

DECORATION VALUE AND HERBICIDE SENSIBILITY OF SOME EPHEMERAL ANNUAL ORNAMENTAL PLANTS

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Abstract

The main reasons of archaeophytes disappearance are the changing structure of agriculture production and increasing chemicals application. In our investigation we tested the sensibility of four species with using two different modes of action herbicides. In preventive applied broadleaf herbicide (glyphosate) did not have significant effect by comparison with control. However the examined soil herbicide (pendimetalin) was lethal in 100 % in case of Adonis aestivalis, Consolida regalis and Papaver rhoeas. This effect was experienced also by preemergent and by postemergent treatment. This herbicide destroyed every plants and the rate of uncovered soil surface was about 80-90 % even if in the middle of summer. Centaurea cyanus was significant in decoration value. Well useable, but just in windless area. Consolida regalis was weak weed competitor in applied sowing density. It had high decoration value, but the flowering period was much shorter by comparison with Centaurea cyanus. The Papaver rhoeas had a medium flowering intensity, good soil covering ability and it is a strong competitor species. The Adonis aestivalis is not recommended in extensive environmental conditions because it's too small sized. The optimal date of sowing of these four species is early autumn (especially in not irrigated area).

Key words: archaeophytes, germination, ornamental value, herbicide sensibility.

INTRODUCTION

Archaeophytes (so called “old adventive” species) are those species, which can be found in flora of scanning area until the end of XV. century (until discovering America). Usually they are identified as epecophytes (their appearance is dependent on the type of cultivated plant). They usually appeared in a given area because some kind of human influence (primarily involuntarily). They are always xenophytes (alien plants), but their appearance and their spreading are largely depending on influence of humans. Because of this reason, they are not dangerous to the natural flora by comparison with the adventive neophytes weeds (THELLUNG, 1919, SCHROEDER, 1968, BALOGH, 2003, PYŠEK et al., 2004). In certain cases – because of the missing information – there can be native also (LAMBODON et al., 2008). These units of flora were „tolerated parts” of the tillage cultivation. Among archaeophytes we can find ornamental plants, medical

plants, vegetables, tinctorial plants and fodder crops. Furthermore they had an important role in biodiversity, in gene preservation, in agricultural-ecological systems (as buffer zone) and as a soil type indicator in the past. However they became insignificant drifted to periphery due to spreading of modern, mechanized cultivation together with the appearance of neophytes (PINKE-PÁL, 2005). For This reason, we examined the sensibility of archaeophytes to herbicides in our research.

MATERIALS AND METHODS

The object and the location of experiments

We investigated four species, which are available in retail sale in Hungary. These are: *Adonis aestivalis* L., *Centaurea cyanus* L., *Consolida regalis* Gray and *Papaver rhoeas* L. The experiment took place in the Corvinus University of Budapest Faculty of Horticultural Science Experimental and Research Farm, which is found next to

Budapest (in Soroksár). In the non-irrigated area only the natural precipitation was accessible to the plants.

The effect of broadleaf herbicide

The method of assessment:

The germinated seedlings were counted once a week. We studied the growing cotyledons, the leaf and the stem by comparison with the control (comparison of distortion, difference in size, growing speed). We investigated soil covering examination and degree the presence of weeds (in per cent). The evaluation was finished in the end of 2013's vegetation period, except the first batch of sowing was kept alive in 2014 as well to evaluate its ornamental value.

Sowing area: 1,5×1,5 m four times of every species (9 m²).

The soil was strongly infected by perennial weeds and uncultivated in the experimental area (convolvulus, twitch). The soil was sandy poor in humus.

The herbicide treatment was executed on September 16th in fifth percent of the whole area with glyphosate-potassium salt agent Glialka Star in 25 ml/l concentration. We used a small manual vaporization sprayer.

The effect of herbicide became visible two weeks after the treatment (leaf turned into yellow and became dry), so we rotated the soil three times with cultivator.

We marked the sowing area and did the first sowing on October 8th.

One metre wide buffer zone was left blank, to ensure, that the treated zone will be isolated from the control zone. From this buffer zone northwards the treated parcels were marked (1,5×1,5 metre territory). The parcels including the same species were linked to each other (without paths), but a 30 cm wide path were formed between different species. The division of control parcels were the same as the treated parcels. *Centaurea cyanus*, *Adonis aestivalis* and *Consolida regalis* were sowed 1-2 cm deep. 200 seeds from *Centaurea cyanus*, 100 seeds from *Consolida regalis*, 400 seeds from *Papaver rhoeas* and 175 seeds from *Adonis aestivalis* were used. To water the sowed parcels 10 litres of water was used each.

