



E-ISSN: 2320-7078

P-ISSN: 2349-6800

www.entomoljournal.com

JEZS 2020; 8(6): 1407-1412

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Received: 08-09-2020

Accepted: 19-10-2020

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Effect of border crops on pest population in *Lablab* bean (*Lablab purpureus* L.)

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Abstract

The research project entitled “Pest management in *Lablab* bean (*Lablab purpureus* L.) by using border crops” was undertaken at Agronomy Farm, College of Agriculture, Dapoli during *rabi* 2016-17. The appearance of *Lablab* bean aphid started from week 1 (1st week of January) and noticed up to week 12 (3rd week of March). Overall mean aphid population per leaf per plant was in the range of 11.70 to 30.17. The minimum mean aphid population (11.70) was recorded in Sweet corn as a border crop which was at par with Marigold, Safflower, Cowpea, Mustard, Coriander, Sunflower, and Sesame which recorded 11.94, 12.83, 13.01, 13.26, 13.71, 13.79 and 14.48 mean aphid population, respectively. The leaf eating caterpillar, *S. litura* was recorded from week 1 (1st week of January) to week 12 (3rd week of March). Overall mean number of holes made by leaf eating caterpillar per leaf per plant in twelve weeks was in the range of 0.60 to 2.17. The treatments Coriander, Mustard, Sweet corn, Sesame, Safflower, Cowpea and Marigold recorded minimum number of holes per leaf per plant of 0.70, 0.74, 0.77, 0.78, 0.86, 0.87 and 0.93, respectively. The infestation of pod borer, *M. vitrata* was noticed from week 7 (2nd week of February) and persisted till the harvest of crop. Overall per cent infestation of pod borer in six weeks was in the range of 9.93 to 19.81. The minimum mean Pod borer infestation (9.93%) was recorded in Sweet corn as a border crop which was at par with Sunflower (10.21%), Mustard (10.22%), Coriander (10.41%), Marigold (10.66%) and Sesamum (11.13%).

Keywords: Border crops, *Lablab purpureus*, Morphometry

Introduction

Lablab bean (*Lablab purpureus* L.) belongs to family leguminaceae is an annual herbaceous crop and commonly called as Dolichos bean, Hycinth bean, Indian bean, Country bean, Pavta, Auri, Butter bean, Field bean and Egyptian kidney bean. It is popularly recognized as “Wal” in Maharashtra state. It is one of the oldest vegetable crops grown as pod vegetable in the world and in India particular. It is a native of tropical Asia, probably India and from there it spread to tropical and subtropical countries of the world like China, Sudan, Egypt and other countries.

India is the largest producer of pulse crops under a wide range of agro climatic conditions and is recognized globally as a major contributor of pulses having about 25 per cent share in global production and 27 percent of total pulses of the world. The domestic production is often less than the estimated demand *i.e.* 2324 million tonnes. Studies on consumption pattern has revealed that in India only 8-10 million tons of pulses are used directly as a food item (Dal), the remaining 12 million tonnes being indirect actual consumption as processed/value added products such as snacks, fast food for domestic consumption and export. Thus the average gap of 5 MT is met through imports. In India, the share of pulses to gross cropped area and in total food grains basket is about 12 percent and 6-7 percent respectively (Anonymous, 2016).

In India, the total area under pulses is 230.98 lakh hectares with an annual production of 17.20 million tonnes with yield 744 kg/hectare (Anonymous, 2015a) ^[2], while in Maharashtra, the total area under pulses is 2977 thousand hectare with an annual production of 1805.9 thousand tonnes with yield 607 kg/ hectare (Anonymous, 2015b) ^[3]. In *Konkan*, the total area under pulses is 88,000 hectares with an annual production of 37 metric tonnes (Anonymous, 2015c) ^[4].

The *Lablab* bean is an important pulse-cum-vegetable crop in India cultivated for its tender and mature pods, seeds and also for fodder. The per capita availability of pulses is @ 42 g per day. Pulses are chief source of vegetable protein in the human diet. The deficiency of protein in human diet often leads to Protein-Energy-Malnutrition (PEM) causing various forms of anemia.

Besides, nutritive value of pulses in human diet, food legumes tend to fix atmospheric nitrogen to N- compounds to the tune of 72 to 350 kg per hectare per year and provide soil cover that helps to sustain soil health.

