Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
www.entomoljournal.com
JEZS 2021; 9(2): 324-328

Received: 18-01-2021
Accepted: 24-02-2021

Patel R
Department of Entomology, College of Agriculture, JNKVV, Tikamgarh, Madhya Pradesh, India

Marabi RS
Department of Entomology, College of Agriculture, JNKVV, Tikamgarh, Madhya Pradesh, India

Nayak MK
Department of Entomology, College of Agriculture, JNKVV, Tikamgarh, Madhya Pradesh, India

Tomar DS
Department of Plant Pathology College of Agriculture, JNKVV, Tikamgarh, Madhya Pradesh, India

Srivastava AK
Department of Agro-Meteorology, College of Agriculture, JNKVV, Tikamgarh, Madhya Pradesh, India

Corresponding Author:
Marabi RS
Department of Entomology, College of Agriculture, JNKVV, Tikamgarh, Madhya Pradesh, India

Population dynamics of major sucking insect pests of mungbean [*Vigna radiata* (L.) Wilczek] in relation to weather parameters

Patel R, Marabi RS, Nayak MK, Tomar DS and Srivastava AK

Abstract
An investigation was conducted to find out the population dynamics of sucking insect pest of mungbean in relation to weather parameters during *Kharif* season 2018. The first occurrence of adult whitefly and jassids on mungbean was recorded during 31st SMW. The pest population of whitefly and jassids was ranged from 4.20-14.10 and 1.20-6.30 cage / plant, respectively during the cropping period. The whitefly population was reached at its first peak (10.90 whiteflies /cage/plant) at 32nd SMW. Thereafter, whitefly population was started gradually decline and again attained second peak (14.10 whiteflies /cage/plant) at 39th SMW. Correlation studies revealed that maximum temperature and sunshine hours had exhibited significantly positive correlation (r= 0.60 and r= 0.69, respectively) with whitefly population. Further, evaporation was positive while, minimum temperature, morning RH and evening RH, wind speed and rainfall were expressed non-significant negative correlation. The jassids population was gradually increased and reached at its peak (6.30 jassids /cage/plant) during 36th SMW. Significant negative correlation was exhibited between evaporation and jassids population whereas, morning RH, evening RH, wind speed and rainfall had non-significant positive correlation.

Keywords: Mungbean, *Vigna radiata,* whitefly, jassids, weather parameters, correlation

Introduction
Mungbean [*Vigna radiata* (L.) Wilczek] is indigenous to India which ranks third most important legume crop just after chickpea and pigeonpea. Mungbean also known as green gram or moong bean and also called as Pesalu in Telugu, Hesarukalu in Kannada Pasi Payaru in Tamil and Mung Sabut in Hindi. It is highly nutritious pulse crop contain 24 per cent protein, 59.9 per cent carbohydrate and 40-70 ppm iron contents, considered it an ultimate resort for balanced diets (Selvi *et al.* 2006 and Vairam *et al.* 2016) [1, 2]. The whole part of grain used as Dal in the preparation of different types of Indian cuisines and recipes. It is majorly used in preparation of many recipes viz; green gram dosa, sprouted moong salad, sprouts sandwich, soup green and Mangodi due to its pleasant taste and easily digestible. The root nodules of mungbean crop has terrific ability to fix the atmospheric nitrogen (30-40 kg/ha) in the soil that is why it is also used as green manure to cherish the soil status (Prasad *et al.* 2014) [3]. India ranks the first position in mungbean production which alone contributes about 75 per cent of the world's production (Taunk *et al*. 2012) [4]. In India, mungbean covers about 42.57 lakh ha area with the production of 20.09 lakh tones having productivity of 481 kg/ha (Anonymous, 2017) [5]. In Madhya Pradesh, it is cultivated in 225 thousand ha area with the production of 132 thousand MT and productivity of 586kg/ha whereas, in Tikamgarh district during 2016-17, it was cultivated in 8 thousand ha area with production of 4 thousand MT and productivity of 545kg/ha (Anonymous, 2018) [6].
The biotic and abiotic factors are the major detrimental constraints of mungbean production. Among the biotic factors about 64 different species of insect pests have been recorded; which are devastating mungbean crop and cause severe yield losses. Out of them whitefly, *Bemisia tabaci* Gennadius and jassid, *Empoasca kerri* Pruthi are the major sucking insect pests of mungbean crop (Lal, 2008) [7]. Both stages (nymphs and adults) of these insects suck the cell sap from the leaves and infested plants become stunted deformed and due to secreting honey dew substance cause black sooty mould on upper surface of leaves which interferes photosynthesis activity. Other hand, *B. tabaci* acts as a vector for transmitting yellow mosaic disease (Nariani, 1960) [8] which has been identified as mungbean yellow mosaic virus (MYMIV) [9] causes detrimental effect on mungbean production.

