экстракта земляники. Полученные данные существенно расширяют спектр антимикробных средств на основе растительных экстрактов и подчеркивают их потенциал в качестве природных фитопрепаратов для терапевтических целей.

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## MORPHOMETRIC DIFFERENCES IN SEEDLINGS AFTER CRYOPRESERVATION OF *CHAMOMILLA RECUTITA* SEEDS OF THE KARAGANDA VARIETY

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This paper presents the analysis of changes in morphometric parameters of Karaganda variety *chamomile* (*Chamomilla recutita*) seedlings subjected to cryopreservation with and without cryoprotective solution PVS2. Leaf length, leaf width, hypocotyl height and root length after freezing for different time intervals were evaluated. The results showed marked differences depending on the freezing conditions, which emphasizes the significance of the cryopreservation method for preserving plant seed viability.

**Keywords:** *Chamomilla recutita, Matricaria chamomilla*, cryopreservation, PVS2, cryoprotectant, liquid nitrogen.

В данной статье представлен анализ изменений морфометрических параметров проростков ромашки аптечной (*Chamomilla recutita*) сорта Карагандинская, подвергнутых криоконсервации с

использованием криопротекторного раствора PVS2 и без него. Оценивались такие показатели, как длина листьев, ширина листьев, высота гипокотиля и длина корней после замораживания на разные временные интервалы. Результаты продемонстрировали заметные различия в морфометрии проростков в зависимости от условий замораживания, что подчеркивает значимость метода криоконсервации для сохранения жизнеспособности семян растений.

**Ключевые слова:** *Chamomilla recutita,* ромашка аптечная, криоконсервация, PVS2, криопротектор, жидкий азот.

**Introduction.** *Chamomile* (*Chamomilla recutita*) is one of the most famous medicinal plants, whose healing properties were discovered in antiquity. Decoctions and infusions of chamomile were widely used to treat inflammations, skin diseases, as well as to normalize the digestive system. In modern medicine, the plant is valued for its content of bioactive components such as essential oils, flavonoids and sesquiterpenoids, which have anti-inflammatory, antispasmodic and antiseptic effects [1, 2]. Preservation of the gene pool of medicinal plants such as Matricaria chamomilla is important for medicine and agro-industry. Traditional seed storage methods have limited capacity for long-term storage, especially in unstable climates. Cryopreservation, which involves freezing seeds in liquid nitrogen, is a promising method that helps to ensure their long-term preservation [3]. Cryoprotectants such as PVS2 play a key role in this technology to prevent cell damage at extremely low temperatures [4]. Despite the advantages, the effect of cryopreservation conditions on seedling development remains poorly understood, which makes this area particularly relevant [5, 6, 7].

The aim of this study was to investigate the effect of different cryopreservation conditions on morphometric parameters of Karaganda variety chamomile seedlings.

**Experimental.** The object of the study was the seeds of Matricaria chamomilla variety Karaganda. The experiment included freezing of seeds in liquid nitrogen using cryoprotectant solution PVS2 and freezing without cryoprotectant. The duration of freezing was 30 minutes, 60 minutes and 3 hours. After thawing at room temperature, seeds were sown in Petri dishes on double layer filter paper. The morphometric parameters of the seedlings were measured at 15 days. The obtained data were processed using Excel 2016 software and the results are presented as mean values and standard deviations.

**Research results and their discussion.** Analysis of morphometric indices of seedlings obtained after cryopreservation showed the following results (Figure 1). Indices of leaf lamina length: the average leaf length of the control group was 2.4 mm. A slight decrease in leaf length was observed at all time intervals of freezing with PVS2 application (2.3-2.4 mm). This indicates the effectiveness of the cryoprotectant in protecting the seed tissue from damage. Without PVS2 application, leaf length remained stable except for the 60 min freezing time where the index decreased to 2.1 mm. This may be due to more pronounced cell damage. Indices of leaf lamina width: in all variants with the use of cryoprotective solution PVS2, leaf width varied between 1.4-1.5 mm, which is comparable to the control group. Without the use of PVS2, the maximum width (1.7 mm) was observed at 3 hours freezing. This may be the result of stress adaptation responses of the plants.

