Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2018; SP1: 2010-2015

Rajesh Kumar Ekka
Institute of Agricultural Science, Banaras Hindu University, Varanasi, Uttar Pradesh, India

Sandeep Mandal
Department of Agricultural Entomology, Uttar Banga Krishi Vishwavidayalaya, West Bengal, India

Dr. RS Meena
Institute of Agricultural Science, Banaras Hindu University, Varanasi, Uttar Pradesh, India

Saurabh Padamshali
Department of Agricultural Entomology, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

Correspondence
Rajesh Kumar Ekka
Institute of Agricultural Science, Banaras Hindu University, Varanasi, Uttar Pradesh, India

Some physical basis of host plant resistance in linseed (*Linumusitatissimum* L.), against bud fly, *Dasyneuralini* (Barnes)

Rajesh Kumar Ekka, Sandeep Mandal, Dr. RS Meena and Saurabh Padamshali

Abstract
Research trials was conducted at Agricultural Research Farm, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi for two consecutive *rabi* seasons of 2015-16 and 2016-17 to evaluate the physical traits in linseed imparting resistance to budfly, *Dasyneuralini* (Barnes). The germplasms of linseed were evaluated under field conditions to know the biophysical basisof resistance against linseed bud fly. Among the physical parameters of linseed bud structures (i.e. length and width of bud) were observed to be positively and significantly correlated with bud fly infestation with pooled (r) values of 0.812 and 0.841, respectively.

Keywords: Host plant resistance, linseed bud fly, bud structure, days to fifty per cent flowering, flower character

Introduction
Linseed (*Linumusitatissimum* L.) is an important oilseed crop belongs to the genus *Linum* of the family Linaceae, which is grown mainly for its fibers and oils. Around the globe, linseed crop occupies an area of 22.70 lakh ha yielding out 22.39 lakh ton having an average productivity of 986 kg per ha. In India, it is grown in an area of 29.2 thousand ha with production and productivity being 141.2 thousand ton and 484 kg per ha, respectively. India contributes about 14.89 per cent and 6.56 per cent to world area and production, respectively. The crop is grown in area of about 1 lakh ha in Uttar Pradesh, which occupied 12.2 per cent of the total area of the country. Annual production of this crop is 40 lakh metric tonnes. The productivity of linseed in Uttar Pradesh is 462 kg per ha against national productivity of 408Kg per ha.

Linseed crop is attacked by a number of insect pests at various phases of its growth. Among which linseed bud fly, *Dasyneuralini* Barnes causing 88 per cent grain yield losses and it is a key pest of linseed (Mukherji *et. al*., 1999) [3]. Among various management options use of resistant variety is most practical and economical method of pest management. The resistant or tolerant cultivars are safer to natural enemies and ultimately to the whole ecosystem. The first step in developing resistant cultivars is to identify the sources of insect pest resistance. Some varieties of Linseed crop have been reported possessing moderate to high level of resistance against linseed bud fly (Singh *et al*., 1990) [4]. Host plant resistance is one of the most effective method of IPM. The present study was undertaken to evaluate the physical traits in linseed for imparting resistance to budfly.

Materials and Methods
A set of 60 germplasm from the Project Coordinating Unit, Kanpur was sown in augmented block design in paired rows of 3 m row length with spacing of 30 x 10 cm on 28th November 2015 an 30thNovember 2016 in the Agricultural Research Farm, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi. The recommended agronomic practices without any plant protection measure were followed. Susceptible check Neelam and resistant check Neela were sown after every 15 entries. Single line of Neelam 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 well as infested buds, which was converted into % bud infestation. The biophysical parameters i.e. buds length and width were recorded. On the basis of average bud infestation, entire germplasm was categorized into resistant, moderately resistant, moderately susceptible, susceptible and highly susceptible on the basis of Infestation Index (B.I.I.) as suggested by Tripathi *et al*., 2002 [6].

These sixty germplasms were studied for biophysical parameters and correlated with bud infestation. When correlation coefficient (r) was found significant, simple regression equation was calculated relationship (Y= a + bx) was worked out.

The Regression equation of *D. lini*Barne was

$y = a \pm bx$

Where,

y = Dependent variable,

a = Constant,

b = Regression coefficient, and

x = Independent variable

To assess basis of resistance of linseed genotypes against bud fly per cent damage were correlated with biophysical parameters of plants. The biophysical parameter i.e. bud length and width.

