Macedonian pharmaceutical bulletin, 68 (Suppl 2) 213 -214 (2022)
Online ISSN 1857 - 8969
DOI: 10.33320/maced.pharm.bull.2022.68.04.098
Short communication

Soilless propagation of wild Ericaceae medicinal shrubs

Marina Stanilova*, Boryanka Traykova, Irena Mincheva, Elina Yankova-Tsvetkova

Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences,
Department of Plant and Fungal Diversity and Resources, 23 Acad. G. Bonchev str., 1113 Sofia, Bulgaria

Introduction

Arctostaphylos uva-ursi (L.) Spreng. (bearberry) and *Vaccinium vitis-idaea* L. (lingonberry) are medicinal shrubs from Ericaceae family, both included in the List of species of medicinal plants under special regime of conservation and use in Bulgaria, based on MPA (2000). Both species take part in the endangered habitat type 09F2 High-mountain communities of Bearberry (*Arctostaphylos uva-ursi*) (Genova and Russakova, 2015) which is protected by BDA, Annex 1 (2002). They are forbidden to be collected for commercial purposes from the natural habitats throughout the country, *A. uva-ursi* being protected by the Convention on International Trade with Endangered Species of Wild Fauna and Flora.

Bearberry is widely used for treating inflammatory diseases of kidney and urinary tract (Shamilov et al., 2021). Fruits of lingonberry are used as food (jelly or syrup) to treat fever, gastrointestinal tract, kidney and urinary tract (Vogl et al., 2013).

Both species have slow growth and development rates, and hydroponics could be a good alternative for their propagation, as the main advantage of these techniques is growth acceleration (Texier, 2013). Soilless cultivation does not depend on weather, precipitations, soil type, pests etc., moreover, water use is minimized owing to solution recycling.

The aim of our study was to test the opportunities for propagation of these valuable protected species by means of hydroponic technologies.

Materials and methods

The initial plant material of both species: *A. uva-ursi* and *V. vitis-idaea*, was gathered in 2019 from the populations on Vitosha Mountain, near Sofia. Cuttings of 10 to 15 cm length were used: young green tips, semi-woody, and woody shoots.

Hydroponic propagation

Flood and Drain (F&D) type hydroponic system was used, with perlite as inert substrate, wetted periodically (15 min every 6 h) with nutrient solution consisting of distilled water, supplemented with Flora Micro, Flora Grow, and Flora Bloom (GHE) in proportion 1:1:1. The pH was maintained between 5.5 and 6.5, and the electrical conductivity between 0.40 and 0.80 $mS.cm^{-1}$. Temperature, light, and air humidity in the room phytotron were controlled as follow: 23±4ºC; 16/8 h photoperiod; air humidity varying around-the-clock between 45% and 75%. A total of 60 cuttings per species were used: 20 per each type for *V. vitis-idaea*, half of them treated with auxin by dipping their basis into 25% powdered indole-3-butyric acid (IBA) prior to their embedding in the substrate, while for *A. uva-ursi* 30 young green tips were IBA-treated in the same way and 30 semi-woody were non-treated. The duration of the experiments was 3 months and a half for lingonberry, and 4 months and a half for bearberry. All survival cuttings were potted in light mix substrate and after 6 weeks in the phytotron they were transferred to a greenhouse. In addition, controls of 20 cuttings per species were potted in soil substrate light mix and agrolava (2:1) for rooting in the phytotron. Criteria for successful hydroponic propagation were: the survival rate of the cuttings and the percentage of acclimatized potted plants after their wintering in the greenhouse.

*marina.stanilova@gmail.com

Results and discussion

The effectiveness of the hydroponic propagation of lingonberry depended on both their type and treatment with IBA. Rooting and survival on the F&D system was 100% only for IBA-treated semi-woody cuttings, while the survival of the untreated cuttings of this type was 60%. Cutting type was more important as 50% of the woody cuttings and only 30% of the young cuttings survived whether or not they were IBA-treated. Almost all rooted cuttings formed new shoots, which number varied between 1.7 ± 0.6 (for young untreated) and 3.0 ± 1.0 (for young treated) per cutting. None of the control cuttings rooted in the soil substrate.

