Corvinus University of Budapest

The foundations of initiating the protected species of Telekia speciosa (Schreb.) Baumg. back in animate nature

Doctoral dissertation

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Made at the Faculty of Horticultural Science
At the Corvinus University of Budapest

Budapest

2010

The doctoral school

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Scholarship:	Science of cultivation and horticulture
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The candidate has fulfilled all the conditions prescribed in the Doctoral Regulation of Corvinus University of Budapest, the candidate has taken the remarks and recommendations in the workshops of the dissertation into consideration; therefore the dissertation can be released for public debate.

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1. Prelude of the work, set aims

I have chosen the native and protected plant that can be found in the Beech' riverbank's associate weeds (HÖHN 2000) mainly, the *Telekia speciosa* (Schreb.) Baumg. as my PhD thesis, its cultivation, furthermore, its cognition of methods for consumption of territory (as ornament and herb), its cultural propagation and ways of growing, as well as the investigation of suitability of the species as cut flowers. The reason for this on the one hand is, that we managed to elaborate generative propagation soon enough, so in this way I have deposed a rather big number of testable stands since the beginning of my research. From a horticultural point of view it is important that the aesthetic value of the plant is high. The *Helianthus rigidus* (Cass.) Desf. and the *Helianthus salicifolius* A. Dietr. would bear a rather meaningful range expansion effect and from a perennial horticultural point of view they would be appropriate for the triggering of shrub replacement, as in contrast the *Telekia speciosa* (Schreb.) Baumg. will not get weedy. Along with all these advantages the *Telekia speciosa* (Schreb.) Baumg. has a really significant extra value, as it is not only an ornamental plant and it cannot keep the ball rolling only as an ornament, but soon it was found out that it has a rather huge active ingredients content, so in this case it is worth getting this plant into culture. The researches of the plant had 3 reasons to make it justifiable: the preservation, the aesthetic and the health-preservation aspects. At present no one else does any similar research and investigation with this plant besides the colleagues and the dissertation writers of the Collage of Nyíregyháza and the Corvinus University of Budapest's Faculty for Horticulture. In my dissertation I expound my experiments and results found between the years 2008 and 2012 at the Faculty for Horticulture of the Department of Floriculture and Dendrology at the Corvinus University of Budapest, as well as at the Tuzson János Botanical Garden.

2. Material and Method

2.1 . The effects of ecological factors on the development of *Telekia speciosa* (Schreb.) Baumg.

2. 1. 1. The pedological research of the original habitat of the Telekia speciosa (Schreb.) Baumg.

The soil samples were drawn in the Hór Valley of the Beech Mountain on 28 June 2009, where the natural population of the plant can be found. During the presentation of the investigation we used 2 sample appellations (Sample 1, Sample 2). Both samples were brought from the same place with the help of a manual borer, the first sample is from a 15 cm depth and the second sample is from a 25 cm depth.

2. 1. 1. 1. Investigation of the lime content of the soil

During the investigation 2 g soil sample was measured on the watch glass, then hydrochloric acid was dropped on it. The investigation is based on that for the lime soil content liable CaCO3 and CaHCo3 react with the help of hydrochloric acid during the formation of CO2. The lime content of the soil is based on the intensity of the effervescence (CO2).

2. 1. 1. 2. The PH value of the soil

During the investigations 15,5 ml distilled water was added to 5 g soil, it was mixed with a glass rod then it was allowed to stand. By the passing of the waiting time the residuary soil is mixed again and with the help of a glass electrode PH value measuring instrument the PH value of the soil solution was measured. The second examination took place in the same way with the difference that instead of distilled water 12,5 ml KCl was added to the soil samples.

2. 1. 1. 3. The definition of the soil's humus content

The organic matter of the soil was disrupted with a chromic acid oxidation. With the measuring of the invariably residual chromic acid (oximetria, Fe 2+ - Fe 3+ reaction) with the

decrease of oxidants the organic bounded C quantity can be computed. Parallel measurements were done.

From the soil sample 1-1 g sample was measured into a 100 ml Erlenmeyer-test tube. A 10 ml vitriolic K2Cr2O7 solution (0,0667 mol/l) and 0,1 g Ag2SO4 was added. A funnel was put in the Erlenmeyer-test tube and a with water half full 25 ml beaker was put on it. The alembic was heated on an electronic hot plate and from the appearance of the first pinhead boiling bubbles on, it was boiled exactly for 5 minutes.

After the completion of the destruction, the mixture was let to cool down. The destructed solution was carried forward into a 250 ml Erlenmeyer-test tube, and it was diluted with 150-160 ml distilled water. 8-10 drops of concentrated H3PO4 and 2-3 drops of ferroin indicator were added. The yellowish mixture was trialled with 0,2 mol/l concentrated Mohr-salt (Fe(NH4)2)SO4)2). At the beginning of the trialling the orange colour of the dichromate was present. With the reduction of the Mohr-salt rather more and more greenish hued chromate salt and the greenish colour of the Mohr-salt came into view. At the shift the colour went from blueishgreen to redishpurple.

2. 1. 1. 4. The definition of the physical soil diversity

During the survey 100g air-dry soil sample was put in the rub mortar, then water was let on it from a burette while constantly rubbing it, just until the soil got the filium test. Finally based on the amount of the disappeared water we were able to define the restriction number. To determine the physical soil differences the Arany restriction number (KA) of defining is used.

2. 1. 2. The effect of different lights on stands planted in gardened circumstances

The 2 tests were set in 2 different places. The 2 test fields were the Arboretum of the Corvinus University in Budapest, as well as the Tuzson János Botanical Garden. During the test the tested plants were put in places where the lights were different (shady, half shady, and sunny), then we examined the morphological changes due to the effect of the lights, as well as the presence of pathogens and pesticides. The plants were selected of the sowed seeds from October 2008. During the selection we made an effort to choose equal sized, healthy

individuals. At both test fields 3-3 habitats were designated. At all habitat types 4 m2 were designated on every square meter 10 plants were planted.

The parameters of the investigation were the following: the height of the plant, the number of inflorescence stems, inflorescence measurer, the number of buds, the number of plant leaves, the length of plant leaves, the cross-section of plant leaves, the number of leaves on inflorescence stems.

2. 1. 3. The changes of chlorophyll content of the Telekia speciosa (Schreb.) Baumg. leaves according to ecological factors

The measuring of the chlorophyll content in the leaves was done at the Corvinus University of Budapest, Department of Floriculture and Dendrology Laboratory, with a spectrophotometer. To do the investigation 3 plants were selected from all 3 treatment groups (shady, half shady, and sunny) and the measurement was done on them. During the vegetation period of the plant samples from the planted plants was taken 3 times: after the shooting (on 27 May, 2010), during the blossoming (on 23 June, 2010) and before the withdrawal (on 4 October, 2010). From the given sample on the basis of DROPPA et.al. (2003) a sample was made then the total volume of chlorophyll-a and chlorophyll-b was measured with the help of a spectrophometer. The results were evaluated statistically.

2. 2. Propagational experiments

The seed of *Telekia speciosa* (Schreb.)Baumg. was gathered in the Nyíregyháza Botanical Garden from gardened circumstances. The seeding was done after the ripening of the achenes in the propagating room of the Botanical Garden at the Collage of Nyíregyháza. The propagating room is not conditioned; its temperature and moisture depend on the weather. The medium of the seeding is Agro Cs soil mixture, the size of the propagation tray is 36x24 cm, which was covered with a transparent plastic bell until the commencement of the germination. Previous 607 SL fungicidal sprayer (agent 607 g propamocarb) was used against the tilting of the seedlings.

2. 2. 1. The effects of different treatments on the germination of Telekia speciosa (Schreb.) Baumg.

