

ONTOGENESIS OF THE FORMS OF *BIOTA ORIENTALIS* (*COMPACTA* AND *AUREA*) INTRODUCED IN THE CONDITIONS OF THE BOTANICAL GARDEN OF THE CITY OF TASHKENT (UZBEKISTAN)

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ABSTRACT: The ontogenesis of 2 forms of *Biota orientalis* (f. *compacta* and f. *aurea*) was studied for the first time under the introduction of the Tashkent Botanical Garden. It was revealed that the virginal period in both species during vegetative reproduction lasts 4 years. From the 5th and 6th year, the plants pass to the general period and fully retain maternal attributes and decorative features.

Keywords: Ontogenesis, *Biota orientalis* (f. *compacta* and f. *aurea*), Latent, Virginal, Generative periods, Seeds, Needles, Temperature.

INTRODUCTION

Coniferous plants occupy an important place in urban greening and are their essential attribute due to their high ornamentation and ability to heal the environment. Their role is also significant as a source of successfully introduced gene pool to provide planting material adapted to the peculiarity of the local conditions, as well as to enrich the plant resources of the region by attracting representatives of the global flora. In addition, conifers produce a powerful disinfection of the surrounding space, emitting phytoncids that disinfect the air, much more than deciduous ones: a clear evidence of this is the familiar aroma of pine forest. Without a doubt, such a "coniferous neighborhood" is very favorable for human health. Coniferous trees and shrubs, this is an interesting and very rich group of ornamental plants. Also noteworthy is the fact that coniferous plants are relatively easy to care for, and they are rarely exposed to diseases and pests [1, 2]. The study of the ontogenesis of conifers plays an important role in assessing the general patterns of plant development and their adaptability to the conditions of existence. It is known that tree ontogenesis is caused by the conditions in which the tree is formed, as well as by the features of the biology of the species, in particular, the ability to grow vegetatively. Depending on the habitat conditions, the plant can completely go through all stages of development (completed ontogenesis) or die at one of the stages (incomplete ontogenesis). The oppressed undergrowth of trees can turn into a senile state, bypassing the generative period (incomplete ontogenesis) [3].

Based on the above, it becomes necessary to study the ontogenesis of species of the genera of the Cupressaceae family, introduced into Uzbekistan (Tashkent Botanical Garden).

The study of species of the genera of the Cupressaceae family, introduced into Uzbekistan, also the study of the initial stages of their ontogenesis is very relevant for the individual development of plant species.

To date, the ontogeny of species and forms of Cupressaceae family species introduced into Uzbekistan has not been studied.

Materials and Methods

The objects of research were two forms of *Biota orientalis* (f. *compacta* and f. *aurea*) under the conditions of introduction of the Tashkent Botanical Garden.

When studying the biology of coniferous plants at the first stage, we studied seed germination at different temperatures, growth energy, seed germination in field conditions, the effect of planting time (spring, autumn), features of seed treatment using the T.I. Slavkina [4]. At the next stage, studies on the morphological and biological features of the young plant (seedling) and seedlings were carried out according to the following scheme: hypocotyl, cotyledon leaf, juvenile needles, real needles, bud, shoot, root system studied in each form in the first year of life. Starting from the second year during the growing season, the growth rates of seedlings sown by seeds were noted. The studied plants were divided into latent, virginal and generative periods.

Results and Discussion

Periods of ontogenesis *Biota orientalis* f. *compacta*

Latent period. Germination of plant seeds is one of the main indicators determining the multiplication and regeneration of seeds, decisive viability of the species and the quality of seeds. Seed germination and factors affecting it have been studied in many literatures. The seeds of *Biota compacta* are large, brown, 0.5-0.6 mm long and 0.2-0.3 mm wide. 1000 pieces seeds is 28-29 g. The optimum temperature for seeds in room conditions was 20-22 °C, while the seeds increased by 2% within 3 days, by 17% - 6 days and by 14% within 12 days by 20%. At an average temperature (25-26 °C), germination was 46%, and at a temperature of 27-28 °C, it was 7%. At the highest temperature (30-32 °C) it was 3% (Figure 1).

