Int.J.Curr.Microbiol.App.Sci (2019) *8*(12): 894-899

International Journal of Current Microbiology and Applied Sciences
***ISSN: 2319-7706* Volume 8 Number 12 (2019)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2019.812.114

Influence of Trichome Length on Bud Damage in Linseed, *Linum usitatissimum* L.

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Keywords

Linseed, Bud fly infestation, Trichome

Article Info

Accepted:
10 November 2019
Available Online:
10 December 2019

A B S T R A C T

A field experiment of thirty five linseed germplasm was conducted at research cum instructional farm, IGKV, Raipur (C.G.) during two consecutive *rabi* season of 2016-17 and 2017-18. Trichome length was measured through trinocular microscope at flowering stage of linseed germplasm. The basis of microscopic observation it was seen that trichome was generally absent in case of susceptible germplasms whereas in case of resistant and moderately resistant germplasm, trichome length exhibited between 73.86 to 137.86µ and observed a highly significant and negative correlation with r value 0.654 to bud fly infestation. Bud trichome is effective physical barrier to insect herbivores by affecting mostly small bodied insects than larger insect. Trichomes may offer a potential insect resistance mechanism for glabrous crops and/or genotypes.

Introduction

Above ground surfaces of most plants have epidermal hairs (trichomes), and some plants such as cotton (*Gossypium* spp) and Salix, produce seed trichomes, which known as longest plant cells. Trichomes are assumed to protect plants against insects, microbes, herbivores, and biotic damages and to assist seed dispersal (Wilkins *et al.,* 2000; Larkin *et al.,* 2003). As unicellular and multicellular epidermal outgrowth, there are a variety of trichomes that exist. These vary in size, morphology, origin as well as where they are sited. They are found in a very large number of plant species and are composed of single-cell or multicellular structures.

Trichomes provide an excellent system for investigation of cell fate determination. In the epidermis, only some cells are committed to becoming a trichome, and the location and timing of trichome differentiation present an example of cell patterning. Once initiated, trichomes often undergo endoduplication and rapid elongation. In addition, trichome

production can be genetically manipulated; alterations and even depletion of trichomes often do not affect plant viability and are readily observable (Larkin *et al.,* 2003). Several studies have shown that trichomes serve numerous functions including defense against phytophagous insect by disturbing them in their movement and/or by direct toxicity through biochemicals they produce and/or release (Kennedy, 2003; Arimura *et al.,* 2005; Peiffer *et al.,* 2009; Kang *et al.,* 2010a,b). Trichome-based plant defense improve sustainability of insect pest management by reducing pesticide application and decreasing the chance to pesticide resistance (Simmons and Gurr, 2004; Holeski, 2007).

In addition, leaf trichomes helps in selection on the antiphytophagy role of leaf trichome can either be constrained or synergistically favoured by selection imposed by other environmental pressure (Roy *et al.,* 1999).

Materials and Methods

A set of thirty five elite germplasm of linseed was obtained from AICRP-Linseed and evaluated for elite germplasm of linseed was sown paired rows of test entries of 3 m length at 30 cm row distance their reaction to bud fly [*Dasyneura lini* (Barnes)] under natural field conditions were carried out at Research-cum-instructional farm, IGKV Raipur during *rabi* 2016-17 and 2017-18. This trail was executed in Augmented Block Design with two checks *i.e.* Neela (Resistant check) and Neelum (Susceptible check) were also planted in each plot. The crop was sown in the mid of November. Flowering duration was recorded ten tagged plants/entry in screening germplasm. Observation on bud-fly infestation was recorded as per method suggested by Jakhmola and Yadav (1983). The length of trichome was measured by trinocular microscope at bud development stage and was correlated with the bud-fly infestation at maturity. The germplasm were grouped into resistant, moderately resistant, moderately susceptible, susceptible and highly susceptible on the basis of Bud fly Infestation Index (B.I.I.) (Table 1) as suggested by Malik (1993).

Measurement of trichome length

For sepal trichome length as per the methodology suggested by Maithi *et al.,* (1980), sample was taken from the apical bud of linseed field collected germplasm. It was taken into the lab and heated in 20ml water in glass vials (2 x 7.5) for 15 minutes in oven set. When the water was poured off than added 20 ml of 95% ethyl alcohol and again boiled for approximately 20 minutes in the oven at 85^0C. After 20 minutes the alcohol was poured off that fresh alcohol was added and boiling procedure repeated till completely removal of the chlorophyll from the sepal. The alcohol again poured off and 20 ml of concentrated (90%) lactic acid was added heated again at 85^0C until the sepal became clear (approximately 45 minutes). The vial was cooled and sepal was stored for further observation under the trinocular microscope for trichome length and finely trichome length was measured.

