

REACTION OF INTERSPECIFIC LINES TO *Alternaria* LEAF AND STEM BLIGHT IN SUNFLOWER

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SUMMARY

Alternaria leaf and stem blight is a potential destructive foliar disease of sunflower in India and elsewhere causing significant yield losses during rainy season. Thirty-two interspecific lines derived from 11 *Helianthus* species were evaluated under natural epiphytotic conditions. Highly susceptible line L-101 was planted all along the borders and in between as an infector and spreader of the disease. The disease severity was assessed by taking 0-9 numerical rating system at three stages. The results indicated none of the wild derivatives showed resistant reaction. All the lines were highly susceptible to *Alternaria* leaf and stem blight.

Key words: *Alternaria helianthi*, *Helianthus* ssp., wild sunflower

INTRODUCTION

The sunflower leaf spot caused by *Alternaria helianthi* (Hansf.) Tubaki and Nishihara is economically important and it appears in most growing seasons and locations in India. The disease is reported to reduce seed and oil yields by 27 to 80% and 17 to 33%, respectively, leading to germination losses varying from 23 to 32% (Reddy and Gupta, 1997; Balasubrahmanyam and Kolte, 1980). Inbuilt genetic resistance would be the most economic way to reduce losses. However, studies so far indicate that high level of resistance is not available in the cultivated species. Wild sunflowers are potential sources for several desirable characteristics including disease resistance (Seiler, 1992). Results of previous studies indicated that significant genetic variation exist in wild sunflowers with regard to the sensitivity to *Alternaria helianthi* (Morris *et al.*, 1983; Lipps and Herr, 1986; Seiler, 1991). There is a strong need to screen the *Helianthus* species and the interspecific lines against *Alternaria* isolates of this geographical region where the disease is more severe in order to identify the potential donor species. In the present study attempts were made to evaluate the interspecific lines derived from eleven *Helianthus* species for their susceptibility to *Alternaria* leaf spot under natural epiphytotic conditions. These lines were hitherto not tested against *Alternaria* leaf spot.

Table 1: List of genotypes evaluated during kharif 1998. Reaction of interspecific lines of sunflower against *Alternaria* leaf blight

Sl. No.	Entry	Sp. Name	PDI at 50% flowering (%)	PDI 15 days after 50% flowering	PDI at physiological maturity
1	EC-413057	PET-PET-1741-2	61.22	91.32	100.00
2	EC-413058	PET-PET-1741-1	59.56	93.00	100.00
3	EC-413059	HIR-1734-1	63.33	93.32	100.00
4	EC-413060	ARG-420-1	56.55	93.22	98.11
5	EC-413061	ANO-1509-1	63.89	97.22	100.00
6	EC-413062	HIR-1743-3	63.72	96.78	100.00
7	EC-413063	PRA-RUN-417-3	64.00	96.55	100.00
8	EC-413064	NEG-1255-1	63.33	97.88	100.00
9	EC-413065	DES-1474-1	62.00	91.78	100.00
10	EC-413066	RES-834-1	57.78	93.32	100.00
11	EC-413067	ARG-1575-3	61.77	97.78	100.00
12	EC-413068	RES-843-3	63.89	93.66	100.00
13	EC-413069	PAR-1673-2	63.56	93.66	98.44
14	EC-413070	ARG-1574-4	65.88	93.89	100.00
15	EC-413071	PAR-1674-2	64.44	97.21	100.00
16	EC-413072	PRA-1084-1	63.89	93.78	100.00
17	EC-413074	PRA-RUN-417-1	59.99	95.66	100.00
18	EC-413075	PRA-PRA-1142	63.88	96.10	99.22
19	EC-413076	DES-1474-3	56.12	90.10	100.00
20	EC-413077	DEB-SIL-367-1	64.44	94.44	100.00
21	EC-413078	ANO-1509-2	63.89	97.33	100.00
22	EC-413079	PRA-RUN-417-1	64.33	96.33	100.00
23	EC-413080	ARG-1575-2	63.67	95.10	100.00
24	EC-413081	ARG-1575-1	65.50	94.89	100.00
25	EC-413082	PAR-1671-1	60.78	92.55	100.00
26	EC-413083	PAR-1673-1	60.00	96.55	100.00
27	EC-413084	DES-1474-2	60.11	91.77	98.56
28	EC-413085	HIR-1734-2	64.26	95.66	100.00
29	EC-413086	BOL-774	60.46	92.89	98.67
30	EC-413087	DEB-SIL-3672	63.89	97.00	100.00
31	EC-413088	DEB-CUC-1810	63.00	93.16	98.88
32	EC-413090	PRA-RUN-1329-1	64.05	92.56	97.67
33	L-101		59.93	89.77	95.21
34	Morden		50.33	87.55	91.66
35	NSP-92-1		50.33	87.66	91.66

