Biology of germination of medicinal plant seeds. Part XXII: Seeds of *Chamaenerion angustifolium* (L.) Scop. from Oenotheraceae family

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S u m m a r y

The aim of the research was finding the best conditions for germination of *Chamaenerion angustifolium* seeds in a laboratory (light, temperature ranging from 20^{0}C to 30^{0}C). For two months after the harvest the germination capacity ranged from 40% to 80%. In next months the capacity decreased. In March and April it increased again, reaching as much as 80%. Seven years after the harvest diaspores lose their germination capacity.

Key words: Chamaenerion angustifolium, germination, seeds

Chamaenerion angustifolium (L.) Scop. (syn. *Epilobium angustifolium* L.) from the *Oenotheraceae* family is a valuable medicinal plant used in folk medicine for a long time. It occurs in the clearings, windbreaks, sites of conflagration, waysides and in low shrubs in the lowlands and mountains throughout Poland [1]. The optimal conditions for the plant are in the community of *Senecioni sylvatici* and *Epilobietum angustifolii*, which occurs in felling sites in the first years after cutting down coniferous forest and poor leafy forest growing on poor, acid and humus forest soil [2].

Epilobii herba and *Epilobii radix* are raw herbal material. *Epilobii herba* contains flavonoid compounds (1.5%), leucoanthocyanidin, anthocyanins, tannins (*ca*. 12%), sterols and triterpene compounds, while *Epilobii radix* contains about 0.35% of flavonoid compounds, tannins (7%), β-sitosterol, pectins and mucous compounds.

Epilobii herba has antiphlogistic and antioedema properties. Tinctura and extract obtained from this herb show antibacterical activity, while the extract obtained from the fresh herb has antiviral properties. Herb and root extracts are

used for treatment in the initial phase of the prostate gland overgrowth, cystitis, and inflammations of mucous membrane of stomach and intestines. The herb extract is also used externally for rinsing oral cavity and washing wounds in the case of difficult cicatrization [3, 4, 5].

The biology of germination of both species in laboratory conditions is not known well yet. Only two references have been found where the problem was referred to [6, 7].

MATERIALS AND METHODS

Seeds of *Chamaenerion angustifolium* originating from plants of our own cultivation (Garden of Medicinal Plants of RIMP in Plewiska near Poznań) were analysed during the presented research, carried out in the years 1999-2004. Diaspores were stored in the unheated room conditions. Analyses of germination were carried out according to the seed estimation methodology, established by ISTA [8]. Blotting chromatography paper (Whatman 3) was used as a basis during the laboratory research. The physical conditions used during the analyses of germination ability were as follows:

– light + changing temperature
– darkness + changing temperature
– light + constant temperature

When the temperature was constant, it was set at 20^0C. When the seeds were kept in darkness, the temperature was 30^0C for 6 hours and 20^0C for 18 hours, while in the case of using light the temperature was 30^0C for 8 hours and 20^0C for 16 hours. The data concerning the atmospheric conditions in the years 2000-2003 come from the Poznań-Ławica Meteorological Office.

Plant description

Chamaenerion angustifolium (L.) Scop. is a perennial plant with long rhizomes and stolons with scale, white-pink leaves. Stems are usually unbranched, reaching the height of 50-200 cm, bare or with rare, short, adherent hairs. Leaves, 5-15 cm long, and 10-15 mm wide, alternate, with linear lanceolate tapering at the base, being densely crowded on the stem. The plant has shiny, bare, darkgreen leaves with conspicuous veins. The leaf edges are even or slightly rigged. Stipules are getting smaller towards the top. The highest ones are small, usually setose.

The flowers of the plant are violet-pink, spreading, in long terminal spike-like racemes, with oblong petals, rounded at tips. Sepals are lanceolate, almost as long as petals, slightly pubescent from the outside. The style is longer than stamens, and the flowers protrandrous. The blooming period is from June to Septem-

ber. The bloom begins at the bottom of the raceme and proceeds upwards slowly. Later in the season, the blossoms are succeeded by capsules (4-8 cm long), usually with red overcolouring, adjacent pubescent, with many seeds with pappus [1]. The chromosome number of *Chamaenerion angustifolium*: 2n = 36 [9].

Diagnostic features of seeds and seedlings

The seeds of *Chamaenerion angustifolium* (L.) Scop. are narrow, obovate, light-brown- greyish, with rough surface. One side of the seed is convex, while the other, trough-shaped, is divided by a prominent, oblong rib. Seeds, 0.8-1.0 mm long, 0.2-0.5 mm wide and 0.2-0.3 mm thick, have long, greyish white pappus. Seeds available in the market are always without pappus [10, 11]. The mass of 1000 seeds with no pappus is about 0.05 g.

