. The investigations made were, therefore envisaged to study the impact of weather parameter on the population of insect pests of munbean. Therefore, it is desirable to take up a detailed study on the succession of insect pest complexes of mung bean under the agro-climatic conditions prevailing in this region.

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The present research undertaken to study their effects of weather parameters like temperature, relative humidity, extent of rainfall etc. influenced the infestation and stabilization of various insect pests in mungbean. Therefore, attempts were made to find out the relationships between pests population and the abiotic factors.

MATERIALS AND METHODS

The field experiments were conducted in the instructional farm at Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar, and West Bengal during the years of 2012 and 2013. The promising variety, Sonali (B-1) was sown during the first season (December, 2012 to April, 2013) and second season (February to April, 2013). Sowing was done in second week of December and February during first and second seasons, respectively with 3 x 2 m^2 plot size and 40 cm (row to row) x 20 cm (plant to plant) spacing followed by recommended agronomic practices. Weekly meterological data were obtained from agrometerological observatory of the university (Table 1and 2). All the normal agronomic practices were followed for raising the crop. The experiment was replicated thrice in a randomized block design. Observations were taken starting from 30 days after sowing for first season and 15 DAS for second season by visually count the number of sucking pests like aphids, thrips, whitefly and pod borer were recorded from ten tagged plants per plot at weekly interval. The aphids were removed from 10 cm shoot tip of ten tagged plants separately at weekly interval with the help of camel hair brush on a white paper sheet and counted. Further mean population of aphids per 10 cm of shoot tip was worked out. Total number of whiteflies was counted on three compound leaves (upper, middle and lower) from each plant at weekly interval and average population of whiteflies per compound leaf was worked out. The thrips were removed from 10 randomly selected flower buds of ten tagged plants at weekly interval with the help of camel hair brush on a white paper sheet and counted(Chandra and Rajak , 2004). Further mean population of thrips per flower bud was worked out. The intensity of pod borer population in flowers and pods was estimated by counting the number of larvae from the ten tagged plants and the average value was worked out for its infestation.

The number of coccinellid predators was also observed on ten tagged plants separately per plot at weekly interval and counted. Further mean population of coccinellid predator per plant was worked out. The data collected on various aspects were subjected to the statistical analysis after suitable transformations. Analysis of variance was calculated to find out the significant differences between the treatments on the basis of CD values and population build up was correlated with abiotic and biotic factors.

RESULTS AND DISCUSSION

With the view to provide a sound base for the management of insect pest, a quantitative estimation of population build up was carried out in relation to abiotic factors, *viz.*,maximum, minimum and average temperatures; morning, evening and average relative humidity and rainfall under the prevailing agro-climatic conditions of the locality.

From the observations made during the two cropping seasons (2012-13), it was observed that insect species belonging to different taxonomic orders appeared at different stages of crop growth. Among these, The aphid, *Aphis craccivora* Koch.; whitefly, *Bemisia tabaci*

(Genn.) thrips, *Caliothris indicus* Bagnall. and spotted pod borer, *Maruca vitrata* Geyer. were found to be the major insect

Table 1: Seasonal incidence of insect pests and natural enemies in mungbean during first season