Buds length and widthwas measured in terms of millimeter with the help of Digital Vanier Calipers Scale. The buds are place in between the Digital Vanier Calipers Scale and the length and width is measured.

Result and discussion

Various plant biophysical factors have been described which are responsible for imparting plant resistance against insects. A plant resistance to insects could be due to one or more morphological or biochemical traits responses shown by the plants against insect. There were sixty linseed germplasm screened against bud fly incidence and the bio-physiological parameters i.e. bud length and width were recorded in field and correlated with per cent infestation of bud fly.

Bud length and width

The mean bud length were ranged from 5.06 (BM-10) to 7.22 (BM-29) and 5.02 (BM-10) to 7.18 (BM-29) during rabi, 2015-16 and 2016-17, respectively. The mean of two consecutive year were observed between 5.04 (BM-10) to 7.20 (BM-29) (Table 4.8) and there was highly significant positive correlation between bud length and bud fly infestation with r value 0.810** (2015-16), 0.813** (2016-17) and 0.812** (mean 2015-16 & 2016-17). These finding are given in table 1, 2, 3 and 4 respectively.

The mean bud width were ranged from 2.43 (BM-9) to 3.18 (BM-42) and 2.45 (BM-9) to 3.25 (Neelam) during rabi, 2015-16 and 2016-17, respectively. The mean of two consecutive year were observed between 2.44 (BM-9) to 3.18 (BM-42) as presented in table 4.8 and there was highly significant positive correlation between bud width and bud fly infestation with r value 0.802** (2015-16), 0.842** (2016-17) and 0.841** (mean 2015-16 & 2016-17). These finding are given in table 1, 2, 3 and 4 respectively.

This result are found to be in close association with result obtained by Gupta (2015) [1], who reported that among the different biophysical parameters of linseed bud structures (i.e. length and width of bud) were observed to be significant and positive correlated with bud fly infestation with (r) values of 0.562 and 0.544, respectively.

The Regression equation of *D. lini*Barne was,

$y = a \pm bx$

Where, y = Dependent variable or Per cent bud fly infestation

a = Constant

b = Regression coefficient

x = Independent variable

Regression equation of *D. lini*Barne for Bud length (mm) (2015-16).

$y = 21.51x – 112.2$

where, y = Per cent bud fly infestation

x = Bud length

Regression equation of *D. lini*Barne for Bud width (mm) (2015-16).

$y = 55.86x – 132.9$

where, y = Per cent bud fly infestation

x = Bud width

Regression equation of *D. lini*Barne for Bud length (mm) (2016-17).

$y = 21.97x – 115.7$

where, y = Per cent bud fly infestation

x = Bud length

Regression equation of *D. lini*Barne for Bud width (mm) (2016-17).

$y = 58.63x – 141.3$

where, y = Per cent bud fly infestation

x = Bud width

Regression equation of *D. lini*Barne for Bud length (mm) (2015-16 and 2016-17).

$y = 21.74x – 114$

where, y = Per cent bud fly infestation

x = Bud length

Regression equation of *D. lini*Barne for Bud width (mm) (2015-16 and 2016-17).

$y = 59.80x – 144.4$

where, y = Per cent bud fly infestation

x = Bud width

Table 1: Bud fly infestation of different germplasm and their biophysical parameters during *rabi*, 2015-16.

Germplasm	Bud fly Infestation (%)	Bud Length (mm)	Bud Width (mm)	B.I.I.
Neela	13.33	6.28	2.77	MR
Neelam	36.11	6.75	2.97	MS
BM-1	16.90	6.36	2.63	MR
BM-2	13.58	6.48	2.57	MR
BM-3	26.72	6.55	2.89	MS
BM-4	35.15	7.02	2.87	MS
BM-5	9.86	5.62	2.57	R
BM-6	8.46	5.53	2.44	R
BM-7	9.29	5.39	2.51	R
BM-8	10.05	5.59	2.51	MR
BM-9	9.34	5.29	2.43	R
BM-10	6.17	5.06	2.63	R
BM-11	13.16	5.35	2.59	MR
BM-12	17.13	6.06	2.85	MR
BM-13	43.16	6.76	2.93	S
BM-14	36.01	6.70	2.93	MS
BM-15	26.23	6.29	2.74	MS

