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T. U. Sachyuka<sup>1</sup>, V. M. Bosak<sup>2</sup><sup>1</sup>Belarusian State Agricultural Academy<sup>2</sup>Belarusian State Technological University**COMPOSITION AND REPRODUCTION OF COLLECTION FUNDS  
OF DECIDUOUS TREES AND SHRUBS OF THE BOTANICAL GARDEN OF BSAA**

Currently, the collection of deciduous trees and shrubs in the Botanical Garden of BSAA is represented by 216 species that belong to 41 tribes and 91 genera.

In researches with 25 types of decorative deciduous exotic species in the Botanical Garden of BSAA there was studied the effect of late autumn grafting on establishment and survival of its cuttings. The studies found that a survival rate of cuttings of studied deciduous exotic species was 30–90%, while using late autumn grafting.

The research findings suggest distinguishing between three types of studied deciduous exotic species according to their regenerative ability: with a high regenerative ability (at least 80% – 17 species), with an average regenerative ability (from 50 to 80% – 6 species), with a small regenerative ability (less than 50% – 2 species).

**Key words:** deciduous trees and shrubs, exotic species, late autumn grafting, regenerative ability.

**Introduction.** Deciduous trees and shrubs belong to the most common plants of the world flora [1, 3, 4, 6].

In the BSAA Botanical Garden, deciduous trees and shrubs grow both in the main exposition and in arboretum. The BSAA Botanical Garden is one of the oldest in Belarus, and dates back to 1840 [1, 3].

Arboretum was announced a botanical natural monument of republican value by the Decree No. 47 of the Ministry of Natural Resources and Environmental Protection of the Republic of Belarus on May 8, 2007. Botanical Garden was declared to be a historical and cultural value of the whole complex of BSAA; its area comprises 20 ha (8 ha of the main exposition and 12 ha of arboretum).

In today's green building decorative deciduous plants form an important additional component, the use of which significantly increases the effect of landscaping compositions. Deciduous plants enrich the air with oxygen, inhibit the strong gusts of wind, soften the climate, absorb noise coming from the streets, and clean the air from dust.

In recent years, due to the massive greening of human settlements and industrial enterprises there is a lack of planting material of decorative deciduous plants adapted to soil and climatic conditions of the Republic of Belarus. Therefore, the nursery staff great challenges to increase the assortment and volume of plants, improve the quality of planting material for landscaping and reduce its cost.

To increase the volume and improve the quality of planting material, there are various methods of mass reproduction in order to implement a broad industrial practice [2, 5].

Deciduous plants can be of both seed and vegetative reproduction, i.e. reproduction from of shoots, branches and roots. Trees and shrubs can be cloned in the following ways: by dividing the bushes, shoots from the stump, root suckers, stem and root

cuttings and cleft-graft. Seed reproduction is often difficult due to the low purity and long germination of some species, as well as the slow growth of seedlings. Decorative species with seed reproduction in most cases are not of the theme type as the mother plant, and many of these reproduced plants do not form seeds, or form unfruitful seeds therefore, in practice of gardening vegetative reproduction of valuable forms and species is widely used, because this type of cloning provides identical reproduction of the organism. In addition, there is a reduction in the period of growing of planting material, since the vegetative reproduction results in much faster growth of trees and shrubs is than the seed one.

Propagation by herbaceous cuttings is another widely used method of cloning of valuable trees and shrubs. They are put film-coated in a high humidity environment with is supported automatically. The correct harvesting cuttings and care for them is of primary importance here. Rooting of cuttings depends on species, terms, methods and propagation conditions.

Cuttings is carried out either at the beginning of spring before the growth, i.e. in the phase of bud swelling (it comes on the end of April in moderate climatic zone), or in summer (June) in the period of intensive growth.

In this case, a significant part of the cuttings take roots in the first year. In the case of later cuttings, only callus culture appears in the first year, and next year there will be the roots.

The age of grafters is very important for cuttings root forming. The younger the plant, the faster and better cuttings root. Age of cuttings is also important. Annual cuttings are worse rooted than 2- or 3-year-old ones.

The aim of the paper was to determine the influence of late autumn grafting on rooting and survival rate of cuttings of deciduous plant introductions.

The experiments were carried out in 2010–2014 in open grounds of the Botanical Garden of BSAA.

**Main part.** Collection of deciduous trees and shrubs in the botanical garden of the educational establishment “Belarusian State Agricultural Academy” as of 2014 is represented by 216 species and 315 sorts of plantations related to 41 kinds and 91 genus.

Researching late autumn grafting, there have been examined 25 types of decorative deciduous exotic species in the amount of 34,603 pieces.

During experiments there have been used late autumn grafting without stimulation of rooting. The original material for grafting was half woody and woody cuttings of deciduous shrubs. Foliage ground, peat and sand were used as substrate in the ratio of 1:1:1.