Month	Week	Aphid /10cm twig	Thrips/flower	WhiteFly/leaf	Pod borer /plant	Lady bird beetle/plant	Temprature (°C)			Relative Humidity (%)			Rainfall (mm)
							Max	Min	Avg	Max	Min	Avg	
January2013	V	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	22.6	7.0	14.8	96	47	71.5	0 .0
	VI	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	24.0	9.0	16.5	98	49	73.5	0.0
	VII	2.58 (1.75)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	1.10 (1.26)	22.8	8.0	15.4	99	51	75.0	0.0
	VIII	3.33 (1.96)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	2.00 (1.58)	26.9	11.3	19.1	99	38	68.5	0.0
February 2013	IX	7.39 (2.81)	0.00 (0.71)	0.85 (1.16)	0.00 (0.71)	3.31 (1.95)	26.5	11.3	18.9	98	45	71.5	0.0
	X	14.0 (3.81)	0.47 (0.98)	1.14 (1.28)	0.00 (0.71)	7.38 (2.81)	23.4	13.2	18.3	99	63	81.0	2.5
	XI	13.87(3.79)	1.28 (1.33)	0.90 (1.18)	0.00 (0.71)	5.57 (2.46)	29.9	13.5	21.7	97	35	66.0	0.0
	XII	4.23 (2.17)	2.14 (1.62)	0.41 (0.95)	0.00 (0.71)	1.48 (1.41)	27.4	12.3	19.8	95	39	67.0	0.0
March 2013	XIII	6.89 (2.72)	4.37 (2.21)	1.68 (1.48)	0.21 (0.84)	2.22 (1.65)	29.5	15.7	22.6	99	45	72.0	0.0
	XIV	4.27 (2.72)	0.88(1.17)	0.58 (1.04)	0.15 (0.81)	0.00 (0.71)	29.9	16.2	23.1	98	41	69.5	0.0
	XV	0.00 (0.71)	0.00 (0.71)	0.14 (0.80)	0.58 (1.04)	0.00 (0.71)	30.1	16.6	23.4	99	32	65.5	0.0
	XVI	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	1.11 (1.27)	0.00 (0.71)	30.9	17.7	24.3	99	43	71.0	0.0
Correlation co-efficient with mean aphid population (r)		0.78*	0.13	0.49	-0.07	-0.51	-0.49	-0.41					
Correlation co-efficient with mean thrips population (r)		0.78*	0.13	0.49	-0.07	-0.51	-0.49	-0.41					
Correlation co-efficient with mean whitefly population (r)		0.79	-0.08	0.45	-0.08	-0.57	-0.55	-0.45					
Correlation co-efficient with mean spotted pod borer population (r)		-0.46	0.79*	0.36	-0.19	0.80	0.69	0.73					
Correlation co-efficient with mean lady bird beetle population (r)		0.75*	0.04	0.40	0.003	-0.53	-0.49	-0.45					

* Indicate significance of value at P = 0.05

pests attacking the crop.The results on periodic mean population of insect pests explicated that four important pests and a natural enemy of crop were found colonizing mungbean crop in Pundibari, Cooch Behar district of West Bengal. The sequential incidence of insect pests revealed that aphids, whiteflies, thrips, spotted pod borer and natural enemy, lady bird beetle were the first to invade the crop at early growth stage *i.e.*, 7th week after sowing (WAS) and remained active till 14WAS. The next pest that appeared on mungbean was whitefly followed by thrips and spotted pod borer. Almost all the insect pests were found abundant in 2nd week of February, *i.e.* 10th week after sowing.

The results presented in Table 1 and 2 revealed that the aphid population started from 7 weeks after sowing (WAS) *i.e.* the 3rd week of January with 2.58/10 cm twig and reached its peak of and the population increased continuously up to 10th WAS with a peak level of 14.0/ 10 cm twig, coinciding with peak stage of flowering and pod formation in 2nd week of February. The peak activity of aphids was seen from 10th week to 11th weeks after sowing. Thereafter, the

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population decreased but remained active till 14 WAS during first season (Dec- Mar, 2012-13). In the second season (Feb-Apr, 2013) incidence of aphid population was recorded in 5 WAS with intensity of 0.85/10 cm twig and reached its peak of 14.18/10 cm twig in 9 WAS. The results are in agreement with Augustine (2011) who stated that peak activity of aphids was from 7-10 WAS and remained active throughout the crop period and also more or less in agreement with Srikanth and Lakkundi (1990) who stated that population of *A. craccivora* on cowpea increased rapidly with crop growth and their peak coincided with peak pod formation. Adipala *et al.,* (1999) stated that *A. craccivora* was the main vegetative pest of cowpea. The present findings are also in agreement with (Vikrant *et al.,* 2013 and Swaminathan *et al.,* 2007).

Aphid population exhibited highly significant positive correlation with maximum temperature (r= 0.78, 0.75), average temperature (r= 0.49, 0.45) and significant negative correlation with evening relative humidity (r= -0.51,-0.52) and rainfall (r=-0.41,-0.47), respectively during first and second seasons. The present findings are differs with observations of Faleiro *et al.,* (1990) from Delhi suggested that aphid abundance on cowpea was negatively correlated with maximum daily temperature, wind speed and sunshine hours and positively correlated with minimum daily temperature, RH and rainfall. The present findings differed with above said author might due to the variations in climatological factors in this region.

The population of thrips started from 10 WAS *i.e.* 2nd week of February (0.47thrips/flower). The incidence of this pest increased slowly and it reached to a peak level (4.37 thrips/ flower) in 13 weeks after sowing *i.e.* 1st week of March. Thereafter, thrips population decreased gradually but was active till 14 WAS during first season (Dec- Mar, 2012-13). In the second season (Feb-Apr, 2013) incidence of thrips population was recorded in 9 WAS with intensity of 2.45/ flower and reached its peak of 6.89/flower(11WAS). Our findings accordance to Meena *et al.,*(2013) Chandra and Rajak, (2004), Vikrant *et al.,* (2013) and Khan *et al.,* (2011).

