

REACTION OF SELECTED GERmplasm LINES AND *Helianthus tuberosus* DERIVED INTRODUCTION TO *Alternaria helianthi*

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SUMMARY

Alternaria leaf significant blight is an important disease of sunflower in India and elsewhere causing significant yield losses during rainy seasons. Twenty three moderately resistant genotypes along with 6 interspecific lines derived from *Helianthus tuberosus* were evaluated under natural epiphytotic conditions. The highly susceptible line L-101 was planted along all the borders and in between as an infector and spreader of the disease. The disease severity was assessed using 0-9 numerical rating system based on infected area of plants during beginning of anthesis and at full maturity of crop growth. None of the genotypes tested including interspecific lines recorded high levels of resistance. Most of the genotypes tested were highly susceptible. Three germplasm lines viz., 180, 873, 1229 and the hybrid ISFH-306 recorded moderate levels of resistance. The results indicate that a high level of resistance is not available in the limited cultivated germoplasm tested. An alternate strategy to utilize the available low levels of resistance to develop resistant populations is discussed.

Key words: Sunflower, *Alternaria helianthi*, *Helianthus tuberosus*, disease severity, resistance.

INTRODUCTION

Sunflower is a major oilseed crop in India in recent years. Concomitant with the increase in sunflower area and production there has been an increased incidence and severity of sunflower diseases. *Alternaria* leaf blight caused by *Alternaria helianthi* (Hansf). Tubaki and Nishihara has been considered as a potentially destructive disease in India and elsewhere (Balasubrahmanyam and Kolte, 1980; Hiremath et al., 1990). Genetic resistance to *Alternaria* leaf spot would be the most economic means of reducing yield losses in sunflower. The information available for both cultivated and other annual taxa (Morris and Yang, 1983). The usefulness of the available level of resistance in the cultivated species is uncertain (Carson, 1985). Although most of the annual species tested were found susceptible, the perennial species *Helianthus tuberosus*, *H. pauciflorus* and *H. hirsutus* showed a high level of resistance (Seiler, 1992). Hence, in the present study an attempt was made to evaluate six interspecific germplasm lines derived from *H. tuberosus*

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and other moderately tolerant germplasm lines under epiphytotic conditions to determine the level of resistance to *Alternaria* leaf blight.

MATERIALS AND METHODS

Six interspecific germplasm lines derived from wild species *Helianthus tuberosus* (Seiler, 1993) were obtained from Northern Crop Sciences Laboratory, USDA – ARS, Fargo, USA through Directorate of Oilseeds Research, India. Twenty three entries which are moderately tolerant to *Alternaria* leaf blight and susceptible check L 101 (anonymous, 1994) were obtained from the sunflower project co-ordinating unit, Bangalore India. Among 23 entries two were hybrids. The hybrid ISFH-306 is a private hybrid (ITC-Zeneca Ltd. India), while KBSH-1 is a public hybrid. The remaining 21 entries were selected from the germplasm pool collected from different countries (Table 1). The selected 23 entries, the susceptible check and the six interspecific derived lines were evaluated for *Alternaria* leaf spot under natural epiphytotic conditions during the rainy

Table 1. Reaction of different genotypes to *Alternaria* leaf blight at two different growth stages

