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HISTOLOGICAL BASIS OF RESISTANCE IN LINSEED AGAINST BUD FLY (*DASYNEURA LINI* BARNES)

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ABSTRACT

Field experiment was conducted during rabi season of 2009-10 and 2010-11 on linseed cv. Neelum in black soil at Research Farm, College of Agriculture, Raipur (C.G.) to study the histological basis of resistance of linseed against bud fly. The results indicated that the resistant germplasm line LMS-103-2K with maximum sepal thickness (52.91 µ) had relatively minimum bud infestation (6.90 %) and was statistically at par with the other resistant germplasm lines viz. R-2852, R-2901, R-2848, Gaurav, R-2885 and PKDL-12. While, susceptible germplasm line R-2661 exhibited minimum sepal thickness (32.88 µ) with maximum bud infestation (58.63 %) which was statistically at par with other susceptible lines viz GP-849, Neelum, T-397, RLC-71, R-4007, LC-54, R-552 and RL-99-32b. The correlation studies showed that there was a highly significant negative correlation (r = - 0.699) between thickness of sepals and % bud infestation (Y = - 1.57 x + 84.43).

Key word: Incidence, bud fly, sepal thickness, linseed

INTRODUCTION

Linseed (*Linum usitatissimum* Linn) is one of the most important industrial crops of India and stands next to rapeseed mustard in *rabi* oilseeds in area and production. Of the two technical oil bearing crops *viz*. linseed and castor, linseed accounts for about 60 per cent with 0.96 million hectare area and 0.32 million tones production. In India, linseed is cultivated in about 4.70 lakh hectares with total linseed production of 1.69 lakh tones and 360 kg/ha productivity (Zajac *et. al.*, 2012*)*. Chhattisgarh is one of the important linseed growing states of India, which accounts for nearly 19.05 % area and 16.21 % production of the country. In Chhattisgarh, linseed is cultivated over 35.25 thousand hectare area with a production of 13.59 thousand tones and productivity of 386.50 kg/ha. It is a major crop grown as **'utera'** during *rabi* season (Anon, 2012). It is used for the manufacture of paints and varnishes, linoleum and oil cloth, printing and lithographic ink and soft soaps. Linseed oil is useful in the treatment of anxiety; benign prostrates hyperplasia, vaginitis and weight loss, hyperlipidemia, (Nestel *et al.*, 1997) and thrombosis and myocardial infection by reducing cholesterol and low density lipids. Linseed crop is attacked by a number of insect pests at various phases of its growth. Linseed bud fly (*Dasyneura lini* Barnes) with 88 % losses of grain yield, is a key pest of this crop followed by semilooper (*Plusia orichalsia* Fab.), thrips (*Caliothrips indicus* Bagnall) and linseed caterpillar (*Spodoptera exigua* Hub.) (Malik *et al.*, 2000). Host plant resistance is one of the most effective method for reducing insect damage and an important component of integrated pest management. Each plant species possessed unique defense mechanism involving various histological traits which have deep effect on the reproduction and survival of insect pests on a plant species. Therefore, present study was undertaken for various detailed studies to pin point the resistance mechanism involved in resistant lines with histological parameter. These resistant or tolerant lines may prove safer to natural enemies and ultimately to the whole ecosystem.

MATERIALS AND METHODS

Field experiment was conducted during *rabi* season of 2009-10 and 2010-11 on linseed *cv.* Neelum in black soil of Research Farm, College of Agriculture, Raipur (C.G.). Raipur is situated in central east part of Chhattisgarh at 21 º16' north latitude, 81 º3' east longitude and 289.56 meters above mean sea level. The climate of Raipur is hot with mild winter followed by hot dry summer intervened at monsoon period of about 4 to 5 months. It receives the annual rainfall of, on an average, 1000 to 1300 mm mostly during June to September with the highest and lowest temperature of 46.0 ^{0}C and 5 ^{0}C, respectively. A set of 1350 germplasm taken from the Oilseed Section, Department of Plant Breeding and Genetics, IGKV, Raipur was sown in augmented block design in paired rows of 3 m row length in first week of December during respective years for screening against bud fly as per the recommended agronomic practices without any plant protection measure. Susceptible check Neelum and resistant check Neela were sown after every 10 entries. Single line of variety Neelum was sown as infester row in between the path and around the field. The bud fly infestation was recorded at dough stage on five plants per entry by counting total number of floral buds as

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well as bud fly infested buds, which was statistically converted into per cent bud infestation. On the basis of two seasons, field screening of 1350 linseed germplasm was done in to four categories i.e. resistant, moderately resistant, moderately susceptible and susceptible. On the basis of bud fly infestation Index (B.I.I.) as suggested by Malik (1993); from each category representative linseed germplasm were selected as resistant-14, moderately resistant-2, moderately susceptible-6 and susceptible-3. These selected 25 linseed germplasm were further undertaken for various detailed studies to pin point the resistance mechanism involved in resistant lines with histological parameter. For the study of histological parameter, the sepals of three tender buds from each identified promising lines were peeled out and the cross sections of sepals were measured in µ under Trinocular microscope. The data of the sepal thickness in different lines and their respective susceptibility to bud fly were statistically analyzed.