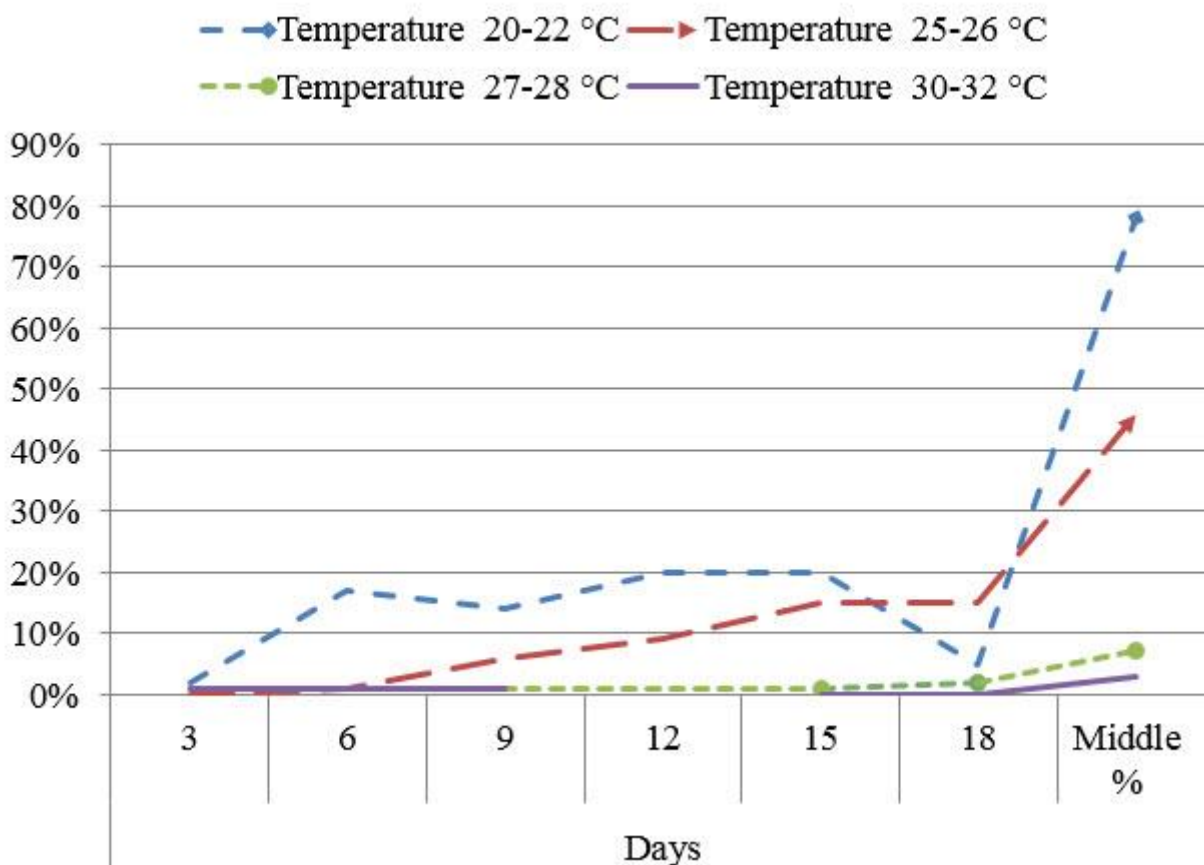


Figure 1. *Biota* seed germination on o. f. *compacta* in laboratory conditions

It is known that temperature is one of the main factors of plant seed germination. According to our observations, plant seeds grew poorly at high temperatures. At a temperature of 20-22°C, germination averaged 78%. Consequently, the seeds of *Biota compacta* grew well at low temperatures. The seeds of this plant were soaked with water.