S1. No.	Entry	Source country	R5 growth stage	R9 growth stage		
				Leaf	Stem	Head
1	Acc No 1484	USA	4.82	6.84	6.34	4.00
2	Acc No 1483	USA	5.35	8.67	7.84	6.34
3	Acc No 1447	USA	4.61	7.49	6.17	6.34
4	Acc No 1445	USA	5.06	8.17	7.17	5.67
5	Acc No 1430	USA	5.82	8.17	7.34	5.67
6	Acc No 1424	USA	4.55	7.34	6.50	5.33
7	Acc No 1391	USA	5.41	7.17	7.00	5.17
8	Acc No 1386	USA	5.06	6.84	6.33	5.34
9	Acc No 1229	Belgium	4.44	5.17	5.17	4.67
10	Acc No 1029	USSR	4.91	8.00	7.84	5.84
11	Acc No 1040	USSR	5.33	8.17	7.34	6.17
12	Acc No 912	Bulgaria	5.35	8.67	7.67	6.00
13	Acc No 905	Bulgaria	5.75	7.84	7.00	6.17
14	Acc No 901	USSR	5.57	8.00	7.84	6.00
15	Acc No 873	USA	4.30	5.50	5.00	4.67
16	Acc No 860	USA	4.66	8.00	7.67	6.17
17	Acc No 810	France	5.21	7.33	7.34	6.00
18	Acc No 180	Romania	4.45	5.84	5.17	5.50
19	Acc No 35	USSR	5.08	7.17	6.34	6.00
20	Acc No 07	USSR	5.86	7.50	7.00	6.34
21	HAR-1	USA	4.82	7.84	8.00	6.34
22	ISFH-306	ITC-Zeneca (India)	3.80	5.00	4.34	4.50
23	KBSH-1	India	4.60	7.17	6.17	5.50
24	L101 (Check)	India	5.50	9.00	9.00	9.00
S.E.			0.28	0.62	0.55	0.40
LSD (5% level)			0.81	1.81	1.62	1.16
CV (%)			7.78	11.89	11.50	9.71

season of 1994 at Main Research Station, UAS, Dharwad where *Alternaria* leaf spot occurs frequently. The occurrence and severity of disease was highest under natural infection during the rainy season of 1994 and hence the plants were not artificially inoculated. The selected 23 entries and the check L-101 were grown in two replications of single row plots of 3.6 meters long with a spacing of 60 cm between rows and 30 cm between the plants. The susceptible check L-101 was grown along all the borders and every five rows to act as an infector and spreader. The six *H. tuberosus* derived lines were grown in a single replication with 5 plants per replication as the seeds were limited. Since the growth of different accessions varied, disease severity was assessed during two stages of crop growth viz., R₅ (beginning of anthesis) and R₉ (full maturity) (Schneider and Miller, 1981). A numerical rating system on a 0-9 scale was used to record the severity of infection of leaves, stem and capitulum (Nagaraju et al., 1993). The percent leaf/stem/capitulum area infected was determined visually by examining the plants.

Rating	Reaction	Disease severity
0	Immune	No reaction
1	Highly resistant	< 1% area covered
3	Resistant	1 to 5% area covered
5	Moderately resistant/moderately susceptible	5 to 25% area covered
7	Susceptible	25 to 50% area covered
9	Highly susceptible	> 50% area covered

Five plants/entry/replication were randomly selected for recording observations. All available plants were scored in case of *H. tuberosus* derived lines during stage R₉. The data were analysed by analysis of variance and the treatments means were compared.

RESULTS AND DISCUSSION

The weather conditions during crop growth period were highly favourable for disease development which is indicated by the maximum severity shown by the susceptible check. The disease appeared at very early stage of crop growth and developed sufficiently by R₅ stage for significant differences between genotypes. At stage R₅ the hybrids ISFH-306 showed least severity (3.80) while Acce. No.7 recorded significantly lower infection compared with the check at this stage. Although significant difference for disease severity was observed, none of the entries tested showed fairly high level of resistance or immunity at R₅ stage. *Alternaria* leaf blight is a low sugar disease; severity increase with age (Bedi and Dhiman, 1980; Kolte, 1985). The susceptibility of most of the genotypes at R₅ stage itself indicate the non-availability of high level of resistance for this disease among the material tested.

The disease developed rapidly and most of the genotypes were highly susceptible for leaf and stem infections at R₉ stage. Among the lines tested only the accessions NO. 180, 873 and 1229 apart from the hybrid ISFH-306 recorded moderate level of resistance under epiphytotic conditions. However, the usefulness of these levels of resistance in reducing economic losses is uncertain. Hence, the search for better sources of resistance to *Alternaria* leaf blight should continue. The cultivated sunflower have a relatively restricted germplasm base. Morris and Yang (1993) confirmed the availability of resis-

tance to *Alternaria helianthi* in *Helianthus tuberosus*. However, in the present study, none of the six *Helianthus tuberosus* derived lines showed resistance under natural epiphytotic conditions (Table 2). This could be either due to absence of disease during selection and development of these lines leading to elimination of *H. tuberosus* chromosomes carrying resistant genes or absence of resistance in the *H. tuberosus* line used to derive these genotypes. Therefore, it is necessary to subject the interspecific populations to disease epiphytotic conditions for developing lines resistant to *Alternaria* leaf blight.

