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Introduction

Lucerne or Alfalfa (*Medicago sativa* L) is the world's most important forage legume and a key component of many crop rotation systems (Osborn *et. al*., 1997). Alfalfa is considered an insectary due to the large number of insects it attracts. Some pests, such as alfalfa weevil, aphids, armyworms, and the potato leafhopper, can reduce alfalfa yields dramatically, particularly with the second cutting when weather is warmest. Chemical controls are sometimes used to prevent this. As a perennial crop, lucerne has a lifespan approaching 5 years, but in some areas of the world fields may remain productive for considerably longer. Such a long stand life affords ample time for the establishment and development of a diverse community structure by an abundance of organisms. In spite of system perturbations caused by frequent harvests and occasional pesticide applications, a lucerne field provides a temporal stability which is uncommon among field crops. As a result of this stability, lucerne supports an immense diversity of flora and fauna which, at times, exceeds that of riparian ecosystems. While most of lucerne's inhabitants have little or no impact on it as a crop, a few are capable of causing extensive damage. Arthropods, plant pathogens, weeds, vertebrates, and plant parasitic nematodes can all cause significant yield and/or quality reductions and frequently contribute to shortening the productive life of the stand. On the other hand large number of beneficial fauna like predators and parasites helps in reducing the aphis population. Pollinators also have a vital role in pollinating the lucerne crop. Cross- pollination in lucerne contributes to 89% seed yield (Somerville, 2002). In the present study, important insect pests of lucerne, their seasonal incidence, their economic threshold level were studied. Role of pollinator fauna and their impact on the seed yield was studied.

Materials and Methods

Studies of insect fauna including pests, parasites, predators and pollinators were carried out at weekly interval. For this purpose 20 randomly selected plants were observed from four spots at the rate of five plants in each spot. All the beneficial as well as harmful fauna were identified in the laboratory and the help of taxonomist was obtained where ever required in identification. Weekly weather data on rainfall, maximum and minimum temperature, morning and evening relative humidity was collected and correlation studies were made to know the relationship of weather parameters on the incidence of insect pests. Loss estimation and Economic Threshold Level (ETL) for aphids was be carried out under field conditions on caged plants. A cage experiment to work out economic injury level of aphids on lucerne variety RL-88 was carried out at Saidapur farm of IGFRI, Dharwad. The experiment was laid out in RBD with three replications. All the recommended packages of practices except plant protection measures were followed to ensure uniform crop stand. Well before the appearance of the aphids, each plot will be individually caged using nylon mesh over iron rectangle of size 1x1 m. Different number of aphids will be artificially released on the central shoot of each plant using camel hair brush. In one treatment no cage is covered, but the aphids were completely controlled up to harvest by dimethoate spraying to know the cost of chemical control. To know the influence of pollination on lucerne seed setting and seed yield, lucerne plots were caged by eliminating the pollinators. In an open field observations on pollinators activity was observed in one sq.mt area at different timings especially during bee active hours. Observations on seed quality and quantity parameters were taken.

Results and Discussion

Seasonal incidence of insect pests in Lucerne indicated that aphids active during Janaury to April with peak count of 310/stem in 3rd week of February. Leaf hoppers found active during 1st week of September to 1st week of November with peak count of 4.8/plant in 2nd week of October. Hairy caterpillars are seen in November and December. Thrips are more active during flowering period. Mites incidence observed during dry winter and early summer months. The relationship with weather parameters indicated aphids incidence was negatively correlated with rainfall (r=-0.55*) and positively correlated with maximum temperature (r=0.45*). Mites incidence was also positively correlated with maximum temperature and negatively correlated with rainfall (Table 1)

Table 1: Correlationship between insect pests and weather parameters in lucerne at Saidapur farm of IGFRI, Dharwad

Weather parameters Insect pests	Max temp(^{o}C)	Min temp (^{o}C)	Morning RH (%)	Afternoon RH (%)	Rainfall (mm)
Aphids	0.45*	0.25	-0.29	-0.20	-0.55*
Leaf hopper	-0.15	0.07	0.17	0.16	0.35
Hairy caterpillar	-0.12	-0.45	-0.21	-0.21	-0.25
Thrips	0.42*	0.06	-0.54	-0.64	-0.26
Mites	0.48*	-0.42	-0.23	-0.60**	-0.55**

Studies on pollinator fauna indicated that honey bees, syrphid flies ,megachilids and butterflies were found to be major pollinators. Among insect orders, hymenopterans are major pollinators in Lucerne (Table 2)

Table 2: Pollinator fauna on lucerne at Saidapur farm of IGFRI, Dharwad

Scientific name	**Family**	**Order**
Apis cerana	Apidae	Hymenoptera
A florea	Apidae	-do-
A.dorsata	Apidae	-do-
Megachile lanata	Megachilidae	-do-
Megachile bicolor	Megachilidae	-do-
Eristalinus megacephalus	Syrphidae	Diptera
Eristalinus obliquus	Syrphidae	-do-
Nomia melanderi	Haltidiae	Hymenoptera
Xylocopa sp	Xylocopidae	-do-
Cerceris sp	Sphecidae	-do-
Danaus chrysippus	Daneidae	Lepidoptera
Papilio demoleus	Papilionidae	Lepidoptera

Results indicated that pod set (%), germination (%) and seed yield (Kg/ha) was significantly influenced by the pollinators (Table 3).

Table 3: Influence of pollinators on seed yield and yield parameters in lucerne

Treatment	Pod set (%) Mean + SD	Germination (%) Mean + SD	Seed yield (Kg/ha) Mean + SD
Caged lucerne without pollinators	5.24±0.70	10.40±0.94	14±0.96
Open pollinated lucerne	32.20±1.90	92.40±2.28	208±2.64
S Em±	±0.420	±0.840	±0.922
LSD p=0.05	6.56	7.28	8.60

Different yield attributes of Lucerne were recorded and aphid incidence significantly influenced the no of branches, number of pods and green forage and seed seed yield in Lucerne. Economic threshold level was calculated for aphids and it was found that 85 aphids/stem. Economic threshold level helps to determine the stage before which the control measures needs to be initiated. In the present study damage caused by *Acyrthosiphon pisum* on seed yield of lucerne *Medicago sativa* was estimated and it was found that 85 aphids/ stem. Sharma and Stern (1980) reported that economic threshold level for blue lucerne aphid *Acyrthosiphon kondoi* was 40-50 aphids/stem. Variation in the economic threshold level may be due to change in the species, change in the plant protection measures and value of the crop.

Conclusion

Among all the insect pests of lucerne *Medicago sativa*, aphids *Aphis carccivora* and *Acyrthosiphon pisum* were the major ones. Important pollinators were honey bees, syrphid flies, megachilids and butterflies. Aphids active during Janaury to March with peak count of 210/stem in 2nd week of February. Aphids incidence was negatively correlated with rainfall and positively correlated with maximum temperature Insecticide. Imidacloprid was proved to be superior in controlling aphids. Significantly higher seed yield was obtained compared in open pollinated lucerne compared to caged lucerne without bees.

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