

Identification of Resistance to *Pythium ultimum* in Sunflower Seedlings

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Abstract: In order to evaluate *Pythium*-mediated damping-off a laboratory experiment was conducted at Biotech Research Center of the University of Zabol, in 2010. The experimental design was a completely randomized with seven genotypes, together with seven replicates. The seeds were inoculated in oospore suspension of fungi (105 mg/mL) for 1 min. After 5 days, seedlings were evaluated with an aim to counting non-germinated seeds, abnormal seedlings and healthy seedlings. Then the healthy seedlings were planted in pots after infecting seedlings through a piece of paper towels contaminated with fungal suspension, and normal seedlings were counted after 12 days. The result showed that there were significant differences among the genotypes for all evaluated traits. The greatest non-germinated seeds were observed in Azargol with 38% and followed by Record and Allstar. Azargol also had the highest abnormal seedlings (86%) and the minimum abnormal seedlings were observed in Xaria with 72%. Regarding normal seedlings at pot, Golshid and Hysun-33 were superior with 60 and 49%, respectively. These findings suggest that all genotypes had a high susceptibility to *P. ultimum*. Also, results obtained from the paper towel experiment were different to the results of the soil.

Key words: Germination, resistance, seed, suspension, zoospore

INTRODUCTION

Sunflower (*Helianthus annuus*) as major oil crop contributes to approximately 14% of the world's oil production (Carmen and Connor, 1994). One of the major problems in sunflower production is various diseases in the seedling stage such as seed decay, damping-off, root rot and wilt disease. *Pythium ultimum* (Trow) is widespread in soil and has a wide host range (Martin and Loper, 1999). This pathogen is involved in seedlings disease complex of sunflower and can attack seeds and or seedlings under favorable conditions of low temperature and high-soil moisture at planting (Hillocks, 1992). This disease occurs as seed decay before germination and as pre-emergence damping-off (Davis, 1982; Hillocks, 1992).

Evaluation of sunflower genotypes for resistance to various diseases, including *Pythium*-mediated damping-off is particularly serious. However, no study has been previously reported in the context of Iran on the identification of resistance to *Pythium ultimum* in sunflower seedlings. Consequently, the aim of this study was to elucidate the effects of *Pythium ultimum* on seed emergence and early seedling growth of sunflower.

MATERIALS AND METHODS

The experiment was carried out in April 2010 at the, Zabol, I.R. Iran. Seven safflower (*Carthamus tinctorius* L.) varieties, Hysun-33, Record, Xaria, Azargol, Allstar,

Golshid and landrace of Isfahan, being widely planted all over Iran, were used in this study. Seeds were kindly provided by Zabol Agricultural Research Center.

Prior to germination, the seeds of wheat were surface-sterilized with 3% Formaldehyde for 10 min and washed 3 times with re-distilled water. The seeds were then inoculated in sterilized container in oospore suspension of fungi (105 mg/mL) for one minute. Petri dishes were subsequently kept in the dark, at 25°C, for a span of 5 days. The solutions were renewed after 3 days. The experiment was laid out as a randomized complete block design with seven genotypes as treatments, together with four replicates. After 5 days, seedlings of containers were evaluated with an aim to counting non-germinated seeds, abnormal seedlings and healthy seedlings. Then the healthy seedlings were planted in pots after infecting seedlings through a piece of paper towels contaminated with fungal suspension, and normal seedlings were counted after 12 days.

Here, germination was considered only when the radicle were longer than 2 mm. Final germination percentage was calculated based on Soltani *et al.* (2006). The experiments were repeated twice and the pooled mean values were separated on the basis of Duncan Multiple Range Test (DMRT) at a probability level of 0.01.

RESULTS AND DISCUSSION

Fungi (*Pythium ultimum*) were caused symptoms such as non-germination, rot in seed, roots and stems of seedlings in all genotypes (Fig. 1).



Fig.1: Non-germinated seeds, normal seedlings and infested seedlings by *P. ultimum* of sun flower

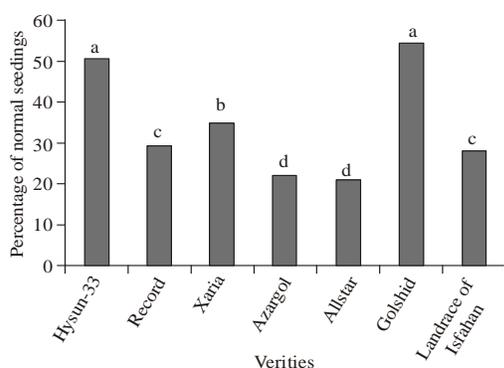


Fig. 2: Normal seedlings percentage of sunflower in a pot experiment after 12 days

Analysis of variance revealed that all traits significantly changed between different genotypes. Sunflower genetic variation in response to fungal disease has been reported by Debaeke and Estragnat (2003), Sadras *et al.* (2000) and Abelardo *et al.* (2007).

The greatest non-germinated seeds were observed in Azargol with 38% and followed by Record and Allstar, while Xaria and Golshid had the least non-germinated seeds (data not provided).

Among the assessed genotypes, Azargol also had the highest abnormal seedlings (86%) and the minimum abnormal seedlings were observed in Xaria with 72%. Other varieties were between these two varieties (data not provided). Xaria with the highest normal seedlings and the least abnormal seedlings was the most resistant genotypes in response to *P. ultimum* at germination stage. Lowest number of non-germinated seeds was observed at landrace of Isfahan (data not provided).

The percentages of normal seedling as affected by the different genotypes at pot experiment are presented in Fig. 2. Golshid showed more resistant than other genotypes at pot culture and followed by Hysun-33. Results obtained from the paper towel experiment were different to the results of the soil. The results also showed that most genotypes are highly sensitive to the *P. ultimum* (Fig. 2).

CONCLUSION

In conclusion, we have shown that statistically significant differences have been found to exist between the genotypes for all traits. Nevertheless, all genotypes had a high susceptibility to *P. ultimum*. Genotypes susceptibility to the pathogenic fungi differed between inoculation in oospore suspension and planting seedlings pots after infecting seedlings through a piece of paper towels contaminated with fungal suspension.

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