The yield losses due to insect pest complex on different cultivars of mungbean have been reported with an average of 32.97 per cent (Duraimurugan *et al*. 2014) [10]. Other hand, weather parameters play vital role in fluctuation of pest population in mungbean ecosystem. Hence, the present study was planned to gather information on population dynamics of sucking insect pest population due to available host plant (mungbean) and prevailing weather factors; which will be helpful for developing pest forecasting module in particular region.

Materials and Methods

A field trial was carried out to study the population dynamics of major sucking insect pests of mungbean crop in relation to weather parameters at College Research Farm, JNKVV, College of Agriculture, Tikamgarh, Madhya Pradesh, India during *Kharif* season 2018. Mungbean (variety TM-37) was grown in experimental field of 200 square meter area (plot size: 20m x 10m) with maintaining plant spacing between rows and plant 30 cm x 10 cm, respectively. The crop was raised under normal agronomical practices expect plant protection measures. Observations on the population of adult whitefly (*Bemisia tabaci*) and jassid (*Empoasca kerri*) was recorded at weekly interval just starting from initiation of pest and continued up to the maturity of the crop. The number of whitefly and jassid population was counted by caging the individual plant from 10 randomly selected plants in the field and mean value of data was subjected to statistical analysis. The meteorological data were collected from the department of Agro-meteorology, College of Agriculture, Tikamgarh. This data was used as standard meteorological week (SMW) to know the relationship between weather parameters and pest population.

Statistical analysis

Simple correlations of the weather parameters on major sucking insect pest population of mungbean were analyzed by using the formula as suggested by Snedecor and Cochran (1967) [11].

$$\text{Correlation (r)} = \frac{\sum x_i y_i - n\bar{x}\bar{y}}{\sqrt{(\sum x_i^2 - n\bar{x}^2)(\sum y_i^2 - n\bar{y}^2)}}$$

Where, r= Correlation coefficient, $\sum xy =$ Sum of product of both variable x and y, $\sum x$ = Sum of variables x, $\sum \bar{x}^2$ = Sum of square of variable x, $\sum \bar{y}^2$ = Sum of square of variable y, n = Total no. of observations. After that, the statistically significant data was found following the formula of test of significance:

$$t = r\sqrt{\frac{n-2}{1-r^2}}$$

Where, 'n' is the number of observation and 'r' is the correlation coefficient, the value of 't' is based on (n-2) degree of freedom. The value of 't' is compared with (n-2) degree of freedom '*t*' table value at the level of 0.05. Finally, the data which found statistically significant was further subjected to regression analysis [$\bar{Y}$ =a+ bx (R^2)] to find the variation due to weather factors.