From a total of 32 potted plants, 62.5% were successfully acclimatized and survived wintering in the greenhouse. Woody cuttings were the most suitable ones for hydroponic propagation of this species, as 50% of the initial cuttings successfully acclimatized and survived the wintering in the greenhouse. In comparison, these percentages for the plants deriving from young and semi-woody initial cuttings were 15% and 35%, respectively. After 2 years plants reached flowering stage in the greenhouse.

Bearberry seemed to be more recalcitrant species for hydroponic propagation. First trials resulted in only few rooted and survival cuttings: 3.3% for young IBA-treated cuttings, and 10% for semi-woody untreated ones. This could be due to the seasonal particularities, as the experiment began in October, instead of June. There are results for other species referring to the importance of the phenophase on the plant growth and development, despite the controlled constant ambient conditions at laboratory level (Stanilova et al., 2010). It is worth to mention that on the F&D system, IBA-treated cuttings developed up to 4 adventive shoots at the cutting base as well as between the internodes, while the untreated ones only grew in height. Control cuttings in the soil substrate did not survive.

Composition of the essential oils of both species and the most abundant classes of their compounds were reported to be highly similar (Radulović et al. 2010), which suggests possible medicinal use of *V. vitis-idaea* instead of *A. uva-ursi*.

Conclusion

First trials to propagate lingonberry by F&D hydroponic system using woody cuttings as initial plant material were successful. Experiments with bearberry should be repeated starting in summer. In both species, pre-treatment with powdered IBA led to formation of new shoots at the base of the young cuttings and in their internodes. The best results were obtained starting with woody cuttings of *V. vitis-idaea* due to their more successful acclimation in the greenhouse.

Acknowledgements

The authors are grateful to the National Science Fund (Grant КП-06-Н26/6/13.12.2018) for the financial support provided.

References

Biological Diversity Act, 2002. State Gazzette, 77, 09.08.2002. (in Bulgarian).

Genova, E., Russakova, V., 2015. High-mountain communities of Bearberry (*Arctostaphylos uva-ursi*), in: Bisserkov, V., et al. (Eds.), Red Data Book of the Republic of Bulgaria, vol. 3, Natural habitats. IBER-BAS & MOEW, Sofia, pp. 224–225.

Medicinal Plants Act, 2000. State Gazette, 29, 07.04.2000. (in Bulgarian).

Radulović, N., Blagojević, P., Palić, R., 2010. Comparative Study of the Leaf Volatiles of *Arctostaphylos uva-ursi* (L.) Spreng. And *Vaccinium vitis-idaea* L. (Ericaceae). Molecules. 15, 6168–6185. https://doi.org/10.3390/molecules15096168.

Shamilov, A.A., Bubenchikova, V.N., Chernikov, M.V., Pozdnyakov, D.I., Garsiya, E.R., Larsky, M.V., 2021. Bearberry (*Arctostaphylos uva-ursi (*L.) Spreng.): chemical content and pharmacological activity. J. Excipients and Food Chem. 12 (3), 49–66.

Stanilova, M., Molle, E., Yanev, S., 2010. Galanthamine production by *Leucojum aestivum* cultures in vitro, in: Cordell, G. (Ed.), The Alkaloids: Chemistry and Biology, vol. 68, Chapter 5, Elsevier Inc., Academic Press, New York, pp. 167–270. https://doi.org/10.1016/S1099-4831(10)06805-7.

Texier, W., 2013. Hydroponics for Everybody. All About Home Horticulture. Mama Editions, Paris.

Vogl, S., Picke,r P., Mihaly-Bison, J., Fakhrudin, N., Atanasov, A.G., Heiss, E.H., C. Wawrosch, Reznicek G., Dirsch V. M., Saukel J., Kopp B., 2013. Ethnopharmacological in vitro studies on Austria's folk medicine – an unexplored lore in vitro anti-inflammatory activities of 71 Austrian traditional herbal drugs. J. Ethnopharmacol. 149(3), 750–771. https://doi.org/10.1016/j.jep.2013.06.007.