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Study the correlation of insect pests with weather parameters in pea crop

Sheeren Parveen Rien, Abhishek Shukla and Dwarka

Abstract
The present research work was carried out at the department of Entomology, College of Agriculture, J.N.K.V.V, Jabalpur during *rabi* session 2016-17. Correlation between *Aphis craccivora* population with maximum temperature was non-significant (r= 0.332). Similarly no correlation was observed between its population and minimum temperature (r =0.114). Population of *Aphis craccivora* indicated positive correlation with morning relative humidity (r = 0.685) and the regression equation was y = 2.776 x – 221.9. Population of *Aphis craccivora* did not show any correlation with evening relative humidity. Population of *Acyrthosiphon pisum* indicated significant positive correlation with morning relative humidity, with r value of 0.768 and the regression equation obtained was y = 0.205x-16.40. Its population did not show any correlation with evening relative humidity (r = -0.06). Population of *H. armigera* was very low during the crop season. Its population did not show significant correlation (r = -0.45) with maximum temperature and minimum temperature (r = 0.217).

Keywords: *Aphis craccivora*, correlation, *H. armigera*, *Acyrthosiphon pisum* and regression

1. Introduction
Vegetable pea (*Pisum sativum*) is an important pulse crop of India. It is the second most important grain legume after soybean. It is grown in all states of the country during rabi season (Singh *et al.*, 2001) [19] and because of its taste, nutritive value, fast growth and high yield this crop is patronized throughout the world. It is used as a vegetable as well as pulse (Singh & Joshi, 1970) [15]. The protein content in this crop is 19 to 27%, it has high caloric value and is a great source of ascorbic acid. In addition to its food value it has proved to be an excellent source of fodder and its vines are used in silage making in off season for feeding livestock. The nitrogen fixing capacity of this crop restores soil fertility (Singh *et al.*, 2002) [18] Population dynamics and activity of insect pests is closely associated with various abiotic environmental influences. Seasonal incidence of different insect pests depends on climatic conditions of the area. Higher relative humidity and rainfall have been reported to be favourable for the development of almost all the pests except *Spodoptera litura* (Tomar *et al.*, 2004) [21]. Pea leaf miner has been reported to increased with increasing maximum temperature (Singh and Saravanan, 2008) [16]. Aphid (*Aphis craccivora*) populations were reported to have positive correlation with maximum temperature (Wale, 2011) [22].
The crop is ravaged by 17 insect pests which lower down the yield of the crop both qualitatively and quantitatively (Dhamdhere *et al.*, 1972) [6].

2. Material and Methods
The mean pest populations during different weather weeks were subjected sample to correlation studies considering weather parameters like the mean minimum and maximum temperature (˚C) and minimum and maximum relative humidity (%) as the independent variables and the density of insect pests as the dependent variable. Regression equations were worked out for insect populations showing correlation with weather parameters. Correlation and regression of the biotic factors on major insect pests population were worked out by using the following formula as suggested by Snedecor and Cochran (1967) [14].

$$\text{Correlation 'r'} = \frac{\sum xy - \frac{\sum x . \sum y}{n}}{\sqrt{\{\sum x^2 - \frac{(\sum x)^2}{n}\}\{\sum y^2 - \frac{(\sum y)^2}{n}\}}}$$

2.1 Test of significance of correlation coefficient

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

Regression Y = a + b x (R^2)
a = Intercept
b = Regression coefficient
R^2=Coefficient of multiple determination

3. Results and Discussion

Insect pests recorded on pea crop included *Aphis craccivora*, *Acyrthosiphon pisum*, *Helicoverpa armigera*, *Liriomyza spp* and *Trichoplusia orichalcea.* Correlation studies between pests population observed during different weather weeks and weather parameters was studied for *Aphis craccivora*, *Acyrthosiphon pisum* and *Helicoverpa armigera.* The population of other pests observed on the crop was too low to make any interpretation.