LSD (P-0.05)

MATERIAL AND METHODS

Thirty two interspecific germplasm lines derived from 11 different *Helianthus* species were obtained from Northern Crop Science Laboratory, USDA, Fargo, USA (Table 1). Along with these 32 wild derivatives, three susceptible check varieties, L-101, Morden and NSP-92-1, were evaluated for their reaction to *Alternaria* leaf blight under natural epiphytotic conditions during kharif 1998 at Main Research Station, UAS, Dharwad. Dharwad is a hot spot for *Alternaria* leaf spot. The selected 35 lines were grown in two replications. Each entry was sown in two rows of 3.3 m with a spacing of 45 cm between rows and 30 cm between the plants. The susceptible check, L-101 was grown along all borders and after 10 rows to act as an infector and spreader. The disease severity of each entry was assessed at three stages viz., 50% flowering (stage I), 15 days after 50% flowering (stage II) and physiological maturity (stage III) on five randomly selected plants per replication. Numerical rating system of 0-9 scale was used to record the severity of the disease (Mayee and Datar, 1986). From disease severity scores, percent disease index (PDI) was calculated using the following formula and ANOVA for PDI values at 3 stages were also calculated.

$$\text{PDI (percent disease index)} = \frac{\text{sum of grades of all observations}}{\text{number of observations} \times \text{maximum grade value}} \times 100$$

RESULTS AND DISCUSSION

The weather conditions during crop growth period were highly favorable for disease development, which is indicated by the maximum severity shown by the susceptible check L-101. The disease appeared at very early stages (Plates 1 and 2) and developed sufficiently during later stages of crop growth.

The analysis of variance indicated significant variability for percent disease index at all the 3 stages (Table 2) among the interspecific lines tested. Such significant differences were reported earlier by several workers (Nagaraju *et al.*, 1993; Ravikumar *et al.*, 1995).

Table 2: Analysis of variance for PDI at three stages in sunflower

Source	d.f.	PDI at 50% flowering (%)	PDI at 15 days after 50% flowering (%)	PDI at physiological maturity (%)
Genotypes	33	12.27**	13.99**	5.65**
Error	33	5.99	6.99	0.86

** Significant at 1% level

The results of the present investigation also indicated that, although significant differences were present among the genotypes tested none of them showed even a moderate level of resistance (Table 3). Disease intensity was very high and all the interspecific lines had higher disease intensity at all stages compared with the susceptible variety Morden.