As many as 55 species of insects and one mite feeding on the *Lablab* bean crop from seedling stage till the harvest in Karnataka. Among the various pests, pod borer complex comprising of *Helicoverpa armigera* (Hubner), *Adisura atkinsoni* (Moore), *Maruca vitrata* (Geyer), *Etiella zinckenella* (Treitschke), *Exelastis atomosa* (Walshingham), and *Lampides boeticus* (Linnaeus) are of considerable importance causing 80 per cent pod damage. Sucking pests like *Lablab* bug *Coptosoma cribraria* (Fabricius), *Riptortus pedestris* (Fabricius), *Nazara viridula* (Linnaeus) and aphid *Aphis craccivora* Koch. occurred commonly and observed in large number throughout the cropping period (Govindan, 1974) [5].

Aphids are one of the most serious pests of crops worldwide, causing major yield and economic losses. The management of these noxious pests is primarily based on synthetic insecticides due to their easy availability and applicability and their indiscriminate use has resulted in the development of insecticidal resistance in the pest, environmental pollution, resurgence of minor pests, pollution hazards and disruption on balance of eco-system. Border cropping is more economical method of pest management and has become popular, particularly among the small and marginal farmers and it is

very well fitted in Bio intensive Pest Management. It is also very good practice for conservation of the natural enemies and pollinators.

Materials and Methods

The present investigation entitled “Pest management in *Lablab* bean (*Lablab purpureus* L.) by using border crops” was undertaken at Agronomy Farm, College of Agriculture, Dapoli during *rabi* 2016-2017 Tal. Dapoli, Dist. Ratnagiri (M.S.). The soil of the experimental site was lateritic, fairly homogeneous with medium drainage. The experimental plot was divided using Randomized Block Design having three replications. Whereas each replication was divided into nine subplots of size 3.6 × 3.6 m. The flat beds were prepared and used for cultivation of *Lablab* bean. The required quantity of F.Y.M. was mixed at the time of field preparation and fertilizers were applied at the time of sowing. The healthy seed of ‘Konkan Wal-1’ variety of *Lablab* bean was obtained from Department of Agronomy, College of Agriculture, Dapoli. The recommended seed rate of 30-45 kg ha⁻¹ was used. Farm Yard Manure as organic manure at the rate of 5 tonnes ha⁻¹ was applied in the soil before last harrowing so as to mix it well in the soil. Nitrogen and Phosphorus were applied in the form of straight fertilizers through Urea (46% N) and Single Super Phosphate (16% P₂O₅) to each plot. The recommended dose, 25:50:0 kg NPK ha⁻¹ was applied at the time of sowing.

Treatments: Treatment Plots

Tr. No.	Name of the plant	Botanical name	Family
T1	Marigold	<i>Tagetes patula</i> L.	Asteraceae
T2	Safflower	<i>Carthamus tinctorious</i> L.	Asteraceae
T3	Sweet corn	<i>Zea mays</i> L.	Graminae
T4	Sesame	<i>Sesamum indicum</i> L.	Pedaliaceae
T5	Mustard	<i>Brassica juncea</i> L.	Cruciferae
T6	Coriander	<i>Coriandrum sativum</i> L.	Umbelliferae
T7	Cowpea	<i>Vigna unguiculata</i> L.	Leguminosae
T8	Sunflower	<i>Helianthus annuus</i> L.	Asteraceae
T9	Control	-	-

Date of Sowing: 2nd Dec., 2016 and Date of harvesting: 5th April, 2017

Five plants per plot were selected randomly to record the observations on the incidence of *Lablab* bean pests and for recording the natural enemies in *Lablab* bean ecosystem. Same *Lablab* bean plants were used for recording the presence of different natural enemies. Similarly, five flowering plants on border were randomly selected for recording the natural enemies. The total of nine treatments having eight flowering plants on borders (mentioned in treatments details) and one control (No flowering plants *i.e.* open border) were used around the plot size of 3.6 x 3.6 m. The flowering plants were grown on the borders.

