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Seed Germination and Vegetative Propagation of Promising Decorative *Lonicera tatarica* L. (Caprifoliaceae Juss.), Introduced into the Tashkent Botanical Garden (Uzbekistan)

Sobitjon S. Nosirov, Nargiza K. Rakhimova*, Asilbek Kh. Matismoilov

Laboratory Dendrology of the Tashkent Botanical Garden Named after Academician F.N. Rusanov, Institute of Botany of the Academy of Sciences, Tashkent, Uzbekistan
Email: *nargizarah1980@mail.ru

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Abstract

Seed germination (in laboratory and field conditions) and vegetative reproduction (by cuttings) of a promising decorative species—*Lonicera tatarica* L. (Caprifoliaceae Juss.) was studied for the first time in the conditions of introduction of the Tashkent Botanical Garden of Uzbekistan. Thus, the optimal temperature for germination of *L. tatarica* seeds in laboratory conditions is +20˚C + 22˚C, at which germination was 73%. The germination rate of seeds sown in autumn in the field was 62%, and the germination rate of seeds sown in spring was 71%. It was noted that in greenhouse conditions at an air temperature of 20˚C - 22˚C and a relative humidity of 49% - 53%, the rootability of cuttings was 75%. It was revealed that the studied species adapted well to the conditions of introduction. Taking into account the effectiveness of vegetative reproduction of *L. tatarica*, it can be recommended for improving the aesthetic condition and landscaping of cities, landscaping and landscape design.

Keywords

Lonicera tatarica, Introduction, Promising, Decorative, Seed Germination, Vegetative Reproduction, Cuttings, Tashkent Botanical Garden, Uzbekistan

1. Introduction

There are about 500 species of the Caprifoliaceae Vent. family in the world, belonging to 15 genera, which are leaf-shedding, evergreen, sometimes creeping, in rare cases low-lying trees or herbaceous plants. They are distributed mainly in

the Northern Hemisphere, temperate and subtropical regions. Most species of this family are extremely ornamental and medicinal forest plants. One of the large genera of the Caprifoliaceae family is *Lonicera* L. which includes about 200 species worldwide. The distribution range of this genus species is quite wide. It is distributed from the Caucasus to Siberia or Altai to the Himalayan mountains from the western regions of Japan, Korea, China. 10 species of this genus are found in the flora of Uzbekistan [1].

Berries of species *Lonicera* are useful in fresh form. In addition, fruits have a positive effect on the figure, as they are low in calories and help speed up metabolism. In folk medicine and cosmetology, not only the berries of the plant are used. Branches, leaves, and the bark of a shrub have useful properties. Species of *Lonicera* are useful for pancreatitis, gastritis, liver diseases, as it has an antioxidant effect and allows you to remove harmful substances that have a negative effect on the organ. The substances included in the fruit are involved in the work of the kidneys and urinary system [2].

2. Materials and Methods

The object of the study is *Lonicera tatarica* Thunb. (Caprifoliaceae), native to: Altay, Central European Rus, East European Russia, Kazakhstan, Kirgizstan, Krasnoyarsk, Manchuria, Mongolia, North Caucasus, South European Russia, Transcaucasus, West Siberia, Xinjiang.

Introduced into: Alaska, Alberta, Austria, Buryatiya, California, Colorado, Connecticut, Czechoslovakia, Delaware, France, Germany, Hungary, Idaho, Illinois, Indiana, Iowa, Irkutsk, Kansas, Kentucky, Krym, Maine, Manitoba, Maryland, Massachusetts, Michigan, Minnesota, Montana, Nebraska, Netherlands, New Brunswick, New Hampshire, New Jersey, New Mexico, New York, North Dakota, Nova Scotia, Ohio, Ontario, Oregon, Pennsylvania, Poland, Primorye, Québec, Romania, Saskatchewan, South Dakota, Spain, Texas, Turkmenistan, Ukraine, Utah, Uzbekistan, Vermont, Virginia, Washington, West Virginia, Wisconsin, Wyoming [3].