RESULTS AND DISCUSSION

The germplasm lines LMS-103-2K and R-2661 showed the maximum (52.91 µ) and minimum (32.88 µ) sepal thickness, respectively (Table1). The relationship of the sepal thickness with bud infestation indicated that resistant germplasm line LMS-103-2K with maximum sepal thickness (52.91 µ) had relatively minimum bud infestation (6.90 %) This germplason was statistically at par with the other resistant germplasm lines *viz.* R-2852, R-2901, R-2848, Gaurav, R-2885 and PKDL-12 with 52.54, 52.40, 50.52, 50.25, 49.73 and 48.44 µ sepal thickness, showing 6.18, 4.28, 4.37, 7.78, 6.74 and 6.60 % bud infestation, respectively. While, susceptible germplasm line R-2661 exhibited minimum sepal thickness (32.88 µ) and suffered maximum bud infestation (58.63 %) which was statistically at par with moderate susceptible lines *viz.* R-552 (38.87 µ), RLC-71 (35.43 µ), T-397 (34.29 µ) and GP-849 (32.96 µ) and susceptible lines *viz.* LC-54 (35.73 µ) and Neelum (34.08 µ). Out of fourteen resistant germplasm lines, nine germplasm i.e. LMS-103-2K, R-2852, R-2901, R-2848, Gaurav, R-2885, PKDL-12, NL-126 and ES-13219 had thickest sepal as compared to moderately resistant, moderately susceptible and susceptible germplasm.

Table 1: Thickness of sepals and bud fly infestation of linseed germplasm

S. No.	Germplasm	Mean % bud infestation (mean of two years)	Mean sepals thickness (µ) (mean of three replications)	Category of germplasm
1	R-2901	4.28 (11.843)	52.40	R
2	R-2848	4.37 (11.672)	50.52	R
3	R-2852	6.18 (14.37)	52.54	R
4	LMS-103-2K	6.90 (11.84)	52.91	R
5	R-2885	6.74 (11.67)	49.73	R
6	PKDL-12	6.60 (11.84)	48.44	R
7	NL-126	7.70 (11.67)	46.91	R
8	ES-13219	7.66 (14.37)	45.36	R
9	GAURAV	7.78 (15.14)	50.25	R
10	GS-294	8.15 (14.97)	40.79	R
11	RL-99-32b	7.32 (14.63)	36.87	R
12	RLC-54	8.40 (16.02)	41.22	R
13	R-4007	7.87 (16.05)	35.53	R
14	R-2735	9.64 (16.11)	38.31	R
15	Neela	15.54 (16.54)	39.98	MR
16	RLC-92	16.07 (15.62)	40.90	MR
17	T-397	25.83 (16.55)	34.29	MS
18	R-552	25.65 (16.14)	35.87	MS
19	KIRAN	32.61 (17.73)	44.39	MS
20	RLC 71	31.50 (23.19)	35.43	MS
21	R2846	38.53 (23.58)	37.70	MS
22	GP 849	38.28 (30.53)	32.96	MS
23	NEELUM	41.31 (30.41)	34.08	S
24	LC-54	41.13 (34.81)	35.33	S
25	R-2661	58.63 (34.10)	32.88	S
	CD (5%)	2.638	4.75	
	SE(m) ±	0.938	1.67	
	CV	12.79	8.90	
Correlation coefficient (r)		Bud infestation (%)	-0.699**	

Figures in parenthesis are angular transformed values

*** Significant at 1% level*

Studies on the histological basis of resistance to *Dasyneura lini* Barnes and their correlation indicated that germplasm line LMS-103-2K with maximum thickness (52.91 µ) of sepal suffered with relatively less bud infestation (6.90 %), whereas, germplasm line R-2661 with minimum thickness (32.88 µ) of sepal suffered with maximum bud infestation (58.63 %). The correlation study showed that there was a highly significant negative correlation (r = - 0.699) between thickness of sepals and bud infestation. It shows that germplasm with thick sepal indicate resistance to bud fly attack.