To record the pest infestation in *Lablab* bean

Five plants from each plot were selected randomly to record the observations on the incidence on *Lablab* bean pests. The number of aphids was recorded from top, middle and bottom leaves of plant. The damaged and healthy pods were recorded for pod infestation by pod borer. The shot holes made by

Spodoptera litura (Leaf eating caterpillar) were counted from top, middle and bottom leaves of plant. The infestation of *Lablab* bean pests like aphid, pod borer and Leaf eating caterpillar was recorded. The observations were recorded at weekly interval till the harvesting of main crop. The average aphid population/leaf, holes/leaf and per cent infestation per plot in the different treatments was calculated. Data thus obtained was converted into square root/arc sine transformation and analyzed statistically.

$$\% \text{ of pod infestation} = \frac{\text{No. of damaged pods}}{\text{Total no. of pods}} \times 100$$

Statistical analysis

Data on per cent infestation of *Lablab* bean pests was converted in arc sine transformation and then analysed.

Table 1: Mean aphid population in per leaves per plant

Treatment	Mean aphid population in per leaves per plant												
	Week 1 (Jan. 1 st wk)	Week2 (Jan. 2 nd wk)	Week3 (Jan. 3 rd wk)	Week4 (Jan. 4 th wk)	Week5 (Jan. 5 th wk)	Week6 (Feb. 1 st wk)	Week7 (Feb. 2 nd wk)	Week8 (Feb. 3 rd wk)	Week9 (Feb. 4 th wk)	Week10 (March 1 st wk)	Week11 (March 2 nd wk)	Week12 (March 3 rd wk)	Pooled mean of all 12 weeks
T ₁ Marigold	20.07 (4.41)*	20.13 (4.42)	16.13 (4.08)	13.47 (3.67)	10.47 (3.29)	12.07 (3.53)	10.27 (3.26)	6.87 (2.67)	4.47 (2.23)	7.93 (2.89)	9.93 (3.15)	11.47 (3.46)	11.94 (3.52)
T ₂ Safflower	29.67 (5.43)	20.00 (4.47)	14.13 (3.81)	15.73 (4.01)	13.07 (3.67)	12.67 (3.63)	8.93 (3.06)	8.20 (2.93)	6.33 (2.59)	6.27 (2.57)	12.87 (3.59)	6.13 (2.57)	12.83 (3.65)
T ₃ Sweet corn	22.67 (4.7)	16.83 (4.16)	13.80 (3.78)	15.67 (3.98)	15.53 (3.94)	13.60 (3.69)	11.53 (3.44)	7.67 (2.83)	5.67 (2.43)	6.67 (2.67)	6.53 (2.57)	4.20 (2.07)	11.70 (3.47)
T ₄ Sesame	25.13 (5.06)	18.93 (4.38)	21.20 (4.44)	18.73 (4.3)	13.20 (3.66)	18.60 (4.06)	14.93 (3.86)	6.33 (2.61)	10.40 (3.15)	7.60 (2.72)	11.80 (3.34)	6.87 (2.61)	14.48 (3.82)
T ₅ Mustard	22.80 (4.83)	21.33 (4.66)	17.67 (4.26)	18.00 (4.25)	14.33 (3.84)	8.80 (3.04)	9.33 (3.13)	10.93 (3.31)	7.40 (2.78)	7.20 (2.77)	8.87 (2.96)	12.47 (3.58)	13.26 (3.7)
T ₆ Coriander	22.60 (4.73)	22.47 (4.63)	28.07 (5.14)	12.53 (3.57)	12.33 (3.57)	10.80 (3.2)	10.73 (3.27)	8.20 (2.93)	8.87 (3.06)	10.40 (3.28)	11.47 (3.37)	6.07 (2.52)	13.71 (3.77)
T ₇ Cowpea	18.33 (4.27)	16.00 (4.05)	19.07 (4.35)	16.07 (4.06)	12.00 (3.53)	12.60 (3.55)	12.47 (3.57)	12.80 (3.55)	11.87 (3.49)	8.20 (2.94)	11.40 (3.23)	5.33 (2.4)	13.01 (3.64)
T ₈ Sunflower	20.80 (4.57)	14.00 (3.79)	17.87 (4.26)	14.53 (3.76)	14.60 (3.81)	18.13 (4.3)	14.93 (3.91)	9.67 (3.15)	8.20 (2.95)	6.53 (2.63)	14.53 (3.65)	11.73 (3.44)	13.79 (3.76)
T ₉ Control	26.07 (5.15)	34.40 (5.9)	43.73 (6.64)	34.53 (5.91)	29.87 (5.51)	31.27 (5.64)	22.00 (4.7)	25.00 (5.03)	23.33 (4.87)	29.40 (5.44)	37.47 (6.16)	24.93 (4.93)	30.17 (5.53)
S.E ±	0.46	0.43	0.49	0.42	0.32	0.49	0.36	0.36	0.29	0.29	0.61	0.42	0.22
C.D at 5%	NS	NS	1.48	1.27	0.95	NS	NS	1.09	0.88	0.87	1.82	1.25	0.66

