Abstract

This study was conducted to evaluate the physiological and biochemical mechanisms of seed priming treatment which improved the quality of milk thistle (*Silybum marianum*) seeds. So this research was performed in two steps: seed priming treatments optimization and seed biochemical analyzing. The experiments of seed priming optimization were conducted in Biotechnology Research of Zabol University. In this step, the best priming treatment was selected from different osmotic concentrations of NaCl, KNO3 and PEG 6000 and different duration times. Indices were included germination percentage, germination rate, mean germination time, radical length, seedling length and seed vigor index. The second step was performed in order to find physiological and biochemical mechanisms of optimized priming treatment which improved milk thistle seed quality under salinity and controlled conditions. This step was conducted in Agricultural Biotechnology Research Institute of Iran (ABRII) and its experimental design was arranged in a completely randomized design with three replications and four factors. The factors were first: genotype (Amol and Majar), second: primed and non-primed seeds, third: salinity (150 mM) and controlled (non-salinity) conditions and the fourth: time of sampling in 24 and 96 hours after sowing. Biochemical indices that were analyzed in this step included antioxidant enzymes activity, alpha amylase enzyme activity,starch and soluble sugars total level malondialdehyde (MDA), alpha, gama and delta tocopherol levels (vitamin E isomers), some important cation and anions, silymarin component level and some fatty acids using advanced analyzing methods. The results of seed priming optimization experiments showed the optimized treatment for Majar cultivar was osmopriming -2 bar of KNO3 for 18 hours and optimized treatment for Amol landrace was osmopriming -2 bar of KNO3 for 6 hours. The results of biochemical analysis showed ascorbate peroxidase and peroxidase enzymes activity was significantly higher in Majar than Amol. Under salinity condition, peroxidase activity was significantly higher in imbibitions than in germination whereas catalase and ascorbate peroxidase activity was higher in germination than in imbibitions. Under control condition, catalase, peroxidase and ascorbate peroxidase activities were greater in germination than in imbibition. The results of evaluating soluble sugars showed that seed priming increased 13% this time under salinity stress condition as compared to controlled condition. Also, soluble sugars level in salinity stress in comparison to controlled condition increased 22.8 % in Majar and 13.5 % in Amol. After imbibition, alpha-amylase activity increased significantly in both primed and non-primed seeds. Seed priming significantly increased alpha and gama tocopherol level under salinity conditions in both genotypes and significantly decreased MDA level. The level of alpha, gama and delta tocopherol were greater in Majar than in Amol. Also, MDA level decreased 24% in primed seeds in comparison to non-primed seeds under salinity stress condition. The effect of seed priming under controlled condition was so considerable that decreased MDA level 11% in primed seeds in comparison to non-primed seeds. From imbibition to germination, alpha, gama and delta tocopherol levels increased and MDA level decreased. The results of ion balance showed seed priming increased potassium level in imbibition and germination respectively, but Na level decreased 16 and 23.5 % in imbibition and germination 1.5 and 10.2% respectively. The effect of seed priming was greater on decreasing Na^+/K^+ in Majar than in Amol. The seed priming decreased the Cl^- level in both genotypes but this decreas was significant just in Majar alone. Seed priming increased taxifolin, silybin, silychristin, silydianin, isosilybin and silymarin level of primed seeds in comparison to non-primed seeds. under controlled condition, their levels decreased from imbibition to germination stage but under salinity conditions increased. Linoleic acid level hasn't effected by seed priming under controlled condition but the priming increased it from 41.4% in non-primed seeds to 42.5% in primed seeds. Also, seed priming increased oleic acid level in Majar significantly but didn't have any significant effect in Amol. The palmitic acid level decreased in Amol by seed priming but in Majar, seed priming didn't have any significant effect on this fatty acid. The palmitic acid level was greater in Amol than in Majar. In summary, the results showed seed priming increased catalase, peroxidase and ascorbate peroxidase activity, soluble sugars total level, alpha amylase activity, alpha and gama tocopherol levels, silymarin level, K^+ level, linoleic acid and oleic acid level and decreased total soluble protein, starch level, MDA level, Na^+ and Cl^- levels, Na^+/K^+ and palmitic acid in Majar in comparison to in Amol. Thus, seed priming improved germination indices in Milk thistle seeds.

Key words: Milk thistle, Seed priming, Salinity stress, Physiological and Biochemical indices

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