Neela	10.17	6.19	2.74	MR
Neelam	32.92	6.66	3.01	MS
BM-16	17.35	6.29	2.90	MR
BM-17	14.56	6.15	2.81	MR
BM-18	9.91	6.29	2.82	R
BM-19	26.91	6.38	2.96	MS
BM-20	26.16	6.09	2.85	MS
BM-21	13.15	6.47	2.92	MR
BM-22	26.15	6.77	3.03	MS
BM-23	9.86	6.28	2.89	R
BM-24	35.91	6.89	2.89	MS
BM-25	43.14	6.67	2.88	S
BM-26	36.02	6.73	3.04	MS
BM-27	44.57	7.05	3.08	S
BM-28	35.92	6.96	3.00	MS
BM-29	44.05	7.22	3.02	S
BM-30	37.04	6.77	3.00	MS

Germplasm	Bud fly Infestation (%)	Bud Length (mm)	Bud Width (mm)	B.I.I.
Neela	17.16	6.29	2.81	MR
Neelam	38.21	7.02	3.01	MS
BM-31	27.21	6.63	3.03	MS
BM-32	31.51	6.86	2.95	MS
BM-33	17.26	6.26	2.61	MR
BM-34	44.07	6.86	3.04	S
BM-35	36.51	6.63	3.06	MS
BM-36	42.07	6.72	3.08	S
BM-37	38.06	6.80	2.95	MS
BM-38	31.15	6.85	2.96	MS
BM-39	37.11	6.69	2.87	MS
BM-40	20.77	6.19	2.80	MR
BM-41	26.35	6.81	3.06	MS
BM-42	50.22	7.02	3.18	S
BM-43	40.67	6.66	2.96	S
BM-44	36.01	6.88	2.85	MS
BM-45	33.55	6.79	3.09	MS
Neela	13.75	6.36	2.74	MR
Neelam	37.41	7.03	3.04	MS
BM-46	13.39	6.52	2.63	MR
BM-47	23.85	6.76	2.91	MR
BM-48	26.38	6.09	2.81	MS
BM-49	21.90	6.33	2.81	MR
BM-50	36.05	6.72	2.92	MS
BM-51	44.66	6.76	3.00	S
BM-52	13.15	6.42	2.69	MR
BM-53	29.54	6.73	3.09	MS
BM-54	52.06	7.18	3.07	S
BM-55	39.45	6.92	2.89	MS
BM-56	39.52	6.73	3.03	MS
BM-57	44.71	6.85	3.07	S
BM-58	29.27	6.92	3.06	MS
BM-59	36.15	6.71	3.07	MS
BM-60	44.22	7.03	3.16	S
Neela	15.01	6.39	2.67	MR
Neelam	35.05	6.86	2.98	MS

Table 2: Bud fly infestation of different germplasm and their biophysical parameters during *rabi*, 2016-17.

Germplasm	Bud fly Infestation (%)	Bud Length (mm)	Bud Width (mm)	B.I.I.
Neela	11.43	6.24	2.73	MR
Neelam	35.22	6.71	2.91	MS
BM-1	15.00	6.32	2.65	MR
BM-2	11.68	6.44	2.55	MR
BM-3	25.83	6.51	2.9	MS
BM-4	34.26	6.98	2.92	MS
BM-5	8.36	5.58	2.55	R
BM-6	6.56	5.49	2.49	R
BM-7	7.39	5.35	2.59	R
BM-8	8.55	5.55	2.55	R
BM-9	7.44	5.25	2.45	R

BM-10	4.27	5.02	2.48	R
BM-11	11.26	5.31	2.61	MR
BM-12	15.23	6.02	2.81	MR
BM-13	41.26	6.72	2.91	S
BM-14	35.12	6.66	2.89	MS
BM-15	25.34	6.25	2.71	MS
Neela	8.67	6.15	2.71	R
Neelam	32.03	6.62	2.98	MS
BM-16	15.45	6.25	2.97	MR
BM-17	12.66	6.11	2.78	MR
BM-18	8.01	6.25	2.87	R
BM-19	26.02	6.34	2.85	MS
BM-20	25.27	6.05	2.79	MS
BM-21	11.25	6.43	2.75	MR
BM-22	25.26	6.73	2.99	MS
BM-23	8.36	6.24	2.73	R
BM-24	35.02	6.85	2.83	MS
BM-25	41.24	6.63	2.85	S
BM-26	35.13	6.69	3.01	MS
BM-27	42.67	7.01	3.12	S
BM-28	35.03	6.92	3.01	MS
BM-29	42.15	7.18	3.12	S
BM-30	36.15	6.73	3.01	MS

