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SHORT COMMUNICATION

Characteristics of seed material and seedlings of *Conium maculatum* L.

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Summary

Introduction: Fresh herbs of poison hemlock (*Conii maculati herba*) are used in homeopathy. The plant is also used in pharmacological and toxicological studies. There are few articles on seed germination capability in available literature.

Objective: The aim of the research was evaluation of *Conium maculatum* seed germination.

Methods: Germination studies of *C. maculatum* L. were carried out according to methodology by ISTA.

Results: It was confirmed that the germination capability of the described species is dependent on access to light and temperature fluctuations. In the first year after harvest, the highest percentage of germinating seeds was found in the winter months (January–February).

Conclusion: The seeds stored in an unheated room still germinated in the fifth year after harvest.

Key words: ***Conium maculatum L., mericarps, germination, morphological traits***

Słowa kluczowe: ***Conium maculatum L., rozłupki, kiełkowanie, cechy morfologiczne***

INTRODUCTION

Poison hemlock (*Conium maculatum* L.) is a biennial belonging to the *Apiaceae* family. It occurs naturally in Europe, North Africa, Asia, and has been brought to North and South America and New Zealand. In Poland, the species is common in gardens, on debris, along roadsides and on waste areas [1]. The plants are characteristic species of the order of *Artemisietalia vulgaris* Lohm. in. R.Tx., which includes communities of remarkably nitrophilic weeds occurring on fresh and

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humus-rich soils [2]. The whole plant has a nasty, mousey odour. In the first year, the plant produces only a rosette of basal leaves with round and empty petioles and 2–4 times pinnatisect leaves with longitudinal leaflets. In second year, it develops a flower stem with a height of over 2 m, which is blue-green with dirt-red spots. Stem leaves have a structure analogous to the first-year leaves. The upper stems terminate in compound umbels of small white flowers. These compound umbels consist of about 8–16 umbellets. Each umbellet consists of about 12–25 flowers. The plants bloom from June to August. The fruit is a broadly egg-shaped schizocarp, splitting into two mericarps [1]. One mericarp is commonly called a seed.

Fresh herbs of poison hemlock (*Conii maculati herba*) are used in homeopathy. All parts of the plant contain pyridine alkaloids: coniine, *N*-methyl-coniine, conhydrine, pseudoconhydrine, and *γ*-coniceine. The content of alkaloids in immature fruits is up to 3%, in mature fruits up to 1%, in leaves up to 1.5%, in stems up to 0.7%, in flowers 1.0% and in roots up to 0.5% [3]. It was found that the concentration of individual alkaloids depends on the origin and development phases of plants and the ecological conditions [4]. *C. maculatum* also contains flavonoids, coumarins, polyacetylenes, vitamins, essential oils, and steroids [5]. Coniine, which is a liquid alkaloid, is highly toxic and gives the plant a distinctive odour. It is easily absorbed by mucous membranes and skin. In small doses it has a stimulating effect, in higher doses it reveals a devastating and prolonged effect on the motor centres of the spinal cord. It affects breath, skeletal muscles and muscles of the respiratory system. Coniine compounds were used as stimulants. Currently, the plant is used in pharmacological and toxicological studies [6].

MATERIAL AND METHODS

The seeds of *Conium maculatum* L. originating from our own cultivation (Garden of Medicinal Plants, Institute of Natural Fibres and Medicinal Plants, Plewiska near Poznań, Poland) were the subject of the presented research. Every year the seeds were harvested from plants at two years of age. Seed material of *C. maculatum* was collected at the end of August and left in a dry, warm and airy place to dry. The plant materials were cleaned and then, starting in November, monthly germination capability analysis was done. The investigations were performed in 2009–2014. The diaspores were stored in unheated room conditions. This material was also used to estimate the following characteristics: thousand-seed weight, the morphology of seeds and seedlings and the viability of seeds during 12, 24, 36, 48, 60, 72, and 84 months of storage.

All the germination analyses were carried out in laboratory conditions according to the methodology for the estimation of seeds worked out by ISTA [7]. Seed material was tested in Petri dishes padded with blotting chromatography paper (Whatman 3). The study of germination capability 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. The seeds were germinated at a constant temperature of 20°C in daylight. A climate chamber was used to obtain darkness and changing temperatures of 30°C for 6 hours and 20°C for 18 hours, while the Jacobsen apparatus was used giving temperatures of 30°C for 8 hours and 20°C for 16 hours. The Jacobsen apparatus was also used in the viability test.

Ethical approval: The conducted research is not related to either human or animal use.

RESULTS AND DISCUSSION

The mericarps of *C. maculatum* are ovate, slightly wider than thicker (fig. 1). They are rounded at the base and narrowed at the top. At the top of the fruit there is a persistent stylopodium. The abdominal side of the mericarp is almost flat. The mericarp's back is strongly convex, with five large ribs, usually corrugated and pale yellowish. The spaces between the ribs are slightly longitudinally wrinkled and a grey-brown to yellowish colour. In cross-section, the endosperm is cut on the abdominal side with a deep narrow furrow. The dimensions of the seeds were in the range: length 2.5–4.1 mm, width 1.3–2.3 mm and thickness 1.0–1.8 mm. These were similar to the values given by other authors [8, 9]. The weight of one thousand seeds, depending on the year of harvest, ranged from 1.6 to 3.2 g.

Seedlings of *C. maculatum* have two cotyledons, the entire margin, which are ovate, slightly fleshy, about 15 mm long and about 8 mm wide (fig. 2). The tops of cotyledons are broadly round and their bases taper towards petioles with a length is of approx. 14 mm.