3.1 *Aphis craccivora*

Its population did not indicate significant correlation with maximum temperature (r= 0.332). Correlation between its population and minimum temperature was non significant with r value of 0.114. Population of *Aphis craccivora* indicated positive correlation with morning RH (r = 0.685) and the regression equation was y =2.776x – 221.9. It's population did not show any correlation with evening relative humidity.

Table 1: Correlation (r) and regression coefficient (byx) of abiotic factors on insect pests complex on pea crop during *Rabi* season 2016-17.

Weather factors	Name of Insects							
	Thysanoplusia orichalcea		*Lipaphis erysimi*		*Aphis craccivora*		*Helicoverpa armigera*	
	R	byx	r	byx	r	byx	r	Byx
Maximum temperature (˚C)	-0.34 NS	-	0.032 NS	-	0.524 NS	-	-0.45 NS	-
Minimum temperature (˚C)	-0.04*	-	0.114 NS	-	0.346 NS	-	0.217 NS	-
Morning relative humidity (%)	0.521 NS	-	0.685*	2.77	0.768*	0.20	-0.432 NS	-
Evening relative humidity (%)	0.036 NS	-	0.035 NS	-	-0.06	-	0.437 NS	-

NS= non significant
* Significant at 5% level

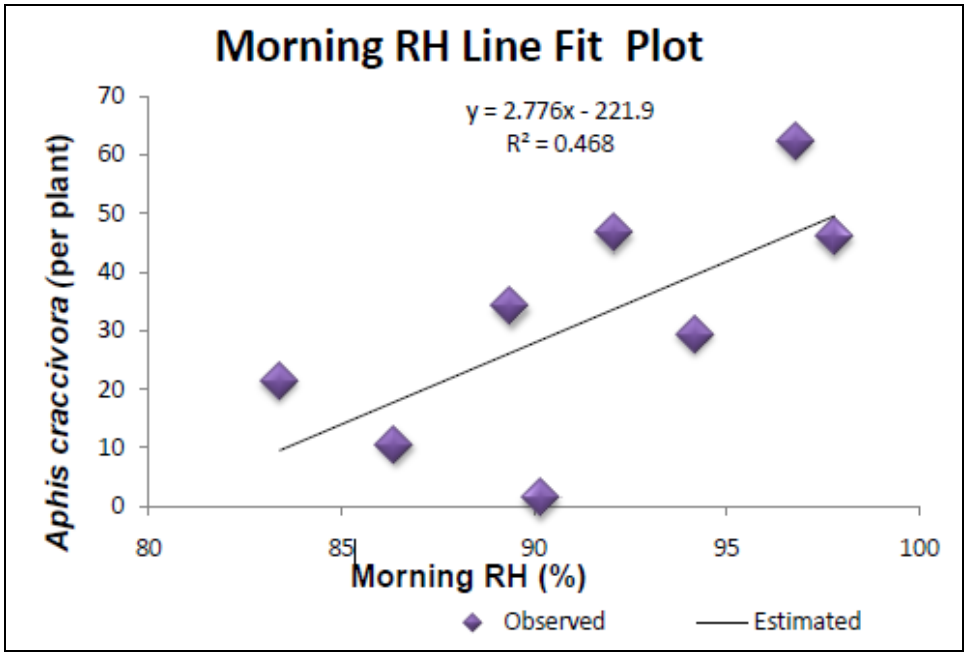

Fig 1: Regression of morning relative humidity on *Aphis craccivora* infesting pea.

3.2 *Acyrthosiphon pisum*

Population of *Acyrthosiphon pisum* indicated more affinity with morning relative humidity, with r value of 0.768 and the regression equation obtained was y = 0.205x-16.40. Its population did not show any correlation with evening relative humidity (r = -0.06).