Results and Discussion

1. Incidence of whitefly, *Bemisia tabaci*

The appearance of adult whitefly on green gram was first recorded during 31st SMW (*i.e.* 30th July to 05th August) (Table 1 and Fig.1). The whitefly population was ranged from 4.20-14.10 whiteflies /cage/plant during the cropping season. Similar findings were also reported by Yadav and Singh (2015) [12] as they reported that whitefly population was first appeared on *Kharif* green gram from during 32nd SMW. Further, Netam *et al*. (2013) [13], Nitharwal *et al*. (2013) [14] and Manju *et al.* (2016) [15] recorded the first appearance of whitefly on green gram during 30th, 32nd and 33rd SMW, respectively. In the present study its population was gradually increased and reached at its first peak (10.90 whiteflies /cage/plant) at 32nd SMW (*i.e.* 06th to 12th August). During this period, the maximum temperature, minimum temperature, morning and evening RH, sunshine, wind speed, evaporation and rainfall were 31.80ºC, 24.50ºC, 92.14% and 71.30%, 2.81 hrs/day, 1.00 km/hr, 3.20 mm and 5.37 mm, respectively. Thereafter, whitefly population was started gradually decline and again attained its second peak (14.10 whiteflies /cage/plant) at 39th SMW (*i.e.* 24th to 30th September). During this period the maximum and minimum temperature were 34.00ºC and 21.10ºC, respectively, whereas morning and evening RH, sunshine, wind speed, evaporation were 86.71% and 40.30%, 8.00 hrs/day, 0.80 km/hr and 3.40 mm, respectively. There was no rainfall was received during this period. After that its population was remained upto the harvesting of the crop. The present findings are partially contradicted with findings of Kumar *et al.* (2004) [16], Nitharwal *et al*. (2013) [14], Raghuvanshi *et al*. (2014) [17] Ahirwar *et al*. (2016) [18], and Bairwa and Singh (2017) [19] as they also reported that the whitefly population was reached at its peak on mungbean during 35th, 36th, 33rd, 31st and 35th SMW, respectively. Whereas, Netam *et al*. (2013) [13] and Kumar and Singh (2016) [20] were recorded its peak on black gram at 38th (3.62 whiteflies/plant) and 37th SMW (8.07 whiteflies/cage/plant), respectively. Jat *et al*. (2017) [21] also recorded the peak population of whitefly on black gram at 34th and 35th SMW during first and second year, respectively. This variation in pest population might be due to available prevailing weather factors, host plants and location effect in particular region. Thereafter, its population was started to declined and available up to the maturity of the crop.

Correlation and regression of *B. tabaci* with weather parameters

Correlation studies revealed that maximum temperature and sunshine had exhibited significantly positive correlation (r= 0.60 and r = 0.69, respectively) with the influence of whitefly population. The regression equations of significant values expressed as $\bar{Y}$= -18.83+0.86x (R^2 = 0.36) and $\bar{Y}$=4.42+0.90x (R^2 = 0.47). From these equations it may be expressed that with every unit increase in maximum temperature and sunshine there was an increase of 0.86 and 0.90 whitefly population/cage/plant (Fig. 2 and 3). Similar findings were also observed by Kumar *et al*. (2004) [16] and Tamang *et al*. (2017) [22] as they also reported that maximum temperature and sunshine had positively significant correlated. The present findings are in the full agreement with Kumar *et al.* (2007) [23] and Bairwa and Singh (2017) [19] as they found significantly positive correlation between the maximum temperature and whitefly population. The present results are the contradictory with the findings of Nitharwal *et al.* (2013) [14], Alam and

Patidar (2014) [24] and Yadav and Singh (2015) [12] as they found significantly negative correlation with whitefly population. Further, Yadav *et al.* (2015) [25], Kumar and Singh (2016) [20] and Manju *et al.* (2016) [15] reported maximum temperature exhibited non-significant negative correlation with the influence of whitefly population. Whereas, Yadav *et al.* (2015) [25] reported that whitefly population with sunshine hours expressed non-significant negative correlation. Other hand, evaporation showed positive correlation (r= 0.48) with the influence of whitefly population, but statistically it was non-significant. This result was also similar with the finding of Bairwa and Singh (2017) [19]. Further, minimum temperature, morning RH and evening RH, wind speed and rainfall expressed negative correlation (r= -0.19, -0.36, -0.55, -0.09 and -0.52, respectively) with whitefly population, but statistically found to be non-significant. Manju *et al.* (2016) [15] and Tamang *et al.* (2017) [22] reported that the morning RH and evening RH exhibited significant positive while, minimum temperature showed significant negative correlation with whitefly population. Further, similar results were also reported by Bairwa and Singh (2017) [19] as they also reported that the correlation between rainfall and whitefly population was found negatively non-significant. Further, the present results are the contradictory with the findings of Yadav *et al.* (2015) [25] as they stated that whitefly population with rainfall, minimum temperature, morning and evening RH and wind speed showed a non-significant positive correlation with whitefly population.

