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Quantitative composition of major insect pests of summer green gram, *Vigna radiata* (L.) and correlation with abiotic factors in Kanpur region, U.P.

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Abstract
The present study was carried out on persuade of abiotic factors on abundance of Green Gram pests during Kharif season of 2018 at Insectary, department of Entomology CSAUAT, Kanpur. Six insect pests were recorded on *Vigna radiata but* only two insects' viz., *Mylabris pustulata* and *Helicoverpa armigera* were found to be major insects. Other insects were minor pests. The population of all six pests show negative correlation with minimum temperature and positive significant with sunshine except grasshopper. *Helicoverpa armigera* had a negative significant with minimum relative humidity (r= -0.5797). *Lampides boeticus* and *Ripotortus serripes* also show negative significant with minimum relative humidity (r= -0.5187 and r=-0.6759) respectively in treated field of Green gram crop. Data calculated on correlation coefficient to estimate the relationship between the numbers of pests associated with weather parameters in Green gram field.

Keywords: Weather parameters, green gram, quantitative, pests, kharif season

Introduction
Green gram, *Vigna radiata* (L) wilczek is the major crop grown in India during *Kharif* season. Green gram is attacked by large number of insect pests Sehgal and Ujagir, (1988) [10], Sehgal *et al.* (2000) [11]. Most economic damage to green gram is caused due to pod borer complex at reproductive stage of the crop. Maximum loss is caused by stem flies at seedling stage and by thrips, sucking bugs and pod borers during flowering and podding stage and together these pests cause about 30-70% crop loss. India has the distinction of being the world's largest producer of pulses, the average productivity is very low because of the abiotic and biotic stresses. India is reportedly the largest pulse growing country in the world both in terms of area as well as production covering 43.30 per cent of land area under pulses with 33.15 per cent production. The important pulse crops are Chickpea (48%), Pigeon pea (15%), Mungbean (7%), Urdbean (7%), Lentil (5%) and Field pea (5%). The major pulse-producing states are Madhya Pradesh, Maharashtra, Rajasthan, Uttar Pradesh, Karnataka and Andhra Pradesh, which together account for about 80% of the total production. Ali and Gupta (2012) [2]. Management of insect pests in mungbean in central and eastern Uttar Pradesh is influenced by the supply of food, the activity of parasitic organisms, including entomophagous insects and disease pathogens, and weather, Agrawal *et al*., (2010) [1]. There is no doubt that weather plays a major role in determining the survival and growth rates of insect populations because of its direct impact on them and on their food supply. Considering these, a study was undertaken to study population dynamics of major pests of mungbean in relation to weather parameters.

Materials and methods
The present study was based on infestation of different pests of green gram crop in treated and untreated fields in Kharif season -2018. The pests of green gram were recorded and collected by hand picking, sweep net technique and direct visual counting method. Finally, average population of pest and natural enemies per ten plants was worked out. The observations of pests' population were recorded starting from first week after transplanting till harvest of the crop. With a view to study the impact of weather parameters on the pest, a simple correlation between pest population and weather parameters was worked out. Weekly data of the pests were correlated with the prevailing climatic factors such as maximum temperature, minimum

temperature and relative humidity prevailing in the field by computing correlation coefficient (r) with a view to study the combined quantitative impact of different weather parameters on the pests population on green gram crop during Kharif season, 2018. Meteorological data were collected from Deptt. of Agronomy CSAUAT, Kanpur.(table-1)

Results and Discussion

The data recorded on seasonal abundance of different Mung pests during Kharif season, 2018 are presented in table2, 3. The data on the larval count of each insect was subjected statistical analysis to find out the correlation between pest population and various meteorological parameters viz temperature humidity, rainy days and rainfall etc. (table 4, 5).