Before the sowing or in some cases after the seeds or the seeding itself it underwent different treatments, in hope of gradual germination.

The Proceedings were the following:

1. Sowing of dry seeds on 20-22 °C temperature
2. Sowing of in water soaked seeds on 20-22 °C temperature
3. Sowing of in four kind concentrated gibberellic acid soaked seeds (900 ppm, 500 ppm, 200 ppm, 20 ppm). The soaking time in all cases took 24 hours.
4. Sowing of punctured, scratched or wounded seeds.
5. Sowing of chilled seeds (2 weeks cooling time, temperature 2-5 °C).
6. Stratification of seeds (1 month stratification time, temperature 2-5 °C)

20-20 seeds were sowed per treatment. The sowing was repeated 4 times.

The sowing of seeds was repeated in spring, but only with the 2 procedures that have shown the most significant differences. The seeds were stored dry and cool until the time of sowing.

2. 2. 2. The effect of different mediums on the germination of Telekia speciosa (Schreb.) Baumg.

During our investigation we followed the germination of the teleki flower up, in different mediums. We used 7 planting mediums. The mediums were as it follows:

A: Soil: Agro CS soil mixture. (Agro CS Hungary Ltd., 3100 Salgótarján, Rákóczi Street 38)

B: Soil - sand, 1-1 ratio mixture (washed fluvial sand)

C: Soil - peat (Agro Cs), 2-1 ratio

D: Sand - peat, 1-1 ratio

E: Soil – compost (Urban Management Ltd. of Nyíregyháza), 2-1 ratio

F: Compost - peat, 1-1 ratio.

G: Soil- perlite, 2-1 ratio mixture.

20-20 seeds were sowed per soil mixture. The sowing was done in 4 repetitions.

In the case of seed sowing the following data were measured:

- germination rate,
- germination time,
- the evolution of seedlings.

2. 2. 3. The effect of the sowing depth of Telekia speciosa (Schreb.) Baumg. on germination

The aim of the experiment is to specify the optional sowing depth of *Telekia speciosa* (Schreb.) Baumg.. Approximately 3-4 cm soil was poured on the bottom of the propagation trays, on every tray 10-10 lives were drawn and 20-20 seeds were put in every line. In the first propagation tray half centimetre soil covered the seeds, whilst at the other trays the sowing depth was increased by half a centimetre fairly until 2,5 centimetre.

2. 2. 4. The vegetative propagation potential of Telekia speciosa (Schreb.) Baumg.

For the root cutting investigations of *Telekia speciosa* (Schreb.) Baumg. 3 in the open air wintered potted plants were brought inside the greenhouse of the Botanical Garden of the Collage of Nyíregyháza. On 17 January, 2012 into the pots 5-5 pieces of root without rhizome was put in the mixture per pot.
into 2 pots the upper part of the root was put (5-7 cm)
into 2 pots the lower part of the root was put (5-7 cm)
into 2 whole-length 10-12 cm root pieces were put.
To the turion cutting experiments of the *Telekia speciosa* (Schreb.) Baumg., in the open air wintered potted plants were brought in the greenhouse of the Botanical Garden of the Collage of Nyíregyháza on 30 January, 2012, where 80 % moisture and 15-22 C° temperature were characteristic. The fresh shoots of the plants were cut on 16 February, 2012 with a small piece of rhizome and the cuttings were planted in a 10 pot. We altogether received 10 pot cuttings. The size of the leaves on the cuttings were changed between 0,5 and 4 cm during the time of cutting. Later we watched the evolution of the 10 cuttings, as well as the possibility of the braird of the remaining plants with the rhizome parts.

2. 3. Micropropagation

In our experiment we investigated the possibility of *in vitro* into culture pulling of *Telekia speciosa* (Schreb.) Baumg. The experiment was set in at the Centre for Agricultural and Applied Economic Sciences of the University of Debrecen's Nyíregyháza Research Institute's Biotechnological Laboratory.

In the interest of the seed's sterilization as a baseline different intensified disinfectant solutions and disinfection times were tested. The intensity of the solution could be regulated by the modification of the rate of the bleech and the water. In each case in 1:2 or 2:1 rate and 2 ml Dodenál Neu/h and Tween-20 bleech was added. The sterilization time was 2 or 7 minutes.

As the next step of the *in vitro* tissue culture traction we aimed at the initiation of the branching of the plant. The branching was investigated on 3 types of soil: MS, Medium 1 (M1) and Medium 2 soil. In the case of Medium 1 100 mg/l inositol, 200 mg/l glutamine, 1 mg/l indol acid (IVS), 2 mg/l kinetin (KIN), 30 g/l sugar, 7 g/l agar was added to the basic medium. In the case of Medium 2 (M2) 5 mg/l KNO_3-at, 500 mg/l casein hydrolyzate, 1 mg/l benziladenin (BA), 1 mg/l naphthylacetic acid (NES), 30 g/l sugar were added to the normal MS medium. This medium did not contain any inositol.

During the experiment the recently in vitro, from seeds amplified plants (Unit 3.3.1) was put on different cytokinin content medium.

The following cytokinins were used: benzyladenine (BA), meta-topolin (TOP), benzyladenine riboside (BAR), kinetin (KIN), zeatin (ZEA), isopentenyl-adenine (2-iP).

The treatments were investigated in the following concentrations: 1 μM, 5 μM, 10 μM.

Besides the above investigated cytokinins and their concentrations the other components of the medium were always the same (M2). 40 ml medium was used for every pot, the shoots were put on this horizontally. 5 shoots were put in every pot. The plants were grown besides 16 hours, 105 μmol s^{-1} m^{-2} (8000 lux) illuminations and 22±2 °C temperature. The effect of the cytokinins was investigated in 15-15 pots, namely on 75 explants. The measurements were done 4 weeks after the contact of the explants on the soil, by pulling the plants out of the pot.
The investigated parameters were the following:

- Multiplication rate (the number of shoots developed by explants)
- Length of new shoots (mm)
- Formation of roots
- Hyperhydricity
- The extent of callus formation (0: none; 1: slight; 2: medium; 3: strong)
- Other changes (the colour and shape of the leaf, possibly appearance of blossoms).

As the closing of the in vitro experiment as a result of a 2-iP treatment we tried the acclimatization of rooted plants. We planted 20-20 plants into the Jiffy power cube and were kept under a cover in a conditioned airspace for 3 weeks. After the 3 weeks the plants were

planted in 10 pots into the 1.1 ratio mixture of peat and Agro Cs, the mulch was continuously removed from it, then the rate of viable individuals was investigated.

2. 4. Raising experiments

2. 4. 1. The opportunities of the further raising of from seed propagated plants

The seedlings from the seeding experiments (Unit 3.2.2) were clasped from the propagating boxes to the 104 cell tray on the 20th week from the sowing. The clasping took place every time into a 1:1 ratio mixture of Jó Föld and Rédei Peat produced by Pax Ltd.

2. 4. 2. The potting of plants, the investigation of their raising vigour in different mediums

The raising vigour of the plants that took part in the seedling experiment was investigated. The plants were transplanted from the clasping trays to pots on 30 March, 2009. After the planting the evolution of the plants was investigated in 2 different mediums. 170 herbs were planted into the 12 plastic walled pots, from these 85 were in Jó Föld P-20 and peat. After that the raising vigour of the herbs was observed, on the basis of the height until the petiole or the diameter of the leaf. The measurements were done in April.

After the herbs have erupted the 12-pots, another planting took place on 7 July, 2009. The herbs were put in 3 litre plastic containers. During the medium experiments applied planting mediums are shown in the 1st Table. In the B0 medium we were going to examine its effect on the evolution of coir. In the case of AF the propagating medium was enriched by Futor (fizzy lime).