Results and Discussion

Trichomes are microscopic pointed hair like epidermal modifications which highly influence by the crop environment and pest pressure. In the present investigation, trichome of thirty-five germplasm were measured under a microscope and presented in table 2 and figure 1. The basis of microscopic observations, it was seen that trichome was mostly present in resistant and generally absent in case of susceptible germplasm. In present investigation, trichome length exhibited ranged between 73.86 to 137.86µ

(Table 2). Germplasm with least bud-fly damage (4.61%) found more sepal trichome length 137.86 µ in RSJ 31 (R) whereas shortest trichome length of sepal 73.86 µ was obtained in R-3019 (MR). The germplasm *viz.*, BRLS-108-1, LCK-1625 and Neela having without trichome were also recorded resistance which confers the occurance of trichome on bud surface may be due to environmental induced resistance in linseed germplasm. Graphical representation of relationship between bud fly infestation and trichome length shown in figure 2. Correlation analysis of trichome length conferred negatively significant with r value 0.654 to bud fly infestation and regression equation being y= 119.8 -2.256x where x is trichome length and y is bud fly infestation. This indicates that with increase in trichome length there was decrease in bud infestation by 2.256 per cent. In agreement of this investigation, Gupta (2012) observed a similar trend as the length of trichome observed on resistant germplasm of linseed was relatively larger than moderate resistant germplasm.

Trichome plays an important role in various crops was also documented in Brinjal crops by Bhanudas (2009). He confirmed that length of trichome was played an important role for the feeding of neonate larvae. Chu *et al.*, (2000) and; Gurr and McGrath (2001) noticed that trichome density was positively correlated with host-plant resistance of cotton and potato, respectively. Similarly, Sharma *et al.*, (2009) observed a significant and positive correlation between the number of eggs laid and the density of trichomes against *Helicoverpa armigera* in wild relatives of pigeonpea.

Eleven germplasms exhibited continuously resistance characters after the rescreening in second year. All these germplasms can be a resistant donar. Here, the germplasm those have without trichome are also showing resistance against bud fly, indicated that the development of trichome does not confer resistance of germpllasm. Above finding has highlighted the role of trichomes as an effective physical barrier bud fly. The distribution and length of plant trichome influence bud fly loads and the relative amount of damage they cause. Trichomes may offer a potential insect resistance mechanism for glabrous crops and/or genotypes. Wild relatives are often a good source of pubescence and have been utilized in several successful breeding programmes. Both conventional breeding and biotechnology might be used to transfer such characters between species.

Table.1 Category of linseed germplasm based on Bud fly Infestation Index (B.I.I.)

S. No.	Bud Infestation (%)	Category	B.I.I.
1	0 to 10	Resistant	R
2	10.1 to 25.00	Moderately Resistant	MR
3	25.1 to 40.00	Moderately Susceptible	MS
4	40.1 to 60.00	Susceptible	S
5	More than 60	Highly Susceptible	HS

Table.2 Influence of trichome length of linseed germplasm against bud fly

Sr. No.	Germplasm	Bud fly infestation (%)			Trichome length (µ)			B.I.I.
		2016-17	2017-18	Mean	2016-17	2017-18	Mean	
1	BRM 9	9.48	9.87	9.68	96.01	78.55	87.28	R
2	RL-26016	7.98	8.14	8.06	133.50	81.82	107.66	R
3	JLS 9	9.87	7.21	8.54	86.13	62.37	74.25	R
4	SJKO 41	7.8	8.02	7.91	137.53	117.15	127.34	R
5	EC-282800	8.66	8.88	8.77	79.25	109.45	94.35	R
6	RSJ 31	7.02	2.20	4.61	129.59	146.13	137.86	R
7	BRLS-108-1	6.46	6.68	6.57	-	-	-	R
8	PKDL-166	6.42	6.64	6.53	123.90	101.38	112.64	R
9	TL-142	9.22	7.24	8.23	80.80	71.65	76.23	R
10	EC-278988	8.03	8.25	8.14	105.34	86.18	95.76	R
11	RL-29005	6.64	6.86	6.75	92.76	128.10	110.43	R
12	LCK-1625	2.81	6.93	4.87	-	-	-	R
13	SJKO 53	9.09	9.31	9.2	94.46	80.46	87.46	R
14	Neela	9.74	9.98	9.86	-	-	-	R
	Mean	7.80	7.59	7.69	105.39	96.66	101.02	
15	SJKO 52	13.07	13.29	13.18	-	-	-	MR
16	BRM-13	10.49.	11.83	11.16	103.96	88.56	96.26	MR
17	RLC-158	15.15	15.37	15.26	97.5136	59.77	78.64	MR
18	Exotic 1	12.72	12.94	12.83	-	-	-	MR
19	Sheela	10.52	10.74	10.63	-	-	-	MR
20	R-3019	24.07	24.37	24.22	69.43	78.29	73.86	MR
21	NL-315	15.59	11.57	13.58	-	-	-	MR
22	NDL-2014-01	16.24	16.46	16.35	76.75	90.10	83.42	MR
23	RSJ 8	15.33	15.55	15.44	-	-	-	MR
24	NL-294	10.96	14.64	12.80	-	-	-	MR
25	RSJ 10	13.07	13.29	13.18	114.25	70.03	92.14	MR
26	RSJ 9	15.15	15.37	15.26	-	-	-	MR
27	SLS-106	18.35	12.91	15.63	71.89	99.27	85.58	MR
28	Binwa	18.64	18.86	18.75	69.48	95.95	82.72	MR
	Mean	14.95	14.80	14.88	86.18	83.14	84.66	
29	AHT-241	29.01	31.55	30.28	-	-	-	MS
30	SLS-41	25.02	25.34	25.18	-	-	-	MS
31	CI-2556	27.88	35.06	31.47	-	-	-	MS
32	JLT-137	27.42	32.32	29.87	-	-	-	MS
33	S-2568	31.32	27.22	29.27	-	-	-	MS
34	R-4228	25.24	27.4	26.32	-	-	-	MS
35	Neelum	38.84	43.8	41.32	-	-	-	S
		29.25	31.81	30.53				