Incidence of Major Pests in Untreated Green Gram Field

The data presented in Table-2 indicates that six insect pests were recorded during Kharif season, 2018. Incidence of insect pests was recorded from 29th to 14th SW during the period of study. The major pest recorded were Gram pod borer (*Helicoverpa armigera*), Blue butterfly (*Lampides boeticus*), Stem fly (*Ophiomyia phaseoli*), Pod bug (*Ripotortus serripes*), Blister beetle (*Mylabris pustulata*) and grasshopper. It is evident from Table 2 that population of *Mylabris pustlata* first appeared in the 30th SW and reached its peak (6.0) in the 38th SW when the maximum and minimum temperature were 32.7 ^{0}C and 23.6 ^{0}C respectively with 71.5 per cent relative humidity and 7.2 hours of sunshine. Thereafter the population showed a decreasing trend. The *Ophiomyia phaseoli* was the second major pest recorded during the period of study. It is evident from the Table -2 that population of *Ophiomyia phaseoli* first appeared in the 30th SW and reached its peak (4.0) in the 38th SW when the maximum and minimum temperature were 32.7 ^{0}C and 23.6 ^{0}C, respectively with 71.5 per cent relative humidity and 7.2 hours of sunshine and 3.0mm rainfall. Thereafter, the population showed a decreasing trend. It was found that *Helicoverpa armigera* appeared in the 30th SW and reached its peak on 38th SW with 0.6 and 3.6 larvae per plant, respectively. As regards the *Lampides boeticus* appeared in 30th SW with 0.4 larvae/plant while *Ripotortus serripes* appeared in the 32nd SW with 0.2 larvae/plant. There was fluctuating incidence of grasshopper with maximum adults/plant in 39th SW when the maximum and minimum temperatures were 33.9 ^{0}C and 22.7 ^{0}C respectively with 65.5 per cent relative humidity and 8.8hours of sunshine.

Incidence of Major Pest in Treated Green Gram Field

The data presented in Table-3 indicates that there were six insect pests recorded during Kharif season -2018. Incidence of insect pests was recorded from 31st to 40th SW during the period of study. The major pests recorded were *Mylabris pustulata* and *Helicoverpa armigera* while *Lampides boeticus*, Stem fly (*Ophiomyia phaseoli*), Pod bug (*Ripotortus serripes*) and Grasshopper were recorded as minor pests. It is evident from Table- 4 that population of Stem fly (*Ophiomyia phaseoli)* of first appeared in the 33rd SW and reached its peak (2.0) in the 38th SW when the maximum and minimum temperature were 32.7 ^{0}C and 23.6 ^{0}C respectively with 71.5 per cent relative humidity and 7.2 hours of sunshine. Thereafter, the population showed a decreasing trend.

The *Helicoverpa armigera* was the second major pest recorded during the period of study. It is evident from the Table -3 that population of *Helicoverpa armigera* first appeared in the 32nd SW and reached its peak (1.6) in the 37th SW when the maximum and minimum temperature were 32.4 ^{0}C and 23.5 ^{0}C respectively with 74.0 per cent relative humidity and 7.5 hours of sunshine. The population showed a decreasing trend thereafter (Table 3). It was found that *Mylabris pustulata appeared* in the 34th SW and reached its peak on 38th SW with 0.4 and 2.0 larvae per plant respectively. As regards *Lampides boeticus*, it appeared in 33rd SW with 0.4 larvae /plant and the population constant thereafter. *Ripotortus serripes* appeared in the 35th SW with 0.6 larvae/plant after which it started decreasing and it vanished after 7th SW. There was fluctuating incidence of grasshopper with maximum Adult/plant in 35th SW. The present results are in the support with the finding of Singh and Kalra (1995) [12] studied the succession and abundance of insect pests on *Vigna radiata* and *V. mungo* in Hisar, India. These crops were attacked by 22 and 16 insect pest species, respectively at different stages of growth. Kumar *et al.* (2004) [5] also reported that the peak population of whitefly on Mung bean and Urd bean was recorded in first fortnight of May and second fortnight of September in Zaid and Kharif crops, respectively. Temperature and sunshine hours were favourable for whitefly population as they had positive correlation. Whereas Dar *et al.* (2002) [3] observed the Insect pests of Mung bean and Urd bean (*Vigna mungo*) in Aligarh district, Uttar Pradesh, India. Similar results found in different crops and location such as Kumar *et al.* (2007) [6], Nayak *et al.* (2004) [7], Yadav and Singh (2006) [15], Thejaswi *et al.* (2010) [13], Nitharwal (2011) [8], Nitharwal *et al.* (2013) [9] and Yadav and Singh (2013) [16].