During the examination of the individuals the number of leaves per plant, the longest petiole, as well as the longest diameter of leaves was measured. These measurements were done on 8 September, 2009.

Table 1. The content of applied mediums during the 3 litre container raising of *Telekia speciosa* (Schreb.) Baumg.

Name of treatment	Content of medium	Number of plants
AF	1:1 ratio mixture of Rédei Peat and Jó Föld +2g/l Futor	15
A0	1:1 ratio mixture of Jó Föld and peat	15
B0	1:1 ratio mixture of Jó Föld and coir	15

Figure 1. The raising of *Telekia speciosa* (Schreb.) Baumg. in a 3l container

2. 4. 3. The opportunities of the production of Telekia speciosa (Schreb.) Baumg. in potted culture

2. 4. 3. 1. The effect of supplementary lights usage on the evolution of *Telekia speciosa* (Schreb.) Baumg.

In our experiment the in a 3l pot raised *Telekia speciosa* (Schreb.) Baumg. plants were brought in poorly heated greenhouse in 3 different times, and assimilation illumination was applied..

In the investigation of untimeliness the effects of natural and supplementary lights were compared with the controlled groups that were brought in a greenhouse and that were

left on the open air. The carrying took place on January 18, in all 3 groups 10-10 plants were put.

For the investigation of the relation between the time of shooting and the evolution of the plant one control group stayed on the open air, the days of taking them in the greenhouse were: January 4, January 25 and February 15.

In both cases the brairding time was noted, the height of the plant, the length of the petiole and the size of the leaf blade, as well as the appearance of the bud, the number of buds and blossoms and the size of the blossoms were measured every 2 weeks with a ruler.

2. 4. 3. 2. The opportunities of the early flowering of *Telekia speciosa* (Schreb.) Baumg., as well as the effect of different fungicides on the evolution of the plants

The experiments of the early potted flowering were done throughout 2 years at the Botanical Garden of the Collage of Nyíregyháza.

Experiment – year 2011

The survey was set in the greenhouse of the Nyíregyháza Botanical Garden. The plants were propagated from seeds in autumn, 2009; which wintered on free land in pots in 2010. They were put in a greenhouse on 7 February, 2011 for the first (5 °C), then on 21 February, 2011 for the second time.

80 plants were divided for 4 parts and set 4 treatments:

Treatment 1: Usage of Cycocel 720 in 1 ml/l concentration

Treatment 2: Usage of Caramba SL in 1 ml/l concentration

Treatment 3: Combined treatment, during which 1 ml/l Cycocel 720 was mixed with 0,5 ml/l Caramba SL-el.

Group 4: control group without treatment

The spraying was started March 11, then on every 2nd day it was repeated. On every 10th day further treatment was planned, based on the original notion, but seeing the powerful evolution of the plant, the frequency was modified and after the 2nd spraying it was already done on a weekly frequency.

The measured morphological parameters were the following: the length of the petiole, the leaf cross-section, height and diameter of flowers.

The measurements were done twice, during which the whole staff and all the leaves were examined. The time of measurements: 1 April, 2011 and 2 May, 2011.

Experiment – 2012

The experiment was repeated in 2012. The concentration of the applied medication and the effects of the new growth inhibitory medications were observed. 30 plants were brought in the greenhouse February 1. The spraying was immediately started after the appearance of the first leaves. Spraying was then done every Tuesday, in the same time, at 3 o'clock in the afternoon.

The treatments were as it follows:

Treatment 1: Alar 85, 3 g/l concentration

Treatment 2: Combined treatment, during which 1 ml/l Cycocel 720 was mixed with 1 ml/l Caramba SL-el.

Group 3: control group

All 3 groups were treated with 3 g/l Plantafol foliar fertilizer April 11 and May 2.

The time of measurements: 29 March, 2012 and 27 April, 2012

3. 4. 4. The production opportunities of Telekia speciosa (Schreb.) Baumg. as a cut flower

3. 4. 4. 1. The determination of frame durability *Telekia speciosa* (Schreb.) Baumg.

The experiments in connection with the vase life of the plant *Telekia speciosa* (Schreb.) Baumg. were set on 11 June, 2012 in the propagation room of the Botanical Garden of the Collage of Nyíregyháza. The room is conditioned, its temperature and moisture depend on the weather. In the case of the experiment in June, the average temperature was between 22 and 30 °C. The plants were gashed in the condition of one full-bloom flower, with a long inflorescence stem, and then the inflorescence stem was cut back for 60 cm before putting it into water. The inflorescences were put in a 1,5 l transparent plastic mineral water bottle. As the *Telekia speciosa* (Schreb.) Baumg. is blossoming sustained, namely the first flowers start to bloom by the end of May and the flower production keeps off right until the middle of July, I have only observed 15 plants, because I have not found any more plants in the same florescence stadium.

The investigated parameters were the following:

- I have taken a photo every day about the changes of the morphology and aesthetics of the main buds.
- I have counted all the buds that opened on that day.

3. 4. 4. 2. The effect of removing the main and side buds of *Telekia speciosa* (Schreb.) Baumg. on morphology.

The experiment was set on the free land area of the Nyíregyháza Botanical Garden. We were investigating what effect it has on the raising of *Telekia speciosa* (Schreb.) Baumg. and the size of flowers if the flower buds are partly removed (STEVENS 1997). In our experiment we took the propagating technique samples of in use already known cut flowers as a starting point (ZIMMER 1991, KOFRANEK 1992, WHEALEY 1992, HAMRICK 2003, BUDAYNÉ 2008). We measured 3 examined groups, in the case of the first staff, only the main bud at the top of the inflorescence stem was plucked out, the side buds were kept. At the second staff only the main bud was kept, the others were removed. The third staff was the control group, no intervention was applied. 20-20 plants were observed per staff. The plants wintered in a container in open-air conditions. The excision of the buds took place May 30.

60 plants were divided for 3 parts, 3 treatments were set:

Treatment 1: the eruption of the main bud

Treatment 2: the eruption of the side buds

Treatment 3: control group

The measured morphological parameters were the following: the height of the plant, the length of the stem including the flower, the diameter of the flower.

The measurements were started June 15, the last measurement took place July 15.

3. RESULTS

3. 1. The effect of ecological factors on the evolution of the Telekia *speciosa* (Schreb.) Baumg.

3. 1. 1. The pedological investigation of the original habitat of Telekia speciosa (Schreb.) Baumg.

During the examination about the lime content we have not experienced effervescence on the effect of the dropped acid on the soil on the watch glass. We came to the conclusion that none of our samples contains lime.

At the measuring of the PH in the case of the aqueous suspension the following results were available:

Soil sample 1: 5,65 pH

Soil sample 2: 5,62 pH

The KCl suspension values were the following:

Soil sample 1: 4,97 pH

Soil sample 2: 4,76 pH

It can be ascertained, that both soil samples are from sour soil.

In the case of the 1st soil sample the humus content was H% = 7,445; in the case of the 2nd soil sample it was H% = 3,099. From this we may conclude, that the lime content of the soil close to the surface is significantly high according to the lower soil.

The Arany-commitment number in the case of the first soil sample was K_A = 57; in the case of the second soil sample K_A = 52. Both samples belong to the category of clay.

3. 1. 2. The effects of different light conditions on the staff bred in garden conditions

1. The herbs planted in the Nyíregyháza Botanical Garden were measured on 10 August, 2009. Table 2 is showing that there is a significant difference between the parameters depending on the different habitat types.

