

EXPERIMENTAL PAPER

Research on morphology and biology of germination of *Salvia przewalskii* Maxim.

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Summary

In this paper, diaspores and seedlings of *Salvia przewalskii* Maxim. were described. The three-year cycle of monthly germination analyses of seeds was carried out. The best germination of seeds was observed in the turn of spring and summer (June, July). It was found that the germination of diaspores of *Salvia przewalskii* in laboratory analysis does not depend on the influence of light and fluctuations of temperature within the range 20–30°C. After 5 years of storage in unheated room conditions, the diaspores of *Salvia przewalskii* germinated about 20%.

Key words: *Salvia przewalskii*, germination, seeds

INTRODUCTION

Salvia przewalskii Maxim. (*Labiatae* = *Lamiaceae* family) has long been used as a traditional Chinese medicine. This perennial plant grows wild in forest margins, hillsides, streamsides, thickets in Gansu, Hubei, Sichuan, Xizang and Yunnan provinces [1]. *Salvia przewalskii* root is a herbal raw material which has been used as a surrogate for *Salviae miltiorrhizae radix* [2-5]. Main components of raw material are abietane diterpenoids [3]. There are also the compounds in form of triterpenoids and phenolic derivatives [4]. In Chinese phytotherapy, *Salvia przewalskii* has major and many-sided significance in treatment of circulatory system diseases. This

plant is used in coronary heart diseases, irregular menstruation, hematemesis, hemafacia, hepatitis and also supports blood circulation to remove blood stasis [6]. The extracts from *Salvia przewalskii* roots show also antibacterial, antioxidant and anti-inflammatory properties [3, 7, 8].

Very little we know about biology of *Salvia przewalskii* germination under laboratory conditions. There are only two articles on seed germination capability in available literature [9,10]. This study was conducted with aim of widening the scientific database.

MATERIAL AND METHODS

The seeds of *Salvia przewalskii* originating from the own cultivation (Garden of Medicinal Plants, Institute of Natural Fibres and Medicinal Plants, Plewiska near Poznań) was the subject of presented research. Investigations were performed in 2009–2014. The diaspores were stored in unheated room conditions. The analyses of germination were carried out according to the methodology of the estimation of seeds worked out by ISTA [11]. Seed material was tested in Petri dishes padded with blotting chromatography paper (Whatman 3). The study was carried out in four repetitions in three different conditions. Physical conditions used during the analyses were as follows: light and changing temperature, darkness and changing temperature, light and constant temperature. Seeds germinated in constant temperature of 20°C in daylight. The climate chamber was applied to obtain darkness and changing temperature of 30°C for 6 hours and 20°C for 18 hours, while Jacobsen apparatus was used to make changing temperature of 30°C for 8 hours and 20°C for 16 hours.

RESULTS AND DISCUSSION

Salvia przewalskii Maxim fruit (schizocarp) is divided into 4 mezocarps (seeds). Their shape is elliptic, while surface verrucose and slightly brilliant. Back side of the seed is convex, longer than abdominal sides. Lateral edges are blunt, the abdominal one is sharp. The length of seeds is 3.0–3.7 mm, the width is 2.0–2.7 mm and the thickness is 1.0–1.8 mm (fig. 1). The mass of 1000 mezocarps is about 5 g.

The radicle appeared in the 4th–7th day from the test beginning. It was white, quite thick, curved and was getting longer in consecutive days. In the initial phase of germination, almost all surface of radicle was covered with hairs. The cotyledons were green, mat and kidney-shaped. The cotyledon blade was entire with the rounded apex and cordate base, coated with short hairs. The first leaves were ovate, green and hairy. Their blade was sinuate with the rounded base and apex (fig. 2–4).



Figure 1.
Seeds of *Salvia przewalskii* Maxim.



Figure 2.
Germinated seeds in the first and in the second week from the test beginning



Figure 3.
Seedlings in the third and fourth week from the test beginning



Figure 4.
Seedlings in the sixth week from the test beginning

The results of the germination capacity of *Salvia przewalskii* seeds in the first year after harvest are pointed out in figures 5-7.