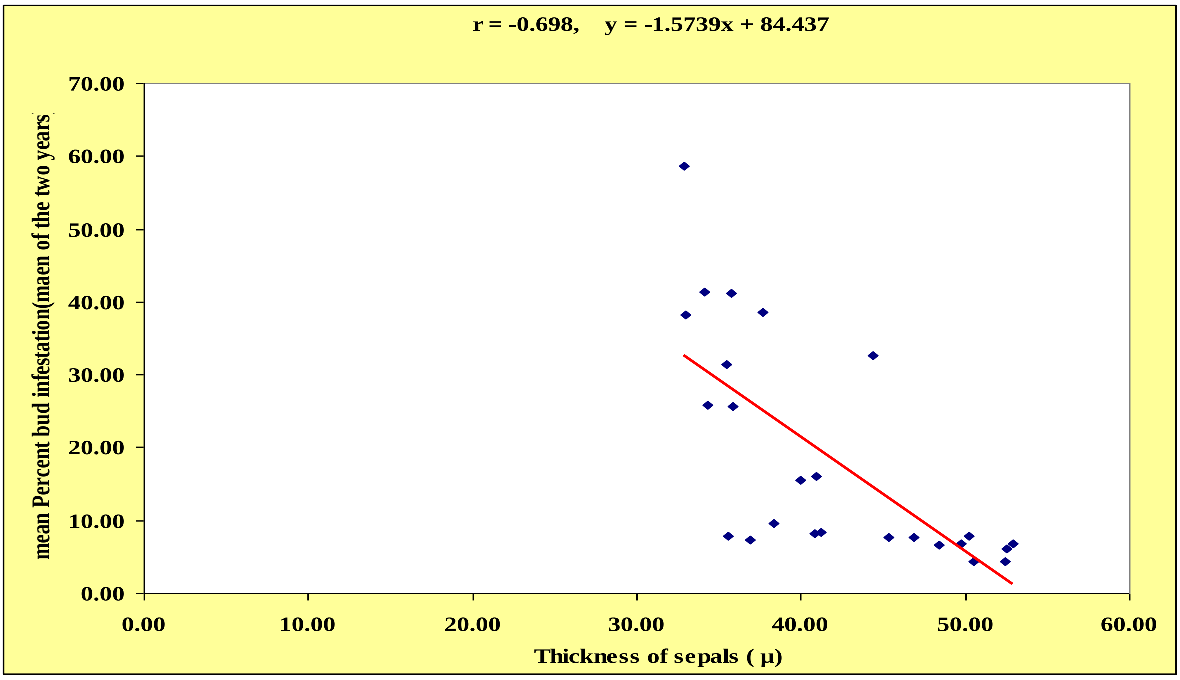

Fig. 1: Regression line showing thickness of sepals and per cent bud infestation

From the above results, it was clear that as the sepal thickness increases, infestation by the *D. lini* decreases. While, considering the thickness of sepals in twenty five lines of selected germplasm under test it was found that there was a highly significant negative correlation (r = -0.699) between thickness of sepals and % bud infestation (regression equation being Y= - 1.57x + 84.43). The b value (regression coefficient) indicated that with the increase of 1.0 µ thickness of sepals there was 1.57 % reduction in bud infestation. Malik *et al.*(1995) reported that bud fly susceptible line i.e. Neelum had maximum sepal thickness, while, resistant line i.e. Neela had minimum sepal thickness. Correlation between bud fly infestation and sepal thickness also studied by Malik *et al.*(1995) observed significant positive impact between them. This finding is contradictory with the present findings as correlation study was a highly significant negative correlation (r = - 0.699) between thickness of sepals and % bud infestation. Similarly, Sood and Pathak (1990) reported that variety JLS (J) with maximum thickness (45.24 µ) of sepals suffered minimum bud infestation (7.82 %) and variety LC 122 with minimum thickness (23.02 µ) of sepals suffered maximum with bud infestation (38.10%). The relationship of the thickness of sepals with % bud infestation showed a perfect correlation. This clearly brought out that with the increase in thickness of sepals, there was a proportionate decrease in the extent of infestation. These findings were in agreement with those of Painter (1951) who reported that thickness of plant parts is an important component when insect plant interaction factors for plant resistance are considered. Sepal is the only egg laying site of bud fly in linseed bud. Female fly probably find difficult to penetrate the ovipositor in to the full thickness of sepals. Host-plant selection theory based on the principle that female prefers the plant/plant part for egg laying where its progeny will survive and develop. In host-plant selection theory, Thorsteinson (1958) clearly indicated that insect female has strong instinct as parental care. Host-plant relationship work has been done by Agrawal (1969) in sugarcane and reported that the stem thickness was associated with the resistance to the sugar cane borer *Diatracea saccharalis* Fabricius.

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