Table 1: Weekly metrological data during the experimentation period- 2018

Sr. No	Standard Week (SW)	Max. Temp. (^{0}C)	Min. Temp. (^{0}C)	Max. Rh (%)	Min. Rh (%)	Rainfall (mm)	Sunshine (hrs/day)	Wind speed (KMph)
1	27 (July 1st week)	38.2	27.5	76	56	6.2	5.1	3.8
2	28 (July 2nd t week)	34.7	26.4	86	72	60.2	3.5	3.2
3	29 (July 3rd week)	34.9	26.9	83	62	7.0	6.8	4.1
4	30 (July 4th week)	31.1	25.1	92	80	101.0	2.2	3.0
5	31 (July 5th week)	28.5	23.0	97	87	333.5	0.3	1.8
6	32 (Aug. 1st week)	32.8	25.7	86	71	28.4	4.8	3.6
7	33 (Aug.2nd t week)	33.8	25.8	86	71	53.1	2.6	4.6
8	34 (Aug. 3rd week)	31.9	24.9	93	77	122.0	2.7	5.5
9	35 (Aug. 4th week)	31.6	25.7	90	77	42.3	3.1	4.0
10	36 (Sept. 1st week)	30.8	23.9	90	79	110.2	3.0	5.1
11	37 (Sept. 2nd week)	32.4	23.5	85	63	19.6	7.5	7.1
12	38 (Sept. 3rd week)	32.7	23.6	82	61	3.0	7.2	6.5
13	39 (Sept. 4th week)	33.9	22.7	78	53	8.6	8.8	4.3
14	40 (Oct. 1st week)	35.6	20.6	73	40	0.0	10.3	3.1

Table 2: Incidence of Insect pests on Green gram crop in untreated field during Kharif season- 2018 (Mean of 10 plants)

Sr. No	Standard Week (SW)	*Helicoverpa armigera*	*Lampides boeticus*	*Ophiomyia phaseoli*	*Ripotortus serripes*	*Mylabris pustulata*	Grasshopper	Max. Temp. (^{0}C)	Min. Temp. (^{0}C)	Max. Rh (%)	Min. Rh (%)	Rainfall (mm)	Sunshine (hrs/day)	Wind speed (KMph)
1	27	0.0	0.0	0.0	0.0	0.0	0.0	38.2	27.5	76	56	6.2	5.1	3.8
2	28	0.0	0.0	0.0	0.0	0.0	0.0	34.7	26.4	86	72	60.2	3.5	3.2
3	29	0.0	0.0	0.0	0.0	0.0	0.6	34.9	26.9	83	62	7.0	6.8	4.1
4	30	0.6	0.4	1.4	0.0	0.4	1.2	31.1	25.1	92	80	101.0	2.2	3.0
5	31	0.0	0.4	0.0	0.0	0.1	0.6	28.5	23.0	97	87	333.5	0.3	1.8
6	32	0.8	0.6	1.4	0.2	0.6	1.2	32.8	25.7	86	71	28.4	4.8	3.6
7	33	1.0	0.6	1.4	0.4	0.8	1.4	33.8	25.8	86	71	53.1	2.6	4.6
8	34	0.6	0.6	1.4	0.6	0.8	0.8	31.9	24.9	93	77	122.0	2.7	5.5
9	35	1.6	1.4	2.0	0.8	2.0	1.4	31.6	25.7	90	77	42.3	3.1	4.0
10	36	1.4	1.4	1.4	0.8	1.6	1.4	30.8	23.9	90	79	110.2	3.0	5.1
11	37	2.0	2.2	2.8	1.0	2.0	1.4	32.4	23.5	85	63	19.6	7.5	7.1
12	38	3.6	3.8	4.0	3.0	6.0	1.6	32.7	23.6	82	61	3.0	7.2	6.5
13	39	3.4	2.8	3.0	3.2	4.2	2.8	33.9	22.7	78	53	8.6	8.8	4.3
14	40	3.2	2.8	2.8	3.2	3.4	2.0	35.6	20.6	73	40	0.0	10.3	3.1