Three days later, the seeds were opened and 0.3-0.4 mm processes appeared. It is known that water is a necessary external factor for seed germination. After five to six days, the seeds formed 2 cotyledon leaves 0.5-0.6 mm long and 0.2-0.3 mm wide, and the length of the process (hypocotyl) was 0.5-0.6 mm. Ten days later, two lanceolate leaves appeared, 1.5-2.3 cm long and 0.2-0.3 mm wide. The hypocotyl has a length of 3-4.1 cm, and its root is 0.8-1.3 cm. After fifteen days, the height of the hypocotyl was 6.2 cm, and the length of the leaf reached 3.2 cm (Figure 2).



Figure 2. Seed germination in laboratory conditions of the form *Biota orientalis f. compacta*

According to some researchers in the literature, the rate of seed swelling depends on the structure of the seed coat and the nature of the substances present in the seed composition [5].

In the period 2014–2018 in field conditions, the seed germination of *Biota compacta* was 85–90%. Seeds of plants ripen in October. Duration of rest lasts from 4.5 to 5 months. Seeds sown in November germinate from mid-March. Virginal period. This species breeds only by seed and vegetative means. To study the morphological and biological features of the seedlings, the proposed scheme was used T.I. Slavkina [4]. Below are data on the growth and development, propagated seed form *Biota compacta*:

1. Hypocotyl. Length 0.8-1 cm, brown, without hairs, root tube diameter up to 1 mm.
2. Cotyledon leaf. Located oppositely, the lanceolate form, 0.8-1.2 cm long, 0.2 to 0.3 cm wide, soft dark green. Cotyledon leaf will begin to dry at the end of September (26.09.), but they do not get enough sleep.
3. Juvenile needles. Soft, light green color, 1.6-2.2 cm long, 0.8-1 mm wide. Saved to 1-3 years. At the end of May (26.05.) the height of young plants reaches 7-9 cm, the root deepens to 15-17 cm. A large number of smaller roots are formed. The roots are branched in 3 orders of magnitude.
4. This needles. At the end of July (30.07.) The height of the plant was 10-15 cm, and from that moment on, real needles began to form. In 3-4 side shoots of a single bush, real needles are formed. During the growing season, the number of single-order lateral shoots formed by the real needles was 8-10. Their length reached 4-8 cm.
5. Start of beating. In the first year, at the end of September, a three-order branching was noted. Branch I order reached 4-8 cm, and II - 1-3 cm, and III - 0.3-0.5 cm.
6. Kidney. Plant height was 20-25 cm, by the end of the growing season, the appearance of buds was not observed. Kidneys appear from the next year with sap flow.
7. Shoot. Green, naked. The length of the main stem is 28 cm, and the lateral branches are 3-7 cm, and the juvenile buds remain on the lower part of the plant and can last up to 4 years or may fall off in subsequent years. The real needles continue to grow in the middle and upper parts of the shoot. The main stem of the plant consists of lateral shoots.
8. Root system. At the end of September (09/26/2018), the main root deepened to 20-22 cm. Numerous 2 and 3 lateral roots were also identified. The length of the roots of the 2nd order reaches 10-15 cm, and the length of the 3rd - 6-8 cm (Figure 3).



Figure 3. *Biota compacta* of the first year of the growing season (September, 2018), b - a general view of the experimental plot

The second year of the growing season began with the first decade of March. At this time, the average air temperature was 13.8 °C, relative humidity of air - 60-65%, illumination - 9000 lux. Plants start growing season from mid-April. Intensive growth occurs in May-June, reaching a height of 20-26 cm, while the average air temperature was 21-26.7 °C, relative humidity -%.