* Figures in parentheses are Square root transformed values.

Table 2: Number of holes made by leaf eating caterpillar per leaves per plant

Treatment	Number of holes made by leaf eating caterpillar per leaves per plant												
	Week1 Jan. 1 st wk	Week2 Jan. 2 nd wk	Week3 Jan. 3 rd wk	Week4 Jan. 4 th wk	Week5 Jan. 5 th wk	Week6 Feb. 1 st wk	Week7 Feb. 2 nd wk	Week8 Feb. 3 rd wk	Week 9 Feb. 4 th wk	Week10 March 1 st wk	Week11 March 2 nd wk	Week12 March 3 rd wk	Pooled mean of all 12 weeks
T ₁ Marigold	2.20 (1.64)*	2.40 (1.67)	1.67 (1.47)	1.60 (1.45)	1.27 (1.33)	0.93 (1.19)	0.20 (0.83)	0.33 (0.91)	0.27 (0.87)	0.20 (0.83)	0.07 (0.75)	0.00 (0.71)	0.93 (1.19)
T ₂ Safflower	1.47 (1.4)	2.47 (1.72)	1.53 (1.42)	1.73 (1.49)	1.33 (1.35)	0.73 (1.1)	0.47 (0.98)	0.27 (0.87)	0.07 (0.75)	0.20 (0.83)	0.07 (0.75)	0.00 (0.71)	0.86 (1.17)
T ₃ Sweet corn	2.20 (1.64)	1.20 (1.3)	1.93 (1.54)	1.53 (1.42)	0.80 (1.13)	0.87 (1.16)	0.20 (0.83)	0.27 (0.87)	0.00 (0.71)	0.20 (0.83)	0.00 (0.71)	0.00 (0.71)	0.77 (1.13)
T ₄ Sesamum	1.73 (1.47)	2.13 (1.62)	1.40 (1.37)	1.80 (1.52)	0.80 (1.14)	0.80 (1.14)	0.47 (0.98)	0.20 (0.84)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.78 (1.13)
T ₅ Mustard	2.40 (1.7)	1.80 (1.51)	1.53 (1.43)	1.53 (1.43)	0.33 (0.9)	0.47 (0.97)	0.27 (0.87)	0.27 (0.87)	0.00 (0.71)	0.07 (0.75)	0.13 (0.79)	0.07 (0.75)	0.74 (1.11)
T ₆ Coriander	2.00 (1.58)	2.00 (1.58)	1.80 (1.51)	0.93 (1.19)	0.53 (1)	0.47 (0.96)	0.20 (0.83)	0.20 (0.83)	0.20 (0.82)	0.00 (0.71)	0.00 (0.71)	0.07 (0.75)	0.70 (1.09)
T ₇ Cowpea	2.07 (1.52)	2.07 (1.6)	1.67 (1.47)	1.40 (1.37)	0.67 (1.08)	0.73 (1.1)	0.40 (0.94)	1.13 (1.28)	0.00 (0.71)	0.20 (0.83)	0.13 (0.79)	0.00 (0.71)	0.87 (1.17)
T ₈ Sunflower	1.67 (1.4)	2.13 (1.62)	0.87 (1.15)	1.00 (1.22)	0.73 (1.11)	0.27 (0.86)	0.20 (0.83)	0.20 (0.84)	0.13 (0.79)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.60 (1.05)
T ₉ Control	4.27 (2.18)	4.37 (2.2)	3.87 (2.09)	4.13 (2.15)	2.80 (1.81)	2.07 (1.6)	1.27 (1.32)	1.33 (1.35)	0.67 (1.08)	0.73 (1.11)	0.40 (0.94)	0.13 (0.79)	2.17 (1.63)
S.E ±	0.16	0.10	0.10	0.07	0.08	0.09	0.06	0.03	0.05	0.05	0.04	0.02	0.03
C.D at 5%	NS	0.30	0.29	0.20	0.25	0.28	0.18	0.10	0.16	0.14	0.12	NS	0.08