Incidence of jassid, *Empoasca kerri*

The appearance of jassids on mungbean was first recorded during 31st SMW (*i.e.* 30th July to 05th August) (Table 1 and Fig. 1). The population of jassids was ranged from 1.20-6.30 jassids /cage/plant. The present findings are corroborated with findings of Netam *et al.* (2013) [13], Nitharwal *et al.* (2013) [14] and Manju *et al.* (2016) [15], as they also reported that first appearance of jassid was recorded during 30th, 31st and 32nd SMW, respectively. After that its population was gradually increased and reached at its peak (6.30 jassids /cage/plant) during 36th SMW (*i.e.* 03rd to 09th September). During this period, the maximum temperature, minimum temperature, morning and evening RH, sunshine, wind speed, evaporation and rainfall were 26.50°C, 22.40°C, 97.00% and 90.60%, 0.34 hrs/day, 1.00 km/hr, 1.60 mm and 13.80 mm, respectively. This finding is in agreement with findings of Nitharwal *et al.* (2013) [14]. Though, the other researchers in India reported that the peak population of jassids during different weeks and years i.e., 32nd SMW (Yadav and Singh 2013; Jat *et al.* 2017) [26, 21], 33rd SMW (Ahirwar *et al.* 2016; Manju *et al.* 2016) [18, 15], 35th SMW (Kujur *et al.* 2011, Bairwa and Singh 2017) [27, 19], 37th SMW (Kumar *et al.* 2016) [20], 38th SMW (Netam *et al.* 2013) [13]. It is found that after the peak population the jassids population was started decline and remained up to harvesting of the crop.

Correlation and regression of *E. kerri* with weather parameters

Correlation studies revealed that morning RH, evening RH, wind speed and rainfall had positive correlation (r= 0.52, r= 0.45, r= 0.39 and r= 0.39, respectively) with jassids population, but statistically found to be non-significant. Similar results were also reported by Bairwa and singh (2017) and Kumar *et al.* (2016) as they reported that morning and evening RH and rainfall had positive non-significant correlation with jassid population. Similarly, Singh *et al.* (2010) recorded jassid population associated with black gram was positively correlated with rainfall. Further, the results were similar with findings of Bairwa and Singh (2017). The correlation study of jassid was found positive correlation and non-significant with minimum temperature. Further, correlation was positive and non-significant between with rainfall with jassid. Further in the present investigation, evaporation was exhibited significant negative correlation (r= -0.65) with the influence of jassid population. The regression equation of significant value is expressed as $\bar{Y}$= 8.07-1.80x (R^2 = 0.43). From this equation it may be estimated that with every unit increase in evaporation there was a decrease of 1.80 jassids population/cage/plant Fig. 4). Whereas, maximum temperature, minimum temperature and sunshine expressed negative correlation (r= -0.47, r= -0.01 and r= -0.20, respectively) with jassids population, but statistically found to be non-significant. Similar results are corroborated with Manju *et al.* (2016) as they reported that maximum temperature exhibited significant negative correlation with jassid population. Further, Nitharwal *et al.* (2013) and Alam and Patidar (2014) reported positive significant correlation between maximum temperature and jassid population. Contrary, Kumar *et al.* (2016) found non-significant negative correlation with maximum and minimum temperature and sunshine against jassid. Bairwa and Singh (2017) also reported minimum temperature exhibited non-significant positive correlation with jassid population. The present result revealed that the prevailing weather parameters are play key role in fluctuation of both pest population during the cropping season of mungbean.

