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SCREENING OF SAFFLOWER GERMPLASM ACCESSIONS FOR RESISTANCE SOURCE AGAINST *MACROPHOMINA* ROOT ROT

VANITA NAVNATH SALUNKHE
Directorate of Medicinal and Aromatic Plants Research, Boriavi, Anand - 387 310, Gujarat
e-mail: vnsalunkhe55@gmail.com

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***Corresponding author**

ABSTRACT
Fifty germplasm accessions of safflower procured from AICRP on safflower, Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra were screened for resistance source against *Macrophomina* root rot under glasshouse condition. The screening revealed that 4 genotypes viz., GMU-3259, GMU-3262, GMU-3306, GMU-3316 were highly resistant (no seedling infection) whereas 3 genotypes GMU-3265, GMU-3285, GMU-3297 were resistant and recorded upto 1-10% seedling mortality whereas 5 moderately resistant genotypes recorded 11-30% seedling mortality. Fourteen genotypes were found moderately susceptible and indicated 31-50% seedling mortality whereas rests of the accessions were found susceptible or highly susceptible.

INTRODUCTION

Safflower (*Carthamous tinctorius* L.), is *rabi* oilseed crop, became popular among the farmers due to its hardy nature, short duration and high commercial value. The world area under safflower is 8.22 lakh ha with 5.83 lakh tones production and productivity of 709 kg/ha. India ranks first in area and production of safflower. Although it is very important oil seed crop, the area under safflower in India has been significantly decreasing from 8 lakh hectares in 1986 to 2.95 lakh hectares in 2009 due to various constraints (Damodaran and Hegde, 2010). Diseases are one of the major constraints in safflower cultivation and causes economical yield losses in the farmer's field. Among diseases, *Macrophomina* root rot of safflower is a devastating one and may kill up to 20-25% of plants in commercial fields (Singh and Bhowmik, 1979).

The disease is characterized by gradual yellowing and drying of leaves, at flowering stage. The affected roots exhibited extensive shredding of the black tissues. The pathogen also causes stem splitting and plant fails to withstand (Govindappa *et al.*, 2005). The pathogen *Macrophomina phaseolina* (Tassi.) Goid. (sclerotial stage = *Rhizoctonia bataticola*) is predominant and causes severe losses mainly due to moisture stress and in the regions where climate is relatively dry and warm during growing season (Arya *et al.*, 2004). The black microsclerotia (0.1-1mm) serve as a primary means of infection and survive up to 15 years depending on environmental conditions (Papavizas, 1977).

Soil borne habitat, long lasting establishment under diverse environmental conditions and high level of morphological and pathogenic variation makes *Macrophomina* root rot management at the field level is challenging. Among various approaches used for the management of such a soil borne pathogen; the most appropriate, cheapest and durable approach is the development of resistant varieties. Therefore, in the present study the safflower germplasms were screened to find out resistance source against *Macrophomina* root rot. The resistance observed in the investigation will help for further development of root rot resistance varieties of safflower.

MATERIALS AND METHODS

Fifty germplasm accessions of safflower procured from All India Coordinated Research Project (AICRP) on safflower, Marathwada Krishi Vidyapeeth, Parbhani, (M.S.) were screened for resistance source against *Macrophomina* root rot. An experiment was planned *in vitro* in split plot design with main treatments: 02 (I_0- Control (without inoculation), (I_1-Inoculation with culture filtrate) and Sub treatments: 50 (Germplasm accessions). High concentration (100%) culture filtrate of *M.phaseolina* was used for seedling inculation.

Preparation of culture filtrate of test fungi

Potato dextrose broth (2%) was autoclaved at 121ºC in 250mL conical flasks with 100 mL broth in each flask. Flasks were inoculated with 5 mm agar discs from margins of actively growing 7-day old fungal colonies and incubated at 28 ± 2ºC for 15 days. The fungal biomass was removed by filtering through sterilized Whatman no.1 filter paper and filtrate obtained was used for seedling inoculation. Vail test technique based on method suggested by Hawere and Nene (1994) was used for screening study.