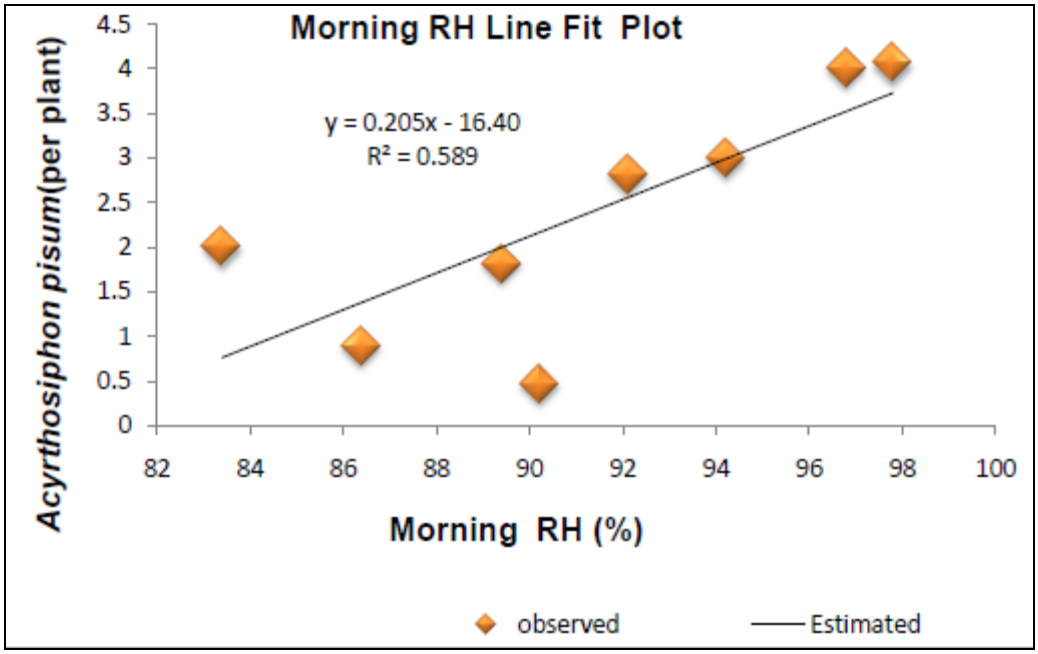

Fig 2: Regression of morning relative humidity on *Acyrthosiphon pisum pea* infesting pea

3.3 *Helicoverpa armigera*

Although the population of *H. armigera* was very low during the crop season, yet the studies on correlation of its population with weather parameters were conducted. Its population indicated non significant negative correlation (r = -0.45) with maximum temperature. Minimum temperature was found to have no significant influence on larval population of *H. armigera* (r = 0.217).

Morning and evening relative humidity also did not indicate any significant correlation with larval population of *H. armigera* (r = -0.432 and 0 .437, respectively) Incidence of *Liriomyza trifolii* was recorded to be 10% leaf infestation during SMW # 1. Its incidence increased gradually with peak infestation of 39.34% infested leaves in SMW # 5 when the average maximum and minimum temperatures were 25.3 ˚C and 7.5 ˚C respectively, with morning relative humidity of 92.1% and evening relative humidity of 37.7%. Present observations confirm the results of earlier workers (Ashlata , 2002 ; Singh and Saravanan, 2008) [1, 16] who have reported the incidence of leaf miner on pea throughout the crop season. They found that the maximum temperature and sunshine hours had positive correlation with population levels and the life cycle of leaf miner on pea crop. However in present studies the correlation between percentage of leaf miner and meteorological parameters was non significant. Mehta and Chandel (1998) [11] also reported high leaf miner incidence in majority of pea varieties. Bijjur & verma (1997) [3] and Sood *et al.,* (1997) [20] had reported temperature as an important factor in governing leaf miner incidence level, however in present experiment no such correlation could be established.

In present observations the population of *Aphis craccivora* was first observed in SMW # 1 (1.37 aphids per plant). Peak population of *Aphis craccivora* was recorded during SMW # 4 (62.30 aphids per plant) and there after its population declined gradually. Its population remained high till the maturity of the crop in SMW # 8 (21.4 aphids per plant). Prasad *et al.,* (1983) [13] also reported *Aphis craccivora* to be a major pest of green pea at Delhi.

In present experiment its population indicated non significant correlation (r= 0.332) with maximum temperature. Correlation between its population and minimum temperature was non significant with r value of 0.114. Population of *Aphis craccivora* indicated significant positive correlation with morning RH (r = 0.685) and the regression equation was y =2.776x– 221.9. Population of *Aphis craccivora* did not show any correlation with evening relative humidity.