Table 1: Population dynamics of sucking insect pests on mungbean during *Kharif* season 2018

SMW	Period		Mean population (cage/plant)	
	From	To	Whitefly	Jassid
30	23 July	29 July	0.00	0.00
31	30 July	05 August	6.10	1.20
32	06 August	12 August	10.90	2.70
33	13 August	19 August	9.70	3.90
34	20 August	26 August	7.60	4.60
35	27 August	02 September	6.00	5.00
36	03 September	09 September	4.20	6.30
37	10 September	16 September	7.30	4.50
38	17 September	23 September	12.30	3.70
39	24 September	30 September	14.10	2.60
40	1 October	7 October	7.50	1.20

Table 2: Correlation (r) and regression co-efficient (byx) of sucking insect pest on mungbean with weather parameters

Weather parameters	Whitefly		Jassid	
	r	byx	r	byx
Maximum temperature (^{0}C)	0.60*	0.86	-0.47 NS	-
Minimum temperature (^{0}C)	-0.19 NS	-	-0.01 NS	-
Morning RH (%)	-0.36 NS	-	0.52 NS	-
Evening RH (%)	-0.55 NS	-	0.45 NS	-
Sunshine (hours)	0.69*	0.90	-0.20 NS	-
Wind speed (km/hr)	-0.09 NS	-	0.39 NS	-
Evaporation (mm)	0.48 NS	-	-0.65*	-1.80
Rainfall (mm)	-0.52 NS	-	0.39 NS	-

Where, r = Correlation co-efficient, byx = regression co-efficient, NS= Non significant, * = Significant at 5% level

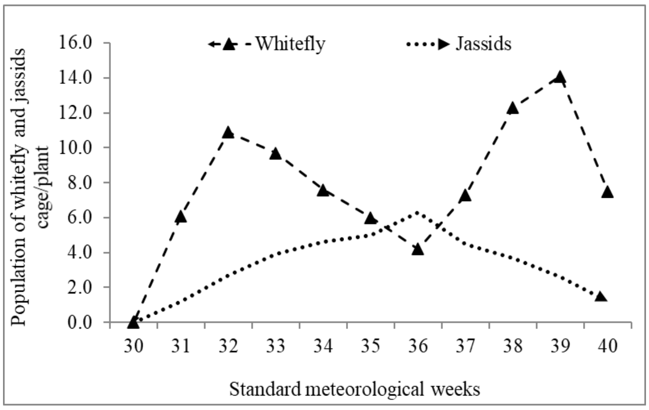

Fig 1: Population dynamics of sucking insect pests of mungbean during *Kharif* 2018

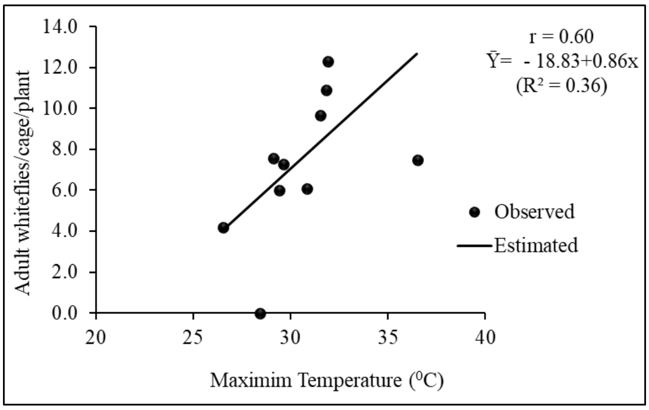

Fig 2: Regression of maximum temperature on whitefly population infesting mungbean

