INFLUENCE OF OVERCOMING DORMANCY METHODS ON *MAGNOLIA X SOULANGEANA* SOUL. BOD. SEEDS GERMINATION

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Abstract. *The goal of the experiments carried out was to analyse the influence of different types of preseeding treatment on the germination and dormancy breaking of Magnolia x soulangeana seeds. Seven types of preseeding treatment were used to break seed dormancy - warm-cold stratification, cold stratification, chemical scarification, pouring with boiling water and any combination of these treatments. The lowest germination was noted after the application of pouring with boiling water. The best results were obtained after chemical scarification in hydrochlorid acid (HCl) in combination with a four month period of cold stratification. After the combination of these mentioned methods it was possible to break the exogenous and endogenous dormancy of the Magnolia x soulangeana seeds.*

Keywords: *Magnolia x soulangeana,* dormancy, seed, stratification, scarification

INTRODUCTION

Magnolia x soulangeana is a hybrid. Its' parents *Magnolia heptapeta* and *Magnolia liliflora* are native to eastern Asia. It grows as a medium or large shrub. It is appreciated in landscaping because of its beautiful flowers.

The most commonly used ways of propagation are methods of autovegetative propagation. In the case of heterovegetative propagation it is necessary to produce rootstocks. Rootstocks are produced in a generative way. A part of generative reproduction is preseeding treatment which, because of the specific type of seed dormancy, is often complicated. Magnolias are woody plants with seeds which have a morphological type of dormancy. This type of dormancy is possible to be overcome in environmental conditions in which the embryo will after ripen. The most often applied is a warm stratification from four to eight weeks MacDonald (1999). Walter (1997) even have the opinion that after ripening of magnolias seeds can continue for four months.

Taking into account the statements of other authors we expect that magnolia seeds are under the influence of more types of exogenous and endogenous dormancy. For example Bärtels (1988) refers to the influence of seed coats on

germination. Young and Young (1995) present a type of magnolia dormancy which needs period from three to six month a cold stratification. Hartmann (1997) recommend, in accordance with the above, from two to three months of cold stratification for *Magnolia grandiflora* seeds. Krüssmann (1964) recommend for magnolia´s seeds cold stratification from two to four month. According Smith (2009) specifically seed dormancy of *Magnolia acuminata* can be overcome by several months of low temperature. Dewayne and Yeager (2009) recommends for seeds of *Magnolia soulangeana* from four to five month of cold stratification.The information mentioned above indicates the lack of clarity in our knowledge of magnolia seed dormancy, which opens up the possibility for a range of experiments. The goal of the experiments was to analyse the influence of different types of preseeding treatments on the germination and dormancy breaking of *Magnolia x soulangeana* seeds.

MATERIAL AND METHOD

Magnolia x soulangeana seeds were harvested in October 2004 in Arboretum Mlyňany (Slovakia) from an approximately 40 year old mother plant. After the harvest they were placed in a closed container and dried at a temperature of 23 °C for five days. The experiments were established after the seeds release from capsules. The experimental works was carried out in seven variants. Each of the variants represented a special way of preseeding treatment with the aim of breaking dormancy. In three of the variants stratification was applied. Two of the variants were represented by stratification in combination with chemical scarification in 36% hydrochlorid acid (HCl). In the last variant boiling water was poured on the seeds (Tabel 1).

Tabel 1

Variants of the preseeding treatment of *Magnolia x soulangeana* seeds

Variant	The type of preseeding treatment
1	Warm-cold stratification (warm phase - 1 month at 23°C and cold phase 3 months at 2 –3°C)
2	Cold stratification: 4 months at 2 – 3°C
3	Cold stratification: 6 months at 2 – 3°C
4	Chemical scarification in 36% hydrochlorid acid (10 min) + Warm-cold stratification (warm phase - 1 month at 23°C and cold phase: 3 months at 2 – 3°C)
5	Chemical scarification in 36% hydrochlorid acid (10 min) + Cold stratification (4 months at 2 – 3°C)
6	Chemical scarification in 36% hydrochlorid acid (10 min)
7	Pouring with boiling water

Seeds were stratificated in wet perlite in 0.3 l containers. The ratio between perlite and seeds was 3:1 in favour of the perlite. Containers were watered with a 2%

concentracion of Previcur (effective constituent: 607 g/l propamocarb). Watering with Previcur was repeated in 14 day intervals until cultivation. Containers were placed in a refrigerator with a temperature 2 - 3°C. Seeds in containers were checked in seven day intervals. After the preparation of seeds (stratification, chemical scarification, the pouring of boiling water) seed samples were cultivated on a foam-rubber germinator. Seeds were disinfected for 5 minutes in a 20% sol of Savo (effective constituent: NaClO) before cultivation. The temperature of germination was 21°C. Seeds were cultivated for 6 weeks. Samples of seeds were cultivated in 3 repetitions for each variant (excluding chemical scarification with two repetitions). In each repetition there were 30 seeds. The first evaluation of the results was made after the seventh day of cultivation. Next, germinating seeds were checked in seven day intervals. The last checking was done after four weeks. As the mathematical-statistical method of results evaluation an analysis of variance and LSD test of statistical significance in differences between average values was used.