Table 2: Seasonal incidence of insect pests and natural enemies in mungbean during second season

Month	Week	Aphid /10 cm twig	Thrips/flower	Whitefly/leaf	Pod borer/ plant	Lady bird beetle/plant	Temprature (ºC) Max	Min	Avg	Relative Humidity (%) Max	Min	Avg	Rainfall (mm)
March 2013	V	0.85 (1.16)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.85 (1.16)	29.5	15.7	22.6	99	45	72.0	0.0
	VI	4.00 (2.12)	0.00 (0.71)	0.52 (1.01)	0.00 (0.71)	4.00 (2.12)	29.9	16.2	23.1	98	41	69.5	0.0
	VII	7.29 (2.79)	0.00 (0.71)	0.81 (1.14)	0.00 (0.71)	7.29 (2.79)	30.1	16.6	23.4	99	32	65.5	0.0
	VIII	12.01 (3.54)	0.00 (0.71)	1.10 (1.26)	0.00 (0.71)	12.01 (3.54)	30.9	17.7	24.3	99	43	71.0	0.0
April 2013	IX	14.18 (3.83)	2.45 (1.72)	2.00 (1.58)	0.00 (0.71)	14.18 (3.83)	32.4	18.6	25.5	96.3	36.3	66.3	0.0
	X	6.55 (266)	5.43 (2.44)	0.70 (1.10)	0.82 (1.15)	6.55 (266)	31.8	20.2	26.0	89.0	41.3	65.2	0.0
	XI	4.27 (2.18)	6.89 (2.72)	0.41 (0.95)	1.76 (1.50)	4.27 (2.18)	28.9	20.4	24.6	98.9	69.9	84.4	4.9
	XII	0.52(1.01)	4.00(2.12)	0.00(0.71)	0.41(0.95)	2.45(1.72)	29.9	19.5	24.7	95.9	61.6	78.7	4.4
Correlation co-efficient with mean aphid population (r)							0.75*	0.08	0.45	0.04	-0.52	-0.50	-0.47
Correlation co-efficient with mean thrips population (r)							0.94*	0.01	0.71	0.51	-0.68	-0.52	-0.70
Correlation co-efficient with mean whitefly population (r)							0.79	0.08	0.47	0.08	-0.54	-0.53	-0.45
Correlation co-efficient with mean spotted pod borer population (r)							-0.34	0.77*	0.41	0.22	-0.77	-0.67	0.73
Correlation co-efficient with mean lady bird beetle population (r)							0.77*	0.14	0.50	0.06	-0.48	-0.47	-0.41

* Indicate significance of value at P=0.05

Thrips population showed significantly positive correlation with maximum temperature (r=0.78) and average temperature(r=0.49), negative correlation with evening relative humidity

(r = -0.51) and rainfall (r=-0.41) during first season. Whereas, during second season thrips population showed significant positive correlation with maximum temperature (r= 0.94), average temperature(r=0.71) and morning relative humidity(r=0.51), significant negative correlation with evening relative humidity (r = -0.68) and rainfall (r=-0.70). These results are in close conformity with the finding of those Yadav and Singh (2015), Aravind Kumar and Akilesh Kumar (2015). Duraimurugan and Jagadish (2002) obtained positive correlation between the population of *Scirtothrips dorsalis* Hood and the minimum and maximum temperature and sunshine hours but negative correlation with the mean relative humidity, the total rainfall and wind velocity.

The correlation of whitefly population with weather factors presented in Table 1 and 2 indicated that the whitefly population positively significant correlation with maximum temperature and non–significant with minimum temperature, relative humidity and rain fall. The population of whitefly (Table 1 and 2) started from 9 WAS *i.e.*1st week of February with a intensity of 0.85 whiteflies/ leaf, increased with crop growth and reached to a peak level of 1.68 whiteflies per leaf in 13 WAS coinciding with 1st week of March during first season, Dec- Mar (2012-13). In the second season (Feb-Apr, 2013) incidence of whitefly population was recorded in 6WAS with intensity of 0.52/leaf and reached its peak of 2.00/leaf in 9WAS. The whitefly population declined continuously during both the seasons. The present findings were resembled with results of Pai and Dhuri (1991), whitefly incidence was appeared in 1st week after germination and continued to build up throughout the crop growth with a peak during the 5th week of October. Similarly, Faleiro *et al.* (1986) found that *B.tabaci* was a minor pest, regularly occurred from seedling to pod formation stage of cowpea during *Kharif* season, 1983 and 1984 at IARI, New Delhi. These findings are in accordance with the findings of Yadav *et al.* (2015).