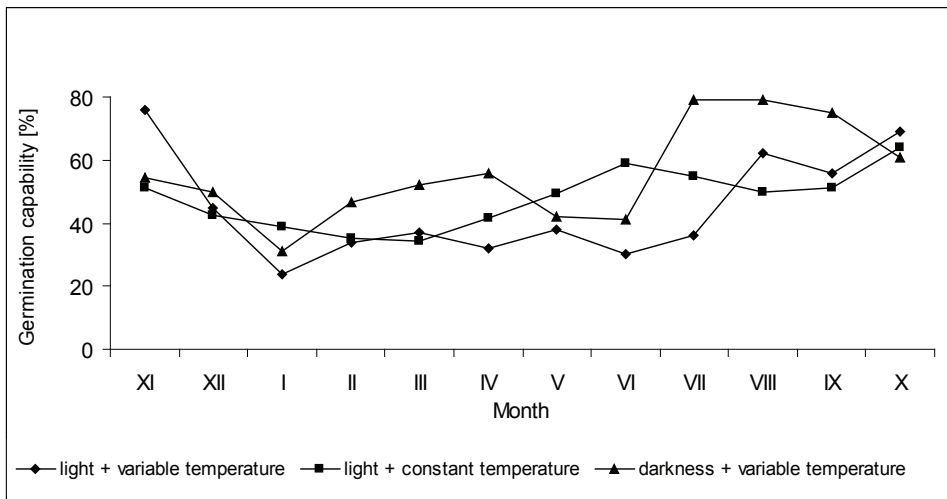


Figure 5.
Germination variability of *Salvia przewalskii* Maxim. seeds in the first year after harvest examined in 2011

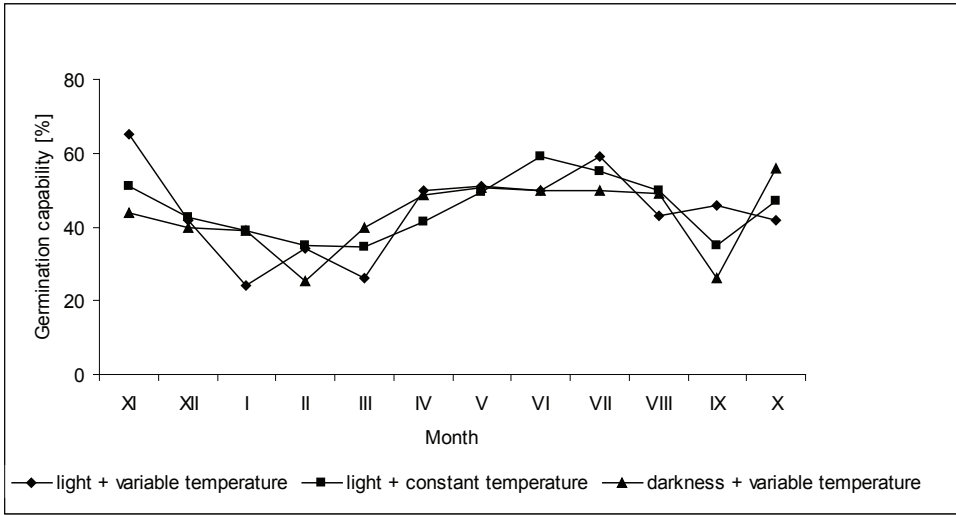


Figure 6.

Germination capability of *Salvia przewalskii* Maxim. seeds in the first year after harvest examined in 2012

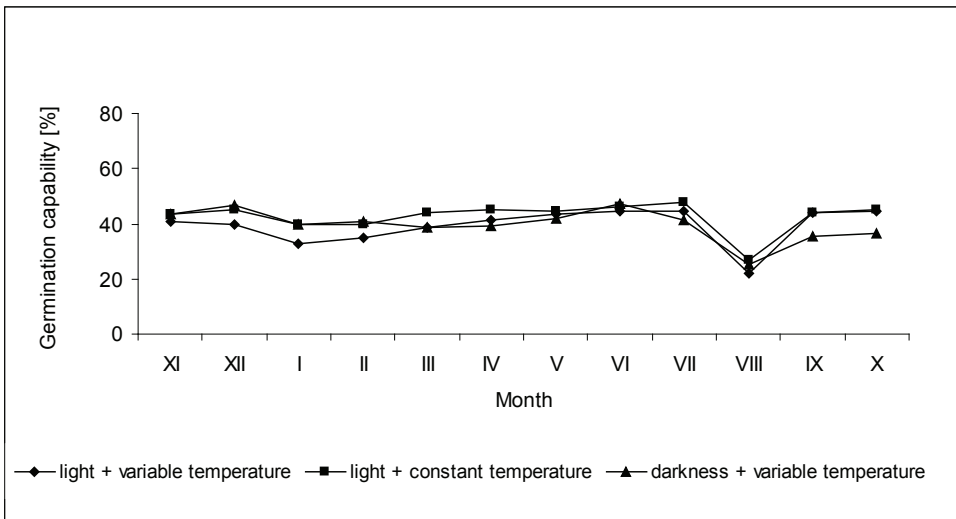


Figure 7.