The effect of soil herbicide

The method of assessment and the sowing area were the same as in the previous examination.

The first batch of autumn sowing was kept alive in 2014 as well to evaluate its ornamental value. The other parcels (in total 16) were cleaned up and the weeds were removed on March 27th. At the same time we sowed four control and four treated parcels. The method of sowing was the same as in the previous examination.

The herbicide treatment was applied on March 31th in the same part of the area which we treated in autumn. We used Pendigran 330EC (pendimetalin) in 10 ml/l concentration. We used a small manual vaporization sprayer. We did not find any growing seedlings during the treatment, but the surface of the soil was already cracked by germinating seeds.

We sowed on April 23th for the second time, followed by the precipitation of previous day (5-10 mm). In this case we only used 5 litres water/parcels. We assessed the first sowing in this day.

Determination of the ornamental value

We used ranking once a week from May until July. The categories were:

5. Very decorative, full blooming, healthy wildflower.
4. Medium decorative, begin or finish blooming, healthy wildflower.
3. Slightly decorative, decorated only by vegetative parts or phenological state. Healthy wildflower.
2. No decoration value because of phenological state, or some kind of stress (e.g. sunshine, wind, insects, pathogen).
1. Plant could not be found, or missed from the area.

RESULTS AND DISCUSSIONS

The four examined species could be divided into two parts. The seedlings of *Papaver rhoeas* and *Centaurea cyanus* covered the parcels very well (90 %). In Figure 1 we can see that *Papaver rhoeas* and *Centaurea cyanus* plants developed rapidly in early spring, so they covered the half part

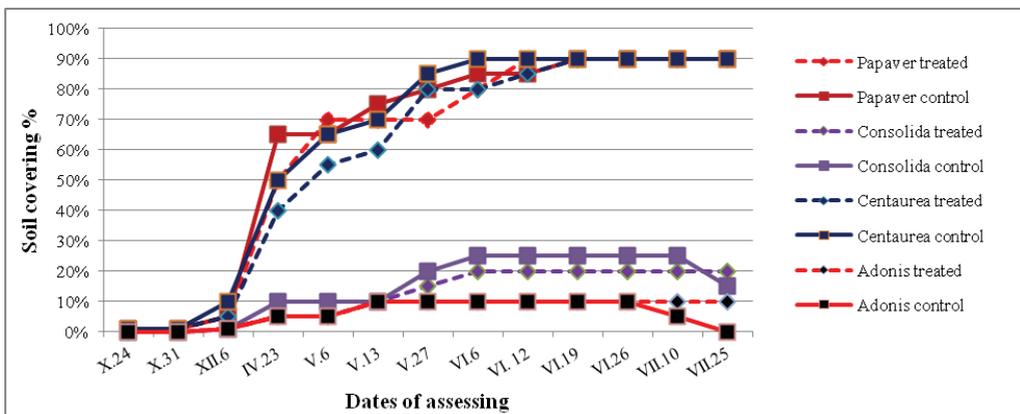
(*Centaurea cyanus*) or two thirds (*Papaver rhoeas*) of the total area, when we began the examination in the end of April. These species were strong competitors against the weeds. At the same time *Consolida regalis* and especially *Adonis aestivalis* covered the soil very poorly (25 % and 10 %), and the plants of *Adonis aestivalis* could not be seen, because of the low height of the plants (20-40 cm). In comparison with glyphosate treated and control parcels no differences could be found in the covering value (Figure 1).

The further sowings (on October 24th, and on October 31th) did not germinate well (the *Consolida regalis* and the *Adonis aestivalis* did not germinated at all, and the parcels of the other two species contained only a dozen of weak seedlings). There was not any differences between the treated and control area.

The spring sowed plants showed more differences. Only the *Centaurea cyanus* could germinate in the eight treated parcels (the soil covering reached 50 % in the pre-emergent parcel, and 15 % in the post-emergent parcels at the end of the experiment). The other three species were killed by the applied soil

herbicide. At the same time the degree of weeds presence was not higher than 10-15 % in August (so large not covered soil surface was created – 80-90% in every parcel).