In July and August, the plant growth slowed down, and the plant height reached 34-40 cm. At this time, the air temperature was 27-28 °C, relative humidity - 49-50%, illumination - 19000-22000 lux. In biennial plants, the number of shoots is 7-9 pieces, the lower shoots are 8-9 cm, the shoots in the middle part are 12-22 cm, the length of the top shoots is 7-9 cm. There are 4-order shoots. The diameter of the root collar was 0.3-0.5 cm.

The main root deepens 24-26 cm, the second order root is 20-22 cm, the third 6-8 cm, and the fourth 2-3 cm. The taproot is well developed. The most formed roots are 3-4 ordinal roots. The condition of the plant is good, dark green.

At the end of the growing season, the average height of three-year-old seedlings of *Biota compacta* reached 40-50 cm. The diameter of the root collar is 0.5-0.8 cm. The number of side shoots is 8-10 pcs., the lower ones are 10-12 cm, the average ones are 14-24 cm. upper 10-11 cm length. Observed 4-order branching: the branches of the first and second order consists of the main trunk and branches, the 3rd and 4th - are shoots. The root length reached 26-30 cm. In 3-year-old seedlings, the root portion is 4-order. The root of the first order is 26-30 cm, the second is 22-25 cm, the third is 7-10 cm, and the fourth is 3-4 cm.

Generative period. In this form, starting from the 6th year, fewer maternal flowers and pollen were observed. Up to 10 cones form in one generative tree. In the conditions of the Tashkent Botanical Garden at the end of the growing season, the height of the five-year *Biota compacta* reached 90-110 cm.

The height of the 20-year-old *Biota compacta* in the Tashkent Botanical Garden has reached 5 m. The diameter of the main stem is 12-14 cm. The plant is a biologically solar plant that grows well in open areas. In trees growing in shady places, there was a lack of decorative features and yellowing.

It should be noted that this form is propagated by vegetative and seminal. With vegetative reproduction, the plant fully retains the signs of motherhood.

Latent period of *Biota orientalis* f. *aurea*. The seeds of *Biota aurea* are brown, 0.5-0.6 mm long and 0.2-0.3 mm wide. Average weight 1000 pcs. seeds is 23.7 g. The optimum temperature of seeds in the laboratory is 20-22 °C, at this temperature the seeds cracked within 2-3 days, and germination reached 2%. Duration of seed germination was 13 days, while up to 56% of the seeds were germinated (Figure 4).

