

**Кріорезистентність антарктичного лишайника  
*Umbilicaria umbilicarioides* визначена  
за допомогою охолодження  
з постійною швидкістю у поєднанні  
з даними флуоресценції хлорофілу**

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**Cryoresistance of Antarctic lichen *Umbilicaria umbilicarioides* Assessed by a Constant Rate Cooling Combined with Chlorophyll Fluorescence Data**

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Lichens from Antarctica are well adapted to low temperature and show a high degree of cryoresistance. However, interspecific differences do exist and are related to particular lichen species adaptation to severe and harsh Antarctic environments. In our team, we have been studying cryoresistance of Antarctic lichens for a decade by using a constant rate cooling of wet lichen sample with simultaneous chlorophyll fluorescence measurements. Up to now, we have investigated cryoresistance of more than 15 lichen species (*e. g.* Folgar-Cameán and Barták 2019, Hájek *et al.* 2022). In this study, we report the experiment with a newly-measured species *Umbilicaria umbilicarioides* collected in a vicinity of Ukrainian Antarctic station – Vernadsky.

To assess critical (cooling) point of the lichen species and the relationship between its photosynthetic parameters and sample temperature, the cooling chamber (Kryo-Planer unit, Great Britain) was used. During a constant rate-cooling (2 deg C min<sup>-1</sup>) from 20 to –40°C, two chlorophyll fluorescence parameters (1) FV/FM – potential photosynthesis in photosystem II and (2) ФPSII – effective quantum yield of photosynthetic processes in PSII were measured by a PAM-2000 fluorometer (H. Walz, Germany). Temperature-response S-curves of FV/FM and ФPSII were plotted and analyzed.

Similarly to other Antarctic lichen species investigated in previous studies, *Umbilicaria umbilicarioides* showed that photochemical processes of photosynthesis in PSII had detectable activity (*i. e.* positive FV/FM and ФPSII values) at the temperature of –20°C. Below that temperature, a substantial inhibition of photochemical processes of photosynthesis was apparent which might be attributed to the negative effects of intra- and extra-cellular ice formation in a lichen thallus.

**Кріоконсервування *Allium tuberosum*  
Rottler ex Sprengel**

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**Cryopreservation of *Allium tuberosum*  
Rottler ex Sprengel**

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*Allium tuberosum* Rottler ex Sprengel is belong to family *Amaryllidaceae* and commonly known as Indian leek, nira, oriental garlic, Chinese chives, garlic chives and it is close wild relative of *A. ramosum*. The species is being preserved in the In Vitro Active Genebank for short- to medium-term. Cryopreservation would be a useful complementary approach for its long-term preservation. The current work aimed to develop an efficient cryopreservation protocol for cryobanking of *A. ramosum* shoot bases.

*In vitro* shoot bases (1.0–1.25 mm) isolated from *A. ramosum* were cryopreserved using vitrification and droplet-vitrification technique. The effects of (i) pregrowth incubation [SCC (4 week), 22/5°C (4 week), 8 week (SCC) and combination of SCC & 22/5 °C (4 weeks each)], (ii), PVS2 duration (0, 10, 20, 30, 40, 50 and 60 min) and PVS3 duration (0, 30, 60, 90, 120, 150 and 180 min) and post-thaw regrowth were evaluated on standard multiplication media.

*In vitro* shoot bases grown on MS+0.1 mg/l NAA+0.02 mg/l 2iP+3% sucrose, precultured on MS basal + 0.3 M at 10°C for 3 days, followed by loading solution (LS: 2.0 M glycerol and 0.4 M sucrose) treatment for 20 min and PVS3 treatment for 90 min, unloading solution (US- 1.2 M sucrose) for 60 min and regrowth on MS+0.1 mg/l NAA+0.02 mg/l 2iP+3% sucrose. Highest average regrowth (89.77%) in five accessions was achieved in droplet vitrification compared to vitrification, *i. e.* 62.22 after cryopreservation and no significant difference among the accessions was observed. There was no significant loss in regrowth of cryostored shoot bases after 3 years of cryobanking.

The standardized protocol was successfully used for cryobanking of *in vitro* shoot bases of *A. tuberosum* in the In Vitro Base Genebank of ICAR-NBPGR, New Delhi.

