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Dose-dependent of melatonin and gibberellin priming improve seed germination and growth indices of *Salvia officinalis* L.

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Abstract: One of the obstacles in cultivating the medicinal plants is the low germination of their seeds due to dormancy. Melatonin and gibberellin are the most important growth regulators which have decisive roles in the growth and development of plants. To identify an effective priming dose of these regulators on seed germination, seedling growth and dry matter of *Salvia officinalis* L. in the lab experiment, effect of ten levels of hormone priming (50, 100, 150, and 200 ppm of gibberellin and 50, 100, 150, 200, 250, and 300 mM of melatonin) along with control in the complete random design with three replicates were tested. Results showed that although all levels of melatonin and gibberellin priming caused increase in seedling growth indices (percentage and germination rate, seed vigour index, root and plumule length, and seedling dry weight), compared to control, their effects strongly was dose-dependent. The least and the most germination percentage belonged to control (30 %) and 300 mM melatonin (90 %) levels, respectively. Albeit, the application of melatonin priming at 100 mM had the highest seed vigour index (18.4 %) and root length (2.04 cm) due, seemingly, to low plumule length, highest increase in seedling dry weight compared to control level was obtained at 200 ppm gibberellin (3-fold) and 300 mM melatonin (2.5-fold), respectively. Findings of the present study reveal that the priming of *S. officinalis* seeds by 300 ppm of melatonin and 200 mM of gibberellin may be played a crucial role in the germination and growth indices of this aromatic plant even under stress conditions.

Keywords: Growth indices, hormone priming, Seed germination, Seedling dry weight, Vigour index.

Introduction: Salvia (*Salvia officinalis* L.) is a perennial medicinal plant and is used for ornamental, medicine and food (Kintzios et al., 1999). Germination as critical and sensitive stage in the plant life cycle is controlled by genetic, hormonal and environmental factors (Meyer and Pendleton, 2000). Seed priming increase the germination rate and seedling establishment, which can strengthen the seedling's ability to absorb water and nutrients (Finch-Savage et al., 2004). There are several different methods for seed priming, including hormonal priming. Melatonin and gibberellin are plant growth regulators whose application as seed priming has a significant effects on plant growth and development stages such as seed germination, stem elongation, leaf development and yield (Khan et al., 2020). However, the positive effects of seed priming with gibberellin and melatonin on germination, growth and yield of crops such as rapeseed (Khan et al., 2020) and soybean (Wei et al., 2015) has been reported, but these effects may vary depending on the concentration of hormones and the plant species. Accordingly, the current study was conducted to determine the most appropriate concentration of gibberellin and melatonin (that can be used in priming) affecting germination and growth characteristics of *S. officinalis*.

Materials and Methods: The experiment was carried out in 2021 at the Lorestan University. *S. officinalis* L. seeds were prepared from Pakan Bazr Company of Isfahan, Iran. Treatments were included 11 levels of seed priming: control (without pretreatment) and seed priming with gibberellin (50, 100, 150, 200, 250 and 300 ppm) and melatonin (50, 100, 150, 200, 250 and 300 µM). The seeds were placed in the dark at hormones solutions for 6 hours and then air dried (Khan et al., 2020). Thirty seeds were planted in each petri dish (9 cm in diameter) on two layers of Whatman filter paper. Then 8 ml of distilled water containing fungicide (Carboxin Thiram 1 per thousand) was added to each petri dish. The petri dishes were placed inside a growth chamber at a temperature of 25± 2 °C. Two weeks after planting, five seedlings were randomly selected and the length of root and shoot were determined with a ruler. Seedling dry weight of 10 seedlings from each experimental unit was measured after oven drying at 75 °C for 48 h.

Results and Conclusion: The results showed that the effects of priming treatments on all studied traits were significant. All levels of gibberellin and melatonin primings increased the percentage and germination rate and growth characteristics such as vigor index, root and shoot lengths and dry weight of seedlings compared to the control (Figure 1-A, B, C, D, E and F). The highest germination percentage (90%) was obtained by melatonin 300 mM (Figure 1-A). The highest germination rate was obtained by gibberellin 50 and 100 ppm (Figure 1-B). The highest vigour index and root length were obtained by melatonin 100 mM (Figure 1-D and C). The highest seedlings dry weight was obtained by the gibberellin 200 ppm pretreatment (0.008 g/seedling) and melatonin 300 mM (0.007 g/seedling) (Figure 1-F).

Findings study reveal that the improvement of germination and growth characteristics of *Salvia officinalis* L. is strongly dose-dependent of melatonin and gibberellin priming. So that, our findings showed the priming of 300 ppm of melatonin and 200 mM of gibberellin may be played a crucial role in the germination and growth indices of this medicinal plant.