Table 2. The variation of the length of blade of the *Telekia speciosa* (Schreb.) Baumg. at different habitat

The parameters / Type of the habitat	average number of leaves/plant	average leaf blade length (cm)	average leaf width	average length of petiole
shady	4, 1-a	8, 6-a	7, 2-a	9, 4-a
half shady	6, 6-b	17-b	13, 1-c	14, 2-b
sunny	6, 6-b	17, 8-b	11, 3-b	13, 1-b

Different small letters in each row indicate significant differences (P<0,05)between at the different habitat

The measurement results of the herbs planted at the Budai Arboretum of the Corvinus University of Budapest are shown in Figure 2. The results are showing significant difference.

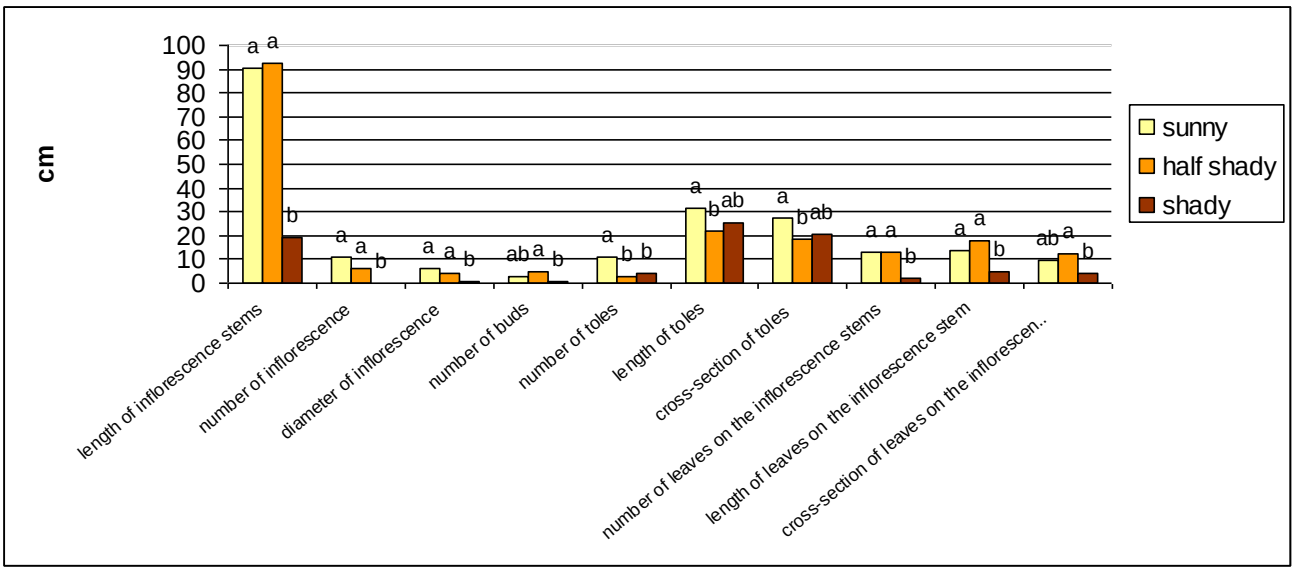

Figure 2: The changes of the size of leaves and flowers of the *Telekia speciosa* (Schreb.) Baumg. in different habitat types of the Budai Arboretum in 2010. (The different small letters at the top of the columns are showing the measured significant difference in the different habitat types (P<0,05))

During the set experiment at the Budai Arboretum of Corvinus University of Budapest it was concluded, that the plant shows no significant difference in regard of half shady or sunny habitat, however, the plants of the shady habitat were significantly shorter. In regard of the sunny habitat could be taken as optimal, as the number and the diameter of the flowers the biggest here. The flower diameter of those plants living in the half shady habitat is slightly smaller, but it cannot be separated from the plants living in the sunny habitat significantly. The plants living in the shady habitat, however, brought little and miniature flowers, and we have also observed that the plant is not only bringing fewer flowers, but from the beginning of June is postponed to the end of June. The biggest toles were brought by the plants living in the sunny habitat, while the biggest leaves on the inflorescence stems were measured in the half shady habitat. As for the number of toles the sunny habitat brought the most significant results.

3. 1. 3. The change of the chlorophyll content of the leaves of the Telekia speciosa (Schreb.) Baumg. depending on ecological factors

The highest chlorophyll content at all 3 measurement times was experienced at those individuals that were planted in a half shady open-air habitat. Individually with the most

similarity as regard to phenotypes were observed in the same place, just like the richest blooming.

Furthermore, it is clearly apparent, that the samples taken at the blooming in the case of all 3 locations contained less chlorophyll amount, than in the other 2 measurement times (Figure 3).

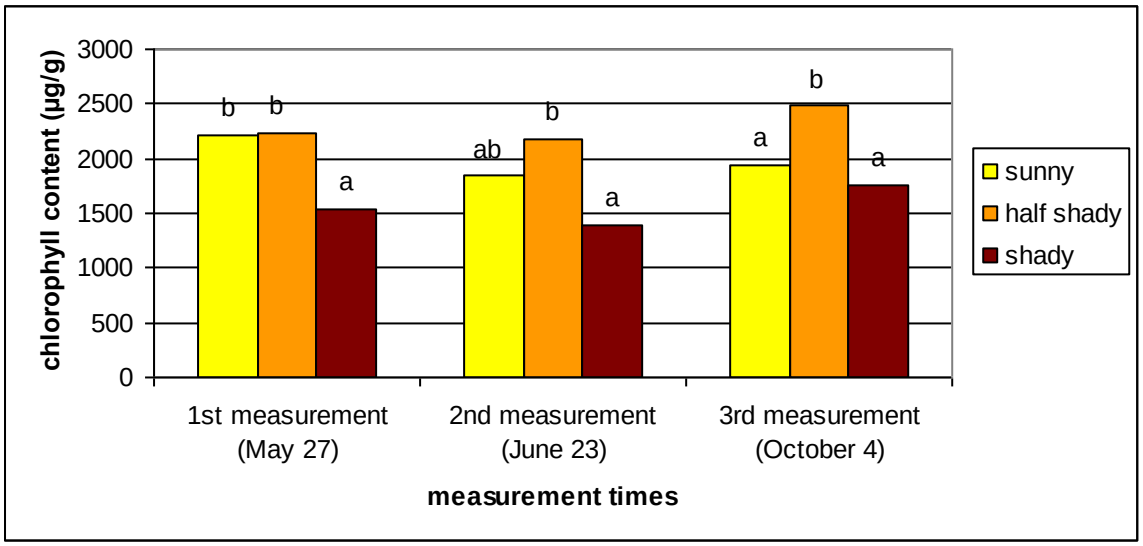

Figure 3. The change of chlorophyll content in the leaves of *Telekia speciosa* (Schreb.) Baumg. depending on ecological factors in 3 different measurement times. The data are showing the chlorophyll content of µg/g in regard of fresh weight. (The different small letters at the top of the columns is showing the chlorophyll content measured in the 3 habitats, whilst the capital letter is showing the significant differences between the chlorophyll content measured in 3 different times).

3. 2. Propagation experiments

3. 2. 1. The effect of different treatments on the germination of Telekia speciosa (Schreb.) Baumg. .

In the case of the autumnal seeding the highest germination rate (85 %) was received in the case of in water pre-soaked, as well as in the 900 and 500 ppm concentrated GA_3 treatment. The GA_3 is rather expensive, its use did not show any significant difference, so in this way its application at this plant is useless. In the case of in vitro propagation a high 80 % germination could be reached. The lowest germination rate was measured in the case of dry

sowing; in that case the number of germinated seeds' rate was only 35 %. The germination has generally started up on the 4th day. (Figure 5)

In the case of the spring seeding an even higher germination rate was reached as according to the autumnal one 97,5 % of the in water pre-soaked seeds germ. The germ rate of dry, untreated seeds was higher in spring, than in autumn, but the result made it clear that to the germination of *Telekia speciosa* (*Schreb.) Baumg*. appropriate water – and vapour content is needed(Figure 4).