Lonicera tatarica—a plant of the genus *Lonicera* L. of the Caprifoliaceae family, a decorative deciduous shrub 1 - 3 m high. The shoots are hollow. The bark of young shoots is yellowish-brown, covered with small dark lentils; in old shoots, the bark is gray, peeling off in stripes. The leaves are ovate or oblong-ovate, 3 - 6 cm long, whole-edged. The flowers are paired, up to 2 cm long, with a double corolla of white or pink color, located in the axils of the leaves. *L. tatarica* blooms in May-June. The fruits are spherical, red or orange, often fused in pairs at the base, with a diameter of about 6 mm, ripen in July-August. Inedible, bitter taste [4].

L. tatarica, due to its rapid growth and unpretentiousness, is often grown as an ornamental shrub. It is especially decorative during flowering and fruiting. Berries are inedible for humans, but are actively eaten by birds. It is easily propagated by seeds and cuttings. There are several garden forms that differ in the

color of the flowers, the shape of the leaves and the compactness of the bush [5].

A good May-June honeydew. Honey is light, pollen is dirty yellow [6]. It is recommended to use when planting around apiaries to fill in the non-harvesting period coming after the flowering of the gardens. It releases a lot of nectar before the rain. One flower secretes 0.580 mg of sugar in nectar [7]. Nectar contains 40% - 50% sugars. Productivity of clean plantings is 60 kg/ha. Honey is pleasant taste and aroma [8].

Lonicera tatarica seeds were brought and sown to the Tashkent Botanical Garden Academician F.N. Rusanov in 1947. Currently, 25 - 30 summer mother bushes of this species grow in the botanical garden (**Figure 1**).

To determine the germination of seeds in laboratory conditions, seeds of the studied species growing in the Tashkent Botanical Garden were used. The study was carried out according to the methodology of M.G. Nikolaeva *et al.* [9]. To determine the germination of seeds in laboratory conditions, the germination of 50 seeds of a plant was studied on filter paper moistened with distilled water in a Petri dish when exposed to 3 different temperatures (**Figure 2**). Pay attention to the fact that seeds and energy are produced at different temperatures. Seed germination in the field was carried out according to the T.A. Rabotnov [10] method. For vegetative propagation of *L. tatarica* according to the method of Z.Ya. Ivanova [11] and H.T. Hartman & D.E. Kester [12], cuttings were harvested in early spring before the start of plant vegetation and taken from the middle part of the shoots. This, of course, is of great importance in the high percentage of rooting cuttings. The resulting branches were prepared 12 - 14 cm long, depending on the spacing of the shoots.

3. Results and Discussion

The development of plant seeds is one of the main indicators that determine the reproduction and renewal of seeds, and the viability of the species determines the quality of the species.

Figure 1. *Lonicera tatarica* in the growing conditions of the Tashkent Botanical Garden.

Seeds of the *L. tatarica* are very small, light brown in color, 0.4 - 0.3 mm long and 0.3 - 0.2 mm wide. The weight of 1000 seeds is 1.9 g (Figure 2).

To determine the germination of seeds in laboratory conditions, they were grown and examined 3 times at temperatures of +20˚C + 22˚C, +24˚C + 26˚C and +28˚C + 30˚C. The optimal temperature for seed germination in laboratory conditions was +20˚C + 22˚C, at which germination was 73%, at +24˚C + 26˚C - 66%, and at +28˚C + 30˚C - 14% (Figure 3, Table 1).

Figure 2. Seeds of *Lonicera tatarica* in the conditions of the Tashkent Botanical Garden.

Figure 3. Laboratory germination of the seeds of *Lonicera tatarica.*

Table 1. Laboratory germination and germination energy of the seeds of *Lonicera tatarica.*

Temperature, ˚C	Days							
	10	15	20	25	30	35	Seed germination, %	Germination energy, %
20˚C - 22˚C	15	38	10	6	3	1	73%	38
24˚C - 26˚C	11	28	11	9	5	2	66%	28
28˚C - 30˚C	-	-	2	6	4	2	14%	6

In the field, seed germination was determined in autumn (November) and spring (March). The seeds were planted to a depth of 0.5 - 1.0 cm in a soil mixture prepared in a ratio of 1 × 1 × 1 (one part of the soil, one part of sand, one part of vermicompost), and the seeds were mulched on top. It was noted that the germination of seeds sown in autumn was 62%, and the germination of seeds sown in spring was 71% (Table 2, Table 3).

