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Sources of resistance to Powdery Mildew of linseed

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Evaluation of 70 extant varieties of linseed under natural field conditions during 2006 and 2007 at Jabalpur resulted 8 varieties to be highly resistant (no disease) and 34 as resistant (1-6% disease) against Powdery Mildew under high disease pressure. Only 5 varieties showed highly susceptible (more than 75% plant area covered). The disease appeared from second fortnight of October to November when the temparature ranged from 16 to 21°C with relative humidity 80-90 % and maximum (16) rainy days, Affected plants did not die, however, complete defoliation was noticed.

Key words: *Oidium lini*, resistant varieties, disease development, disease rating scale, effect of temparature and humidity

INTRODUCTION

Among the annual oilseed crops, the linseed or common flax (*Linum usitatissimum* L) is an important one in India. The crop is commercially cultivated in the country, mainly in Madhya Pradesh, eastern Maharashtra, Bihar and Uttar Pradesh (Gill, 1987). Madhya Pradesh and Uttar Pradesh account for 70 per cent of total linseed production in the oilseed-pool sector of the country, whereas the country accounts for 27 per cent of current world accarage (Anon, 2004). Among the diseases powdery mildew (*Oidium lini*) is an important factor responsible for oil-yield reduction and seed quality (Singh and Singh, 2002; Sangwan *et al.,* 2005; Kar and Lenka, 1998).

MATERIALS AND METHODS

Evaluation of 70 extent varieties of linseed was made under natural field conditions during 2006 and 2007 at Seed Breeding Farm, JNKVV, Jabalpur, Madhya Pradesh. A complete randomized block design with 2 replications, and 7 numbers of rows, 5 m-row length, 30 cm row-to-row distance and 10 cm plant-to-plant distance was adopted. The genetic pure seed was obtained from Project Coordinator (Linseed), Kanpur to test the Distinctiveness, Uniformity and Stability of the extant varieties of implement of PPV and FR act (Chakrabarty *et al.,* 2007)

The varieties were evaluated under natural conditions of disease pressure and the disease index scale (Table 1) proposed by Bhale *et al.* (2001) was adopted.

RESULTS AND DISCUSSION

Symptoms

Severe out break of Powdery Mildew was experienced in 2007 as comparison to 2006 in the experimental fields at Jabalpur. Initially the disease appeared in the form of small, circular to irregular dirty white powdery patched on few leaves of the plant. Soon it spread to cover the entire plant including leaves, stem, branches and flowers and even up to capsules. The leaves and stem were covered with thick powdery mass exhibiting curling, twisting and drooping symptoms that ultimately dried up. Diseased plants did not dry but the yield reduced drastically. Similar symptoms have been observed by Sangwan *et al.,* (2005). The pathogen was identified as *Oidium lini* Skoric (Ainsworth *et al.,* 1973).

The disease has been reported from north India, especialy from Punjab, Haryana (Saharan and Saharan, 1994), Bihar (Pandey *et al.,* 1981), and Orissa (Kar and Lenka, 1998).

Table 1 : Disease index and scale for powdery mildew of linseed

Powdery mildew symptoms	Per cent area covered	Scale	Infection	Grade
Plants free from infection	0	0	Healthy	Highly Resistant
White patches on few lower leaves only	1-6	T	Trace	Resistant
White patches on both the surface of leaves (middle and upper leaves, stem, capsules free)	6-25	3	Light	Moderately Resistant
White patches up to middle leaves (stem moderately infected and capsules free)	26-50	5	Moderate	Tolerant
White patches covering whole leaves of plant, stem, and capsules moderately infected	51-75	7	Heavy	Susceptible
White patches covering whole leaves, stem, capsules, severely infected, leaves dropping, and drying of plants commence	76-100	9	Severe	Highly susceptible

Development of the disease

In the present investigation it was recorded that the powdery mildew disease development was highly influenced by the environment fluctuations. The range of relative humidity enhanced in the month of November 2006-07 with more number of rainy days in comparison to the year 2005-06. The temparatures ranged from 16 to 21°C with relative humidity 80-90% with the maximum 16 rainy days during the period of observation. Such weather conditions were encountered during second fortnight of October to mid November at Jabalpur, Madhya Pradesh. Under north Indian conditions, disease appeared in the last week of February and reached to maximum by the middle of March when the temperature reached between 20-25°C with humidity is less than 65%. Rainfall was unfavourable for the diseases development under north conditions as observed by Saharan and Saharan (1994).