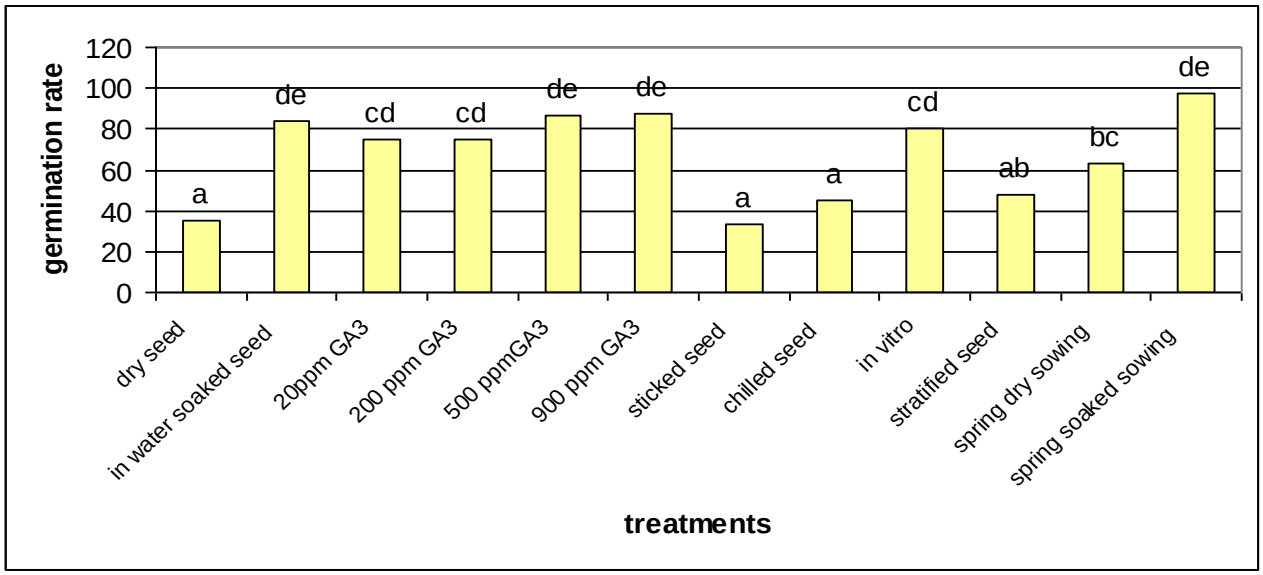

Figure 4. The germination time of *Telekia speciosa* (Schreb.) Baumg., as well as the change of germination rate on different treatments in the case of autumnal and spring sowing. (The different letters at the top of the columns is showing significant difference between the different treatments).

3. 2. 2. The effect of different mediums on the germination of Telekia speciosa (Schreb.) Baumg.

On the basis of the results of the medium studies set in the Nyíregyháza Botanical Garden the highest hatching rate (80 %) was given by the 1:1 ratio mixture of sand and peat, a significant difference but rather positive germination rate was positive germination rate was produced by the 2:1 ratio soil and compost; the 1:1 ratio soil and sand and the 1:1 ratio soil and peat mixture as well as the sowing in the propagation soil. The perlite pulled the germination back, the germination rate in this case was only 20 %.

4. 2. 3. The effect of the seeding depth on the germination of Telekia speciosa (Schreb.) Baumg.

The germination is more shallow (0 cm – 2 cm) in the case of seeding it began on the 4th day. The seeds sowed on 2,5 cm deep started the germination on the 10th day, and in that case with a rather low germination rate as well. The germination rate was the highest in the case of seeds sowed on the surface and it was constantly rising in the rating of the past days on Day 13it has reached 63,5 %. In the case of the 0,5 and 1 cm deep sowing the germination rate and percentage of the germination has almost half decreased according to the surface sowing. The seeds sowed 1 cm deeper were germinated lightly and scattered.

3. 2. 4. The possibilities of the vegetative propagation of Telekia speciosa (Schreb.) Baumg.

On 12 February, 2012; a month after the transportation of the plants into a greenhouse, and 12 days after the planting of the turion cuttings of the shot plant, 9 out of 10 shootings grew healthily and regenerated so we may determine, that the process of the combined turion cuttings can be successful. The results are rather indicative because of the small number of individuals.

The experiments of root cuttings were not successful, the root pieces put on the soil did not sprout.

3. 3. Micropropagation

During the in vitro generative seeding only the stronger (2 Hypo : 1 H_2O) sterilization solution and a relatively long, 7 minute long sterilization time brought some results. In this way of sterilization the germination rate was 80 % and the seeds were not infected.

As for the branching of in vitro generative way from the propagated plants from the 3 applied mediums (MS, M 1, M 2) only the M2 brought some result.

In the phase of propagating the BA 5.0 μM concentrated treatment proved to be the most effective, in regard of the size of the shooting – multiplication, however, the leaves got clear and a slight hyper hydration could be observed at the plants. The second best result was brought by the BA 1.0 μM concentrated treatment with a 10,33 value multiplication rate and a relatively short 24 mm shooting length. Hyperhydration was not observed this time.

A remarkable shooting-multiplication was observed at the BAR 5.0 μM concentrated medium, but this concentration was characterized by strong callusing, as well as pallid shaped leaves, so the usage of this method is not recommended. In the case of 5.0 μM concentrated Meta-topolin containing medium usage the multiplication rate is rather high, but at 5 % of the shootings hyper hydration and notable callusing could be observed (Table 3).

At the BAR 1.0 μM concentrated medium the root formation was 39 % and the multiplication was as well high and so the concentration has brought rather positive results. Strong callusing and hyperhydration was observed in the case of 10.0 μM Meta-topolin usage. The number of new shootings was 8,5 per explants. At the 1.0 μM Meta-topolin treatment the callusing is already weaker, the root formation was 35 %, and the multiplication rate was 8,19 (Table 3).

The longest shooting was measured at the 2-iP 1.0 μM concentrated treatment (58,97 mm), with slight callusing and nice, big and dark green leaves. The 100% root formation could be mentioned as an advantage of the 2-iP , that means that during the technique the phases of shooting growth and root formation can be united and be done in one step. Those plants, that were grown on 2-iP content medium are in general strong, are confirmed to ex vitro circumstances well and could be acclimated (Table 3).

44,78 mm long shoots were measured on zeatin 1.0 μM medium with 100 % root formation. The kinetin resulted in slight shooting-multiplication and average shooting length, so the use of the much more effective cytokinin is recommended (Table 3).

Based on our research the 1.0 μM concentrated treatment of BA is the most suitable for the propagation of the plant, because besides the high number of shootings, 63 % root formation was perceived as well as the leaves were big, healthy and medium green (Table 3).

As the longest shooting with 100% root formation was measured at the 1.0 μM concentrated 2-iP treatment, it is expedient to register this treatment before planting outside and acclimatization.

As a result of acclimatization at the first staff 18 out of 20 plants were viable so it was 90 % at the second the rate of viable individuals was 85 %. I have not made any further examination with the outside planted staff.

Table 3. The effect of different cytokinins on shooting-multiplication, on the length of shootings, on root formation and on hyper hydration (the different small letters in the lines and the capital letters in the columns are showing the significant differences between the treatments (P <0, 05)).