Vail test

Thermo stable test tubes were filled in with fine sand up to 1/

Table 1: Frequency distribution of safflower accessions in various disease reaction groups

Disease rating	Disease reaction	Name of accession	% of total
0	Highly resistant (HR)	GMU-3259, GMU-3262, GMU-3306, GMU-3316	8
1	Resistant (R)	GMU-3265, GMU-3285, GMU-3297	6
3	Moderately resistant (MR)	GMU-3302, GMU-3307, GMU-3345, GMU-3346, GMU-3353	10
5	Moderately susceptible (MS)	GMU-3268, GMU-3277, GMU-3287, GMU-3292, GMU-3296, GMU-3333, GMU-3341, GMU-3342,GMU-3343, GMU-3348, GMU-3351, GMU-3369, GMU-3371,GMU-3375	28
7	Susceptible (S)	GMU-3256, GMU-3286, GMU-3323, GMU-3326, GMU-3327, GMU-3329, GMU-3330, GMU-3334,GMU-3344, GMU-3352, GMU-3363, GMU-3366, GMU-3373, GMU-3375	28
9	Highly susceptible (HS)	GMU-3289, GMU-3310, GMU-3314, GMU-3315, GMU-3320, GMU-3322, GMU-3356,GMU-3364, GMU-3365,GUM-3368	20

4th of its capacity, plugged with cotton and sterilized at 15psi for 15 minutes. After cooling the tubes were filled in with culture filtrate of *M. phaseolina*. For control treatment tubes were filled in with sterilized water. For each germplasm four tubes were maintained. Safflower seedlings of 15 days old grown under aseptic condition were uprooted, washed with sterile water and transferred to control tubes (4 seedlings in each tube) as well as inoculation tubes. Symptoms were observed on sixteen seedlings of each accessions. Seedlings were examined for the extent of root damage using 0-9 scale (Nene *et al.*, 1981) where 0 (no infection) = Highly resistant (HR), 1(10 % seedlings infected) =Resistant (R), 3(30% seedlings infected) = Moderately resistant (MR), 5 (50% seedlings infected) = Moderately susceptible (MS), 7(70% seedlings infected) = Susceptible (S) and 9 (90% or above 90% seedlings infected)= Highly susceptible (HS).

RESULTS

Results of the present study, revealed considerable variation towards disease reaction among safflower germplasm accessions (Table 1). Genotypes were grouped into six different groups in relation to their resistance reaction. Out of fifty, 4 genotypes viz., GMU-3259, GMU-3262, GMU-3306, GMU-3316 were observed highly resistant and recorded no seedling infection, whereas 3 genotypes viz., GMU-3265, GMU-3285, GMU-3297 were found resistant and indicated 1-10% seedling mortality. Majority of genotypes were indicated susceptible and highly susceptible reaction to *Macrophomina* root rot.

DISCUSSION

Earlier investigation by Ingle *et al*. (2004) recorded that safflower varieties viz., AKS-152 and AKS-68 were showed resistant reaction against *Macrophomina* root rot under artificial inoculation whereas none of the varieties was found immune. Pahlavani *et al*. (2007) screened nineteen safflower genotypes originated from different geographical regions of Iran and found considerable variation among genotypes for reaction against *Macrophomina* charcoal rot. In their study, genotypes IUT-K115, GUA-Val6, CW-74 and AC-Stirling showed moderately resistance reaction under field condition. In the present study, accessions GMU-3259, GMU-3262, GMU-3306, GMU-3316 were found immune to *Macrophomina* root rot whereas GMU-3265, GMU-3285, GMU-3297 showed resistant. The genotypes those found resistant are needed to be screened under field conditions to confirm the level of resistance at adult plant stage. Further, the resistant accessions will used as donors in future safflower breeding programme for incorporation of resistance in agronomically desirable high yielding varieties of safflower.

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