

# GYTOGENETIC ANALYSIS OF *RHODIOLA KIRILOWII* PLANTS *IN VITRO*

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**Introduction.** *Rhodiola kirilowii* (Regel) Maxim is a medicinal plant of the Crassulaceae family, which is used in herbal medicine, mainly in Tibetan, as an adaptogen with immunomodulatory, detoxifying and anti-edematous properties. Modern pharmacological studies have identified a number of biologically active compounds, including salidroside and rosavins, which indicate its similarity to *R. rosea*. Genome studying of the species can provide insight into the biosynthetic pathways of compounds, as well as identify new genes that may contribute to plant adaptation to high-altitude growth conditions. There is limited research on *R. kirilowii* genome, therefore we conducted a cytogenetic analysis of *in vitro* plants of the species.

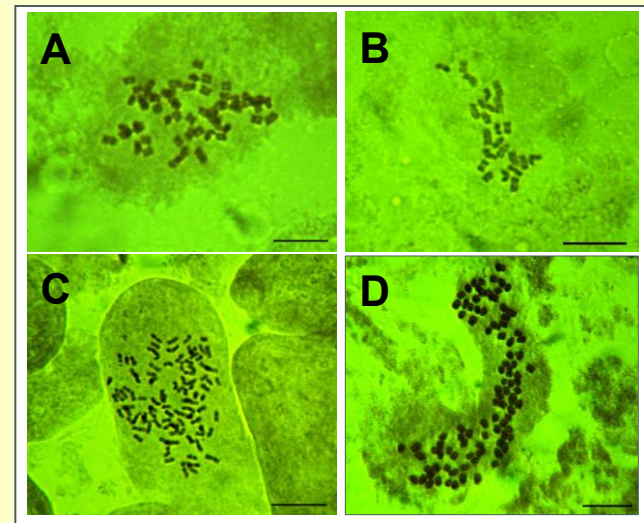
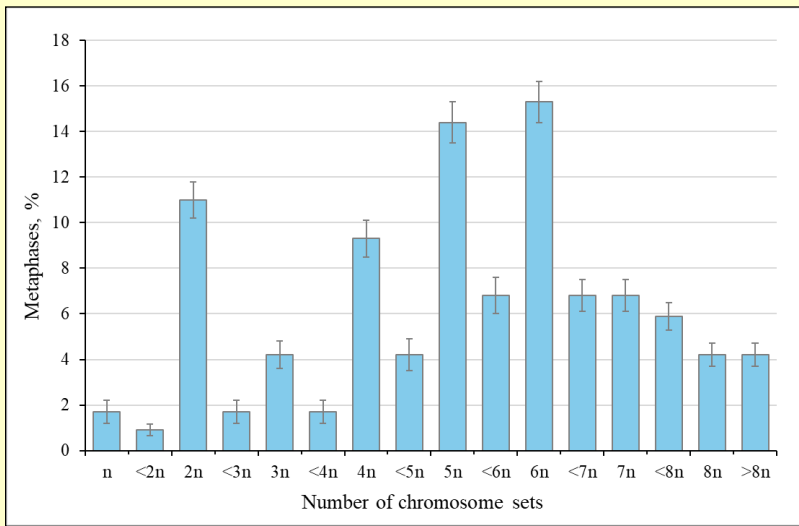
**Methods.** Cultivation *in vitro*, cytogenetic analysis.



**Fig. 1.** Plants of *R. kirilowii*: A – *in vitro*, B – indoor, C – flowering

**Results.** We have created a collection of *R. kirilowii* plants, which are grown under sterile conditions on the MS nutrient medium with half the content of macro- and microsalts, at the light (3000 lux), 20–22°C temperature, 55–65% humidity and a light day of 16 hours (fig.1).

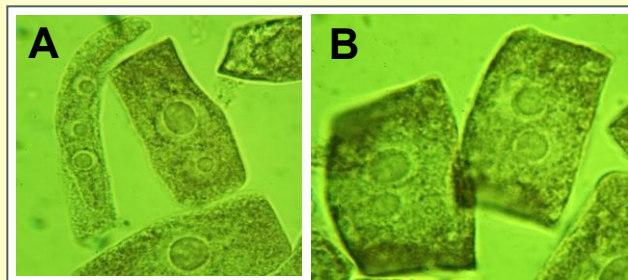
Cytological studies of this species are a complex process due to widespread polyploidy and small chromosome size. Cytogenetic analysis of *in vitro* *R. kirilowii* plants showed that the number of chromosomes in metaphase plates ranged from 10 to 102, with a diploid number of  $2n=22$  (fig.2). The size of the chromosomes was 1.5-2 $\mu$ m (fig.3). Almost all roots studied were mixoploid.



**Fig. 2.** Distribution of cell ploidy level in *R. kirilowii* plants *in vitro*

**Fig. 3.** Metaphase plates with different chromosome number in root tips of *R. kirilowii* *in vitro* plants: A – 48 chromosomes (hypotetraploid), B – 22 chromosomes (diploid), C, D – 88 chromosomes (octaploid). Bar=10  $\mu$ m

Among the analyzed cells, 11% were diploid. We found two haploid cells ( $n=11$ ) numbering 1.69% of the total metaphases. The proportion of polyploid cells was high: the modal class was formed by hexaploid and pentaploid cells, which were 15.25% and 14.41%, respectively (fig.2). Among all analyzed cells, 32.2% were aneuploid. An increased number of nuclei (2-3) was found in the cells (fig. 4), which confirmed polyploidy for this species.



**Fig. 4.** Diverse number of nuclei in root cells of *R. kirilowii*

**Conclusions.** The cytogenetic analysis evidenced the predominance of hexa- and pentaploid cells in the roots of *R. kirilowii* indicating its polyploid origin. The species' ability to aneu- and mixoploidy was also revealed. These phenomena may be a consequence of anthropogenic load and growth in mountainous conditions, as well as evidence of the increased adaptive potential of plants with a changed number of chromosomes to survive in adverse environmental conditions. These mechanisms are the main driving forces in the reticular evolution of plants.