In laboratory conditions germination starts after 2-3 days from the beginning of the test. Cotyledons are green, bare or sparsely hairy, entire, egg-shaped or oval with long petioles. First leaves are egg-shaped, bare or with scarce hairs, while the next ones are oval and crenated (Fig. 1).

Figure 1. Morphological features of seed and seedlings of *Chamaenerion angustifolium* (L.) Scop.

Seed germination

It was found that light and variable temperature were the optimal laboratory conditions for the analysis *of Chamaenerion angustifolium* seed germination ability. In the darkness the number of germinating seeds ranged from just a few to 40% during the first year after harvest.

The results of this research, showing the optimal germination conditions, are presented in Figure 2. The curves showing the fluctuations of germination capacity in particular years are similar. In the first two months after the harvest the seeds of *Chamaenerion angustifolium* germinated well (40%-80%). In November and December the number of germinating seeds decreased. Next the germination ability began to increase slowly, reaching its peak in March and April (from 50% to over 80%). From May on a decrease in germination ability was observed again (Fig. 2).

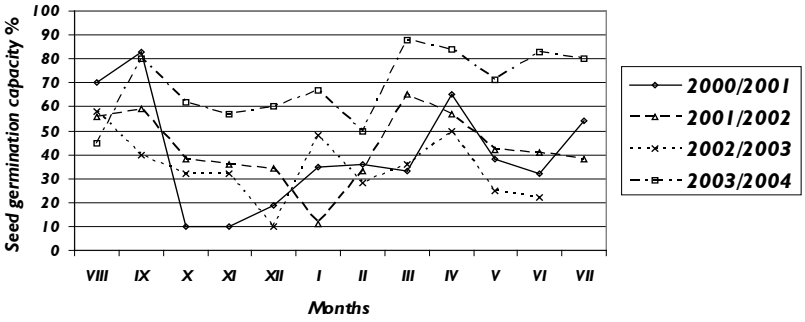

Fig. 2. Germination capacity of *Chamaenerion angustifolium* (L.) Scop. seeds during first year after harvest - light, variable temperature

The atmospheric conditions in particular years can be supposed to have influenced the germination capacity. Seeds collected in 2003 germinated the best (45%-88%), despite disadvantageous weather conditions during the time of fruit-setting (it was relatively dry and sunny; see Table 1). There were about 120 hours of insolation more and 94 mm of precipitation less in comparison with the year 2002 which was the worst for setting seeds.

Table 1.

Atmospheric conditions in vegetation seasons in the years 2000-2003 (data obtained from the Poznań-Ławica Meteorological Office).

Year	May to October
Average air temperature (°C)	
2000	15.6
2001	15.6
2002	16.3
2003	15.7
Precipitation, total (mm)	
2000	350.2
2001	360.3
2002	340.9
2003	246.8
Insolation, total (hours)	
2000	1284.6
2001	1167.5
2002	1244.5
2003	1365.8

The effects of atmospheric conditions are also seen when the amplitudes of germination capacity during the first year after the harvest are analysed. These fluctuations were smaller (45%-88%) in 2003, whereas the germination rate of the seeds collected in 2000 ranged from 10% to 83%. Sunny and dry weather is likely to affect the quality and germination of *Chamaenerion angustifolium* seeds.

Viability of stored seeds

After one year of storage in the unheated room conditions the germination capacity of *Chamaenerion angustifolium* seeds was about 70%. These diaspores can be used as seed material of standard value. After two years of storage the germination capacity of diaspores is only about 40%, and three and four years after the harvest its value is as low as 10%. After seven years of storage seeds do not germinate at all.

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BIOLOGIA KIEŁKOWANIA NASION ROŚLIN LECZNICZYCH. CZ. XXII: NASIONA LECZNICZEGO GATUNKU *CHAMAENERION ANGUSTIFOLIUM* (L.) SCOP. Z RODZINY *OENOTHERACEAE*

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S t r e s z c z e n i e

Ustalono optymalne warunki oceny laboratoryjnej nasion wierzbownicy (światło, temperatura zmienna 20/30^{0}C). Materiał siewny w ciągu dwóch pierwszych miesięcy po zbiorze kiełkuje w powyższych warunkach dość dobrze (w 40-80%), następnie w miesiącach jesienno-zimowych wykazuje pewne obniżenie zdolności kiełkowania, wreszcie w marcu lub kwietniu następuje wzrost do poziomu wynoszącego od 50% do ponad 80%, po czym odsetek nasion kiełkujących spada. Po siedmiu latach materiał nasienny całkowicie traci zdolność kiełkowania.

Słowa kluczowe: Chamaenerion angustifolium, kiełkowanie, nasiona