On the control parcels we could generally observe that the sowings germinated better in March than in April. The *Papaver rhoeas* sowed in March was an exception, because these seeds died of the two weeks long dry period after sowing. *Centaurea* showed notable vegetative development and blooming, the flowering period started from the middle of June (end of June by seed sowed in April), but the intensity of blooming and the size of plants were more poor compared to the ones sowed in autumn. We could extend the blooming period of *Consolida regalis* with the spring sowings. The seeds sowed in March began to bloom when the plants of the autumn parcel finished flowering. Thus the decoration period can be extended with one month, but the problems of spring sowings should be taken into consideration. The March sowed *Adonis aestivalis* remained vegetative for a long time, but it was blooming the end of July.



Note: the treatment happened with Glialka Star (glyphosate) soil herbicide

Figure 1. Soil covering of autumn sowed archaeophytes in soil herbicide treatment and control, Budapest, HU, 2014

The highest decoration value was measured in *Centaurea cyanus* among the examined species (Figure 2 and 3). These plants bloomed intensively for more than two months despite the extensive environmental

conditions. Aphids attacked the plants before flowering, but the blooming intensity was not impaired. The other problem was the leaning of plants in the middle of summer. The extent of leaning was not high enough to enable a

weed infection of the parcel but the leaned plants partly covered the neighbouring species creating a disturbed looking site. The *Centaurea cyanus* was the most strongly growing plant among the examined species. We could count almost 400 flowers at the top of blooming period.

The blooming time of *Consolida regalis* continued from middle of May until first decade of June in this experiment. The number of flowers was also the highest in this period (Figure 3). This species had the highest number of flowers individually. The tallest plant (170 cm high) had 124 flowers at the top of blooming period. The blooming finished at the end of June, and from this time on the plants were not decorative anymore. The stand was very heterogeneous, we could find plants from 15 cm to 170 cm. We could not observe any biotic damage, but a teratomatic plant was developed from one seed, and this plant bloomed 2 weeks later than the others. The flower stems were strong, and the higher plants resisted the wind, but their soil covering capability was minimal.

Papaver rhoeas had moderate blooming intensity compared to the previous species. The plants flowered from the end of May to

the beginning of July continuously (Figure 2). We could observe also buds, flowers and fruit in the stand at the same time. We found sign of deer chewing the end of May; this might explain moderate blooming. We did not find other biotic damage during the experiment. The plants were of the same form (60-90 cm), covered the soil well, resistant to wind.

Adonis aestivalis was the last regarding of ornamental value. It had the shortest blooming period, the flowering time lasted from middle of May to beginning of June (but it had a second blooming time in the beginning of September). It had more flowers than the *Papaver rhoeas*, but their significance is smaller because of the short blooming period. The biggest problem was the small size (20-40 cm) because of this the *Adonis aestivalis* cannot decorate under extensive environmental conditions. We could still assess the flowering, but the fertile plants were totally disappeared between the growing neophytes. We did not observe any other biotic damage (neither the wind damage), but the soil covering ability of *Adonis aestivalis* was less than *Consolida regalis* covering (Figure 1).

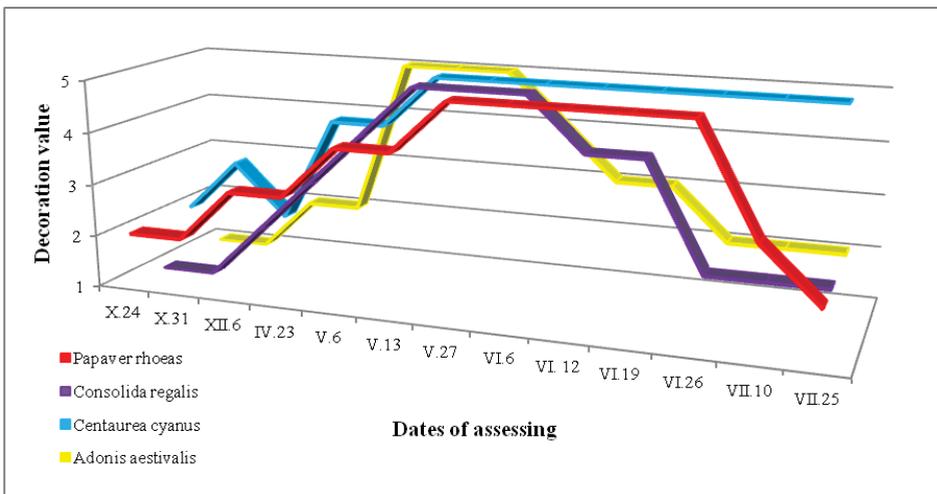


Figure 2. Ornamental value of some autumn sowed archaeophytes from October to July, Budapest, HU, 2014