In conclusion, it can be noted that *Lonicera tatarica* seeds are recommended to be sown in spring in open ground conditions to achieve high results.

For vegetative propagation by cuttings of *Lonicera tatarica*, a special site was prepared in the greenhouse of the Tashkent Botanical Garden (03/15/2022). Clean soil 2 - 4 cm thick was poured onto the prepared plot, and clean river sand 8 - 10 cm thick was poured over it, bringing the cuttings ready for planting. The prepared cuttings were planted in rows of 10 cm, 6 - 8 cm between the stems. In the first decade of April (06.04.2022) the formation of many callus was observed on *L. tatarica* cuttings. In the second decade of April (04/18/2022), primary roots 1 - 1.5 cm long were formed. At this time, it was noted that the buds on the ground top of the cuttings began to awaken. In the first decade of May (07.05.2022),

Table 2. Germination of *L. tatarica* seeds in the field (seeds sown in Autumn).

Sowing time (*Autumn*)	**(16.11.2021)**									
Germinated months (2022)	**March**			**April**			**May**			**Total**
Days (decade)	1 decade	2 decade	3 decade	1 decade	2 decade	3 decade	1 decade	2 decade	3 decade	92 days
Average air temperature, ˚C and humidity, %	15.9˚C 68.5%	14.7˚C 71%	21.7˚C 50%	18.2˚C 55%	18.3˚C 55%	24.9˚C 40%	26.2˚C 38%	24.7˚C 38%	30.8˚C 33.4%	21.7˚C 49.9%
Germination of seeds (100 pcs), %	6%	10%	15%	12%	4%	6%	5%	4%	–	62%

Table 3. Germination of *L. tatarica* seeds in the field (seeds sown in Spring).

Sowing time (*Spring*)	**(27.02.2022)**									
Germinated months (2022)	**March**			**April**			**May**			**Total**
Days (decade)	1 decade	2 decade	3 decade	1 decade	2 decade	3 decade	1 decade	2 decade	3 decade	92 days
Average air temperature, ˚C and humidity, %	15.9˚C 68.5%	14.7˚C 71%	21.7˚C 50%	18.2˚C 55%	18.3˚C 55%	24.9˚C 40%	26.2˚C 38%	24.7˚C 38%	30.8˚C 33.4%	21.7˚C 49.9%
Germination of seeds (100 pcs), %	4%	8%	18%	12%	10%	8%	7%	4%	–	71%

the root part of the cuttings was fully formed (Figure 4).

On the cuttings of *Lonicera tatarica*, it was noted that after the end of the growing season, two primary shoots were formed, and their length increased to 8 - 14 cm. At this time, it was observed that roots of four orders were formed in the root part, the roots of the first order reached a length of 12 - 15 cm, the second order 8 - 10 cm, the roots of the third order reached 4 - 5 cm, and the fourth order reached 1 - 3 cm. *L. tatarica* cuttings growing vegetatively on special plots in the greenhouse of the Tashkent Botanical Garden are shown in Figure 5.

In studies conducted at the Tashkent Botanical Garden it was found that during vegetative reproduction in greenhouse conditions from *Lonicera tatarica* cuttings, the rootability of their cuttings reached 75%. According to the results, it was noticed that the work on vegetative reproduction gives a good effect in the spring season, when the action of aphids on trees is carried out before its appearance. According to the results obtained, *L. tatarica* is recommended to be used in gardening from the 3rd-4th year, with vegetative reproduction in the spring.