Figure 1: Early incidence of disease on inter-specific line ARG-1575-3

Figure 2: Early incidence of disease on inter-specific line ARG-1575-4

Table 3: Comparison of 11 *Helianthus* species for PDI at three stages

Species name	Number of line	PDI at 50% flowering (%)	PDI at 15 days after 50% flowering (%)	PDI at physiological maturity (%)
<i>H.petiolaris</i> (ssp.) <i>petiolaris</i>	3	60.89	92.16	100.00
<i>H.hirsutus</i>	3	63.77	95.25	100.00
<i>H.argophyllus</i>	5	61.87	94.24	99.52
<i>H.anomalous</i>	2	63.89	94.85	100.00
<i>H.praecox</i> (ssp.) <i>runyanii</i>	5	63.25	94.97	99.53
<i>H.praecox</i> (ssp.) <i>praecox</i>	1	63.88	96.10	100.00
<i>H.neglectus</i>	1	63.33	97.88	100.00
<i>H.deserticola</i>	3	59.41	91.21	99.26
<i>H.resinosus</i>	2	60.83	93.49	100.00
<i>H.paradoxus</i>	4	62.19	94.99	99.61
<i>H.debilis</i> (ssp.) <i>silvestris</i>	2	64.00	95.72	100.00
<i>H.debilis</i> (ssp.) <i>cucumarifolius</i>	1	63.00	93.16	98.88
<i>H.bolanderi</i>	2	61.11	95.33	99.33
L-101	1	65.30	87.77	100.00
Morden	1	59.33	85.21	95.20
NSP-92-1	1	60.33	87.66	91.66

Although moderate levels of resistance have been reported in wild species viz., *H. argophyllus* (Anilkumar *et al.*, 1976), *H. tuberosus*, *H. pauciflorus*, *H. hirsutus* (Seiler, 1991), *H. rigidus* (Morris *et al.*, 1983), *H. maximiliani*, *H. divericatus*, *H. mollis*, *H. resinosus* and *H. simulans* (Sujatha *et al.*, 1997), none of the derivatives recorded even moderate level of resistance under natural epiphytotic conditions in this study. The comparison of PDI values of interspecific lines derived from different wild species did not show differences between species. All the lines were equally susceptible. This could be either due to absence of disease during selection and development of lines or due to elimination of chromosomes carrying resistant alleles during backcrossing or absence of resistance in the wild species used to derive these genotypes. Therefore, it is necessary to subject interspecific populations to disease epiphytotic conditions at each cross for conserving resistance alleles.

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**REACCIÓN DE LAS LÍNEAS INTERESPECIES DE GIRASOL
EN ALTERNARIOSIS DE LA HOJA Y TALLO (*Alternaria
helianthi*)**

RESUMEN

La alternariosis de la hoja y del tallo (*Alternaria helianthi*) es una enfermedad foliar de girasol, potencialmente destructiva en la India y en un rango más amplio, que lleva hasta una significativa disminución de rendimiento durante la temporada pluvial. En las condiciones del epifitocio natural, se han evaluado 32 líneas interespecies, derivadas de 11 especies del género *Helianthus*. La sumamente sensible línea L-101, sembrada por los bordes del ensayo, y entre líneas, con el objetivo de provocar infección y divulgar la enfermedad. La intensidad de la enfermedad fue evaluada en tres fases en la escala de 0 a 9. Los resultados han demostrado que ninguno de los derivados salvajes no tiene resistencia a alternariosis de la hoja y del tallo. Todas las líneas investigadas han demostrado una alta sensibilidad a esta enfermedad.

**RÉACTION DES LIGNES DE TOURNESOL INTERSPECIES
À LA ROUILLE DES FEUILLES ET DE LA TIGE (*Alternaria
helianthi*)**

RÉSUMÉ

La rouille des feuilles et de la tige (*Alternaria helianthi*) est une maladie foliaire du tournesol en Inde et ailleurs. Elle est potentiellement destructrice et conduit à une diminution importante du rendement au cours de la saison des pluies. L'examen portait sur 32 lignes interspecies issues de 11 espèces du genre *Helianthus* dans des conditions d'épiphytie naturelle. Dans le but de provoquer l'infection et de répandre la maladie, on a semé la ligne particulièrement sensible L-101 en bordure du champ expérimental et entre les rangs. L'intensité de la maladie a été évaluée en trois phases sur une échelle de 0 à 9. Les résultats ont montré qu'aucun des dérivés sauvages n'a de résistance à la rouille des feuilles et de la tige. Toutes les lignes examinées ont montré une grande sensibilité à cette maladie.