Germination capability of *Salvia przewalskii* Maxim. seeds in the first year after harvest examined in 2013

The curves of the germination ability in particular years indicate certain differences and regularities. In November the seeds of *Salvia przewalskii* germinated quite well. In December or January, the number of germinating seeds gradually

started to decrease and next slowly increased. The maximum of the germination capability observed in spring and summer months (June and July). From these time, the decrease of germination ability was observed again. Seeds coming from 2010 showed the best germination. In November, June, July and August they reached germination higher than 75% in darkness. In that year, the weather in time of fruit setting was advantageous. It was relatively dry, sunny and warm period. From the beginning of June to the last decade of July, the precipitation was 89.8 mm, the mean insolation was 241 W/m² and the average temperature was 17.9°C (data obtained from the Adam Mickiewicz University Botanical Garden in Poznań).

It was found that the germination of diaspores of *Salvia przewalskii* in laboratory analysis does not depend on the influence of light and temperature fluctuations within the range of 20–30°C. Obtained results are in agreement with suggestions that seeds from large-seeded species are less likely to require light for germination than those of small-seeded species [9]. The germination depends mainly on the atmospheric conditions during blossoming and ripening of seeds.

The results of the studies on viability of *Salvia przewalskii* seeds are given in figure 8. After 2 years of storage in unheated room conditions, the germination capacity of *Salvia przewalskii* seeds was 40%. These diaspores can be used as a seed material of standard value. After 3–5 years of storage, the germination capacity of diaspores was only about 20%. It is slightly lower than the results found in seeds of *Salvia przewalskii* coming from Eastern Tibet Plateau. The percentage of the germination seeds stored for few years in dry cold conditions was 44%, while stored in dry warm conditions was 27% [10].

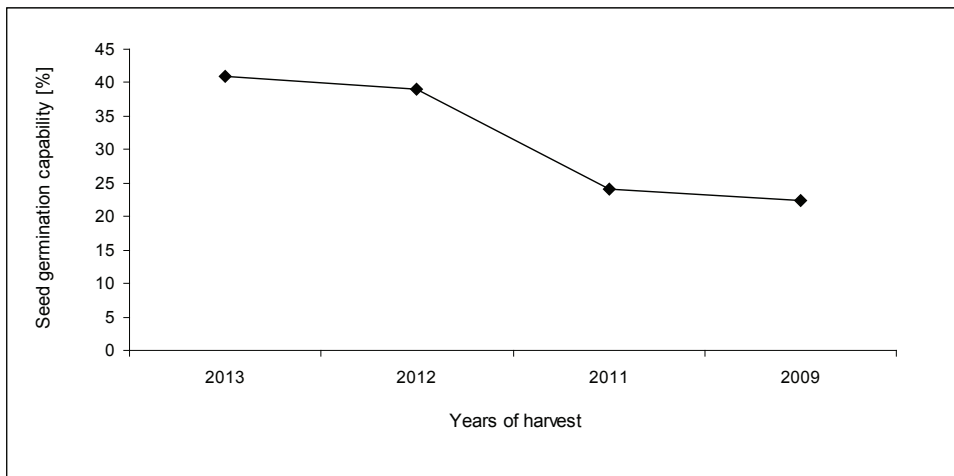


Figure 8.

Germination capability of *Salvia przewalskii* Maxim. seeds stored in the conditions of unheated room examined in 2014

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BADANIA MORFOLOGII I BIOLOGII KIELKOWANIA *SALVIA PRZEWALSKII* MAXIM.

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Streszczenie

Opisano cechy morfologiczne diaspor i siewek szaławii Przewalskiego. Przeprowadzono także trzyletni cykl comiesięcznych badań zdolności kiełkowania nasion. Odsetek nasion kiełkujących był najwyższy na przełomie wiosny i lata (czerwiec, lipiec). Stwierdzono, że proces kiełkowania omawianego gatunku w warunkach laboratoryjnych nie zależy od wpływu światła i wahań temperatury w granicach 20–30°C. Po pięciu latach przechowywania w warunkach nieogrzewanego magazynu materiał nasienny kiełkował w około 20%.

Słowa kluczowe: *Salvia przewalskii*, kiełkowanie, nasiona