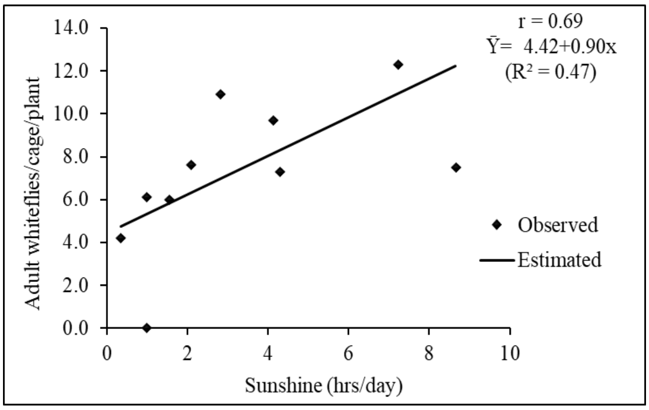

Fig 3: Regression of sunshine on whitefly population infesting mungbean

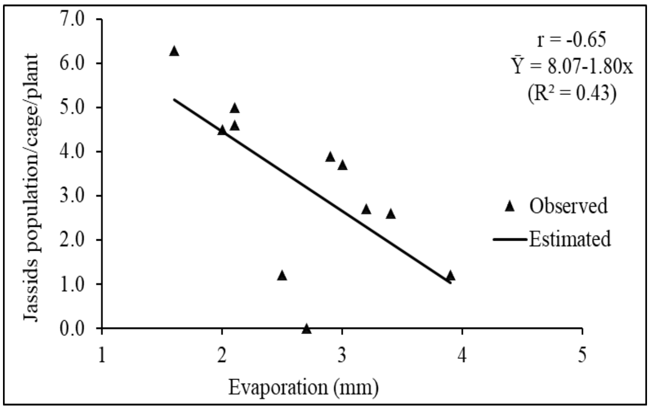

Fig 4: Regression of evaporation on jassid population infesting mungbean

Conclusion
The present study revealed that the first incidence of whitefly and jassid on mungbean was recorded during 31st SMW. Both the insect pests population were dynamically fluctuated on mungbean during the crop period. Apparently, prevailing weather parameters were found to be exclusively responsible factors to oscillate the pest population. The maximum temperature and sunshine hours were exhibited significantly positive correlation with whitefly population while, evaporation was exhibited significant negative correlation with the influence of jassid population.

Acknowledgement
The authors are acknowledge to the Dean, JNKVV, College of Agriculture, Tikamgarh, Madhya Pradesh, India for providing experimental field and facilities to carried out this piece of research work and proper guidance, ceaseless encouragement during the course of investigation.

References
1. Selvi R, Muthiah AR, Manivannan N. Tagging of RAPD marker for MYMV resistance in mungbean (*Vigna radiata* (L.) Wilczek). Asian J Plant Sci. 2006;5:277-280.
2. Vairam N, Lavanya SA, Muthamilan M, Vanniarajan C. Screening of M3 mutants for yellow vein mosaic virus resistance in greengram [*Vigna radiata* (L.) Wilczek]. Int. J Plant Sci. 2016;11(2):265-269.
3. Prasad SK, Singh MK, Singh J. Response of rhizobium inoculation and phosphorus levels on mungbean (*Vigna radiata*) under guava-based agrihorti system.The Bioscan-An International Quarterly Journal of Life Sciences 2014;9(2):557-560.
4. Taunk J, Yadav NR, Yadav RC, Kumar R. Genetic diversity among green gram genotypes varying in micro nutrients (Fe and Zn) content using RAPD markers. Indian Journal of Biochemistry 2012;11(1):48-53.
5. Anonymous. Agricultural statistics at a glance 2017. Directorate of Economics and Statistics, Ministry of Agriculture & Farmers Welfare, Govt. of India 2017.
6. www.http://mpkrishi.mp.gov.in/hindisite_New/APY%20 2016-17_to_201819.pdf
7. Lal SS. A review of insect pests of green gram and their control in India. Tropical Pest Management 2008;31(2):105-114.
8. Nariani TK. Yellow mosaic of mungbean (*Phaseolus aureus* L.). Indian Phytopathology. 1960;13(1):24-29.
9. Marabi RS, Sagare DB, Das SB, Tripathi N, Noda H. Molecular identification of Mungbean Yellow Mosaic India Virus (MYMIV) from alternate weed and crop hosts. Annals of Plant Protection Sciences 2017;25(1):152-155.
10. Duraimurugan P, Tyagi K. Pest spectrum, succession and its yield losses in mungbean and urdbean under changing climatic scenario. Agricultural Research Communication Centre 2014;37(2):212 -222.
11. Snedecor GW, Cochran WG. Statistical Methods, Oxford and IBH Publishing Company, New Delhi 1967, 1-292.
12. Yadav NK, Singh PS. Population dynamics of insect pests of green gram in genetic plains. Journal of Food Legumes 2015;28(2):82-84.
13. Netam HK, Gupta R, Soni S. Seasonal incidence of insect pests and their biocontrol agents on soybean. Journal Agriculture and Veterinary Science 2013;2(2):11.
14. Nitharwal M, Kumawat KC, Choudhary M. Population