Germplasm	Bud fly Infestation (%)	Bud Length (mm)	Bud Width (mm)	B.I.I.
Neela	15.26	6.25	2.79	MR
Neelam	38.32	6.98	3.25	MS
BM-31	26.32	6.59	2.93	MS
BM-32	30.62	6.82	2.88	MS
BM-33	15.36	6.22	2.71	MR
BM-34	42.17	6.82	2.95	S
BM-35	35.62	6.59	3.01	MS
BM-36	40.17	6.68	3.01	S
BM-37	38.17	6.76	2.92	MS
BM-38	30.26	6.81	2.91	MS
BM-39	36.22	6.65	2.96	MS
BM-40	18.87	6.15	2.69	MR
BM-41	25.46	6.77	3.01	MS
BM-42	48.32	6.98	3.19	S
BM-43	39.78	6.62	2.94	MS
BM-44	35.12	6.84	2.84	MS
BM-45	32.66	6.75	3.01	MS
Neela	11.85	6.32	2.7	MR
Neelam	36.52	6.99	3.24	MS
BM-46	11.49	6.48	2.69	MR
BM-47	21.95	6.72	2.89	MR
BM-48	25.49	6.05	2.76	MS
BM-49	20.00	6.29	2.76	MR
BM-50	35.16	6.68	2.95	MS
BM-51	42.76	6.72	3.01	S
BM-52	11.25	6.38	2.71	MR
BM-53	28.65	6.69	2.95	MS
BM-54	50.16	7.14	3.21	S
BM-55	38.56	6.88	2.91	MS
BM-56	39.63	6.69	3.01	MS
BM-57	42.81	6.81	3.01	S
BM-58	28.38	6.88	2.95	MS
BM-59	35.26	6.67	2.98	MS
BM-60	42.32	6.99	3.11	S
Neela	15.01	6.354	2.71	MR
Neelam	35.05	6.82	2.95	MS

Table 3: Mean Bud fly infestation of different germplasm and their biophysical parameters from *rabi*, 2015-16 and 2016-17.

Germplasm	Bud fly Infestation (%)	Bud Length (mm)	Bud Width (mm)	B.I.I.
Neela	12.38	6.26	2.75	MR
Neelam	35.67	6.73	2.94	MS
BM-1	15.95	6.34	2.64	MR
BM-2	12.63	6.46	2.56	MR
BM-3	26.28	6.53	2.89	MS

BM-4	34.71	7.00	2.89	MS
BM-5	9.11	5.60	2.56	R
BM-6	7.51	5.51	2.47	R
BM-7	8.34	5.37	2.55	R
BM-8	9.30	5.57	2.53	R
BM-9	8.39	5.27	2.44	R
BM-10	5.22	5.04	2.55	R
BM-11	12.21	5.33	2.60	MR
BM-12	16.18	6.04	2.83	MR
BM-13	42.21	6.74	2.92	S
BM-14	35.56	6.68	2.91	MS
BM-15	25.78	6.27	2.73	MS
Neela	9.42	6.17	2.73	R
Neelam	32.47	6.64	2.99	MS
BM-16	16.40	6.27	2.93	MR
BM-17	13.61	6.13	2.79	MR
BM-18	8.96	6.27	2.85	R
BM-19	26.46	6.36	2.90	MS
BM-20	25.71	6.07	2.82	MS
BM-21	12.20	6.45	2.84	MR
BM-22	25.71	6.75	3.01	MS
BM-23	9.11	6.26	2.81	R
BM-24	35.46	6.87	2.86	MS
BM-25	42.19	6.65	2.86	S
BM-26	35.57	6.71	3.02	MS
BM-27	43.62	7.03	3.10	S
BM-28	35.47	6.94	3.00	MS
BM-29	43.10	7.20	3.07	S
BM-30	36.60	6.75	3.01	MS

