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التوثيق الإلكتروني والميكروفيلم

بسم الله الرحمن الرحيم

HANAA ALY

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التوثيق الإلكتروني والميكروفيلم

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SEED SPROUT CHARACTERISTICS OF SOME FABACEAE AND BRASSICACEAE VARIETIES

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B.Sc. Agric. Sc. (Horticulture), Fac. of Agric., Ain Shams University, 2010

M.Sc. Agric. Sc. (Plant Breeding), IAMZ, Lleida University, 2014

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ABSTRACT

Mahmoud Adel Ahmed Ali: Seed Sprout Characteristics of Some Fabaceae and Brassicaceae Varieties. Unpublished PhD. Thesis, Department of Horticulture, Faculty of Agriculture, University of Ain Shams, 2021.

Germination is one of the unique properties of the earlier stages of plant growth. It is a morphological expression of various metabolic activities in seeds. Exposure plants to the abiotic stresses for instance salinity, influenced physiological processes, anatomy, developmental systems and plant development. Agriculture production under arid and semi-arid conditions facing many stress factors as an accumulation of salts in soils and water, where the total salinized land area about 953 million ha. This study aimed to evaluate the germination characters of five faba bean (*Vicia faba* L.) varieties [Nubaria1, Giza 843, Sakha 1, Sakha 3 and Sakha 4] seed under 3 saline solutions (0, 1000 and 2000 ppm NaCl) and its biochemical response to salicylic acid, glycine betaine and UV-C as inducers to salt stress tolerance. Seeds of 2 cabbage varieties were also subjected to the same faba bean seed treatments. To enhance phytochemical content and immune compounds which improving seed tolerant to altered condition used to enhance human immunity system to establish an introductory basis for knowing behavior of seed germination under altered condition and get benefit from compounds will be formed to constitute additive value with sprouts nutritional value. To verify the effect of the experimental treatments, data of water uptake, germination percentage, germination index, relative salt injury rate, radicle length, sprout fresh and dry weight, weight losses and seed volume were collected. The results indicated that the higher concentrations of salt decrease nutrients and water uptake, germination percentage, radical length, sprout fresh and dry weight, seed volume, and relative salt injury rate and mineral content. At all salinity concentrations, faba bean varieties showed different degrees of salt tolerance. Sakha 3, 4 and Giza 843 had

better salt tolerance index than Nubaria 1 and Sakha 1. Varieties of Nubaria 1, Giza 843 had the highest percentage and index of germination, while Sakha 1 had a shorter radical length and susceptible to salt injury rate. Micronutrients like zinc and iron were decreased with increasing salinity whereas copper and manganese increased with increasing salinity. Also macronutrients such as magnesium, potassium and calcium decreased with increasing salinity levels. Variety of Giza 843 had the greatest K/Na ratio while Sakha 1 recorded the lowest K/Na ratio. Data showed that the K/Na ratio decreased with increasing salinity levels. Moreover, Giza 843 and Sakha 3 genotypes can be considered more tolerant to salt stress compared to the others.

Concerning the biochemical response of the germinated faba bean seeds to salicylic acid (1and 5mM), glycine betaine (1and 5mM) and exposure to UV-C (one hour), these treatments induced salt stress tolerance of the germinated seeds under NaCl salt at 0-2000 ppm appeared in enhancing their germination characters, phytochemical compounds and amino acid content. Glycine betaine at 5mM recorded the higher germination percentage of Sakha1 followed by Giza843 but recorded the highest germination index of Nubaria1 followed by Giza843. Salicylic acid at 1mM concentration presented better index especially with Nubaria1 (96.79%) but the highest salicylic acid concentration (5 mM) prevents germination in all faba bean varieties. Salicylic acid at 1mM, glycine betaine 5mM and UV-C, enhanced coumarin derivatives, chalcone, flavonoids derivatives in the germinated seeds. Data of essential amino acids indicated that valine, isoleucine, leucine, phenylalanine, histidine, lysine and methionine recorded higher concentration at 2000 ppm NaCl in Nubaria1 variety. Proline amino acid recorded a higher concentration with increasing salinity of water of seeds soaking. Glycine betaine reduces proline under saline conditions. Salinity resulted in an irregular aspect of the seed coat, cotyledons and radical. However, the investigation by electron scanning microscope confirmed that using

glycine betaine at 5mM and UV-C under saline conditions stimulated normal seed coats, cotyledons and radical.

Mitigation salt stress on two cabbage varieties (Sabaeny and Ganzory) using seed priming by salicylic acid (1mM), glycine betaine (1mM) and exposure to UV-C for one hour were investigated, afterward, these seeds were germinated in 0-2000 ppm NaCl. The seedling characters were examined, and its phytochemical contents were measured. Seed priming and treatment led to enhancing cabbage seedling growth parameters and alleviates salinity effect. Sabaeny variety responded positively to salicylic acid at 1 mM under all salt levels where it recorded higher sprout fresh weight and dry weight. While remarked the minimum sprout weight loss percent and recorded the highest sprout yield ratio. Moreover, Salicylic acid 1mM recorded the highest hypocotyl / radical ratio.

Our results suggest that seed priming treatments for both faba bean and cabbage seeds induced salt tolerance through inducing secondary metabolites molecules which involved in salicylic acid defense pathway and jasmonic acid as well as producing glycine betaine. Also, other molecules act as plant growth promoters. Besides, enhancing biosynthesis of valuable phytochemical compounds in brassica and faba bean which use in nutraceutical and medicine applications for enhancing the human immune system.

Keywords: Salicylic acid, Glycine betaine, UV radiation, Salinity stress, Seed priming treatment, Faba bean, cabbage, Antioxidant system, Phytochemicals.

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