Woody and half woody cuttings of trees and shrubs were cut by means of sharp clipper into pieces with 2–5 internodes (depending on species). When of graftage the lower cut were made at an angle of about 45°. The cut at the bottom of the

graft was directly under the kidney and the upper section – up to 1.5–2.0 cm above the kidney. There have been removed one or two pairs of leaves from the lower part of the graft depending on the length and number of internodes. The top pair of leaves on the graft have been shortened by 1/3. The length of grafts obtained ranged from 10 to 25 cm.

When cloning, cuttings were planted in open ground during the period from October to December without rooting stimulants. The formation of callus in cuttings and roots came to in May – June of the following year.

To root the cuttings there have been prepared cultivation beds with water and air-permeable soil. The cuttings have been planted into grooves arranged on the seed beds at a distance 3×15 cm. Then they have been buried in the soil at 5–10 cm, having a slope. Planted cuttings have been periodically irrigated during the spring-summer period.

Research results of late autumn grafting are given in Table 1.

Table 1

Research results of late autumn grafting of deciduous species

Species	Planting date	Rooting date	Quantity of planted grafts, pcs.	Quantity of rooted grafts, pcs.	Rooting, %
<i>Ligustrum vulgare</i>	2 <sup>nd</sup> decade of October	3 <sup>rd</sup> decade of May	2,500	2,000	80
<i>Sambucus canadensis</i>	1 <sup>st</sup> decade of October	2 <sup>nd</sup> decade of June	500	400	80
<i>Sambucus nigra</i>	2 <sup>nd</sup> decade of October	1 <sup>st</sup> decade of June	1,000	800	80
<i>Vitis amurensis</i>	1 <sup>st</sup> decade of November	3 <sup>rd</sup> decade of June	380	323	85
<i>Parthenocissus</i>	1 <sup>st</sup> decade of November	1 <sup>st</sup> decade of June	1,000	850	85
<i>Hydrangea bretschneideri</i>	1 <sup>st</sup> decade of November	3 <sup>rd</sup> decade of June	430	387	90
<i>Hydrangea arborescens</i>	2 <sup>nd</sup> decade of November	3 <sup>rd</sup> decade of June	530	477	90
<i>Deutzia scabra</i>	1 <sup>st</sup> decade of November	1 <sup>st</sup> decade of June	1,600	1,440	90
<i>Cornus alba</i>	2 <sup>nd</sup> decade of October	1 <sup>st</sup> decade of July	320	262	82
<i>Cornus alba</i> var. <i>argenteomarginata</i>	1–2 <sup>nd</sup> decade of October	1 <sup>st</sup> decade of July	190	152	80
<i>Cornus sanguinea</i>	1 <sup>st</sup> decade of December	1 <sup>st</sup> decade of July	370	303	82
<i>Lonicera caprifolium</i>	1 <sup>st</sup> decade of November	3 <sup>rd</sup> decade of May	300	240	80
<i>Symphoricarpos albus</i>	3 <sup>rd</sup> decade of October	1 <sup>st</sup> decade of June	3,250	2,600	80
<i>Forsythia europaea</i>	2–3 <sup>rd</sup> decade of November	2 <sup>nd</sup> decade of June	1,750	1,555	90
<i>Phyladelphys coronarius</i>	3 <sup>rd</sup> decade of October	2 <sup>nd</sup> decade of June	2,250	1,912	85
<i>Phyladelphys coronarius</i> “nana”	1 <sup>st</sup> decade of November	3 <sup>rd</sup> decade of June	630	535	85

End of Table 1

Species	Planting date	Rooting date	Quantity of planted grafts, pcs.	Quantity of rooted grafts, pcs.	Rooting, %
<i>Barberis amurensis</i>	2 <sup>nd</sup> decade of October	2 <sup>nd</sup> decade of July	1,000	550	55
<i>Barberis vulgaris</i> var. <i>purpurea</i>	2 <sup>nd</sup> decade of October	3 <sup>rd</sup> decade of July	520	286	55
<i>Buddleja davidii</i>	1 <sup>st</sup> decade of October	3 <sup>rd</sup> decade of July	240	120	50
<i>Hypericum densiflorum</i>	1–2 <sup>nd</sup> decade of October	3 <sup>rd</sup> decade of July	1,560	1,092	70
<i>Spiraea bumalda</i>	3 <sup>rd</sup> decade of October	2 <sup>nd</sup> decade of June	2,040	1,224	80
<i>Spiraea salicifolia</i>	1 <sup>st</sup> decade of November	2 <sup>nd</sup> decade of June	1,360	816	60
<i>Spiraea japonica</i>	3 <sup>rd</sup> decade of October	2 <sup>nd</sup> decade of June	10,700	6,420	60
<i>Hydrangea macrophylla</i>	1 <sup>st</sup> decade of October	3 <sup>rd</sup> decade of July	75	22	30
<i>Actinidia kolomikta</i>	1 <sup>st</sup> decade of October	3 <sup>rd</sup> decade of July	108	32	30