Source of resistance

Seventy extant linseed varieties were evaluated under natural field conditions of high disease pressure conditions at Jabalpur. The modified disease index and scale proposed by Bhale *et al.* (2001) was adopted. During the testing, 8 varieties (Jawahar 23, Jeevan, Kiran, KL 210, KL 224, Mukta, Nagarkot and RLU 6) were completely free and considered as hightly resistant. Out of 70 varieties, 34 were classified as resistant where the infection was in traces, while, five varieties exhibited highly susceptible reaction to Powdery Mildew disease (Table 2). The results revealed the presence of wide-variability for reaction. High number of varieties (62%) in resistant to moderately resistant group indicated that the resistant is probably under the control of a few genes and resistance appeared to be dominant as disease incidence trait skewed towards resistance.

Many workers in Punjab, Haryana and Bihar had attempted inheritance of resistance and research for sources. The attempts are continued under AICRP on Linseed. Singh and Sharan (1979) identified four highly resistant lines (LC216, LC255, LC256 and LC269) whereas uniform disease nursery trails conducted at various locations all over India have resulted in identification of 15 lines to be highly resistant (Saharan and Saharan, 1999), while Kar and Lenka (1998) did not find desired resistance under conditions of Orissa State. Pandey *et al.* (1981) re-

Table 2 : Reaction of linseed varieties against powdery mildew

Symptom	Disease incidence (%)	Varieties/Strain	Scale	Infection	Grade
Plants free of infection	< 20	Jawhar 23, Jeevan, Kiran, KL 210, KL 224, Mukta, Nagarkoi, RLU 6	0	Healthy	Highly Resistant
White patches on lower leaves only	20	Himalsi 1, Himalsi 2, Himani, Janaki, Jawahar 7, Jawahar 17, KL 215, KL 221, KL 226, LC 2023, LC 2063, LC 4036, LC 2279-4, LMS 153-3, LMS-9-2K, LMS-95-4, Meera, NL 126, NL 165, OLC 10, Padmini, Parvati PKDL 21, PKDL 41, RL 2206, RL 914, RLC 100, RLC 102, RLC 81, RLC 92, RLC 94, RLC 95, SLS 66, Surabhi	1	Trace	Resistant
White patches on both the surface of leaves	21-40	LMS 4-27, Rashmi Shekhar, Shikha, SLS 27	3	Light	Moderately resistant
White patches on the leaves present up to middle part of the plant	40-60	Chambal, Garima, Gaurav, JLS 9, LC 185, NL 97, R 552, Sheela	5	Moderate	Tolerant
White patches covering whole parts of plant	60-80	C 429, Jawhar 1, Himalini, Tira, K 2, Laxmi 27, LC 54, Sweta, Shubhra, T 397	7	Heavy	Susceptible
White patches covering whole levees and stem, defoliation and drying of plant commences	> 80	Neela, Neelum, Pusa 2, Pusa 3, S 36	9	Severe	Highly Susceptible

ported high HCN (hydro cynic acid) content in resistant cultivars like EC 77959 and EC 1456 and low in susceptible cultivars.

A single pair of dominant genes governing resistance to rust and powdery mildew has been reported by Mishra and Pandey (1981). Resgene for rust (*Melampsora lini*) In EC 77959 appears to be the same or allelic to that of A-7-1-1 that has been identified by Saharan and Saharan (1999). Singh and Saharan (1979) have concluded that resistant to *Oidium lini* in each of the four lines cvs. viz. LC 216, LC 255, LC 256, and LC 269 are conditioned by one dominant gene. They have also concluded the resistance in cvs LCK 8776, RL 33-4, RL 49-4-8-2 and DPL 20 is conditioned by single dominant gene whereas resistance in RL 50-3 and Flake 1 is controlled by dominant genes and the resistance gene which in those cultivars, are located on different loci.

Identification of resistant varieties in the present investigation offers a bright opportunity to use the material as donors for evolving varieties that can be grown throughout the central, north, northeastern part of the country for sustainable production of the oil and fiber, as per need.

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