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TAXUS BACCATA L., IN THE NATURE AND CULTURE OF EASTERN GEORGIA

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ABSTRACT

The article discusses contemporary bio-ecological condition of *Taxus baccata* L., as one of the endangered species, in its natural spreading area in Georgia, particularly, in Batsara National Reserve and in ornamental horticulture of eastern Georgia.

We have studied the periods of bud opening, vegetation ending, starting and ending of cambium action, sprout woodening process, time and rate of growth in height, and regularities of accumulation-transformation of storage carbohydrates.

The studies revealed that the Yew growth duration is affected by the snowless winter and frequent droughts increased in the last decades, as they cause the lack of water in soils and badly affect the plant growth.

The study of sprout woodening, cambium action peculiarities and regularities of accumulation-transformation of storage carbohydrates, prove its strong ability of frost-resistance.

The study of bio-ecological peculiarities of *Taxus baccata* L. and its wide introduction in ornamental horticulture, greened areas and forest cultures will be useful for conservation of this endangered species.

Key words: yew, vegetation, cambium, height growth period, frost resistance, conservation.

Introduction

Taxus baccata L. is an evergreen coniferous, precious decorative tree-plant, that easily endures pruning. It has many decorative forms and is used in ornamental horticulture. It is often 25-33m in height and 1.5-2.5m in diameter, having pointed flat conifers 2-3.5cm in length. The conifers are alive for 4-8 years; the seeds are hard, 6-8mm in size. The trunk is round cylindrical or pyramidal, branched from the root. It grows slowly – annual growth in height is rarely more than 20cm, endures shade and dryness. *Taxus baccata* L. is characterized by long life, some of its representatives live for 2000-3000 years. Fruit-bearing starts at the age of 20-25 years (in open place) and 60-100 years (in forests) [2]. It is characterized by reddish bark, reddish-yellowish hard wood, which does not rot for long. That's why this tree is often called "nonperishable tree". Its wood is used in carpentry and furniture production. *Taxus baccata* L. has strong anti-bacterial features. The substances released into the air from the conifers of the plants eliminate the microorganisms around them. The conifers contain

essential oils. The conifers and the seeds of *Taxus baccata* L. are very poisonous, they contain alkaloids - toxin, and glycoside toxicantine. In recent years, it has been used in medicine – to cure cancer, asthma, bronchitis, rheumatism, and in cardiology, as well. *Taxus baccata* L. is a rare, endangered relict.

It is naturally spread in western Europe, northern Persia, and the Caucasus. In the mountains it elevates up to: 1100-1400 m height in the Alps; 1600 m - in the Carpathians, 1500 m – in the Caucasus, 2300-m - in Asia Minor from the sea level. In Caucasus it occurs in Georgia, Armenia and Azerbaijan. It's spread almost in all regions of Georgia. It's more widely represented in eastern Georgia[2]. The unaffected yew grove is remained in the south slopes of the Caucasus, in Batsara Valley at the sources of the Alazani River, where the preserve was founded in 1935 to protect the yew forest. The preserved area is more than 3000 hectares. Here the beech and yew groves are spread at elevations of 1000-1500 (1666) meters from the sea level [1].

The yew grove occupies the area of 800 hectares in Batsara Valley; it's the most extensive yew grove in

the world. Most of the yew trees existing here are more than 500-1000 years old. 220 000 yew trees grow on the preserved territory, 13 000 of them are 100 years older, and some of them with the height of 25-30 m and diameters of 150 m, reach 1200-1500 years. [3]

Based on its biology, yew is characterized by the very slow updating, productivity and low growth rate that causes the high level of vulnerability from all kinds of negative factors. Mainly two kinds of stem damages can be seen almost at all young plants of the 11th block of the preserve and outside of it. In the first case the wood is eaten by mammals, e.g. roe, bear. In another case it's scratched with fags or claws, in some cases the scratch diameter is 9 mm.[1]

The dendroflora of yew in Batsara Valley includes 60 Species. of *Taxus baccata* L. Along with yew, Maple (*Acer campestre* L.), Ash (*Fraxinus excelsior* L.), Linden (*Tilia Caucasica* Rupr.), Chestnut (*Castanea sativa* Mill.), Cherry-laurel (*Laurocerasus officinalis* Rome.) and other species, included in the

“Red Book of Georgia”, also exist there. All of them give Batsara Preserve the worldwide significance[1].

Besides Batsara Reserve, *Taxus baccata* L. is frequently found in gardens, parks and greenery of the city (in Tbilisi, Telavi, Tsinandali, Lagodekhi, Kvareli), in the form of separate trees or groups. Here they are characterized by a good growth-development in open as well as in shady places, like in Tbilisi Botanical Garden (where it was introduced in 1950s.), here the height of these trees aged about 150 years reach 16-18m. Well-developed trees of this size are also in the city greenery, where they maintain good growth-development and endure droughts well.

Approximately 30 yew trees grow in Tsinandali Park [picture№1]. One of them, standing at the entrance of the park, reaches 7 meters and has a strong trunk. The lower branches lay on the ground. Some of them have roots. One plant occupies approximately 10 m² space. Here also are trees of 12 m in height and 38 cm in diameter.



Figure 1. *Taxus baccata* in Tsinandali Park



Figure 2. *Taxus baccata* L. in the center of Telavi

Sources and methods

The aim of our research was the study of bio-ecology of *Taxus baccata* L., spread in eastern Georgia that seems to be very important as its bio-ecology has not been studied yet more or less, in spite of being endangered species. Tsinandali Park and *Taxus baccata* L., trees grown in greenery of Telavi center have been chosen as test objects for the study of mentioned issue. [picture.№2].