Table 2. Reaction of interspecific *Helianthus tuberosus* derived lines to *Alternaria helianthi* at R9 stage

	Leaf	Stem	Head
Tub-1709-2	8.00	7.00	6.00
Tub-1709-3	8.00	7.50	5.00
Tub-346	7.00	8.00	8.00
Tub-365	7.00	7.80	6.00
Tub-1789	7.33	8.00	5.33
Tub-1709-1	7.33	7.33	6.00

The low level of resistance reported here among a few genotypes can be expressed quantitatively as a reduction in disease severity. Until better sources of resistance are available, the use of recurrent selection scheme based on progeny test is probably the best strategy for developing resistant populations. Such populations could be further utilized to develop inbred lines with high level of resistance.

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REACCIÓN DE LÍNEAS SELECCIONADAS E INTRODUCCIONES DERIVADA DE *HELLANTHUS TUBEROSUS* A *ALTERNARIA HELLANTHI*.**RESUMEN**

La marchitez de hojas por *Alternaria* es una importante enfermedad de girasol en India y otros lugares, donde causan pérdidas significativa de rendimiento durante la estación lluviosa. Veinte y tres genotipos moderadamente resistentes así como seis líneas interespecíficas derivadas de *H. tuberosus* fueron evaluadas bajo condiciones epifitóticas naturales. La línea altamente susceptible L-101 fueron sembradas en todos los bordes y entre plantas infectoras y expandidoras de la enfermedad. La severidad de la enfermedad fue comprobada utilizando una escala de 0 a 9 basada en el área infectada de las plantas durante los estados R₅ y R₉ del crecimiento de los cultivos. Ninguno de los genotipos incluyendo líneas interespecíficas mostraron un alto nivel de resistencia. La mayor parte de los genotipos testados fueron altamente susceptibles. Tres líneas, 180, 873, 1229 y el híbrido ISFH-306 mostraron un nivel de resistencia moderada. Los resultados indican que el alto nivel de resistencia no está disponible en el limitado germoplasma cultivado. Una estrategia alternativa es la utilización del bajo nivel de resistencia disponible para desarrollar poblaciones resistentes es también discutida.

RÉPONSES À L'*ALTERNARIA HELLANTHI* DE LIGNÉES ISSUES DU GERMPLASM CULTIVÉ OU DÉRIVÉES D'*HELLANTHUS TUBEROSUS*.**RÉSUMÉ**

L'*Alternaria* sur feuille est une maladie importante du tournesol en Inde et dans le reste du monde, conduisant à des pertes de productivité significatives durant la saison des pluies. Trente trois génotypes modérément résistants et 6 lignées interspécifiques dérivées d'*Helianthus tuberosus* ont été évaluées en conditions d'infection naturelle. La lignée très sensible L-101 a été plantée autour et à l'intérieur du dispositif comme agent infectant et propagateur de la maladie. L'intensité de l'attaque a été estimée selon une échelle numérique de 0 à 9, fondée sur la surface foliaire infectée durant les stades de développement R₅ et R₉ de la culture. Aucun des génotypes, lignées interspécifiques incluses, n'a montré un degré élevé de résistance. La plupart des génotypes testés étaient très sensibles. Trois lignées viz 180, 873, 1229 et l'hybride ISPH-306 ont présenté un niveau modéré de résistance. Les résultats indiquent que les niveaux élevés de résistance n'existent pas dans la base génétique du matériel cultivé. Une stratégie alternative visant à utiliser les faibles niveaux de résistance disponibles pour créer des populations résistantes, est aussi discutée.