7th International Safflower Conference
WAGGA WAGGA AUSTRALIA

Sources of resistance to Alternaria leaf spot among *Carthamus* wild species

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Abstract
Cultivated safflower (*Carthamus tinctorius*) is highly susceptible to the Alternaria leaf spot (*Alternaria carthami*). Four wild *Carthamus* species *viz*., *C. palaestinus*, *C. lanatus*, *C. creticus* and *C. turkestanicus* were found immune to Alternaria leaf spot in laboratory as well as under field screening. Twenty-four F1s derived from crosses between *C. tinctorius* x *C. creticus*, *C. tinctorius* x *C. oxyacantha*, *C. tinctorius* x C. *turkestanicus* , *C. tinctorius* x *C. lanatus* x *C. palaestinus* and *C. oxyacantha* x *C. tinctorius* cross were found to be immune to the Alternaria leaf spot. The resistant lines can be used in breeding programmes for developing Alternaria resistant varieties and hybrids

Key words: *Alternaria carthami* - wild safflower - resistance source

Introduction

Alternaria leaf spot caused by *Alternaria carthami* Choudhury is a serious problem in safflower (*Carthamus tinctorius*) in India especially when wet cloudy weather prevails continuously for more than a week during flowering period. Available reports indicate considerable yield loss from the disease in USA (Zimmer, 1963; Crowell, 1973) and Ausatralia (Irwin, 1976). In India, the disease is reported to cause 25-60% yield loss every year (Singh,Vijay and Prasad, 2005). Survey on intensity of Alternaria leaf blight of safflower in northern India revealed 27-90% yield loss when the disease appears at early stage of crop growth (Krishna Prasad, 1988). The pathogen survives in seed and infected plant debris. Primary infection develops from infected seed; secondary infection takes place through airborne conidia. Continuous cloudy and wet weather conditions are conducive for disease development and spread of the disease. The disease becomes particularly severe in irrigated crops and in warmer areas where periods of dew or frequent rainfall occur.

Sources of resistance to *Alternaria* are not available in cultivated safflower (*Carthamus tinctorius* L.) genepool. In search of resistance sources, six *Carthamus* wild species *viz*., *C. glaucus* L., *C. oxyacantha* L., *C. palaestinus* L., *C. lanatus* L., *C. creticus* L., *C. turkestanicus* L. and interspecific derivatives obtained from crosses between cultivated and wild safflower species were screened against *Alternaria* under high disease conditions in the field as well as in the laboratory using detached leaf technique along with susceptible *C. tinctorius* lines and reported in this paper.

Materials and Methods

Six wild *Carthamus* species and 150 lines derived from crosses between cultivated and wild species viz., *C. palaestinus*, *C. lanatus*, *C. creticus* and *C. turkestanicus* were sown in Directorate of Oilseeds Research, Research Farm, Hyderabad, India during the month of August 2005-06 (normal sowing period-September to October) as early sowing predisposes the crop to natural occurrence of the disease. The cultivated species *C. tinctorius* was the female parent in cultivated x wild species crosses while F_1 of C. *tinctorius* x C. *lanatus* was the female parent in C. *tinctorius* x *C. lanatus* x *C. palaestinus* cross. Femle parents were emasculated one day prior to pollination. Two to five crosses were made in each combination. The crop was sown in rows 5 m long with spacing of 30x20cm as against recommended 45x20cm spacing as the less space between rows helps in congenial microclimate for disease development. All lines

were sown in three replications. Disease severity was recorded at pre flowering, flowering and seed filling/maturity stages following standard disease scoring scale (Mayee and Datar, 1986). In laboratory screening, a detached leaf technique (DOR, 2005) was followed for screening safflower against Alternaria leaf spot disease. Leaves from wild safflower species and from interspecific crosses (Cultivated X Wild) from the field were collected during pre-flowering to the flowering stage from bottom, middle and top of the plant. *Alternaria carthami* spore suspension having 1 x 10^6 spores/ml was prepared from 10-day-old pure culture and sprayed on leaves kept on moist blotters in a petri dish. Brown necrotic spots were developed by third day after inoculation.

Results and Discussion

The wild safflower species *C. palaestinu*s, *C. lanatus*, *C. creticus* and *C. turkestanicus* were immue to *Alternaria carthami* in field and the results were further validated by screening the wild species by the detached leaf technique with artificial inoculation. The other two wild species *viz*., *C. glaucus* and *C. oxyacantha* were tolerant with 20-30% disease severity. The cultivated species (*C. tinctorius*) was highly susceptible, showing 100% disease severity in the laboratory as well as in the field. The F_1 plants between cultivated safflower and resistant wild species showed resistance against *Alternaria* with less than 5% disease severity under high disease pressure in the field as well as in the laboratory. Two immure lines were identified from the *C. tinctorius* x *C. creticus* cross, 11 lines from *C. tinctorius* x *C. oxyacantha* cross, 3 each from *C. tinctorius* x C. *turkestanicus* cross and the *C. tinctorius* x *C. lanatus* x *C. palaestinus* crosses and 5 lines from *C. oxyacantha* x *C. tinctorius* cross.

The resistant wild species would serve as base material in disease resistance breeding programmes as well as to tag the resistant genes at molecular level for marker assisted selections in the field for *Alternaria* resistance.

Acknowledgements: The authors are thankful to Project Director, Directorate of Oilseeds Research, Rajendranagar, Hyderabad, India for providing necessary facilities for conducting the research work.

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