Figure 1.
Seeds of *Conium maculatum* L.

Figure 2.
Seedlings and the first pairs of *Conium maculatum* L. leaves.

The cotyledons are light green, gloss-free, glabrous, and their venation is concave from the top and convex from the bottom. The first leaves are long-term, three times pinnate, with ovoid-lanceolate and feathery-indented sections. The roots of the seedlings are taproots.

The results of the germination capacity of *C. maculatum* seeds in the first year after harvest are shown in fig. 3. In all variants of the experiment, the seeds showed characteristic fluctuations in germination. From autumn to spring, the seeds germinated relatively well. Analysing the source data for the calculation of the averages included in the diagram it was found that the highest percentage of germinating seeds was higher than 60% and occurred in the winter months in the seed material coming from the harvests in 2011 and 2013. In summer, the germination capacity decreased markedly. Later, depending on the germination conditions, the percentage of germinating seeds increased more or less visibly.

It was found that seeds germinate better in the light than in the dark. This dependence has already been noted in the available literature [10, 11]. It may be considered optimal to carry out laboratory analyses in the light at variable temperatures. Under these conditions, the germination rate of seeds was, on average, from 33 to 65%. This percentage of germinating seeds is associated with the occurrence of morphophysiological dormancy in a part of the seed [10].

It has been experimentally proven that seeds stored in unheated room conditions for 36 months after harvest germinate at a level of 45%. After 48 months of storage, the viability of the material dropped by up to 31%. In the fifth year of storage, 6% of seeds germinated while longer storage limits the germination of seed material (fig. 4). In the work of other authors, in the experiment established by sowing the seeds in the ground, the majority of seedlings appeared in the first year after sowing, in the following years the number of seedlings suddenly decreased [12].

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Conflict of interest: Authors declare no conflict of interest.

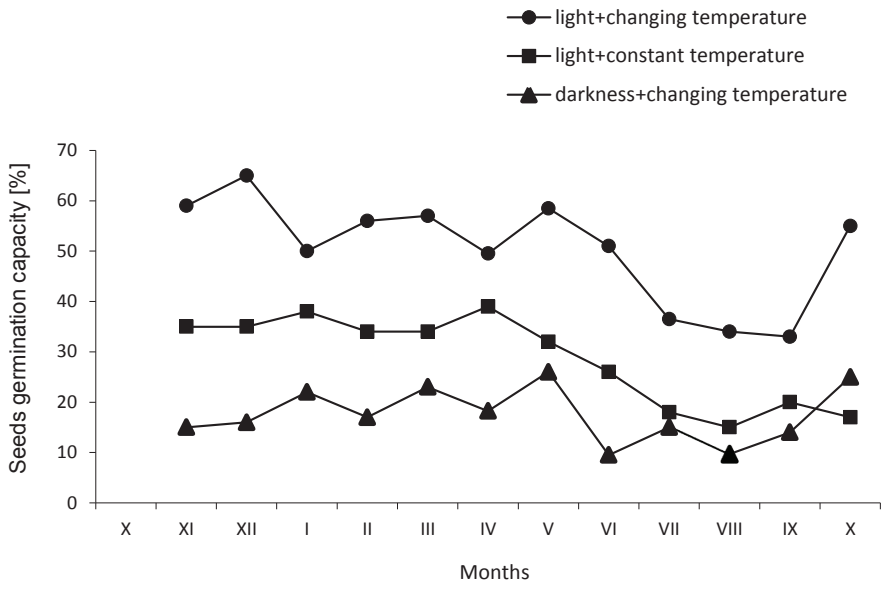

Figure 3.
Germination capacity of *Conium maculatum* L. in the first year after harvest (the average of 2009-2011 and 2013)

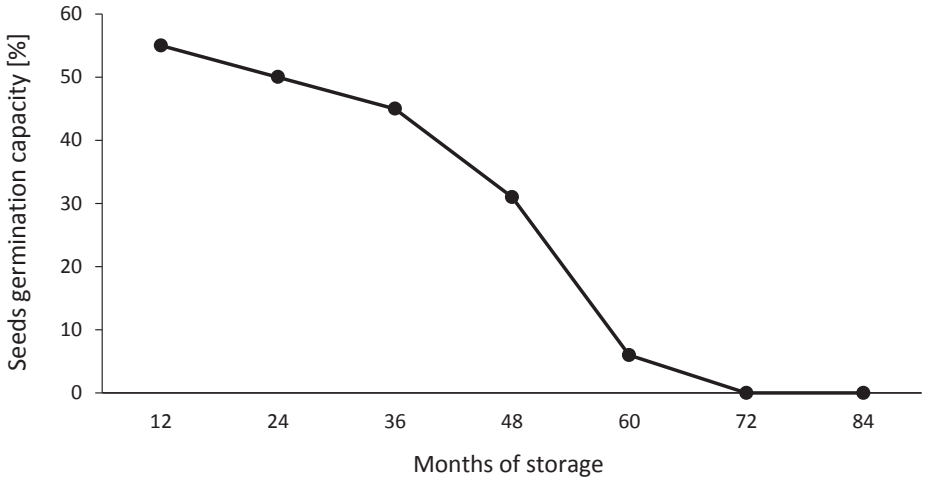

Figure 4.

Germination capacity of *Conium maculatum* L. diaspores stored at unheated room. The figure shows the fluctuation curve of germination capacity in each year during the storage time

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