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Population Dynamics of Lucerne Aphid

N. D. Makwana*, P. V. Patel, D. B. Nariya and M. F. Acharya

Department of Entomology, College of Agriculture, Junagadh Agricultural University, Junagadh, Gujarat, India

**Corresponding author*

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A B S T R A C T

Investigations on population dynamics of lucerne aphid were carried out under field condition during 2018-19 at Instructional Farm, Junagadh Agricultural University, Junagadh. The activity of aphid, *Aphis craccivora* was commenced from 2nd week of February and remained upto 3rd week of March having peak during 4th week of February in lucerne crop. Simultaneously, higher population of lady bird beetles was observed during 4th week of January to 3rd week of March and showed significantly highly positive correlation with aphid population.

Introduction

Lucerne (*Medicago sativa* L.) is known as "Green Gold" or Queen of Forage crops, which is also known as alfalfa and in Arabic meaning "the best". Lucerne is one of the important perennial forage crops, mostly grown for pasturage, silage, soilage, hay, dehydrated meal and medicinal purpose. It contains 4 to 5 times as much protein as forage sorghum and ample quality of vitamin-A. It also contains 20.2 % crude protein, 16.2 % digestible crude protein, 30.1 % crude fibre, 1240g calcium and 350g phosphorous/100 kg green fodder and metabolic energy 2.17 Mcal/kg. In Gujarat, the average production of lucerne is 60-130 tonnes/ha and average productivity is about 600 kg/ha (Anon, 2018) [(1).] Field crops are found to be infested by various species of aphids. They have a pair of tube like structure on the posterolateral region of the abdomen known as cornicles. Their wings when present are transparent with black lines on them and held in roof like position. There are almost 4,000 identified species of aphid in the world [(3)] Forbes *et al.*, (1985) About 149 species are known to occur in India [(4)] Ghosh (1974). Among them, lucerne aphid (*Therioaphis trifolli* from *maculata* Buckton), pea aphid (*Acyrthosiphon pisum* Harris.), groundnut aphid (*Aphis craccivora* Koch) are commonly found in gujarat. Out of 149 species in India, 32 species are known to be capable of transmitting one or more plant

viruses such as rosette and mosaic [4] Ghosh (1974). The losses caused by various species of aphid on their host crops are reported by various scientists. [8] Kindler *et al.,* (1971) reported 28 % yield loss in dry matter. The losses in green fodder yield of lucerne due to *T. maculata* have been reported as 33 % in New Mexico [10] Melton and Wilson (1989). [11] Sorenson *et al.,* (1988) and [6] Irwin *et al.,* (2001) reported 25 % yield loss in hay production. Information on the population dynamics of lucerne aphid is very scanty. Therefore present study will be very useful to know the relationship of aphid population with different weather parameters.

Materials and Methods

In order to determine the population dynamics of lucerne aphid, experiment was carried out on lucerne Instructional farm, College of Agriculture, JAU, Junagadh during 2018-2019. To determine the population fluctuation of aphid, ten quadrate of 1 m x 1 m was selected. The observations were recorded from five apical branches of length 5 cm from each quadrate, till the maturity of the crop in the morning at weekly intervals. The data, thus obtained were correlated with weather parameters. The weekly meteorological data on different abiotic parameters were obtained from the meteorological observatory of Junagadh Agricultural University, Junagadh. To study the impact of different abiotic factors on pest incidence, a simple correlation between pest population and weather parameters was worked out by using Microsoft Excel 2013.

Results and Discussion

Infestation due to lucerne aphid

The data (Table 1) indicated that the incidence of aphid was commenced from 4th week of December *i.e.* 52nd Standard Meteorological Week (SMW) and continued till 4th week of March (13th SMW) which ranged from 0.15 to 3.05 (aphid index (AI)/plant). The population of *A. craccivora* fluctuated during the crop period.

The infestation (0.15 AI/plant) was started from 4th week of December (52nd SMW) and showed the first peak (3.05 AI/plant) during 4th week of February (9th SMW). In subsequent weeks, the incidence was decreased and reached to 0.45 AI/plant during 4th week of March (13th SMW). Beginning from the outbreak to the harvest of the crop pest showed a continuing trend of increasing and after reaching its first peak aphids were continuously decreased.

Close monitoring of this pest indicated that relatively higher (1.30 to 3.05 AI/plant) infestation of aphid was observed during 2nd week of February to 3rd week of March with a peak on 4th week of February. According to [12] Swathi *et al.,* (2015), the highest aphid population remained active from January to March. However, the highest activity of this pest was observed in the first week of March in lucerne crop.

