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Cultivar Resistance of Linseed Against *Bemisia tabaci* Genn. and *Helicoverpa armigera* Hb.

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Abstract: Twenty cultivars of linseed were screened out for their resistance to *Bemisia tabaci* Genn. and *Helicoverpa armigera* Hb. under field conditions, at the experimental field of Oil Seed Section, Agricultural Research Institute, Tandojam during 2005. Result indicated that *Bemisia tabaci* Genn. minimum average population was recorded in ILsi-90 (0.04), which was, followed by, Bally (0.06), Raja (0.06), H-106 (0.19), L-15 (0.19), CW-2 (0.19), L-38 (0.21), LFC-387 (0.23), Red wood (0.24), Rajwina (0.24), Rocket (0.25), L-54 (0.25), CW-1 (0.26), L-46 (0.28), Marrina (0.28), L -52 (0.28), B-56-56 (0.29), Summit (0.29), Cree (0.31) and L-27 (0.33). In case of *Helicoverpa armigera* Hb. the minimum averages population was recorded on L-15 (0.07) and that was followed by H-106(0.11), Raja (0.16), L-54(0.16), LFC-387 (0.18), Rocket (0.18), B-56 (0.18), L-38 (0.18) Red wood (0.19), cree (0.19), L-46 (0.19), marina (0.20), summit (0.20), Rajwina (0.21), Cw-1,(0.21), L-52 (0.21), ILsi-90 (0.22), L-27 (0.25), CW-2 (0.29) and Bally (0.38). Results revealed that in case of *Bemisia tabaci* Genn. the most resistance cultivar was ILsi-90 and most susceptible cultivar was L-27. Whereas, in case of *Helicoverpa armigera* Hb. most resistant cultivar was L-15 and most susceptible variety was Bally.

Key words: Resistance, *Bemisia tabaci* Genn., *Helicoverpa armigera* Hb. ILsi, *Linum usitatissimum* L.

INTRODUCTION

Linseed (Flax) *Linum usitatissimum* L. belongs to the plant family Linaceae. Linseed is called ILsi throughout Pakistan. It is an annual rabi crop, plant grown for its seed and fibre. The stem is thin and rounded and about 50-100 cm tall. Linseed has a tap root system which does not penetrate deep into the soil, but rather is concentrated in the upper soil layer. The flowers may be white, blue, or dark red. Usually linseed is self-pollinated, but a considerable rate of cross-pollination is found in certain cultivars. The fruit is a capsule, containing about 10 shiny, flat seeds of different colours, flowering is initiated 60 days after sowing. Linseed is a long-day plant, but day-neutral cultivars also have been evolved. The seed contains 20-25% protein and 30-40% oil, which has been increased to 45% in some cultivars^[1].

The major significant attack among insect pests is caused by whitefly, *Bemisia tabaci*, family Aleyrodidae order Homoptera. The *Bemisia tabaci* Genn. is distributed throughout the northern and western regions of the Indian sub-continent and is very serious pest of American cotton, particularly in dry area. Apart from linseed. This insect also feeds on various other plants such as Cabbage, cauliflower, sarsoon, toria (*Brassica campestris*), melon, potato, brinjal, okra and some weeds^[2].

The nymphs, which suck the sap, are sluggish creatures, clustered together on the under surface of the leaves and their pale yellow bodies make them stand out

against the green background. In the winged stage, they are 1.0-1.5 mm long and their yellowish bodies are slightly dusted with a white waxy powder. They have two pairs of pure white wings and have prominent long hind wing. The females lay eggs singly on the under side of leaves, averaging 119 eggs per female. They hatch in 3-5 days in April-September, 5-17 days in October- November and 33 days in December-January. The nymphs, on emergence, look elliptical and soon fix their mouth parts into the plant tissues. They feed into the plant tissues. The life cycle is completed in 14-122 days and 11 generations are completed in a year^[3].

Damage by this pest and the vitality of the plant is lowered and caused through the loss of cell sap and the attacked crops given sickly, black appearance, consequently, the growth of the plants adversely affected and when the attack appears late in season, the yield is lowered considerably. *Bemisia tabaci* is known to transmit a number of virus diseases including the leaf curl diseases of tobacco and cotton, the vein clearing diseases of okra and the leaf curl of sesame^[4].

The linseed capsule borer, *Helicoverpa armigera* Hb. Family Noctuidae, order Lepidoptera. *Helicoverpa armigera* Hb. is cosmopolitan and widely distributed in Indo-Pakistan. It is a serious pest of linseed and is known as linseed capsule borer, it also a serious pest of gram, where it is known as gram pod borer^[5].

The females lay eggs singly on tender parts of the plants. A single female may lay as many as 741 eggs in 4 days. The eggs are shining greenish yellow and are

round. They hatch in 2-4 days in April to October and 6 days in February and the young larvae feed on foliage from some time and later bore into the capsule and feed on the developing grains, with their bodies hanging out side. They move from capsule to capsule and are full-fed in 13-19 days. The full-grown larvae come out of the capsule and pupate in the soil. The pupal period lasts 8-15 days, but in winter the duration is prolonged, particularly in northern India. There may be as many as 8 generation in year^[6].