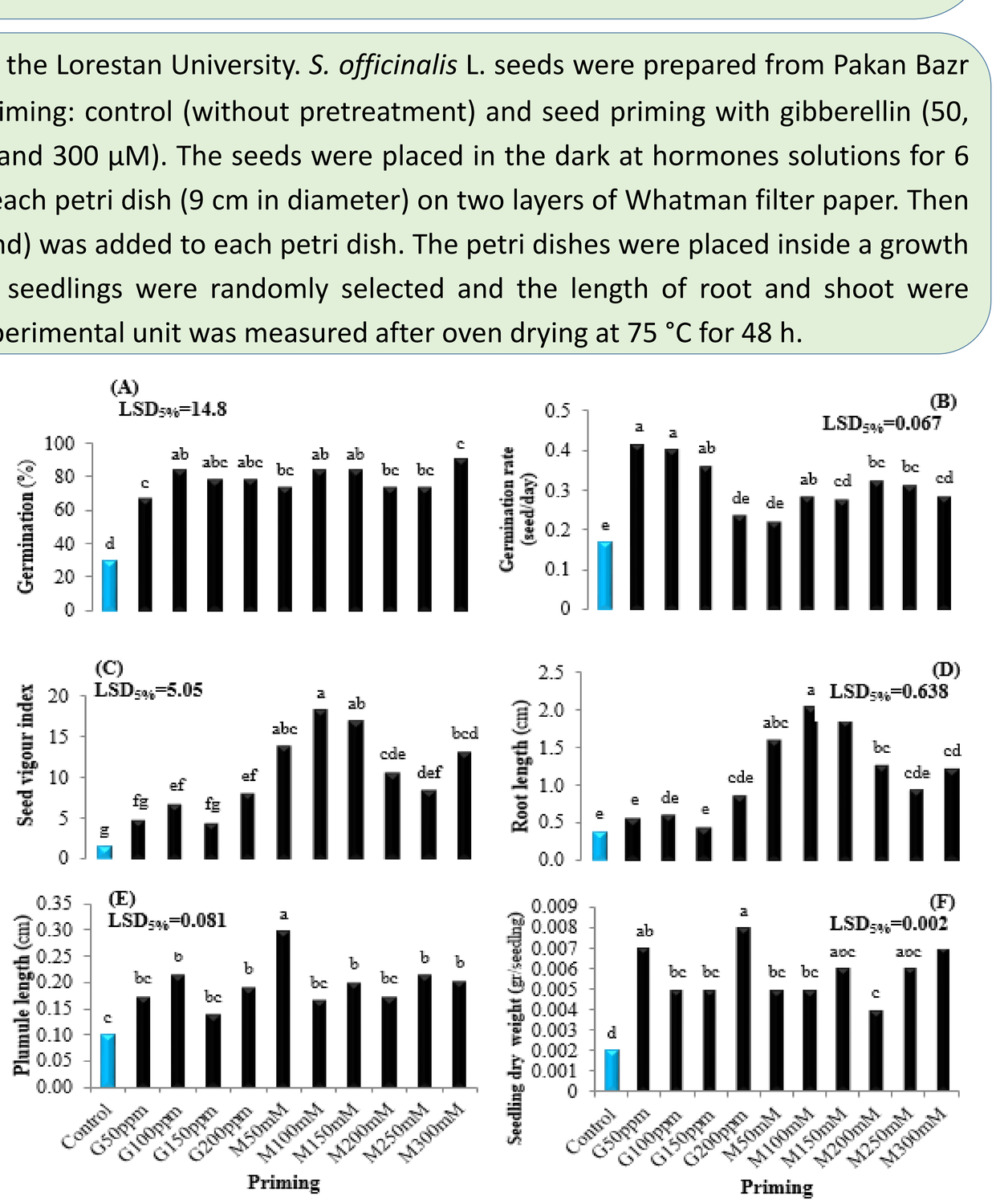

Figure 1. Effects of gibberellin and melatonin seed primings on germination percentage (A), germination rate (B), seed vigour index (C), root length (D), plumule length (E), and seedling dry weight (F) of *Salvia officinalis* L. G and M indicate gibberellin and melatonin, respectively. For each trait, means with the same letters do not have statistically significant differences at 5% level of probability according to LSD.

References

- Khan, M.N., Khan, Z., Luo, T., Liu, J., Rizwan, M., Zhang, J., Xu, Z., Wu, H. and Hu, L., 2020. Seed priming with gibberellic acid and melatonin in rapeseed: Consequences for improving yield and seed quality under drought and non-stress conditions. Industrial Crops and Products 156: 1-11.
- Kintzios, S., Nicolaou, A. and Skoula, M., 1999. Somatic embryogenesis and in vitro rosmarinic acid accumulation in *Salvia officinalis* and *Salvia friticosa* leaf callus cultures. Plant Cell Reports 18 (6): 462-466.
- Meyer, S. E. and Pendleton, R. L., 2000. Genetic regulation of seed dormancy in Purshia tridentate (Rosaceae). Annal of Botany 85: 521-529.
- Wei, W., Li, Q.T., Chu, Y.N., Reiter, R.J., Yu, X.M., Zhu, D.H., Zhang, W.K., Ma, B., Lin, Q., Zhang, J.S. and Chen, S.Y., 2015. Melatonin enhances plant growth and abiotic stress tolerance in soybean plants. Journal of Experimental Botany, 66(3): 695-707.