Table 3: Incidence of Insect pests on Green gram crop in treated field during Kharif season- 2018 (Mean of 10 plants)

Sr. No	Standard Week (SW)	*Helicoverpa armigera*	*Lampides boeticus*	*Ophiomyia phaseoli*	*Ripotortus serripes*	*Mylabris pustulata*	Grasshopper	Max. Temp. (^{0}C)	Min. Temp. (^{0}C)	Max. Rh (%)	Min. Rh (%)	Rainfall (mm)	Sunshine (hrs/day)	Wind speed (KMph)
1	27	0.0	0.0	0.0	0.0	0.0	0.0	38.2	27.5	76	56	6.2	5.1	3.8
2	28	0.0	0.0	0.0	0.0	0.0	0.0	34.7	26.4	86	72	60.2	3.5	3.2
3	29	0.0	0.0	0.0	0.0	0.0	0.0	34.9	26.9	83	62	7.0	6.8	4.1
4	30	0.0	0.0	0.0	0.0	0.0	0.0	31.1	25.1	92	80	101.0	2.2	3.0
5	31	0.0	0.0	0.0	0.0	0.0	0.6	28.5	23.0	97	87	333.5	0.3	1.8
6	32	0.6	0.0	0.0	0.0	0.0	0.6	32.8	25.7	86	71	28.4	4.8	3.6
7	33	0.8	0.4	0.6	0.0	0.0	1.2	33.8	25.8	86	71	53.1	2.6	4.6
8	34	0.8	0.4	0.6	0.0	0.4	1.2	31.9	24.9	93	77	122.0	2.7	5.5
9	35	0.8	0.4	1.4	0.6	0.6	1.2	31.6	25.7	90	77	42.3	3.1	4.0
10	36	1.4	0.6	1.4	0.6	0.6	0.6	30.8	23.9	90	79	110.2	3.0	5.1
11	37	1.6	0.4	1.4	0.6	0.8	0.6	32.4	23.5	85	63	19.6	7.5	7.1
12	38	1.6	1.4	2.0	1.4	2.0	0.6	32.7	23.6	82	61	3.0	7.2	6.5
13	39	1.4	1.4	2.0	1.0	1.4	0.6	33.9	22.7	78	53	8.6	8.8	4.3
14	40	1.4	1.4	1.4	0.8	1.4	0.4	35.6	20.6	73	40	0.0	10.3	3.1

Correlation studies between pest populations and weather parameters in untreated green gram field

The correlation coefficient between pests' population and abiotic factors i.e. temperature, Relative humidity, Rainfall, wind speed and sunshine are presented in Table-4. The correlation studies clearly revealed that the abundance of *Grasshopper* only affected by minimum temperature while *ophiomyia phaseoli* population exhibited significant positive correlation with sunshine (r= 0.582) and negative significant with minimum temperature (r= - 0.6353). It was observed that all six pests show negative correlation with minimum temperature and positive significant with sunshine except grasshopper. *Helicoverpa armigera* had a negative significant with minimum relative humidity (r= -0.5797). *Lampides boeticus* and *Ripotortus serripes* also show negative significant with minimum relative humidity (r= -0.5187 and r=-0.6759) respectively.