The residual effect of insecticides and other problems created by chemical control, the present investigation was carried out to evaluate linseed varieties for resistance against *Bemisia tabaci* Genn. and *Helicoverpa armigera* Hb. under field conditions. These studies will help in evolving resistant varieties which will aid in reducing the use of insecticides.

MATERIALS AND METHODS

An experiment, to evaluate the relative susceptibility of linseed cultivars against *Bemisia tabaci* Genn. and *Helicoverpa armigera* (Hb.) was conducted during January-April 2005, at the Experimental field Oil Seed Section, Agricultural Research Institute, Tandojam.

All susceptibility screening was done in an isolated field away from the areas of frequent insecticide use. Having prepared the land, seeds of twenty cultivars of linseed namely.

V ₁	ILsi-90	V ₁₁	CW-2
V ₂	Red wood	V ₁₂	B-56.56
V ₃	LFC-387	V ₁₃	Raja
V ₄	Rocket	V ₁₄	Summit
V ₅	Cree	V ₁₅	L-15
V ₆	Maina	V ₁₆	L-27
V ₇	Rajwina	V ₁₇	L-54
V ₈	Bally	V ₁₈	L-46
V ₉	H-106	V ₁₉	L-38
V ₁₀	CW-1	V ₂₀	L-52

They were sown with the help of single row rabi drill in a Completely Randomized Block Design with three replicates. Each cultivar had one row of 4 length. The distance between row to row was maintained at 30 cm and plant to plant distance was 10 cm.

Size of the plot for cultivar was 0.45x4. The crop was raised by standard cultural practices, throughout the growing season except that insecticide were not used.

First observation was recorded thirteen days after the planting of linseed cultivars. Ten plants were selected at random on each replication. *Bemisia tabaci* Genn. and *Helicoverpa armigera* Hb. counts were made. The whole plant was screened out. All the plants were randomly

selected and observed once a week to note population development of insect pests and this was continued till the harvesting crop.

RESULTS AND DISCUSSION

Incidence and mode of attack of the *Bemisia tabaci*

Genn.: The appearance of *Bemisia tabaci* Genn. was recorded during 2nd week of January with 1st observation and it continued upto last week of February i.e., adults and nymphs feed on cell-sap and caused damage in two ways (a) the vitality of the plant was lowered through the loss of cell sap and (b) normal photosynthesis was interfered with due to growth of sooty mould on the honey dew excreted by the insect. From a distance, the attacked crop gives a sickly, black appearance. Consequently, the growth of the plant is adversely affected.

Relative resistance to *Bemisia tabaci* Genn.:

According to Table 1 average population of *B. tabaci* V₁ (ILsi-90) with average population of *B. tabaci* developed to 0.04 is proved as most resistant variety among twenty observed varieties. After ILsi-90, V₈ (Bally) and V₁₃ (Raja) ranks second position among resistant of all, which were observed the mean population of V₈ (Bally) and V₁₃ (Raja) developed to 0.06 *B. tabaci* Genn. The third least population, according to the Table 1, developed to the 0.19 *B. tabaci* on V₉ (H-106) and V₁₅ (L-15). Whereas the mean population on ten varieties, i.e., V₂ (Red wood), V₃ (LFC-387), V₄ (Rocket), V₆ (Marina), V₇ (Rajwina), V₁₀ (CW-1), V₁₁ (CW-2), V₁₇ (L-54), V₁₈ (L-46), V₁₉ (L-38), V₂₀ (L-52) developed more or less upto the same level. The average population of *B. tabaci* on there varieties developed to the 0.24, 0.23, 0.25, 0.28, 0.24, 0.26, 0.21, 0.25, 0.28, 0.21 and 0.28, respectively.

The mean population of *B. tabaci* an other group of few varieties, i.e., V₅ (Cree), V₁₂ (B-56-56) and V₁₄ (Summit) is also more or less upto equal level and is developed upto the 0.31, 0.29 and 0.29, respectively. The V₁₆ (L-27) is most susceptible among the all observed varieties and the mean population, on this variety developed to the 0.33 *B. tabaci*. Similarly Deshmukh *et al.*^[7] reported that the response of several flax (linseed) varieties, the pest 33.31 to 39.09% damaged capsules.