Application of introduced representatives of *Lonicera pileata* Oliv. in landscaping of the right-bank forest-steppe of Ukraine was carried out by Varlashchenko *et al.* [13]. A taxonomic study on pollen morphology characteristics, chromosome karyotype characteristics, floral and fruit pigment compositions of 13 species and hybrids of *Lonicera* L., is given by Dalong *et al.* [14]. Bioactive

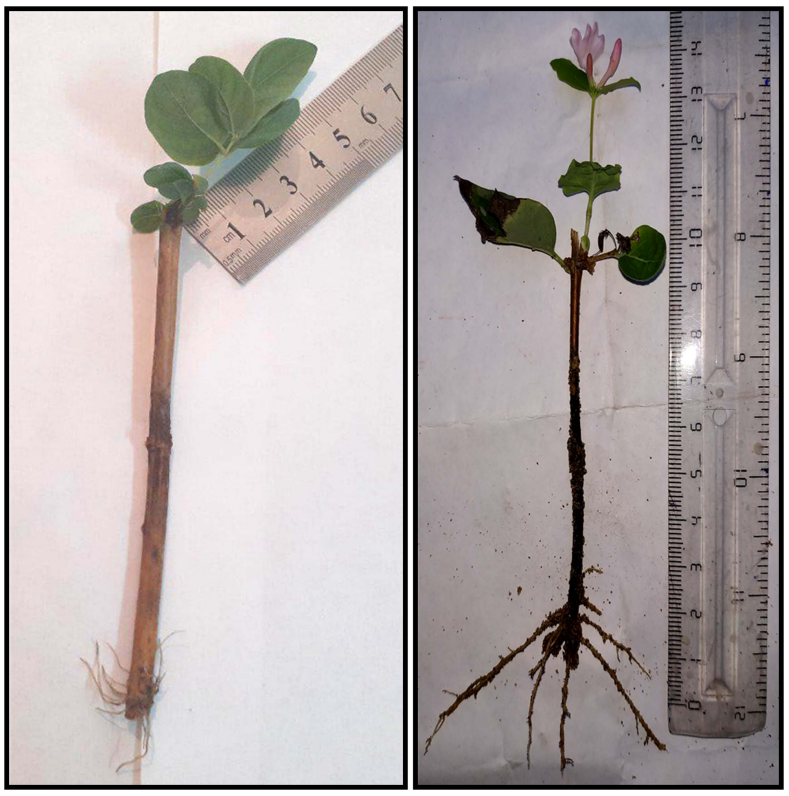

Figure 4. Growth and development of *Lonicera tatarica* cuttings in greenhouse conditions of the Tashkent Botanical Garden.

Figure 5. Vegetative reproduction of *Lonicera tatarica* by cuttings in greenhouse conditions of the Tashkent Botanical Garden.

constituents from the leaves of *Lonicera japonica* studied by Yu *et al.* [15].

Phytochemical and medicinal properties of species of the genus of *Lonicera* have been studied and are still being studied by many researchers [16]-[34]. Bubulica, M.V., Anghel, I., Grumezescu *et al.* [35] conducted studies on In vitro evaluation of bactericidal and antibiofilm activity of *Lonicera tatarica* and Viburnum opulus plant extracts on *Staphylococcus* strains. Yuan, W., Ma, Y., He, Sh. *et al.* [36] studied the characterization of the complete chloroplast genome of *Lonicera tatarica* L.

In Uzbekistan, research on the growth and development, seed germination and vegetative reproduction by cuttings of the valuable decorative plant *Lonicera tatarica*, introduced into the Tashkent Botanical Garden, is carried out by us for the first time. Similar studies have not been carried out in Uzbekistan so far.

4. Conclusion

Thus, the optimum temperature for the germination of *Lonicera tatarica* seeds in laboratory conditions is +20˚C + 22˚C, at which the germination rate was 73%. The germination rate of *L. tatarica* seeds sown in autumn in the field was 62%, and the germination rate of seeds sown in spring was 71%. It was noted that in greenhouse conditions at an air temperature of 20˚C - 22˚C and a relative hu-

midity of 49% - 53%, the rootability of cuttings was 75%. It was revealed that the studied species adapted well to the conditions of introduction. Taking into account the effectiveness of vegetative reproduction of *L. tatarica*, it can be recommended for improving the aesthetic condition and landscaping of cities, landscaping and landscape design. According to the results of the study in vegetative cultivation, *L. tatarica* is recommended to be used in landscape design from the 3rd - 4th year. In addition, this species is recommended for use in beekeeping on farms. It is also recommended as the second tier of the plant in the development of the forests in the mountainous regions of the republic.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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