The penology and penometry has been conducted on the selected plants systematically/ once or twice in the decade. Selected copies have been monitored systematically since 2007. We have observed the periods of bud opening, vegetation ending, starting and finishing of cambium action, sprout woodening process, the time and rate of the height growth.

Besides the apical growth, the cambial growth of the lateral branches has also been studied[4,5,6]. We have also studied the peculiarities of accumulation and transformation of storage carbohydrates in the lateral branches with regard to annual development rhythm and overcoming winter frosts [7].

Conclusions

The study revealed:

The yew specimens existing in the selected area (Telavi, Tsinandali Park) start vegetation at the end of March and in the beginning on April. Apical growth of sprouts ends in August-September.

The bud opening and the beginning of sprout growth generally is not depended on the changes of air temperature. As usually, the yew pollens at first, and then the sprout growth start. The growth of yew sprout is rapid in the beginning of vegetation, and then stunts. The height growth lasts approximately for 80-90 days.

The cambium activity in the sprouts begins in 4-8 days after the bud opening. For example, in 2008 the buds opened on April 23th, the needle leaves completely appeared on May 1th, cambium activity started on April 26th. In 2010 the buds opened on April 26th, the needle leaves completely appeared on May 4th, cambium activity started on April 30th. The beginning of cambium action is the earliest marked at the light side of the plant.

Formation of the wood cells lasts 125-145 days in the lateral twigs, and 145-165 days – in the stem. The studies of sprout woodening conducted over the years revealed that the sprout woodening starts instantly after the xylem cells formation, or a bit later, and lasts for a quite long period.

Taxus baccata L. trees selected in Tsinandali park and Telavi greenery were characterized by long-term growth in 2007-2011 years. After that, from 2014 to 2019, duration of *Taxus baccata* L. growth has decreased. We do not consider this fact to be connected to its age, since these trees, taking into account life expectancy of *Taxus baccata* L., are not that old (not more than 400 years). It is supposed that the growth duration of *Taxus baccata* L., is affected by frequent drought and snowless winters in Kakheti in recent years, as they cause water shortage in soil and have a bad effect on vegetation growth. Consequently, we assume, that for further development of *Taxus baccata* L., existing in Tsinandali Park and Telavi greenery,

their intensive irrigation is desirable from the beginning of April. Therefore, it is preferable to choose humid soils for planting plantations of *Taxus baccata* L.

Seeds ripen the same year and are spread by birds. Degree of seed fullness is 23-40%. Accumulation and transformation of carbohydrates in the branches of *Taxus baccata* L. is equal to the cold zone plants. Starch hydrolysis is connected with seasonal development of the plant. Its content in the branches is the maximum by the beginning of vegetation in spring; the amount is decreased in summer, increased in autumn and still decreased in winter. As a result of temperature falling the sugar and fat content is increased. Fat content reaches 3-4 points in December-February and in summer it's presented by a pretty small amount or in the form of track. In the studied plant branches regularity of accumulation and transformation of carbohydrates is correlated with annual development rhythm. The maximum starch content was revealed in September-October and at the beginning of vegetation in April-May.

The study of regularities of accumulation-transformation of stored carbohydrates, sprout woodening and cambium action peculiarities of *Taxus baccata* L., proves its strong frost-resistance ability.

Nowadays, *Taxus baccata* L., in on the path to extinction that is caused by its slow growth and weak renewal on the one hand, and by its great demand, on the other hand. Due to its resistant and strong wood and increased demand for its 1-2 year old sprouts used in pharmaceutical industry, exploitation of *Taxus baccata* L., has been expanded. Natural renewal of *Taxus baccata* L., is happening weakly almost everywhere, but in gardens, parks and open places good growth-development is characteristic for this plant. Reproduction is possible both by seed as well as by vegetation. Stump and cut trunk provide lots of sprouts. The lower branches of the tree are easily rooted when touched to the ground. *Taxus baccata* L., is also well reproduced by 1-2 year old cuttings, layering and sleeping buds as well, which is not characteristic for many coniferous plants.

In order to widen its area, it is desirable to plant *Taxus baccata* L., plantations with seeds or rooted cuttings. To increase rooting indicator, it is preferable to use bio-stimulators cuttings will be transplanted after being placed in mixed of bio-stimulators with pure water 1-5% for 48 hours. *Taxus baccata* L., is less demanding for soil, is characterized by good growth indicator on damp and muddy humus soil. The study also revealed the this plant grows well on limed soil as well. While transplanting rooted cutting it is very important not to damage its root system. It is advisable to select moist soils and to pre-process them for plantations.

Taxus baccata L., is resistant against pests, but the pith of very old trees are damages by *Garicus geleus*, whereas *Polyporus sulphureus* settles on alive trees damaging the trees in Caucasus. Consequently, protective measures against pests should be taken in time; abnormal examinations should be conducted to reveal their outbreaks and intensity in order to define further radical measures of proper struggle.

Nowadays, small groves or single trees of *Taxus baccata* L., are still preserved or declared as natural monuments and included in “Red Book” of every region, as well as in “Red Book” of Georgia (1982), in the Red List of Georgia (2006) and Red List of IUSN. It is desirable to pay more attention to planting *Taxus baccata* L., for various purposes, like city greenery, gardens and parks, in greenery of cities generally and settlements, in the forms of single tree units or groups and in forest cultures as well. This will promote conservation of *Taxus baccata* L., as one of the endangered species.

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