Germplasm	**Bud fly Infestation (%)**	**Bud Length (mm)**	**Bud Width (mm)**	**B.I.I.**
Neela	16.21	6.27	2.80	MR
Neelam	38.26	7.00	3.13	MS
BM-31	26.76	6.61	2.98	MS
BM-32	31.06	6.84	2.92	MS
BM-33	16.31	6.24	2.66	MR
BM-34	43.12	6.84	3.00	S
BM-35	36.07	6.61	3.04	MS
BM-36	41.12	6.70	3.04	S
BM-37	38.11	6.78	2.94	MS
BM-38	30.71	6.83	2.94	MS
BM-39	36.66	6.67	2.92	MS
BM-40	19.82	6.17	2.75	MR
BM-41	25.91	6.79	3.04	MS
BM-42	49.27	7.00	3.18	S
BM-43	40.23	6.64	2.95	S
BM-44	35.56	6.86	2.85	MS
BM-45	33.11	6.77	3.05	MS
Neela	12.80	6.34	2.72	MR
Neelam	36.96	7.01	3.14	MS
BM-46	12.44	6.50	2.66	MR
BM-47	22.90	6.74	2.90	MR
BM-48	25.93	6.07	2.79	MS
BM-49	20.95	6.31	2.79	MR
BM-50	35.60	6.70	2.93	MS
BM-51	43.71	6.74	3.01	S
BM-52	12.20	6.40	2.70	MR
BM-53	29.09	6.71	3.02	MS
BM-54	51.11	7.16	3.14	S
BM-55	39.01	6.90	2.90	MS
BM-56	39.57	6.71	3.02	MS
BM-57	43.76	6.83	3.04	S
BM-58	28.83	6.90	3.00	MS
BM-59	35.71	6.69	3.03	MS
BM-60	43.27	7.01	3.13	S
Neela	15.01	6.37	2.69	MR
Neelam	35.05	6.84	2.96	MS

Table 4: Correlation coefficient (r) of biophysical parameters of linseed germplasm with bud fly infestations.

Insect pest	Year	Value of Correlation coefficient (r)	
		Bud length (mm)	Bud width (mm)
Budfly infestation (%)	2015-16	0.810**	0.802**
	2016-17	0.813**	0.842**
	Pooled (2015-16 &2016-17)	0.812**	0.841**
**. Correlation is significant at the 0.01 level (2-tailed).			
*. Correlation is significant at the 0.05 level (2-tailed).			

Summary and Conclusion

During the present investigation the study was made on the occurrence of insect pests in relation to the various stages of the crop and season. On the basis of experimental findings the linseed bud fly *Dasineuralini* Barnes was recorded as major pest of linseed. There was great achievement recorded in case of biophysical parameter such bud length and width. Screening trial in present investigation indicated that most of the germplasms were categorized under moderately susceptible and resistant categories. Nine germplasms exhibited continuously resistance characters after the rescreening in second year. All these germplasms can be used as a resistant donor. In case of biophysical basis of resistance in linseed against linseed bud fly bud length and width showed positive correlation with bud fly infestation. It was observed that during the experiment the germplasms with higher bud fly damage was having more bud length and width.

References

1. Gupta AK. Biophysical basis of resistance in linseed against bud fly, *Dasyneuralini* Barnes. Indian Journal of Entomology. 2015; 77:345-352.
2. Gupta MP. Field screening of linseed, *Linumusitatissimum* Linn. genotypes against the incidence of budfly, *Dasyneuralini* Barnes and blight, *Alternarialini* Dey. Journal Oilseed Research. 2004; 21(1):108-111
3. Mukharji KG, Dubey OP, Upadhyaya R. Insect pests of linseed, IPM system in Agriculture Oilseed crops. 1999; 5:250-263.
4. Singh B, Jha RC, Pandey ND. Relative resistance of different linseed varieties against Dasyneuralini Barnes under varied conditions. Indian Journal of Entomology (India), 1990.
5. Sood NK, Pathak SC. Thickness of sepal- a factor for resistance in linseed against *Dasyneuralini* Barnes. Indian Journal Entomology. 1990; 52(1):28-30.
6. Tripathi R, Ali S, Kumar R. Screening of linseed germplasm against bud fly, *Dasyneuralini* Barnes. Shashpa. 2002; 9(1):85-86.