* Figures in parentheses are Square root transformed values

Table 3: Percent infestation of Pod borer, *Maruca vitrata* (Geyer)

Treatments	Per cent infestation of Pod borer						
	Week7 (Feb. 2 nd wk)	Week8 (Feb. 3 rd wk)	Week9 (March 4 th wk)	Week10 (March 1 st wk)	Week11 (March 2 nd wk)	Week12 (March 3 rd wk)	Pooled mean of all 6 weeks
T ₁ Marigold	10.35 (18.77)*	10.22 (18.64)	8.06 (16.49)	12.78 (20.95)	12.29 (20.52)	10.18 (18.55)	10.66 (3.34)
T ₂ Safflower	11.76 (20.04)	11.06 (19.42)	9.45 (17.79)	11.60 (19.88)	11.88 (20.16)	11.83 (20.11)	11.26 (3.43)
T ₃ Sweet corn	9.03 (17.48)	7.54 (15.94)	8.04 (16.12)	12.86 (20.97)	11.67 (19.98)	10.44 (18.44)	9.93 (3.23)
T ₄ Sesame	10.55 (18.95)	8.67 (17.11)	7.58 (15.96)	13.26 (21.35)	15.58 (23.21)	10.51 (18.82)	11.13 (3.39)
T ₅ Mustard	8.50 (16.84)	9.10 (17.55)	6.46 (14.72)	13.82 (21.82)	13.25 (21.33)	10.90 (19.13)	10.22 (3.29)
T ₆ Coriander	10.58 (18.97)	10.36 (18.63)	9.35 (17.64)	11.89 (20.12)	11.45 (19.7)	8.81 (17.24)	10.41 (3.3)
T ₇ Cowpea	12.44 (20.57)	12.01 (20.04)	12.54 (20.64)	14.75 (22.57)	15.72 (23.35)	10.99 (19.34)	12.76 (3.68)
T ₈ Sunflower	8.25 (16.58)	7.63 (16.02)	8.68 (17.08)	12.85 (20.98)	11.72 (19.9)	12.12 (20.35)	10.21 (3.27)
T ₉ Control	15.72 (23.36)	22.05 (28)	21.93 (27.81)	17.87 (24.93)	21.73 (27.78)	19.31 (25.99)	19.81

							(4.5)
S.E ±	0.79	1.11	1.42	0.96	0.94	1.58	0.06
C.D at 5%	2.36	3.32	4.25	NS	2.81	NS	0.19

* Figures in parentheses are Square root transformed values.

Results and Discussion

To record the pests infesting *Lablab* bean.

The infestation of *Lablab* bean pests viz., Aphid, Leaf eating caterpillar and Pod borer was observed and presented here with.

Aphid, *Aphis crassivora* Koch

Data on mean aphid population per leaf per plant is presented in Table 1. The incidence of *Lablab* bean aphid started from week 1 (1st week of January) and noticed up to week 12 (3rd week of March).