Examined parameter		1 µM	5 µM	10 µM
Multiplication rate	BA	10. 33bC	13. 17cD	7. 57aD
	TOP	8. 19aB	9. 63aC	8. 50aD
	KIN	2, 48aA	4, 99bB	4, 93bC
	BAR	8, 93abB	10, 09bC	8, 17aD
	2-iP	1, 31aA	2, 07bA	1, 91bA
	ZEA	2, 19aA	3, 32bA	3, 48bB
Length of new shoots (mm)	BA	24, 00cAB	17, 74bB	15, 12aB
	TOP	24, 21cAB	21, 68bC	18, 66aC
	KIN	25, 12cB	21, 86bC	20, 33aD
	BAR	22, 32cA	15, 62bA	13, 26aA
	2-iP	58, 97bD	33, 39aE	35, 10aF
	ZEA	44, 78bC	29, 52aD	26, 28aE
Formation of roots	BA	63 %	-	-
	TOP	35 %	-	-
	KIN	100 %	100 %	100 %
	BAR	39 %	-	-
	2-iP	100 %	100 %	100 %
	ZEA	100 %	100 %	100 %
Hyperhydricity	BA	-	50 %	14 %
	TOP	-	5 %	10 %
	KIN	-	-	-
	BAR	-	-	-
	2-iP	-	-	-
	ZEA	-	-	-
Size of callusing (0: none; 1: slight; 2: medium; 3: strong)	BA	1	1	2
	TOP	1	2,3	2,8
	KIN	2	2	2
	BAR	1	3	3
	2-iP	2	3	3
	ZEA	2,1	3	3

3. 4. Raising experiments

3. 4. 1. The possibility of the further growing of from seed propagated plants

During the pricking all the 170 seedlings stayed alive, then grew further undisturbed. On the basis of these it can be identified, that the plant is applicable for seedling growing and it is not sensitive for pricking.

3. 4. 2. Potting plants, the examination of their growth strength in different mediums

After pricking the staff grown in 12-pot is ‘A’, as well as it has shown significant difference growing in medium ‘A0’. The plants grown in medium ‘A’ (Jó Föld) were bigger, than the ones in medium ‘A0’ (Jó Föld: peat 1:1) grown plants but there the difference is not significant.

In the “Jó Föld” the average height of plants was 17,56 cm, the average diameter of leaves was 12,72 cm, and the average length of leaves was 10,72 cm. The same parameters were the following in the other medium: average height 17,03 cm, diameter of leaves 11,21 cm, average length 10,63 cm.

After the transplantation into the 3 l container the evolution of the plants has been followed. In case of the number of leaves and the length of the petiole no significant difference could be observed on the effect of the 3 soil types. In the case of the diameter of the leaf at all 3 treatments a distinct result was received. The biggest leaf diameter was a result of with Futor (limp lime flour, which contains at least 90 % calcium-carbonate) enriched medium (AF), the mixture of Jó Föld and peat at a 1:1 ratio (A0). At the same time it can also be observed that in the case of B0 medium the staff is the most uniformed, as the lowest dispersion of data is here. The most uneven staff was emerged in the case of the medium A0. Completing the results with our own visual observation, although the Futor rich medium are the results of the most positive; the aesthetic value of the leaves was the lowest here, they were becoming yellow-fragmented and spotted.

3. 4. 3. The possibilities of propagating Telekia speciosa (Schreb.) Baumg. in potted culture

3. 4. 3. 1. The effect of supplementary lights application on the evolution of *Telekia speciosa* (Schreb.) Baumg.

Based on our received results we may conclude that the race has a determinate vernalization cycle. The individuals of those plants in groups that were brought in the greenhouse January 15, did not sprout neither after the end of the survey, nor during the summer. In the case of in the second and third time launched plants no significant difference could be shown between the measured parameters. The degree of the growth of the plants equalized January 25 at a one and only plant. During the experiment blossoming could be observed.

At the plants grown on supplementary lights the light of plants (average: 30 cm) in all cases could be measured, however, this factor did not affect the number of leaves per plant.

4. 4. 3. 2. Investigation of the early flowering possibility of the *Telekia speciosa* (Schreb.) Baumg. as well as the effect of different fungicides on the growth of plants

<u>Measurement results of the experiment in the year 2012/1</u>

The measurements have confirmed the presumption that the used growth inhibitory and fungicides may affect the growth of the *Telekia speciosa* (Schreb.) Baumg.. The most effective procedure was the combined procedure (length of petiole: 15,63 cm, length of leaf: 10,5 cm, width of leaf 9,03 cm). Rather good results could be achieved with the use of Caramba SL (length of petiole: 19,23 cm, length of leaf: 12,31 cm, width of leaf 10,63 cm), with which we got a rather smaller length of leaf than as in the control group. However, Cycocel 720 on its own in the case of the *Telekia speciosa*(Schreb.) Baumg and in this concentration it did not cause any decrease in size (length of petiole: 20,45 cm, length of leaf: 16,26 cm, width of leaf 13,25 cm).

We were about to measure the length of the flowering stem and the number of flowers per plant according to our plans, however, only 3 plants have grown flowers, so in this dissertation it cannot be evaluated.

Measurement results of the second measurement in the year 2012

During the measurements in 2012 with the use of Alar 85 growth inhibitory agent, as well as with the raising of the dose of combined treatment a significant difference could be reached in the plant staff.

The length of the petiole has shown a difference at all 3 treatments (Alar 85: 3,82 cm, combined treatment: 8,6 cm, control: 10,86 cm), which means at the same time that the diminutive effect of both treatments were proved. In the case of the width and length of the leaf blade the use of Alar 85 meant unequivocal size decrease, which is also shown in Figure 5.

Figure 5. The diminutive effect of Alar 85 (left) and the combined treatment (middle) of *Telekia speciosa (Schreb.) Baumg*. (right: control)

3. 4. 4. The propagational possibilities of Telekia speciosa (Schreb.) Baumg. *as a cut flower*

3. 4. 4. 1. The definition of the vase sustainability of *Telekia speciosa* (Schreb.) Baumg.

During the observation of the blooming we have determined, that the nature of blooming as for aesthetic values can be divided for 4 phases (Figure 6).

Phase 1: The flower keeps the observed aesthetic value at the moment of the cutting totally.

Phase 2: The first brownish stains appear among the dise flowers, but the aesthetics of the flower befits the requirements.

Phase 3: An intensive browning can be observed, it enters the stage of wilting, but it still can be kept in a vase.

Phase 4: The flowers are browning intensively, are drying they do not fit the requirements of the vase sustainability.

Based on our experiments it can be determined that the lifetime of the *Telekia speciosa* (Schreb.) Baumg. is 10 days. The first phase, namely keeping it in a vase lasts for 5 days. The second phase lasts from Day 6 until Day 8, whilst the third phase lasts right until Day 10. A total value decrease can be observed after Day 10, then the plant does not fit the requirements of vase sustainability any more.

Figure 6. Photodocumentary of a 12 day investigation of the sustainability of *Telekia speciosa* (Schreb.) Baumg. .

Investigating the tendency of the opening of the buds during the time of vase sustainability, we came to the following conclusions:

76 % of the buds open in the first phase. By the end of the second phase of the number of opened buds reaches 96 %. 7% of the buds unfolded not even in the later period. Based on this it can be grouped under the post unfolding cut flowers. Although, no examination was made as in regard of the picking maturity, we can draw conclusions from the survey as well.

3. 4. 4. 2. The effect of the removal of the main-and side buds of morphology of *Telekia speciosa* (Schreb.) Baumg.

The biggest flower diameter was received in the case of the notching of the main bud (8,8 cm), the second biggest diameter was a result of the removal of the side buds (8,42 cm) the smallest flowers were grown on the control staff (7,53 cm). Although the 3 results cannot be divided statistically, it is still worth mentioning that 1,27 cm difference was between the average of the staff that brought the smallest beds.

