Genetic Evaluation of *Brassica juncea* and *Sinapis alba* Seedling Traits under Multi Stress Conditions

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ABSTRACT. *Brassica* is an important oil seed crop plant species grown throughout the world. *Brassica juncea* and *Sinapis alba* are very sensitive to abiotic stress conditions which included drought, heat, salt, heavy metals and cold which disturb their growth and yield. For this purpose to check the effect of heavy metals, salt and drought, an experiment was conducted the green house of Institute of Molecular Biology and Biotechnology, The University of Lahore. Seeds were grown in 36 ports filled with pure 2 kg sand. The treatments that used for both varieties were included control (no stress applied), T1 (40% H_2O), T2 (60% H_2O), T3 (0.25 mM NaCl), T4 (0.5 mM NaCl), T5 (0.25 mM $ZnSO_4$), T6 (0.5 mM $ZnSO_4$). The average performance of both plant species was highly affected due to heavy metals, salt and drought stress applications. The study was concluded that different abiotic stresses effect the growth, structure and functions of cells of plants. The higher genetic advance and heritability were recorded for most of the studied traits of *Sinapis alba* as *Brassica juncea* also it was concluded from mean comparisons under all stress conditions that *Sinapis alba* performed batter under stress conditions and showed as a good stress tolerant genotype that can be very useful for the improving of oil yield and productivity under different abiotic stresses.

Keywords: *Sinapis alba*; *Brassica juncea*; Drought; Heat; Salt; Water; Heavy metals

INTRODUCTION

Brassica juncea is very important oilseed crop plant. Soybeans and palm oil are important oil but *brassica* is the third most necessary plant oil in the world. Repressed *Brassica* is of good quality oil and their repressed meal is used for the livestock feeding industry. *Brassica* species play an important role in nutritional and economical values of growing countries (Ashraf et al., 2004). Brown mustard is a functional food that provides some health benefits and disease prevention (Kim et al., 2003). Allyl isothiocyanate is the major component of the oil that is produce in early processing of the seeds (Yu et al., 2003). It also provides some health benefits like to treat cancer (Zhang et al., 2010) and antimicrobial agent (Luciano et al., 2009). There is less production of edible oil in Pakistan which forced to import the edible oil and oilseed from different countries.

Pakistan imports 1,326 million tons of edible oil that worth about Rs. 97 billion (Ashraf et al., 2004). However, traditional cropping pattern of Pothwar region has provided opportunity for increasing the area under oilseed crops. *Brassica juncea* is major oilseed that is produced in Nepal, Bangladesh and India (Appelqvist et al., 1973). In Pakistan *Brassica juncea* and white mustard are usually grown on large area because they show resistant to different stresses and produced large quantity of oil.

MATERIALS AND METHODS

Brassica is very sensitive to the abiotic stress that includes drought, heat, heavy metal and cold stress that effect the growth and development of the brassica plant. To make sure the effect of various stresses experiment was carried out in the greenhouse of IMMB, The University of Lahore. The purpose of our study to know the effect of NaCL and $ZnSO_4$ and drought on the *Brassica juncea* and *Sinapis alba* which were grown in the pots filled with pure sand. For this experiment we used different apparatus, reagents and chemicals and follow various procedure. The treatments were provided 4 times after every 7 days and data of root length, leaf length, number of roots, shoot length and leaf width was recorded 4 times. The recorded data was pooled and subjected to analysis of variance to check out the significance of results.

RESULTS AND DISCUSSION

The finding of from result showed that the statistical analysis revealed significant differences between *brassica* and *Sinapis alba* under salt, drought and heavy metal abiotic stress conditions. The treatment which caused major adverse effects on plants were stress concentrations of 0.5 mM $ZnSO_4$, 0.5 mM NaCl, 40% H_2O as compared with control (no stress applied) condition. It was found from results (Table 1) that the coefficient of variance was recorded as lower for all studied traits both for *Brassica juncea* and *Sinapis alba* which indicated that there was consistency among the results and selection may be made on the basis of lower coefficient of variance to improve oil production of *Brassica juncea* and *Sinapis alba* (Iqra et al., 2020ab; Masood et al., 2020; Zubair et al., 2016). The genetic advance was found for root length (11.25%, 17.23), leaf length (15.62%, 19.32%), number of roots (19.23%, 18.24%), shoot length (11.13%, 19.14%) and leaf width (21.16%, 19.96%) for *Brassica juncea* and *Sinapis alba* respectively. the heritability was found for root length (89.12%, 90.13), leaf length (89.82%, 92.04%), number of roots (93.14%, 92.01%), shoot length (91.02%, 91.03%) and leaf width (92.11%, 94.10%) for *Brassica juncea* and *Sinapis alba*.

The results showed that the genetic advance was recorded higher for both of the plant species, while heritability was found higher for all studied traits of *Sinapis alba*, which indicated it as stress tolerance genotypes. The higher heritability and genetic advances indicated that the selection of higher oil yielding genotypes may be help to produce stress tolerance genotypes (Asif et al., 2020; Mazhar et al., 2020).

Sources	Root Length	Leaf Length	No. of Roots	Shoot Length	Leaf Width
		Brassica juncea			
Coefficient of variation	4.13	7.21	9.21	6.25	9.10

Genetic Advance (%)	11.25	15.62	19.23	11.13	21.16
Heritability (%)	89.12	89.82	93.14	91.02	92.11
		Sinapis alba			
Coefficient of variation	8.03	9.831	8.13	7.01	8.15
Genetic Advance (%)	17.23	19.32	18.14	19.14	19.96
Heritability (%)	90.13	92.04	92.01	91.03	94.10

Table 1. Genetic components for morphological traits from pooled data analysis.

CONCLUSION

It was concluded form our study that the *Sinapis alba* may be used to increase oil production under drought, slat and heavy metal stress conditions.

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