The mean aphid population per leaf per plant in week 1 (1st week of January) and week 2 (2nd week of January) was in the range of 18.33 to 29.67 and 14.00 to 34.40 respectively and data was non-significant. In week 3 (3rd week of January) the mean aphid population per leaf per plant was in the range of 13.80 to 43.73. The minimum mean aphid population (13.80) was recorded in Sweet corn as a border crop which was at par with Safflower (14.13), Marigold (16.13), Mustard (17.67), Sunflower (17.87) Cowpea (19.07) Sesame (21.20) and Coriander (28.07). The highest aphid population (43.73) was recorded in control. The data of week 4 (4th week of January) observed that the mean aphid population per leaf per plant was in the range of 12.53 to 34.53 percent. The minimum aphid population (12.53) was recorded in Coriander as a border crop which was at par with Marigold (13.47), Sunflower (14.53), Sweet corn (15.67), Safflower (15.73), Cowpea (16.07), Mustard (18.00) and Sesame (18.73). The highest aphid population (34.53) was recorded in control. The mean aphid population per leaf per plant was in the range of 10.47 to 29.87 in week 5 (5th week of January). The treatments Marigold as border crop recorded (10.47) mean aphid population which was at par with Cowpea (12.00), Coriander (12.33), Safflower (13.07), Sesame (13.20), Sunflower (14.60), Mustard (14.33) and Sweet corn (15.53). The highest aphid population (29.87) was recorded in control. The mean aphid population per leaf per plant in week 6 (1st week of February) and week 7 (2nd week of February) was ranged from 8.80 to 31.27 and 8.93 to 22.00 respectively and data was non-significant. In week 8 (3rd week of February) the mean aphid population per leaf per plant was in the range of 6.33 to 25.00. The minimum aphid population (6.33) was recorded in Sesame as a border crop which was at par with Marigold, Sweet corn, Safflower, Coriander Sunflower, Mustard and Cowpea which recorded 6.87, 7.67, 8.20, 8.20, 9.67, 10.93 and 12.80 mean aphid population respectively. The highest aphid population (25.00) was recorded in control. The data of week 9 (4th week of February) showed that the mean aphid population per leaf per plant was in the range of 4.47 to 23.33. The minimum mean aphid population (4.47) was recorded in Marigold as a border crop which was at par with Sweet corn, Safflower, Mustard, Sunflower and Coriander which recorded 5.67, 6.33, 7.40, 8.20 and 8.87 mean aphid population, respectively. The highest aphid population (23.33) was recorded in control. The data of week 10 (1st week of March) showed that the mean aphid population per leaf per plant was in the range of 6.27 to 29.40. The minimum mean aphid population (6.27) was recorded in Safflower as a border crop which was at par with Sunflower,

Sweet corn, Mustard, Sesame, Marigold, Cowpea and Coriander which recorded 6.53, 6.67, 7.20, 7.60, 7.93, 8.20 and 10.40 mean aphid population respectively. The highest aphid population (29.40) was recorded in control. The mean aphid population per leaf per plant was in the range of 6.53 to 37.47 in week 11 (2nd week of March). The treatments Sweet corn as border crop recorded (6.53) minimum mean aphid population, which was at par with Mustard Marigold, Cowpea, Sesame, Coriander, Safflower and Sunflower by recording 8.87, 9.93, 11.40, 11.80, 11.47, 12.87 and 14.53 mean aphid population respectively. The highest aphid population (37.47) was recorded in control. The data of week 12 (3rd week of March) showed that the mean aphid population per leaf per plant was in the range of 4.20 to 24.93. The minimum mean aphid population (4.20) was recorded in Sweet corn as a border crop which was at par with Cowpea, Coriander, Safflower and Sesame and recorded 5.33, 6.07, 6.13 and 6.87 mean aphid population respectively. The highest aphid population (29.40) was recorded in control. The pooled mean of twelve weeks was analyzed and presented in Table 1 and depicted in Fig.1. Overall mean aphid population per leaf per plant was in the range of 11.70 to 30.17. The minimum mean aphid population (11.70) was recorded in Sweet corn as a border crop which was at par with Marigold, Safflower, Cowpea, Mustard, Coriander Sunflower, and Sesame which recorded 11.94, 12.83, 13.01 13.26, 13.71, 13.79 and 14.48 mean aphid population respectively. The highest aphid population (30.17) was recorded in control.

The results of present finding are in agreement with the reports of Prasad *et al.* (2011). They investigated the incidence of insect pests on new variety, HA-4 of dolichos bean. The sucking pest population was found throughout the year. The peak population of aphids (49.00/3 leaves) were observed on 60 days after sowing (DAS).

Leaf eating caterpillar, *Spodoptera litura* Fabricius

The weekly data on mean number of holes made by leaf eating caterpillar, *Spodoptera litura* per leaf per plant on *Lablab* bean from week 1 (1st week of January) to week 12 (3rd week of March) is presented in Table 2.

