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Short Note

Natural epiphytotic reaction of linseed/ flax cultivars and their cross combinations to powdery mildew (*Oidium lini*) in diverse environments

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Linseed (*Linum usitatissimum* L.) is universally grown either to produce seed for oil or fibre extraction. In India, it is an important oilseed crop of *rabi* season, cultivated on marginal and sub-marginal lands. The importance of the crop can be understood by the fact that every part of the plant has some specific utility. Linseed oil due to its drying property is used in paints, varnish and polymer industries (Gill, 1987). The stalk produces fibre, which is used for clothing, furnishing canvas, hosepipe and several indigenous uses like rope making, etc. In Himachal Pradesh, flax is mainly grown under zero tillage system *i.e. utera* system of cultivation. The sub-mountainous paddy fields of the state where linseed is grown are acidic (pH ranging 4.5-6.5) in nature and diseases further aggravate the problems and affect the production of linseed in this region. Among major diseases of the crop (Rust, Powdery mildew and wilt), powdery mildew largely affects the crop in the last five years due to changed weather conditions *i.e.* dry conditions prevailing in the area. Thus, in the present study improved linseed cultivars and their F_1's were screened under field conditions for powdery mildew disease.

The experimental material consisted of 14 improved linseed cultivars and 24 cross combinations developed in line x tester fashion. The experiment was laid out in a randomized block design with three replications at two locations viz., CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur and Wheat and Rice Research Centre, Malan during *rabi* 2003 representing two diverse climates.

Palampur: The experimental farm is situated at 32°8' N latitude and 76°3' E longitude at an elevation of 1290.8 m above mean sea level. Agro-climatically, the location represents the mid-hill zone of Himachal Pradesh (Zone-II) and is characterized by humid sub-temperate climate with high rainfall (2500 mm). The soil is acidic in nature with pH ranging from 5.0 to 5.6.

Malan: The experimental farm is situated at an elevation of 950m above mean sea level with 32°07' N latitude and 76°23' E longitude representing sub-humid mid hill conditions having high rainfall. The soil of the experimental area is clay-loam with pH ranging from 5.8 to 6.0.

Each entry was raised in three rows, 2.5m long with row-to-row and plant-to-plant spacing of 30 cm and 5 cm, respectively. All the recommended package and practices for raising the crop were followed. Disease reaction was recorded on ten plants tagged randomly in each entry and in each replication following the 0-5 scale devised by All India Coordinated Project on Linseed (AICRP, 1991) under natural epiphytotic conditions.

Field reaction of parents and their crosses against powdery mildew is presented in Table 1 and 2, respectively. The perusal of results revealed that none of the genotypes was highly resistant to disease in both the environments. Based on the reaction of 14 parents, three genotypes (Aoyagi, Flak-1 and LCK-9826) were observed to be resistant in both the environments. Similarly, out of the 24 cross-combinations (F_1's), none of the cross was highly resistant or resistant in both the locations. However, the cross combination LC-2323 x LCK-9826 was found resistant at Palampur. The cross-combinations B-509 x LCK-9826 in both the environments and LC-2323 x LCK-9826 at Malan were moderately resistant; B-509 x Flak-1, B-509 x Aoyagi, B-509 x KL-210, B-509 x KL-233 and LC-2323 x Aoyagi were moderately susceptible in both the environments, B-509 x KL-178 and B-509 x Janaki at Malan, LC-2323 x Flak-1 at Palampur were also moderately susceptible, whereas B-509 x LMH-62 and B-509 x Ariane in both the locations and LC-2323 x LMH-62

Table 1. Reaction of linseed parents to powdery mildew (*Oidium lini*) in E_1 and E_2 environments

Disease score	Reaction		Genotypes	
			E_1	E_2
0	Highly resistant	HR	— — —	— — —
1	Resistant	R	Aoyagi, Flak-1, LCK- 9826	Aoyagi, Flak-1, LCK- 9826
2	Moderately resistant	MR	— — —	Janaki and KL-233
3	Moderately Susceptible	MS	Janaki and Belinka	KL-178 and KL-210
4	Susceptible	S	B-509, KL-178, KL-210, Ariane, KL-233, LC-2323 and KL-187	B-509, Belinka, KL-221, LC-2323 and KL-187
5	Highly Susceptible	HS	LMH-62 and KL-221	LMH-62 and Ariane

E_1: Palampur; E_2: Malan

Table 2. Reaction of linseed cross-combinations to powdery mildew in E_1 and E_2 environments

Disease score	Reaction		Cross-combinations (F_1's)	
			E_1	E_2
0	Highly resistant	HR	— — —	— — —
1	Resistant	R	LC-2323 x LCK-9826	— — —
2	Moderately resistant	MR	B-509 x LCK-9826	B-509 x LCK-9826, LC-2323 x LCK-9826
3	Moderately Susceptible	MS	B-509 x Aoyagi, B-509 x Flak-1, B-509 x KL-210, B-509 x KL-233, LC-2323 x Aoyagi, LC-2323 x Flak-1	B-509 x Aoyagi, B-509 x Flak-1, B-509 x KL-210, B-509 x KL-178, B-509 x Janaki, B-509 x KL-233, LC-2323 x Aoyagi
4	Susceptible	S	B-509 x Belinka, B-509 x KL-221, B-509 x KL-178, B-509 x KL-187, Janaki, LC-2323 x KL-178, LC-2323 x KL-210, LC-2323 x Ariane, LC-2323 x KL-187, LC-2323 x KL-221, LC-2323 x Belinka, LC-2323 x Janaki, LC-2323 x LMH-62, LC-2323 x KL-233	B-509 x Belinka, B-509 x KL-221, B-509 x KL-187, LC-2323 x Flak-1, LC-2323 x KL-178, LC-2323 x KL-210, LC-2323 x KL-187, LC-2323 x KL-221, LC-2323 x Belinka, LC-2323 x Janaki, LC-2323 x KL-233
5	Highly Susceptible	HS	B-509 x LMH-62, B-509 x Ariane	B-509 x LMH-62, B-509 x Ariane, LC-2323 x LMH-62, LC-2323 x Ariane

E_1: Palampur; E_2: Malan

and LC-2323 x Ariane at Malan were highly susceptible to powdery mildew. The remaining crosses were susceptible to it.

The results clearly revealed that none of the parents and F_1's was completely free from disease. Only three parents Aoyagi, Flak-1 and LCK-9826 were resistant to powdery mildew in both the environments. Resistance of Flak-1 to the disease has also been reported from the AICRPO (linseed) centers-Mauranipur, Nagpur and Kanpur and Palampur (Pathania, 1999 and Sood, 2004). The parents-Janaki and KL-233 were moderately resistant at Malan whereas the same parents were moderately susceptible and susceptible respectively, at Palampur. This clearly showed the influence of environment on disease severity however, the parents and cross-combinations coming under resistant and highly susceptible categories were least influenced by the environmental fluctuations. Belinka at Palampur, and KL-178 and KL-210 at Malan were moderately susceptible. All the remaining genotypes were susceptible except LMH-62 and KL-221, which were highly susceptible to powdery mildew in both the locations. It was observed that cross-combinations involving resistant parents Flak-1 and Aoyagi with susceptible testers B-509 and LC-2323 were all moderately susceptible to disease whereas F_1's of resistant parent LCK-9826 with both susceptible testers were moderately resistant except resistant reaction with LC-2323 at Palampur. This revealed that resistance in LCK-9826 is conditioned by dominant genes whereas recessive genes control the resistance reaction in Flak-1 and Aoyagi but needs further confirmation.

References

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