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Loss estimation and economic threshold level for aphids (*Acyrthosiphon pisum* Harris) in lucerne

N. S. Kulkarni*
Southern Regional Research Station, ICAR-Indian Grassland and Fodder Research Institute, Dharwad- 580 005, India
*Corresponding author e-mail: narendrask@yahoo.co.in
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Abstract
Lucerne (*Medicago sativa* Linn.) is cultivated globally as a feed resource for all classes of livestock. In addition to its versatility as a feed resource, *M. sativa* is well known for its ability to enrich soil and an effective source of biological nitrogen. Over 1000 species of Arthropods have been reported to occur in lucerne fields. Of these about 20 are injurious and few serious pests lead to economic injury. Pea aphid, *Acyrthosiphon pisum Harris* is a sap-sucking insect of family Aphididae and a major pest species. It feeds on several species of legumes (Family: Fabaceae) worldwide including forage crops. These aphids are responsible to reduce yield and also palatability of lucerne fodder to livestock due to the secondary growth of black sooty mould. In the present studies estimation of losses and economic threshold level (ETL) for *A. pisum* was carried out. ETL for *A. pisum* was calculated to be 85 aphids/stem.

Keywords: *Acyrthosiphon pisum,* Economic threshold level*,* Lucerne

Lucerne (*Medicago sativa* L.) is one of the important forage legumes and a key component of many crop rotation systems (Osborn *et al*., 1997; Pathan and Kumble, 2014). It is widely grown throughout the world as forage for cattle and most often harvested as hay but can also be made into silage, grazed, or fed as green chopped materials. It is also the third most important forage crop after sorghum and berseem in India and cultivated in around one million ha area, yielding average green fodder in the range of 50 to 70 t/ha during eight months cultivation period from November to June (Singh and Garg, 2015). But some insect pests such as lucerne weevil, aphids, armyworms and the potato leafhopper, can reduce lucerne forage yields dramatically, particularly with the second cutting when weather is warmest. Over 1000 species of Arthropods have been reported to occur in lucerne fields. Among them, about twenty are injurious and few serious pests cause economic injury. An effective pest management programme can significantly reduce such losses caused by these pests (Summers *et al.,* 2007). Aphids were found responsible for spreading of *Verticillium* wilt (*Verticillium alboatrum*) in Egypt (Adawy *et al*., 2001). In southern Califronia, *Acyrthosiphon kondoi* Shinji at a density of 20 insects/stem on lucerne regrowth, resulted in severe stunting and sometimes curling, yellowing and premature leaf fall. Lucerne feeding causes 25% of global production losses influencing both quality and quantity (Ryalls, 2013). Hence, pest control decision must think about economic threshold levels (ETL) including the effects of control practices on the pest, beneficial and non-target organisms and the potential for developing pesticide-resistant pests. In the present study efforts were made to know the economic threshold level (ETL) for aphids *Acyrthosiphon pisum* in lucerne and its impact on yield and yield attributes.

A cage experiment was carried out at Saidapur Farm, Indian Grassland and Fodder Research Institute, Dharwad during *Rabi* 2011 to work out economic injury level of aphids on lucerne variety RL-88. The experiment was laid out in randomized block design with three replications. All the recommended package of practices except plant protection measures was followed to ensure uniform crop stand. Before the appearance of the aphids each plot was individually caged using nylon mesh over iron rectangle of size 1 m x 1 m. Known number of aphids *i.e*. 20, 40, 60, 80,100 and 120 aphids/ plant were released (Fig. 1). Untreated check along with no release of aphids and no cage but complete control of aphids by dimethoate was also maintained. Aphids were released on the central shoot of each plant using camel hair brush. Observation on aphid count and yield data was taken. Different yield attributes of lucerne were recorded. Aphid incidence significantly influenced the number of branch

Table 1. Influence of aphid infestation on yield attributes of lucerne

No. of aphids released/stem (X)	Plant height (cm)	No. of branches /plant	No. of pods /plant	1000 seed weight (g)	Seed yield (q/ha) (Y)
20	80.2	18.2	68.2	3.52	2.40
40	80.8	17.6	68.0	3.50	2.36
60	82.6	17.4	67.2	3.48	2.34
80	80.4	17.2	64.2	3.44	2.32
100	81.0	16.8	56.2	3.10	2.02
120	82.2	18.0	54.2	3.06	1.98
O	81.20	18.4	70.2	3.50	2.48
Insecticide treated	74.20	17.8	76.2	3.60	2.52
Control	72.60	16.8	52.2	3.04	1.96
CV (%)	1.6	1.8	1.4	1.12	1.30
CD (P<0.05)	2.10	1.40	2.42	0.20	30.60
SEm	0.73	0.92	1.02	0.82	0.94

Fig 1. Release of aphids (*Acyrthosiphon pisum)* under nylon cages

Methodology adopted by Stone and Pedigo (1972) was followed to work out economic injury level (EIL) after establishing the regression coefficient between population of lucerne aphid and yields. The economic injury level was then worked out from gain threshold and regression coefficient using standard formula. When cost of insecticide application/ha was about Rs.1350/- (Dimethoate Rs.300/l with labour charge of Rs. 375/ha, for 2 rounds), and market price of product was Rs.40,000/ q (@ 400/kg), then gain threshold (GT) was found 0.34, besides regression coefficient (b) of 0.004, which led to working out of economic injury level (EIL).

EIL = Gain threshold (GT)/Regression coefficient (b) = 0.34/0.004 = 85 aphids/stem

Thus, the economic threshold level for aphids was found as 85 aphids/stem. This economic threshold level helps to determine the stage before which the control measure needs to be initiated. In the present study damage caused by *A. pisum* on seed yield of *M. sativa* was estimated and it was also found to be 85 aphids/ stem. Sharma and Stern (1980) reported that economic threshold level for blue lucerne aphid *Acyrthosiphon kondoi* was 40-50 aphids/stem. Earlier Knowles (1968) reported the economic threshold level for all the three species of aphids in lucerne *viz.,* blue lucerne aphid 50 to 60/ stem, pea aphid 70 to 80/ stem, spotted lucerne aphid 50 to 70/ stem. Anonymous (2015) reported that 100 pea aphids/ sweep was the economic threshold level for the pea aphid *Acyrthosiphon pisum* in alfalfa. Thus the present findings were in conformity of previous studies conducted elsewhere on lucerne. Variation in the economic threshold level might be due to change in the species and ecological factors. Economic threshold levels are influenced by the intensity of the pests species and plant yield which vary from location to location.

Pea aphid, *Acyrthosiphon pisum* Harris is considered as one of the economically important insect pests of lucerne. These aphids are responsible to reduce yield and also palatability of lucerne fodder to livestock due to the secondary growth of black sooty mould. In the present study estimation of losses and economic threshold level (ETL) for *A. pisum* was carried out. ETL for *A. pisum* was calculated to be 85 aphids/stem.

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