The mean number of holes made by leaf eating caterpillar, *Spodoptera litura* per leaf per plant was in the range of 1.47 to 4.27 in week 1 (1st week of January) and the data was non-significant. The data recorded in week 2 (2nd week of January) showed that the mean number of holes made by leaf eating caterpillar, per leaf per plant was in the range of 1.20 to 4.37. The minimum number of holes (1.20) was recorded in Sweet corn which was at par with Mustard (1.80), Coriander (2.00) and Cowpea (2.07). The data recorded in week 3 (3rd week of January) showed that the mean number of holes made by leaf eating caterpillar, per leaf per plant was in the range of 0.87 to 3.87. The minimum numbers of holes (0.87) were recorded in Sunflower which was significantly superior over rest of the treatments. In week 4 (4th week of January) the mean number of holes made by leaf eating caterpillar per leaf per plant was in the range of 0.93 to 4.13. The minimum numbers of holes (0.93) were recorded in Coriander which was at par with Sunflower (1.00) and Cowpea (1.40). The data of week 5 (5th

week of January) showed that the mean number of holes made by leaf eating caterpillar per leaf per plant was in the range of 0.33 to 2.80. The minimum numbers of holes (0.33) were recorded in Mustard which was at par with Coriander (0.53), Cowpea (0.67), Sunflower (1.11), Sweet corn (1.13) and Sesame (1.14). In week 6 (1st week of February) the mean number of holes made by leaf eating caterpillar per leaf per plant was in the range of 0.27 to 2.07. The minimum numbers of holes (0.27) were recorded in Sunflower which was at par with Coriander (0.47), Mustard (0.97), Safflower (1.10), Cowpea (1.10) and Sesame (1.14). The data of week 7 (2nd week of February) showed that the mean number of holes made by leaf eating caterpillar per leaf per plant was in the range of 0.20 to 1.27. The minimum numbers of holes (0.20) were recorded in Sweet corn, Coriander, Sunflower and Marigold which was at par with Mustard (0.27) and Cowpea (0.40). In week 8 (3rd week of February) the mean number of holes made by leaf eating caterpillar per leaf per plant was in the range of 0.20 to 1.33. The minimum numbers of holes (0.20) were recorded in Coriander, Sunflower and Sesame, which was at par with Mustard (0.27). The mean number of holes made by leaf eating caterpillar per leaf per plant was in the range of 0.00 to 0.67 during week 9 (4th week of February). The minimum numbers of holes (0.00) were recorded in Mustard, Sesame, Sweet corn and cowpea which was at par with Safflower (0.07) and Sunflower (0.13). The data showed that the mean number of holes made by leaf eating caterpillar per leaf per plant was in the range of 2.00 to 0.73 during week 10 (1st week of March). The minimum numbers of holes (0.00) were recorded in Sesame, Coriander and Sunflower which was at par with Mustard (0.07) and Marigold (0.20). The mean number of holes made by leaf eating caterpillar per leaf per plant was in the range of 0.00 to 0.40 during week 11 (2nd week of March). The minimum numbers of holes (0.00) were recorded in Sweet corn, Sesame, Coriander and Sunflower which was at par with Marigold (0.07) and Safflower (0.07). The maximum numbers of holes (0.40) were recorded in control. The data on mean number of holes made by leaf eating caterpillar per leaf per plant was in the range of 0.00 to 0.13 during week 12 (3rd week of March) and data was non-significant.

The pooled mean of all twelve weeks is presented in Table 2 and graphically illustrated in Fig.2. Overall mean number of holes made by leaf eating caterpillar per leaf per plant in twelve weeks was in the range of 0.60 to 2.17. The treatments Coriander, Mustard, Sweet corn, Sesame, Safflower, Cowpea and Marigold as flowering plants at *Lablab* bean bunds recorded minimum number of holes per leaf per plant of 0.70, 0.74, 0.77, 0.78, 0.86, 0.87 and 0.93 respectively.

The results of present findings are corroborative with the results of Higuchi (1991). Yield losses caused by early infestation of leaf eating caterpillar at flowering and pod-development stages were attributed mainly to the reduced production of pods per plant. Infestation at later reproductive stages caused yield losses by reducing the weight of individual beans.

The results of present findings confirms with results of MinNan (1994) who reported that *Spodoptera litura* was economically important pests on pea plants. *S. litura* infested the leaves and serious infestations at the harvesting stage.

Pod borer, *Maruca vitrata* Geyer

The data pertaining to the effect of border crops on per cent infestation of pod borer, *M. vitrata* is presented in Table 3.