Acyrthosiphon pisum appeared at a low level for the first time in SMW # 1 (0.47 aphids per plant) the population remained low throughout the crop season (below 4.07 aphids per plant). The peak population of *Acyrthosiphon pisum* was observed in SMW # 4 (4.02 aphids per plant) and in SMW # 6 (4.07 aphids per plant) when the maximum and minimum temperatures were 27.1 ˚C and 9.7 ˚C and morning and evening relative humidities were 97.8% and 42.4% respectively. Biswal and Patel (2015) [4] also reported that aphid, whitefly and thrips were the first to enter and colonize field pea crop followed by leaf miner and remained active till harvest of the crop. Dixon and Harrington (2000) [7] reported that the variation in aphid population was closely associated with temperature from January to July. Cool weather in January to February results in large number of aphids population. Their findings are in conformity to present observations where the peak populations were recorded at 9.7 ˚C mean minimum temperature.

Its population indicated non significant correlation with maximum temperature (r = 0.524) with regression equation of y = 0.291x – 5.023. Population of *Acrythosiphon pisum* did not show any correlation with mean minimum temperature (r = 0.346).

Population of *Acrythosiphon pisum* indicated more affinity with morning relative humidity with r value of 0.768 and the regression equation obtained was y = 0.205x-16.4 while Wale (2011) [22] observed negative correlation between aphid population and relative humidity and found negative correlation of rainfall with aphid population (r= -0.98) means when rainfall decreased ,the aphid population increased significantly at $P<0.05$. Negative correlation was also found between aphid population and minimum temperature (r =-0.20) but it was non significant.

Significant positive correlation was found between maximum temperature and aphid population. Its population did not show any correlation with evening relative humidity (r = -0.06).

Wale (2011) [22] reported that aphid population showed positive correlation with maximum temperature, and negative correlation with minimum temperature and relative humidity. Increasing maximum temperature promoted the buildup of aphid populations while increased minimum temperature, rainfall and relative humidity suppressed it.

Bhaduria (1993) [2] Chakraborty & Dutta (1999) [5], Kushwaha (2002) [9], Mittal & Ram (2007) [12], and Singh & Mishra (2013) [17] have reported the incidence of pod borers in green pea. However, under Jabalpur conditions the borers incidence in green pea was almost absent.

Tomar *et al.*, (2004) [21] reported the most favorable period of insect pests from first week of December to the second week of January for green pea. Relative humidity and rain fall were favorable for the development of almost all the pests (except *Spodoptera litura*). The maximum and minimum temperatures were negatively correlated with the population of all the insect pests.

Helicoverpa armigera was recorded in pea crop at very low level between SMW # 50 and SMW # 4 with peak population of 0.65 larvae per plant in SMW # 1. Dubey *et al.*, (1993) [8] reported its activity in February and March and found that environmental factors (temperatures, RH, and rainfall) had an impact on the development of pest population. Martinovich (1993) [10] reported that the degree of infestation was related to time of occurance of spring temperature, precipitation and RH.

The population of *H. armigera* was very low during the crop season, yet the studies on correlation of its population with weather parameters were conducted. Its population indicated non significant negative correlation (r = -0.45) with maximum temperature. Minimum temperature was found to have no significant influence on larval population of *H. armigera* (r = 0.217).

Morning and evening relative humidity also did not indicate any significant correlation with larval population of *H. armigera* (r = -0.432 and 0.437,respectively Dubey *et al.*, (1993) [8] studied the *Helicoverpa armigera* on various crops including pea in Jabalpur condition over two years. The peak activity was observed in February and March and they found that environmental factors (temperature, relative humidity and rainfall) had an impact on the development of pest population.

4. Conclusion

Positive correlations of *Aphis craccivora* and *Acyrthosiphon pisum* populations with morning relative humidity (r = 0.685 and 0.768, respectively) may be given due weightage in formulating forewarning modules of this pest.

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