(Ranking of ornamental value: 5. Very decorative, full blooming, healthy wildflower. 4. Medium decorative, begin or finish blooming, healthy wildflower. 3. Slightly decorative, decorated only by vegetative parts or phenological state. Healthy wildflower. 2. No decoration value because of phenological state, or some kind of stress (e.g. sunshine, wind, insects, pathogen). 1. Plant could not be found, or missed from the area.)

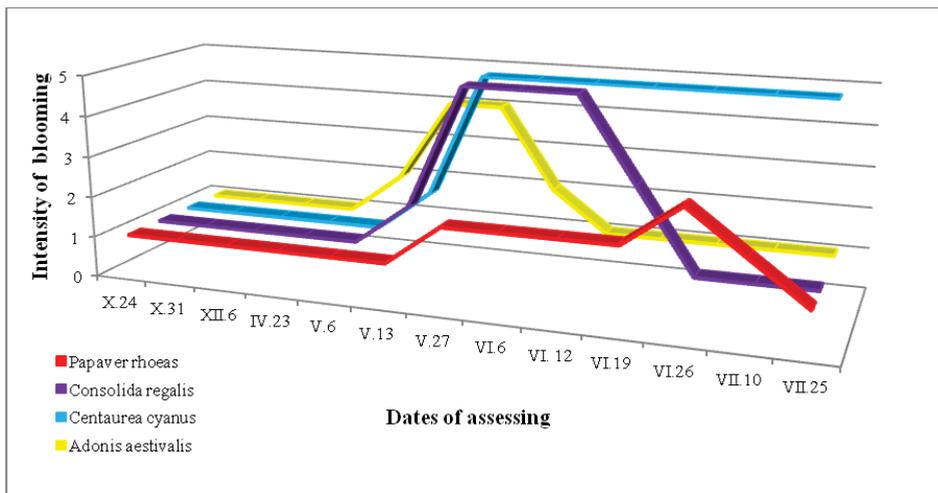


Figure 3. Blooming intensity of some autumn sowed archaeophytes, Budapest, HU, 2014

(Ranking of blooming intensity: 5. More than 50 flowers/parcel. 4. 21-50 flowers/parcel. 3. 11-20 flowers/parcel. 2. 1-10 flowers/parcel. 1. No flowers.)

CONCLUSIONS

The examined broadleaf herbicide did not have any harmful effect to the seeds of archaeophytes. It did not influence the vegetative and generative development. The tested soil herbicide caused total destruction by *Adonis aestivalis*, *Consolida regalis* and *Papaver rhoeas*, and it had partly harmful effect to *Centaurea cyanus* (lately blooming, less flower as control). Because this reason we should not recommend to use it in margins of arable land or gene conservation fields. In these locations we should use a broadleaf herbicide treatment at the end of summer. Thus we can reduce the number of thermophile neophytions and the perennial weeds, but the seeds of archaeophytes do not get damaged. After the pendimetalin treatment a large, not covered soil surface was formed on the treated parcels which is good for the mass-production tillage cultivation, but it has detrimental effect on the biodiversity.

The best sowing date of archaeophytes is early autumn (from middle of September until middle of October), especially extensive application. So the natural soil moisture

content is enough for germination and for the growing in early spring. The blooming period lasts in this case from the second half of May until the end of June. *Centaurea cyanus* was especially valuable, because the blooming time lasted until the end of July – the beginning of August in 2014. We can apply it to natural gardens or wildflower meadows. *Consolida regalis* has also significant decoration value, but this species is not as good competitor as the *Centaurea cyanus*. Their blooming time can be expanded with spring sowing, but irrigation must be provided for sufficient development. *Papaver rhoeas* has a short blooming time and strong competition ability. It can be used in extensive environmental areas. *Adonis aestivalis* is suitable to be applied as a border plant, because of its small size.

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