To our surprise the biggest difference did not appear in the size of the flower, but in the length of the flowering stem. By those flowers, where the last buds were excised, the length of the stem remained only 97 cm. This has significantly differed in the length of the staff from the control group (107,54 cm), as well as from the plants that have no main buds (108,52 cm).

3. 6. New scientific results

1. I have determined the light-and shadow tolerance of the plant the physical and chemical nature of the specific soil's original habitat, or in the most appropriate and optimal ecological requirements in the case of propagating the plant.

According to the results the main features of the habitat are:

- The soil does not contain any lime.
- Its pH is sour: moving between 4,76 and 5,62 pH
- Humus content (H%) in the upper part of the soil is 7,44, whilst in the lower parts 3,1
- The soil is clayey; K_A value is 52-57.

According to the results the strength of the luminance has affected the evolution of the plant in the following way:

- The plant brings the highest leaf-and shooting yield in a sunny habitat, in the case of summer drought, however, necrosis can be observed on the foliage.

- The evolution of the plant is perfect in a half shady habitat.
- In a shady habitat the number of shootings is much lower, the number of flowers and the leaf yield but the ornamental value of the plant is here as well satisfactory as in regard to a horticultural point of view. That is why it can be recommended for shady perennial bedding usage, in particular when the number of plants that can be planted in a shady area is rather few.

2. I have worked out the generative propagation of *Telekia speciosa* (Schreb.) Baumg..
   - The plan can be successfully propagated from seeds in the autumn as well as in the spring period with a rather high germination rate, although the germination rate is higher in spring.
   - The germination time is 4 days.
   - To make the germination stimulated the most successful procedure is the soaking of seeds throughout 24 hours.
   - The optimal medium of the germination might be a good quality propagation soil or sand: peat 1:1 ratio mixture. Perlite cannot be used while germinating the *Telekia speciosa* (Schreb.) Baumg. .
   - The optimal sowing method is sowing on the surface. With the depth of the sowing the germination rate decreases dramatically.

3. I have worked out the micropropagation of *Telekia speciosa* (Schreb.) Baumg..
   - I have stated that the sterilization in a 2 Hypo: 1 H_2O sterilization solution and in the rather long, 7-minute sterilization time can successfully be done.
   - I have stated that the optimal medium in regard of the in vitro germination of the plant.
   - I have stated that the in different concentration to the medium added cytokinin has different effects on the formed new shootings, as well as on the size of the shootings, on callusing and on the health state of the leaves. According to my results:
     - the 1.0 μM of the BA is the most appropriate for the in vitro propagation of *Telekia speciosa* (Schreb.) Baumg., as the shooting-multiplication is high, the leaves are green and healthy (shooting-multiplication 10,33, shooting length 24 cm, root formation 63 %).
     - the longest shooting was the result of the 2-iP 1.0 μM treatment (shooting-multiplication 1,31, shooting length 58,97 cm, root formation 100 %).

4. I have stated that the seedling can be done successfully and without any drawbacks and I have defined the optimal growing medium of *Telekia speciosa* (Schreb.) Baumg..

- Although the biggest vegetative production was given by the soil mixture mixed with Futor, the plants were less healthy, than in the case of the 1:1 ratio mixture of application of Jó Föld and peat.
- The most balanced staff resulted by 1:1 ratio mixture of Jó Föld and coir.

5. I have stated the conditions of the early end-of-winter potted propagation. I have investigated the possibilities of making the plant more compact with the application of fungicides.

- The effect of the winter supplemental lights on the growing of the plant and on flower induction. The height of the plant has grown on the effect of the supplementary lights (27,78 cm), however, the early flower formation could be shown at only one flower.
- The criterion of the evolution of the plant is the exposure to cold in winter, so in this case the involvement into early potted culture may be started in February.
- It is developing during the growth in the greenhouse quick and strong, so the reduction of the plant must be started by the appearance of the first green leaves and it must be done rather frequently, weekly.
- With the help of the reduction procedure the plant becomes more impact, it can later be used for potted propagation.
- Alar 85 is the most effective reduction agent, which results in a significant size reduction, but the combined treatment of Caramba SL it is also effective.
- During the early potted propagation only a few plants grew flowers, so several procedures must be done to intensify the blooming (fertilization, application of blossoming, blossom intensifying agents are recommended).

6. I have stated that the *Telekia speciosa* (Schreb.) Baumg. in open-air planting can be produced as cut flower usage. I have observed the changes happening in the habitat and size of the plant as effects of the notching of buds situated differently.

- Notching the side buds caused the decrease of the flowering stem as well as the growth of the size of the plant.
- Cutting the main bud out in comparison of other cut flower cultures (rose, carnation, and chrysanthemum). it did not reach the expected results.
- The potential vase lifetime is 8-10 days.

4. CONCLUSIONS AND SUGGESTIONS

4. 1. The effect of ecological factors on the evolution of *Telekia speciosa* (Schreb.) Baumg.

- We have stated that from the original habitat of *Telekia speciosa* (*Schreb.) Baumg*. from the Hór Valley the pH value of the soil sample was sour, the humus content is much higher in the upper layer, than the soil sample taken from the lower layer, that can be caused by the litter on the surface and the decomposition process taken place in it. Both investigated soil samples belong to the category of clay; this is confirmed by the geologigal descriptions of Hór Valley.
- Relying on our results, we could state that during the habitat examination of the *Telekia speciosa* (Schreb.) Baumg. the highest leaf yield, the number of flowers, the number of shootings per plant, as well as the biggest flower diameter was caused by the staff grown in a sunny habitat. But as we have discovered necrotic spots on the sunny plants from June on their healthy condition was weaker, thus the half shady habitat was determined an optimal one. The plants were healthy at the half shady habitat, rather similar but slightly low level yields characterized them than the plants in the sunny habitat. In the case of perennial bed usage the herb is planted in the half shady beds. It is worth choosing a bed, where the plant can enjoy full sunlight during the day, but the summer afternoon sunshine reaches it only scattered. In the case of perennial production the sunny lay can be used, with watering and with covering.
- In the case of plants planted in places where the lights are different, the chlorophyll content was examined. The highest chlorophyll content was measured in the half shady habitat; these results have significantly differed from the data of the other 2 habitats. In the other 2 places the chlorophyll content is not divided, it is less than the data measured in the half shady habitat, but based on all the data we made the consequence that as an effect of the sunlight or in its absence occurring chlorophyll-defect it does not stay alive in neither of the habitats.
- The *Telekia speciosa* (Schreb.) Baumg. is evolving satisfactory in all 3 places. The best results were measured at plants living in the half shady habitats, in the case of cut flower usage, however, the bed is recommended to be put in a sunny habitat. It is important that the aesthetic value of the plants living in shady habitats is the lowest; its usage is rather recommended. The reason for this is that there are rather a few

blooming flowers in the summer, that would even bear a shady habitat. The plants living in a sunny habitat have rather remarkable species and breed varieties, there are a plenty of half-shade bearing plants that we know about and that we use, the least choice can be found from shady perennials.

4. 2. Propagation experiments

- It can certainly be proved, that the soaking before sowing intensifies the germination remarkably. The germination rate as an effect of treatments is almost twice as much. The GA_3 solution soaking in the case of *Telekia speciosa* (Schreb.) Baumg. did not bring any significant difference according to the clear tap water soaking, that is why its usage is not recommended. We have stated that the germination time is short, 4 days in general; this can be lengthened by drawback factors, just like the low temperature, the wound of the seed, its pricking or the previous stratification.
- Based on our results the optimal propagation medium is the 1:1 ratio mixture of peat and sand, but good quality, in factories mixed propagation-and seed soil can also provide an appropriate medium for the germination of the plant, for the optimal evolution of seedlings
- We may state that the optimal sowing method in the case of *Telekia* is the surface sowing; the bigger covering soil layer draws the germination back. Against the dehydration of the seeds we may use slight plant coverage or even we may do the sowing under a foil or plastic covered coverage, in this way the dehydration of the propagation medium and the seed may be prevented.