Whitefly population exhibited significant positive correlation with maximum temperature (r= 0.79, 0.79), average temperature (r= 0.45, 0.47) and significant negative correlation with evening relative humidity (r= -0.57, -0.54) and rainfall (r=-0.45, - 0.45), respectively during first and second seasons. Kumar *et al.*, (2004) noticed that temperature and

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sunshine hours were favorable for whitefly population with a positive correlation in mungbean and urd bean which goes in line with the present investigation.

Ladybird beetle is an important predator which feed on aphids, jassids, whiteflies and few other sucking pests. The data presented in Table 1 and 2 revealed that the population of ladybird beetle started in 7 weeks after sowing (WAS) *i.e.* the 3rd week of January with 1.10/plant and reached its peak of and the population increased continuously up to 10th WAS with a peak level of 7.38/ plant, coinciding with peak stage of flowering and pod formation in 2nd week of February. The peak activity of ladybird beetle was seen from 10th week to 11th weeks after sowing. Thereafter, the population decreased but remained active till 13 WAS during first season (Dec-Mar, 2012-13). In the second season (Feb-Apr, 2013) incidence of lady bird population was recorded in 5 WAS with intensity of 0.85/plant and reached its peak of 14.18/plant in 9 WAS. *i.e.*1st week of April where aphids, whiteflies and thrips were present in large numbers. Thereafter, the population of ladybird beetle decreased gradually with the decrease in the sucking pest population and finally disappeared at the last stages of the crop.

The population of ladybird beetles showed significant positive correlation with maximum temperature (r=0.75, 0.77) and average temperature (r=0.40, 0.50), respectively during first and second seasons. Significant negative correlation with evening relative humidity (r = -0.53,-0.48), average relative humidity (r = -0.49,- 0.47) and rainfall (r= -0.45, - 0.41), respectively during both the seasons. Bajia and Singh (2014) revealed that coccinellids population was greatly influenced by different abiotic and biotic factors. The maximum and minimum temperature and temperature range showed a positive correlation with the coccinellids population, whereas relative humidity had a negative correlation. Suresh *et al.*, (2012) also worked on the topic related to the present investigation. Sharma and Yadav (1994) reported that the natural populations of both the *Aphis craccivora* and its predator *C. septempunctata* reacted sharply to changing weather factors (temperature and RH) but in almost the opposite direction. Malik *et al.*, (1989) obtained similar negative correlation between the populations of *Aphis craccivora* and the *C. septempunctata* predators.

The population of *M. vitrata* (Table 1 and 2) started from 13 WAS *i.e.* 1st week of March (0.21 larva/plant) coinciding with the pod development. The population reached to a peak of 1.11 larvae per leaf during 16 WAS during first season, Dec-April (2012-13). In the second season (Feb-Apr, 2013) incidence of spotted pod borer population was recorded in 10 WAS *i.e* 2nd week of March with intensity of 0.82/plant and reached its peak of 1.76/plant in 11 WAS i.e 3rd week of March. Thereafter, the population declined by the time of final picking. The results are in agreement with Patel *et al.,* (2010). They stated that *M. vitrata* on cowpea was initially noticed during middle of March at pod setting stage and reached to its highest (1.21 larvae/plant) level during peak pod formation *i.e.* fourth week of March.

Correlation co-efficient values worked out between spotted pod borer and weather parameters (Table 1 and 2) revealed that borer population exhibited significant positive correlation with minimum temperature (r= 0.79), evening relative humidity (r=0.80) and rainfall(r=0.73). Significant negative correlation with maximum temperature (r= -0.46) and morning relative humidity (r= -0.19) during first season. Whereas, during second season significant positive correlation with minimum temperature (r= 0.77), morning relative humidity (r=0.22) and rain fall(r=0.73). Significant negative correlation with maximum temperature (r= -0.34) and evening relative humidity (r= -0.77). Similar findings have also been reported by Aravind Kumar and Akilesh Kumar (2015), Yadav and Singh(2013),Umbarkar *et al., (*2010). Oghiakhe *et al.*, (1991) obtained a positive correlation of percentage pod damage and larval infestation of *M. testulalis* in flowers with relative humidity, and negative correlation with temperature.

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