Incidence and mode of attack of *Helicoverpa armigera*

Hb.: The first occurrence of linseed capsule borer *H. armigera* recorded during the 2nd week of February, 1st observation that is first week of April and continued its activity. The young caterpillars of pest, after

Table 1: Average population of *Bemisia tabaci* Genn. on different cultivars of linseed

Varieties	R ₁	R ₂	R ₃	Total	Average
V ₁	0.05	0.03	0.06	0.14	0.04
V ₂	0.25	0.26	0.23	0.74	0.24
V ₃	0.23	0.21	0.25	0.69	0.23
V ₄	0.26	0.23	0.26	0.75	0.25
V ₅	0.33	0.30	0.31	0.94	0.31
V ₆	0.28	0.35	0.26	0.84	0.28
V ₇	0.25	0.25	0.23	0.73	0.24
V ₈	0.06	0.05	0.08	0.19	0.06
V ₉	0.23	0.15	0.20	0.58	0.19
V ₁₀	0.31	0.21	0.28	0.80	0.26
V ₁₁	0.23	0.21	0.20	0.64	0.21
V ₁₂	0.31	0.28	0.30	0.89	0.29
V ₁₃	0.06	0.08	0.04	0.18	0.06
V ₁₄	0.31	0.28	0.30	0.89	0.29
V ₁₅	0.21	0.18	0.20	0.59	0.19
V ₁₆	0.35	0.31	0.33	0.99	0.33
V ₁₇	0.28	0.23	0.26	0.77	0.25
V ₁₈	0.3	0.26	0.28	0.84	0.28
V ₁₉	0.21	0.20	0.23	0.64	0.21
V ₂₀	0.3	0.28	0.26	0.84	0.28
Total	4.81	4.30	4.54	13.67	
Mean	0.240	0.215	0.225	14.610	

Table 2: Average population of *Helicoverpa armigera* Hb. on different cultivars of linseed

Varieties	R ₁	R ₂	R ₃	Total	Average
V ₁	0.20	0.23	0.21	0.68	0.22
V ₂	0.20	0.18	0.20	0.58	0.19
V ₃	0.20	0.18	0.18	0.56	0.18
V ₄	0.20	0.18	0.16	0.54	0.18
V ₅	0.20	0.20	0.18	0.58	0.19
V ₆	0.20	0.21	0.20	0.61	0.20
V ₇	0.21	0.23	0.21	0.65	0.21
V ₈	0.04	0.36	0.38	0.14	0.38
V ₉	0.13	0.10	0.11	0.34	0.11
V ₁₀	0.23	0.20	0.21	0.64	0.21
V ₁₁	0.30	0.28	0.31	0.89	0.29
V ₁₂	0.18	0.16	0.20	0.54	0.18
V ₁₃	0.16	0.18	0.15	0.49	0.16
V ₁₄	0.20	0.20	0.21	0.61	0.20
V ₁₅	0.08	0.06	0.08	0.22	0.07
V ₁₆	0.25	0.26	0.25	0.76	0.25
V ₁₇	0.16	0.15	0.18	0.49	0.16
V ₁₈	0.20	0.18	0.21	0.59	0.19
V ₁₉	0.16	0.20	0.18	0.54	0.18
V ₂₀	0.21	0.23	0.20	0.64	0.21
Total	4.07	3.97	4.01		
Mean	0.203	0.198	0.200		

hatching, feed on epidermal layer of tender leaves. Then they borer and destroy fruit parts, resulting in failure of the crop.

Relative resistance to *Helicoverpa armigera* Hb.: Table 2 revealed that V₁₅ (L-15) is most resistant variety against *H. armigera*. The average population of *H. armigera* on V₁₅ developed to 0.07. The second position among observed resistant varieties is attended by V₉ (H-106) on which the average population of *H. armigera* is

developed upto the 0.11 caterpillars. After this, V₁₃ (Raja) and V₁₇ (L-54) rank as third most resistant varieties. The mean population on these range upto 0.16 caterpillars.

Then there is group of seven varieties i.e., V₂ (Red wood), V₃ (LFC -347), V₄ (Rocket), V₅ (Cree), V₁₂ (B-56-56) V₁₈ (L-46) and V₁₉ (L-38) on which the mean population of *H. armigera* caterpillar is more or less equal. The average population on these varieties developed upto the 0.19, 0.18, 0.18, 0.19, 0.18, 0.19 and 0.18, respectively, another group of six varieties i.e., V₁ (ILsi-90) V₆ (maina), V₇ (Rajwina), V₁₀ (CW10), V₁₄ (Summir) and V₂₀ (L-52) also range upto the same level. On these the mean population developed upto the 0.22, 0.20, 0.21, 0.21, 0.20 and 0.21, respectively. The third highest peak of average, population of *H. armigera* is found on V₁₆ (L-27), on average population ranges 0.25 caterpillars, where as the second most susceptible variety among twenty varieties of linseed is V₈ (Bally) on that the mean population of insect is 0.29 caterpillars. The most susceptible variety among all observed cultivars in V₈ (Bally) on that the average population of insect is reached upto 0.38 caterpillars. Similarly Sharma *et al.*^[8] and Alberg^[9] reported that, larvae found mostly inguring the seed capsule.

The result of studies on the cultivar resistance of linseed against *B. tabaci* and *H. armigera* it was concluded that cultivar ILsi-90, Bally, Raja, H-106, L-15 and L-54 were comparatively most resistant to the infestation of *B. tabaci* and *H. armigera*.

Similarly on the other hand linseed cultivars, Cree, L-27, Bally and CW-2 were comparatively more susceptible to the infestation of *B. tabaci* and *H. armigera*.

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