Fig.1 Trichomes on the surface of bud of linseed

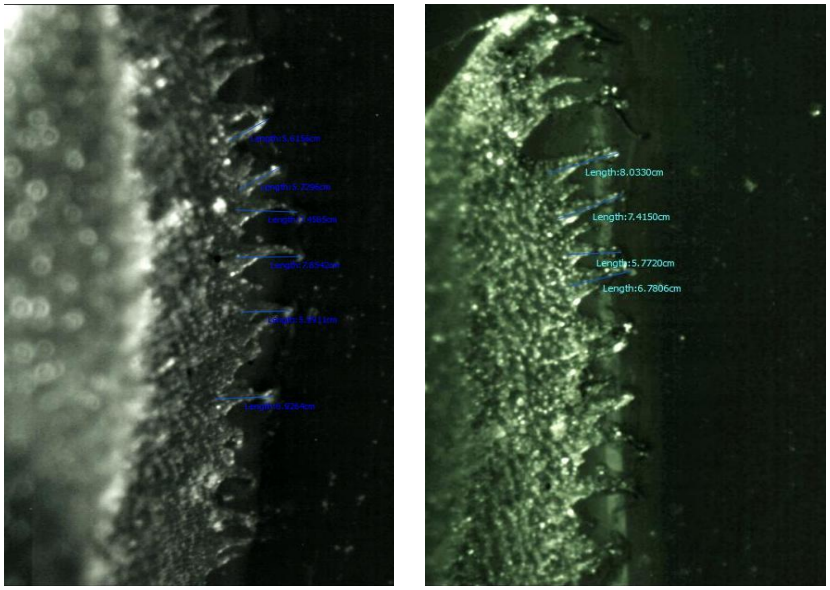
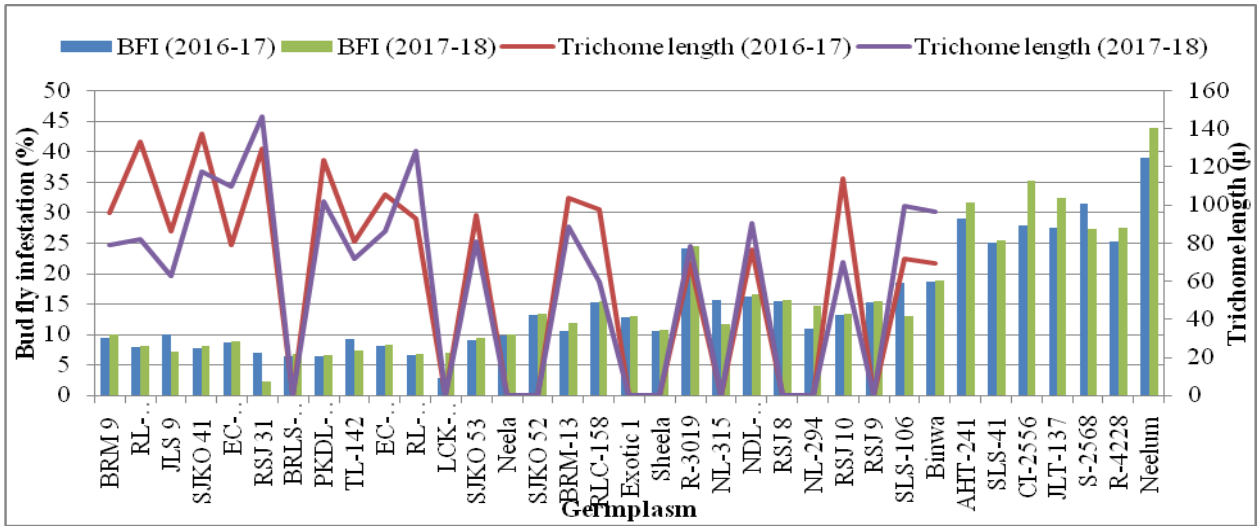


Fig.2 Relationship between bud fly infestation and trichome length



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How to cite this article:

Pankaj Bhargav, B. P. Katlam, Y. K. Yadu and Yogesh Kumar Sidar. 2019. Influence of Trichome Length on Bud Damage in Linseed, *Linum usitatissimum* L. *Int.J.Curr.Microbiol.App.Sci.* 8(12): 894-899. doi: https://doi.org/10.20546/ijcmas.2019.812.114