However, the highest activity of this pest was recorded during the first week of March in Lucerne crop. [5] Godwal (2010) reported that the peak population of aphids in Lucerne crop was recorded during February and March.[2] Dalwadi *et al.,* (2007) revealed that the aphid, *A. craccivora* remained active from mid-November to the end of March with two clear stages of peak periods.

The first peak (2.44 AI/plant) was noticed during the second week of February and the second peak (2.68 AI/plant) during the first week of March in case of Lucerne crop. Overall, the results obtained by the present study follow a more or less similar trend with the earlier reports.

Table.1 Population of lucerne aphid and ladybird beetle

Sr. No	SMW	Month	Mean AI/ plant	No. of ladybird beetle/plant
1	51	December	0.00	0.00
2	52		0.15	0.00
3	1		0.25	0.00
4	2		0.40	0.00
5	3	January	0.55	0.50
6	4		0.70	1.75
7	5		0.85	2.25
8	6		0.95	4.25
9	7	February	1.30	8.00
10	8		2.15	13.25
11	9		3.05	15.00
12	10		2.85	9.50
13	11		2.50	6.00
14	12	March	1.90	3.75
15	13		0.45	0.25

Table.2 Correlation of Lucerne aphid with various weather parameter

Abiotic factors	Correlation
Maximum Temperature, ^{0}C (Max T)	0.522
Minimum Temperature, ^{0}C (Min T)	0.410
Morning Relative Humidity, % (RH_1)	0.198
Evening Relative Humidity, % (RH_2)	0.181
Rainfall, mm (R)	0.434
Wind Speed, kmhr^{-1} (WS)	0.226
Bright Sunshine Hours, hrday^{-1} (BSS)	-0.165
* **Significant at 5% level (r = 0.444)**	

Population of ladybird beetle

The population (0.50 ladybird beetle/plant) was started from 3rd week of January (3rd SMW) and showed its first peak (15.00 ladybird beetle/plant) during 4th week of February (9th SMW). In subsequent weeks, the population was decreased and reached to (0.25 ladybird beetle/plant) during 4th week of March (13th SMW). Starting from the population to the harvest of the crop ladybird beetle showed a continuing trend of increasing and after reaching its first peak they were continuously decreased.

Thus, it is clear from the data (Table 1) that relatively higher (1.75 to 15.00 ladybird beetle/plant) population was observed during 4th week of January to 3rd week of March

having the highest peak on 4th week of February.

Effect of weather parameter on lucerne aphid

The population of aphids *A. craccivora* was found dependent on environmental factors. The data (Table 2) on the association between aphid infestation and weather factors indicated that there was a positive impact on the appearance of aphid due to MinT (0.410*). There was not any linear correlation either negative or positive between incidences of aphid population form the rest of the physical parameters. However, MaxT (0.522), windspeed (WS) (0.226) and relative humidity (RH1 (0.198), RH2 (0.181) were positive where as bright sunshine hours (BSS) (0.165) were negatively correlated with the incidence of aphid population but the relationship was non-significant. According to [2] Dalwadi *et al.*, (2007) found that the relative humidity and wind speed are positively correlated with the aphid population. [9] Kumar and Kumar (2014) found that there was a negative correlation between aphid and maximum temperature, sunshine hour and wind speed. [7] Jhansi and Verma (2006) also reported more or less similar results that the aphid population was negatively correlated with afternoon relative humidity, maximum and minimum temperature and positively correlated with wind speed. The present study is varied due to the variation in the sowing period or environmental condition during the experimentation.

The incidence of aphid was commenced from 4th week of December *i.e* 52nd standard meteorological week (SMW) and continued till 4th week of March (13th SMW) which was ranged from 0.15 to 3.05 (aphid index (AI/plant)). The infestation showed its first peak (3.05 AI/ plant) during the 4th week of February (9th SMW). Beginning from the outbreak of pest to the harvest of the crop pest showed a continuing trend of increasing and after reaching its first peak aphids were continuously decreased. Relatively higher (1.75 to 15.00 ladybird beetle/plant) populations of ladybird beetles predators were observed during the 4th week of January to 3rd week of March having the highest peak on 4th week of February.

A study on the correlation between aphid infestation and weather factors indicated that there was a positive impact on the appearance of aphid due to MinT (0.410*). There was not any linear correlation either negative or positive between incidences of aphid population for the rest of the physical factors. While an association between ladybird beetle and biotic (aphid infestation) as well as abiotic factors (weather parameters) indicated that there was negative significant impact on the population of ladybird beetle due to bright sunshine hours (BSS) (-0.535*) while the highly positive significant impact on the population of coccinellids due to aphid population (0.888**).

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