dynamics of insect pests of green gram, (*Vigna radiata*) in Semi-Arid region of Rajasthan. Journal of insect science 2013;26(1):90-92.
15. Manju, Singh V, Mehra K. Population dynamics of major sucking pests of green gram, (*V. radiata*). Journal of Experimental Zoology 2016;19(2):1043-1046.
16. Kumar R, Razvi SMS, Ali S. Seasonal a varietal variation in the population of whitefly, (*Bemisiatabaci* (Genn.) and incidence of yellow mosaic virus in black gram and green gram. Indian Journal of Entomology 2004;66(2):155-158.
17. Raghuvanshi S, Singh P, Chauhan P. Succession and incidence of insect pests of soybean in Gird region of M.P. Annals of Plant Protection Sciences 2014;7(3):207-209.
18. Ahirwar B, Bhowmick AK, Gupta PK, Khan MA, Sharma SR, Nayak S. Efficacy of insecticides against sucking pests and yield of green gram. Annals of Plant Protection Sciences 2016;24(1): 34-37.
19. Bairwa B, Singh PS. Population dynamics of major insect pests of green gram [*Vigna radiata* (L.) Wilczek] in relation to abiotic factors in genetic plains. The Bioscan-An International Quarterly Journal 2017;12(3):1371-1373.
20. Kumar M, Singh PS. Population dynamics of major insect pest of black gram [*Vigna Mungo* (L.) Hepper] in relation to weather parameters. International Journal of Agriculture Environment and Biotechnology. 2016;9(4):673-677.
21. Jat SK, Lekha, Rana BS. Effect of abiotic factors on the incidence of major insect pests of black gram [*Vigna mungo* L. Hepper]. International Journal of Agriculture Sciences 2017;9(17):4159-4161.
22. Tamang S, Venkatarao P, Chaterjee M, Chakraborty G. Population dynamics of major insect pest of green gram and correlation with abiotic factors under Tarai agro-climatic Zone of West Bengal. International Quarterly Journal of Life Sciences 2017;2(2):893-897.
23. Kumar R, Ali S, Chandra U. Seasonal Incidence of Insect-Pests on black gram and its Correlation with abiotic Factors. Annals of Plant Protection Sciences 2007;15(2):366-369.
24. Alam MA, Patidar A. Studies on population dynamics of sucking insect pests in soybean crop under excessive rain condition in Rewa condition. Challenge and opportunities for agriculture crop productivity under climate change 21-22 September. JNKVV College of Agriculture Rewa, Madhya Pradesh, India 2014, 227(248).
25. Yadav SK, Agnihotri M, Bisht RS. Seasonal incidence of insect-pests of black gram, (*Vigna mungo* (Linn.) and it's correlation with abiotic factors. Agricultural Research Communication Center, Agriculture Science Digest 2015;35(2):146-148.
26. Yadav NK, Singh PS. Seasonal abundance of insect pests on green gram and its correlation with abiotic factors. Journal of Entomological Research 2013;37(4):297-299.
27. Kujur J. Population dynamics of major insect-pests of soybean and management of defoliators and girdle beetle. M.Sc. (Ag.) Thesis, IGKV, Raipur, CG, India 2011.