Correlation studies between pests' populations and weather parameters in treated green gram field:

The correlation coefficient between pests' population and abiotic factors i.e. temperature, Relative humidity, Rainfall, wind speed and sunshine are presented in Table-5. The correlation studies clearly revealed that the abundance of *Helicoverpa armigera was* affected by maximum &minimum temperature, sunshine and wind speed (r= 0.08720, r= -0.6590, r= 0. 5575 and r=0.6910) respectively while *ophiomyia phaseoli* population exhibited significant positive correlation with wind speed (r= 0.5864) and negative significant with minimum temperature (r= - 0.6260). It was observed that all six pests showed negative correlation with minimum temperature and except grasshopper. *Mylabris pustalata* had a negative significant with minimum relative humidity (r= -0.6924) with positive significant to sunshine (r= 0.6831). *Lampides boeticus* and *Ripotortus serripes* also show negative significant with minimum relative humidity (r= -0.7337 and r=-0.6279) respectively. Similar findings have also been reported by Kumar Arvind and Kumar Akilesh (2015) [5], Yadav *et al.* (2015) [17], Yadav and Singh (2013) [16], Umbarkar *et al.*, (2010) [14]. Hossain *et al.* (2009) [4], found that the incidence and population fluctuation of various insect pests was very much dependent on the prevailed climatic conditions of the cropping season.

Table 4: Simple Correlation coefficient (r) between pest populations on Green crop crop in untreated field with weather parameters during Kharif season 18.

S. No	Pest (Scientific name)	Temperature (ºC)		Relative Humidity (%)		Rainfall (mm)	Sunshine Hrs./day	Wind speed (Kmph)
		Max. temp	Min. temp	Max. RH	Min. RH			
1	*Helicoverpa armigera*	0.0359	-0.7202**	-0.4929	-0.5797*	-0.4385	0.7011**	0.4430
2	*Lampides boeticus*	-0.0433	-0.7374**	-0.4214	-0.5187*	-0.3545	0.6638**	0.5029
3	*Ophiomyia phaseoli*	-0.0891	-0.6353*	-0.3266	-0.4265	-0.4267	0.5852*	0.5881
4	*Ripotortus serripes*	0.1457	-0.7487**	-0.5800*	-0.6759**	-0.3996	0.7509**	0.3119
5	*Mylabris pustulata*	0.0056	-0.6322*	-0.4325	-0.5052	-0.3900	0.6302*	0.4798
6	Grasshopper	-0.1523	-0.6945**	-0.2923	-0.3857	-0.2887	0.5267	0.2666

Table 5: Simple Correlation coefficient (r) between pest populations on Green crop in treated field with weather parameters during Kharif season 18.

S. No	Pest (Scientific name)	Temperature (ºC)		Relative Humidity (%)		Rainfall (mm)	Sunshine Hrs./day	Wind speed (Kmph)
		Max. temp	Min. temp	Max. RH	Min. RH			
1	*Helicoverpa armigera*	0.08720***	-0.6590*	-0.3100	-0.4012	-0.3628	0.5575*	0.6910**
2	*Lampides boeticus*	0.01068	-0.7337**	-0.5243	-0.6127*	-0.3674	0.6763*	0.3637
3	*Ophiomyia phaseoli*	-0.0775	-0.6260*	-0.3262	-0.4022	-0.3527	0.5468	0.5864*
4	*Ripotortus serripes*	-0.0192	-0.6279*	-0.4174	-0.4780	-0.3769	0.6255*	0.4904
5	*Mylabris pustulata*	0.0367	-0.6924**	-0.4627	-0.5583*	-0.3764	0.6831**	0.4882
6	Grasshopper	-0.4124	-0.1943	0.3365	0.2656	0.1528	-0.2251	0.3433

*= Significant at 5% level, **= Significant at 1% level, ***=Significant at 0.1% level

Conclusion

The present study concluded that in mung field, the incidence and development of all the insect pests are much dependent upon the prevailing weather conditions. Among the various abiotic factors, temperature is an important force to drive the insect pests it can cause the direct effects like survival, growth, development and dispersal of natural enemy.

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