RESULTS AND DISCUSSION

After analyses of results high conclusive differences could be ascertained concerning the influence of preseeding treatment (Tabel 2) on the germination of *Magnolia x soulangeana* seeds (Fig. 1 and 2). By the usage of the LSD test of statistical significance in differences types of preseeding treatment were divided into three statistically different homogenous groups (Tabel 3). The worst type of preseeding treatment was the use of pouring with boiling water. After the application of this type of preseeding treatment 1.1% of seeds germinated. A higher percentage of germination was obtained after the application of other types of preseeding treatment. The application of warm cold stratification led to a 13.8% level of germination. We expected higher germination because this type of stratification is often used in practise. Even germination after the application of chemical scarification (22.2%) and 4 months of cold stratification (22.5%) was higher. After 6 months of cold stratification germinated 33.5% of seeds. A level of 54.0% germination was noted following the usage of chemical scarification in combination with four months of cold stratification. The highest germination (61.9%) was obtained after the application of chemical scarification in combination with warm cold stratification.

Tabel 2

Analysis of variance of *Magnolia x soulangeana* seeds germination influenced by preseeding treatment

Source of variation	Sum of squares	DF	Mean square	F-ratio	Significant level (α)
Variant	16920.9	6	2820.160	9.07	0.0000
Residual	10886.0	35	311.028		
Total	27806.9	41			

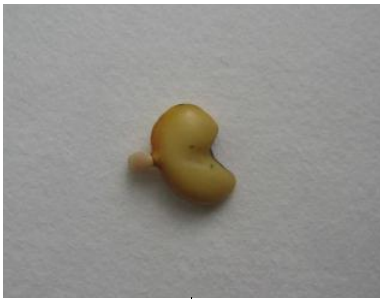

Fig. 1. Beginning of *Magnolia soulangeana* seed´s germination - emergence of radicula

Fig. 2. Germinated seed of *Magnolia soulangeana* with the seed coat

Tabel 3

LSD test of statistical significance in differences between average values of *Magnolia x soulangeana* seeds germination influenced by preseeding treatment

Source of variation		N	Average germination (%)	Homogenous groups			
Variant	7	6	1.1	A			
	1	6	13.8	A	B		
	2	6	22.2		B		
	6	6	22.5		B		
	3	6	33.5		B	C	
	5	6	54.0			C	D
	4	6	61.9				D

The best results were obtained after the application of chemical scarification in hydrochlorid acid and then followed by the application of cold or warm cold stratifications. Only the application of chemical scarification, cold stratification or warm cold stratification did not cause dormancy breaking so successfully as the other mentioned types of treatment.

Between the years, we found out statistically significant differences in germination of *Magnolia soulangeana* seeds (Tabel 4 and 5). The difference in average germination was probably caused by not specified factors of the year.

Tabel 4

Analysis of variance of *Magnolia x soulangeana* seeds germination influenced by factors of the year

Source of variation	Sum of squares	DF	Mean square	F-ratio	Significant level (α)
Year	5449.2	1	5449.200	9.75	0.0033
Residual	22357.7	40	558.943		
Total	27806.9	41			

Tabel 5

LSD test of statistical significance in differences between average values of *Magnolia x soulangeana* seeds germination influenced by factors of the year

Source of variation		N	Average germination (%)	Homogenous groups	
Year	2	21	18.4762	A	
	1	21	41.2571		B

When we analyse the results it is necessary to know the effect of types of preseeding treatment. The aim of the usage of chemical scarification is to break exogenous types of seeds dormancy. Warm stratification is used to overcome morphological endogenous dormancy and types of endogenous dormancy are the most often overcome by cold stratification. Considering what we have mentioned we can state that dormancy of *Magnolia x soulangeana* seeds is caused by immature embryo, seed coats and endogenous inhibitors. Obtained results are principally consistent with the statements of Bärtels (1988), Young and Young (1995) Hartmann (1997) and Macdonald (1999) mentioned in the introduction.

CONCLUSIONS

Conclusions reached from the results obtained:

1. The best way to break the dormancy of *Magnolia x soulangeana* seeds was chemical scarification in hydrochlorid acid followed by the application of four months of cold stratification or combined warm cold stratification.
2. The application only of warm cold stratification caused significantly lower germination than chemical scarification in combination with warm cold stratification.
3. Significant differences in germination after the application of different methods of preseeding treatment were probably caused by a combined type of exogenous and endogenous dormancy of *Magnolia x soulangeana* seeds.

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