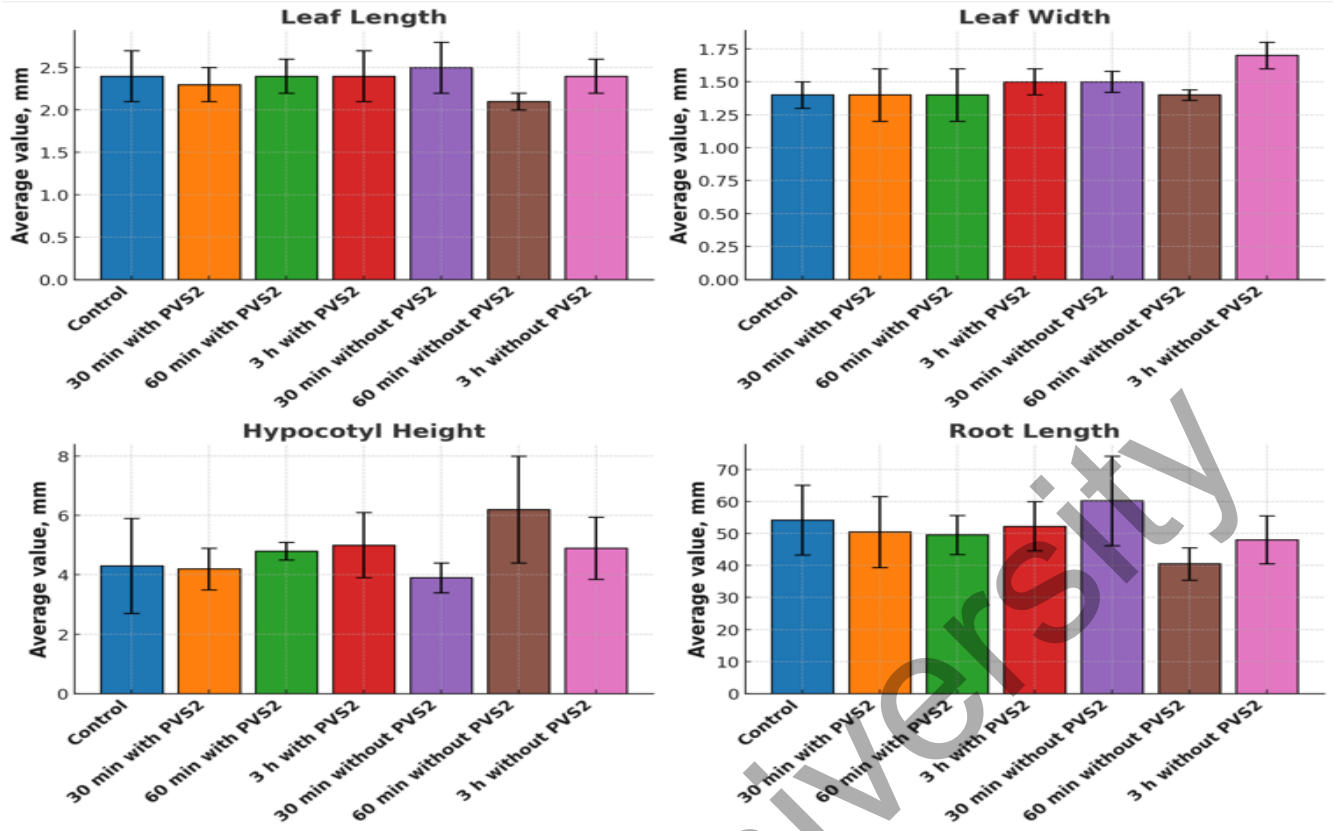


**Figure 1. Morphometric indices of *Chamomilla recutita* seedlings of Karaganda variety grown from cryopreserved seeds**

Hypocotyl height increased with increasing freezing time when PVS2 was used, reaching 5.0 mm at 3-h exposure. The highest height (6.2 mm) was observed at 60 min freezing without cryoprotectant. This may indicate intensive hypocotyl growth as a compensatory response to stress. The root length of the control group was 54.2 mm. When frozen using PVS2, the values of root length remained close to the control values (50.5-52.3 mm), indicating that normal plant viability was maintained. Without applying cryoprotectant during seed freezing, we see a sharp decrease in root length with increasing cryopreservation time. The minimum value (40.5 mm) is reached at 60-minute freezing.

The findings emphasize the effectiveness of PVS2 application to prevent seed damage during cryopreservation [4]. In addition, the duration of freezing has a significant effect, which is in line with other studies [4, 6].

**Conclusion.** The study confirmed that cryopreservation using PVS2 solution allows to minimize the negative effects of low-temperature storage and provides preservation of viability of Karaganda chamomile seeds. The results may be useful in the development of standard cryopreservation protocols for other species of medicinal plants.

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## КРИОКОНСЕРВАЦИЯДАН КЕЙІН ДӘРІЛІК ТҮЙМЕДАҚТЫҢ «ПОДМОСКОВНАЯ» СҰРЫПЫНЫҢ ӨСКІНДЕРІНІҢ САЛМАҚ КӨРСЕТКІШТЕРІН ЗЕРТТЕУ

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The article studies the effect of weight indices of seedlings of *Matricaria chamomilla* variety «Podmoskovnaya» after cryopreservation. Raw and dry weight of seedlings of the variety were evaluated after short-term cryopreservation for 30, 60 minutes and 3 hours with PVS2 at -196 °C (in liquid nitrogen), as well as 30, 60 minutes and 3 hours without PVS2 and -196 °C. The development of seedlings from seeds and their weight parameters were monitored. Short-term cryopreservation did not deteriorate seed quality and seedling weight, seeds of Matricaria chamomilla variety “Podmoskovnaya” stored at negative temperature (-196°C) retained germination and seedling weight, seedlings of the varieties developed normally.

**Keywords:** Matricaria chamomilla, seedling mass, dry, raw mass, cryopreservation, PVS2, cryoprotectant, liquid nitrogen.

Мақалада дәріханалық түймедақтың «Подмосковная» сұрыпының өскіндерінің салмақ көрсеткіштеріне криоконсервациядан кейінгі әсері зерттелген. Сұрып өскіндерінің шикі және құрғақ массасы қысқа мерзімді криоконсервациядан кейін -196°С температурада (сұйық азотта) PVS2 қолдану арқылы 30, 60 минут және 3 сағат ішінде, сондай-ақ PVS2 және -196° С қолданбай 30, 60 минут және 3 сағат бойысыналды. Тұқымнан өскіндердің дамуына және олардың салмақ көрсеткіштеріне бақылау жасадық. Қысқа мерзімді криоконсервация тұқымның сапасын және төмен температурада (-196°С) сақталған өскіндердің салмағын төмен детпеді. Дәріханалық түймедақтың