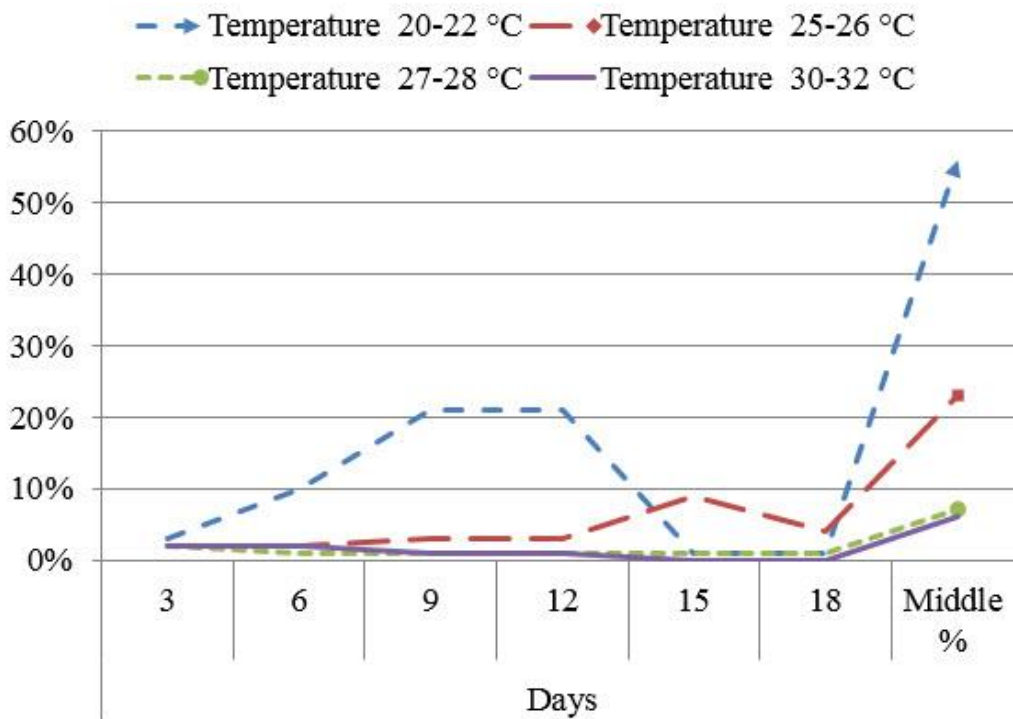


Figure 4. Seed germination of the *Biota aurea* form in the laboratory

After 15 days in the laboratory, 2 seedlings were formed. Their length is 1.5-2.5 cm, width 0.3-0.4 mm, length of the hypocotyl 3-5 cm, root 1-2.5 cm (Figure 5).



Figure 5. Germination of seeds of *Biota aurea* in the laboratory

Seed germination of *Biota aurea* in field conditions during 2017–2019 amounted to 42-48%.

Virginal period. Seeds planted in November 2017 were germinated in March 2018. The average air temperature was 13.8 °C, the highest - 19.3°C, and the lowest temperature - 8.8°C. Length of cotyledon leaves 0.6-1.0 cm, width 0.1-0.2 cm, dark green, cotyledon leaves dry and remain in the stem. In mid-May, the height of the juvenile plant was 5-6 cm, and the main root was 7-10 cm. The lateral roots were 4-order. At the end of July, the height of the plants reaches 8-10 cm, a smaller number of these needles and side shoots are formed.

The average air temperature during this period was 30.6°C, the highest - 38.4°C and the lowest - 21.1°C. At the end of the growing season, no bud formation was observed. The buds began to appear from March of the following year. Plant growth begins with the division of the needles. It was noted that in annual plants the root part became 15-18 cm deeper and formed a large number of 2nd and 3rd order roots (Figure 6).



Figure 6. The first year of the growing season of the form of *Biota aurea*, propagated by seeds.

In order to propagate vegetatively the form of *Biota aurea*, cuttings were planted in early March. Growth of cuttings was observed in May. At this time, the average air temperature was 21°C. The cuttings height reached 18-22 cm at the end of the first year of vegetation. The main root deepened to 8-13 cm and formed 3 ordinal roots. The second order root was 1–3 cm, and the third – 0.5–1.5 cm. At the end of the second year, the cuttings height reached 24–28 cm, part of the main root was 12-15 cm.

Generation period. Starting from the 6-8th period of the growing season of trees, many mother flowers and anthers appeared. Cones are formed from August and are formed from next spring. By the end of October 2018 (October), the height of the 12-14 year old *Biota aurea* reached 2.30-2.60 m. The diameter of the root collar was 6.2-6.9 cm. 35-41 pieces of perennial lateral branches are formed from the main stem, reaching a length of 36 to 170 cm. Cones began to form 50 cm above the tree. The average number of them in one tree was 645-660 pieces. The width of the bumps is 1.5-1.8 cm, length - 1.7-2.3 cm.

4. Conclusion

Thusly, it was determined that the optimum temperature in laboratory conditions of two forms is 20-22 °C. At this temperature, the germination of seeds of the *Biota compacta* form was 78%, and the seeds of the *Biota aurea* form - 56%. In both of the above-mentioned forms of eastern biota belonging to the same species, the virginal period lasted four years and passed to the generative age from the 5-6th year. When these forms reproduce in a vegetative way, they completely retain the maternal attributes with them, which are preserved and enhanced by their decorative features.

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