4. 3. Micropropagation

The germination of the *Telekia speciosa* (Schreb.) Baumg. seed starts only on the M2 (MS + 5 mg/l KNO_3, 500 mg/l casein, 1 mg/l BA, 1 mg/l NES, 30 g/l saccharose) medium, so the only applicable procedure is the initiation of the in vitro culture seed. This medium does not contain any inositol.

The *Telekia speciosa* (Schreb.) Baumg. can successfully be drown into culture. The technology makes it possible to do a quick propagation. The phases of the shooting-multiplication and the root formation may be done in one step. But it is worth stating the production aims before the production itself. In the case when we do the propagation for conservational reasons, it is worth pursuing the preservation of genetical variability. In this case it is expedient to start the staff off with a seed; the medium quality shooting-

multiplication is enough, beside the formation of healthy big sized leaves, along with root formation if possible, which staff is appropriate for the optimal acclimatization of the plant. The above defined criteria according to our experiments may equal a 2-iP 1.0 μM concentrated treatment, as we got the longest shooting in this case (58,97 mm), with a slight callus formation and nice, big and dark green leaves. The 100% in vitro root formation can be mentioned as an advantage of the procedure, which means that in the procedure the phases of shooting growth and root formation can be done in one step. The plants were grown in 2-iP containing medium are in general strong, they accommodate ex vitro circumstances well and they can be acclimatized.

In the case if we would like to propagate the plant for horticultural reasons, the aim is rather a homogeneous staff, so it is worth choosing other techniques.

The 1.0 μM concentration in the case of a BA is recommended, as besides the 10,33 value shooting-multiplication 63% root formation was observed, as well as the leaves were big, nice, healthy and dark green.

4. 4. Raising experiments

- According to our experiments it can be claimed that the plant is appropriate for seedling and it is not sensitive against pricking, so in case of any of the usage methods the seedling can successfully be done.
- It can be stated that the *Telekia speciosa* (Schreb.) Baumg. might appear in several propagation medium. The first medium experiments after the pricking the leaf production was shown in the case of the Jó Föld propagation medium, during the later container growth the 1:1 ratio mixture of the Jó Föld and peat proved to be the most effective medium. However, it is worth thinking the usage of coir through, as the most balanced staff was made in the case of the 1:1 ratio Jó Föld and coir mixture.

  Along with the special production and application requirements this could also be a recommended procedure. In the case of the Futor containing medium a rather higher leaf production could be observed, but the value of the leaves was lost according to the herb planted in the Jó Föld, so their usage is not recommended in the rate mentioned by us.
- The Teleki flower has a determined resting period. From the later flower induction's point of view the low temperature is also very important during the resting period. We may state that the application of supplementary lights increases the vegetative production of the plant, this however, as we were investigating the instalment of

potted culture, and it was no desirable aim. In the case of other applications (flower arrangement application, medical application) it can however be imagined the usefulness of these results. The results show that the plant can successfully be produced in greenhouse circumstances in February. To the spotted application a rather more compact habitat can be realized with individual fungicides and growth regulating agents. The weekly 85 3 g/l treatment proved to be the most effective, during which application a decrease in size can be reached. The condition of the survey, production is however not closed down with this dissertation as the degree of blossoming requires the completion of further experiments. The application of supplementary lights did not mean higher flower induction, so it would be worth examining the possibilities of nutrition supply, maybe with the usage of different blossoming agents.

- The *Telekia speciosa* (Schreb.) Baumg. can be applied in the production of cut flowers. The stem of the staff growing on the open air is straight, the flowers are healthy and they meet the requirements aesthetically. The vase durability of the flowers is 10 days. The habitat and the size of the blossoms can be regulated by the removal of the buds. The removal of the side buds resulted in a more compact habitat as well as a bigger flowering nest, so the application of the plant's flower arrangement might be recommended.

5. THE LIST OF THE PUBLICATIONS IN CONNECCTION WITH THE DISSERTATION

Journal articles

IF-journal

Csabai J. –Nagy Z. –Tilly-Mándy A. (2011): In vitro shoot proliferation of Telekia speciosa (Schreb.) Baumg. induced by different cytokinins. *Acta Biologica Hungarica*, 62 (4), 453-461. IMPACT FACTOR (2011): 0, 593

NEM IF-journals

Csabai J. –Nagy Z. –Tilly-Mándy A. (2010): The impacts of different habitats on the development of *Telekia speciosa* (Schreb.) Baumg. Int. J. of Hort. Sci. 16, (5), 31-33.

Csabai J. –Lengyel A. –Koppány, N. –Tilly-Mándy, A. (2012): The effects of Caramba SL and Cycocel 460 diminutives on the species of *Telekia speciosa* (SCHREB.) BAUMG. . Horticulture.. (in press/lektorálva)

Csabai J. –Lengyel A. –Koppány, N. –Tilly-Mándy, A. (2012): The effect of the removal of main - and side buds on the evolution of *Telekia speciosa* (Schreb.) Baumg.. Horticulture. (in press/lektorálva)

Publications in conference issues

Hungarian (full paper)

Csabai, J.- Nagy, Z.- Tillyné Mándy, A. (2009): The generative propagation of Telekia speciosa (Schreb) Baumg. in regard of gene conservation, XV. *Annual Plant production Scientific Days,* (March 17, Budapest, Hungary), 66-70.

Hungarian (abstract)

Csabai, J.- Nagy, Z.- Tillyné Mándy, A. (2009): The effect of different habitats on the evolution of Telekia speciosa (SCHREB) Baumg.. *Lippay János-Ormos Imre-Vas Károly Scientific Session*, October 28-30., Budapest, Hungary. Summaries, 8-9.

Koppány N., Kohut I., Csabai J. (2011): The chlorophyll change in the leaves of Telekia speciosa (Schreb.) Baumg. ,12. Magyar Magnézium Szimpózium, 2011. április 15. Budapest, Hungarian Chemists' Association, Summaries, 29.p., ISBN 978-963-9970-10-6

International conference (full paper)

Kohut, I. –Koppány, N. –Csabai, J. –Tilly-Mándy, A. (2010): The Effect of Light Intensity of the Growth and Development of *Telekia speciosa* (Schreb.) Baumg., *Bulletin of University of Agricultural Sciences and Veterinary Medicine*, 67 (1), 364-367

Csabai, J.- Nagy, Z.- Tilly-Mándy, A. (2011): The impacts of different habitats on the development of *Telekia speciosa* (Schreb.) Baumg., *10th ALPS-ADRIA Scientific Workshop*, (March 14-19, Opatija, Croatia), 443-446.

International conference (abstract)

Csabai, J. (2008): Protected Plants in Eastern Hungary, Possibilities of their Preservation (Telekia speciosa). *Experimental Science in Pablo de Olavide University*, 12-16. November, Sevilla, Spain. Book of Abstracts, 74.

Csabai, J.- Nagy, Z.- Tilly-Mándy, A. (2011): The impacts of different habitats on the development of Telekia speciosa (Schreb.) Baumg. VII. *International Scientific Conference for Graduate and PhD Students*, 5-8 April, Lviv, Ukrajna. Book of Abstracts, 90-91.

Koppány, N.- Kohut, I.- Köbli V.-, Csabai, J.- Honfi, P.- Tilly-Mándy, A. (2011): The winter forcing of *Telekia speciosa* (Schreb.) Baumg. 19th *SYMPOSIUM of the Serbian Plant Physiology Society*, 13-15. June, Banja Vrujci, Serbia. Book of Abstracts, 42.