The studies revealed a high rooting of cuttings in the shoot growth attenuation period (without growth regulators): 90% for *Forsythia eupopaea*, *Deutzia scabra*, *Hydrangea bretschneideri*, *Hydrangea arborescens*; 80–85% for *Ligustrum vulgare* (80%), *Sambucus canadensis* (80%), *Sambucus nigra* (80%), *Cornus alba* var. *argenteomarginata* (80%), *Lonicera caprifolium* (80%), *Symphoricarpos albus* (80%), *Spiraea bumalda* (80%), *Cornus alba* (82%), *Cornus sanguinea* (80%), *Vitis amurensis* (85%), *Parthenocissus* (85%), *Phyladelphys coronarius* (85%), *Phyladelphys coronarius* “nana” (85%).

From 55 to 70% rooting of cuttings was observed in *Barberis amurensis* (55%), *Barberis vul-*

*garis* var. *purpurea* (55%), *Buddleja davidii* (50%), *Spiraea salicifolia* (60%), *Spiraea japonica* (60%), *Hypericum densiflorum* (70%).

Low rooting of cuttings is characteristic for *Actinidia kolomikta* and *Hydrangea macrophylla* (30% rooting).

The results of the research allowed to categorize all the studied species into three groups according to the regenerative capacity (Table 2).

The first group includes plants with high regenerative capacity, the second group comprises plants with relatively high regenerative capacity, the third group includes plants having a relatively low regeneration ability.

Table 2

## Ability to regeneration of introduced deciduous species

1 <sup>st</sup> group, not less than 80%	2 <sup>nd</sup> group, from 50 to 80%	3 <sup>rd</sup> group, less than 50%
<i>Ligustrum vulgare</i> <i>Sambucus canadensis</i> <i>Sambucus nigra</i> <i>Vitis amurensis</i> <i>Parthenocissus</i> <i>Hydrangea bretschneideri</i> <i>Hydrangea arborescens</i> <i>Deutzia scabra</i> <i>Cornus alba</i> <i>Cornus alba</i> var. <i>argenteomarginata</i> <i>Cornus sanguinea</i> <i>Lonicera caprifolium</i> <i>Symphoricarpos albus</i> <i>Spiraea bumalda</i> <i>Forsythia europaea</i> <i>Phyladelphys coronarius</i> <i>Phyladelphys coronarius</i> “nana”	<i>Barberis amurensis</i> <i>Barberis vulgaris</i> var. <i>purpurea</i> <i>Hypericum densiflorum</i> <i>Buddleja davidii</i> <i>Spiraea salicifolia</i> <i>Spiraea japonica</i>	<i>Actinidia kolomikta</i> <i>Hydrangea macrophylla</i>

**Conclusion.** Investigations of 25 types of decorative deciduous exotic species in the Botanical Garden of BSAA has proved that late autumn grafting is characterized by 30–90% of grafts root-taking. The examined species can be divided

into three groups of regeneration ability: having high regenerative capacity (at least 80% – 17 species), having average regenerative capacity (from 50 to 80% – 6 species) and those having small regenerative capacity (less than 50% – 2 species).

#### References

1. Aksenova N. A., Frolova L. A. *Derev'ya i kustarniki dlya lyubitelskogo sadovodstva i ozeleneniya* [Trees and shrubs for amateur gardening and landscaping]. Moscow, MGU Publ., 1989. 160 p.
2. Borisova A. A. *Zimnyaya privivka plodovykh kultur* [Winter grafting of fruit crops]. Moscow, VSTISL Publ., 2011. 205 p.
3. Gordeeva A. P., Sachyuka T. U. *Pytevoditel po Botanicheskomu sadu BGSZA* [Guide to Botanical Garden of BSAA]. Gorki, BGSZA Publ., 2014. 32 p.
4. *Dekorativnye i lekarstvennye rasteniya (otkrytyy grunt): catalog Botanicheskogo sada BGSZA* [Ornamental and medicinal plants (outdoor): catalogue of the Botanical Garden of BSAA]. Gorki, BGSZA Publ., 2013. 308 p.
5. Ivanova Z. Ya. *Biologicheskie osnovy i priemy vegetativnogo razmnozheniya drevesnykh rasteniy steblevymi cherenkami* [Biological basis and techniques of vegetative reproduction of woody plants from stem cuttings]. Kiev, Naukova dumka Publ., 1982. 287 p.
6. Sycheva A. V. *Landshaftnaya arkhitektura* [Landscape architecture]. Minsk, Paradoks Publ., 2002. 88 p.

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