The infestation of pod borer, *M. vitrata* was noticed from week 7 (2nd week of February) and persisted till the harvest of crop *i.e.* week 12 (3rd week of March). The highest per cent infestation was observed in control in all six weeks. The data of week 7 (2nd week of February) showed that the infestation of pod borer, *M. vitrata* was in the range of 8.25 to 15.72 percent. The minimum infestation (8.25%) was recorded in Sunflower as a border crop which was at par with Mustard, Sweet corn and Marigold. In week 8 (3rd week of February) the infestation of pod borer, *M. vitrata* was in the range of 7.54 to 22.05 percent. The minimum (7.54%) infestation was recorded in Sweet corn as a border crop which was at par with Sunflower, Sesame, Mustard, Coriander and Marigold. The percent infestation of pod borer, *M. vitrata* was in the range of 6.46 to 21.93 in week 9 (4th week of February). The treatments Mustard as border crop recorded minimum of 6.46 per cent pod borer infestation, which was at par with Sesame, Sweet corn, Marigold, Sunflower, Coriander and Safflower. The percent pod borer infestation was ranged from 11.60 to 17.87 per cent in week 10 (1st week of March) and data was non-significant. The percent infestation of pod borer, *M. vitrata* increased in week 11 (2nd week of March) and was in the range of 11.45 to 21.73 per cent. The minimum infestation (11.45%) was recorded in Coriander as border crop followed by Sunflower (11.72%), Sweet corn (11.67%), Safflower (11.88%), Marigold (12.51%) and Mustard (13.25%). All these treatments were at par with each other. The results of the pod borer infestation in week 12 (3rd week of March) were non-significant. The percent infestation of pod borer was in the range of 8.81 to 19.31 percent.

The data of all six weeks was statistically analyzed and pooled mean of the Pod borer infestation is presented in Table 3 and depicted in Fig.3. Overall percent infestation of pod borer in six weeks was in the range of 9.93 to 19.81. The minimum mean Pod borer infestation (9.93) was recorded in Sweet corn as a border crop which was at par with Sunflower (10.21), Mustard (10.22), Coriander (10.41), Marigold (10.66) and Sesame (11.13). The highest pod infestation (19.81) was recorded in control.

The results of present findings are corroborative with the findings of Patel and Singh (1977). They reported that damage caused by *Maruca* larvae alone at a density of 1-4 individuals/plant caused 10 percent damage to the crop by destroying flowers, buds and developed pods.

The present findings confirm the results of Prasad *et al.* (2011). They reported that the higher pod damage due to *Maruca vitrata* was 16.66 percent at 80 days after sowing (DAS) on new variety, HA-4 of dolichos bean.

Conclusion

The appearance of *Lablab* bean aphid started from week 1 (1st week of January) and noticed up to week 12 (3rd week of March). Overall mean aphid population per leaf per plant was in the range of 11.70 to 30.17. The minimum mean aphid population (11.70) was recorded in Sweet corn as a border crop which was at par with Marigold, Safflower, Cowpea, Mustard, Coriander, Sunflower, and Sesame which recorded 11.94, 12.83, 13.01, 13.26, 13.71, 13.79 and 14.48 mean aphid population, respectively.

The leaf eating caterpillar, *Spodoptera litura* was recorded on *Lablab* bean from week 1 (1st week of January) to week 12 (3rd week of March). Overall mean number of holes made by leaf eating caterpillar per leaf per plant in twelve weeks was in the range of 0.60 to 2.17. The treatments Coriander,

Mustard, Sweet corn, Sesame, Safflower, Cowpea and Marigold as flowering plants at *Lablab* bean bunds recorded minimum number of holes per leaf per plant of 0.70, 0.74, 0.77, 0.78, 0.86, 0.87 and 0.93, respectively.

The infestation of pod borer, *M. vitrata* was noticed from week 7 (2nd week of February) and persisted till the harvest of crop *i.e.* week 12 (3rd week of March). Overall percent infestation of pod borer in six weeks was in the range of 9.93 to 19.81. The minimum mean Pod borer infestation (9.93) was recorded in Sweet corn as a border crop which was at par with Sunflower (10.21), Mustard (10.22), Coriander (10.41), Marigold (10.66) and Sesame (11.13).

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