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Published in the Slovak Republic  
Central European Journal of Botany  
Has been issued since 2015.  
E-ISSN 2413-757X  
2018, 4(1): 28-30

DOI: 10.13187/cejb.2018.1.28  
[www.ejournal34.com](http://www.ejournal34.com)



## Bio-Ecology of Some Coniferales Introduced in Eastern Georgia

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### Abstract

The article discusses the introduction results of two genera species of Pinaceae family, genus *Pinus* and genus *Picea*, introduced in Eastern Georgia.

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

The studies revealed that the annual development cycle of all these species includes all morphological-physiological periods: sprout growth, latent growth, organic and forced rest. They are characterized by the good growth-development; almost all of them are perspective for eastern Georgia, particularly, for all regions of inner Kakheti.

However, in recent years, massive drying up of pine forests groves takes place in eastern Georgia. That is why it is necessary to conduct the fitopatologic research, identify the pest causing the damage and plan the measures against it.

**Keywords:** *Pinus*, *Picea*, vegetation, cambium, life expanse, height growth period. accumulation-transformation of carbohydrates.

### 1. Introduction

Introduction of new plants in Georgia has a long history. About 2500 species of introduced woody plants exist here. Almost all of them belong to ecological group. We have studied the results of acclimatization-adaptation of two genera species of Pinaceae family, genus ***Pinus*** and genus ***Picea***, introduced in Eastern Georgia.

From the gymnosperm of modern flora, coniferous plants are the richest in representatives. Genus *Pinus* L. involves approximately 100 species, naturally spread in the North Hemisphere. More than 40 species are introduced in Georgia.

Genus *Picea* includes about 45 species, naturally spread in temperate and cold zones of the north Hemispheres. Only one species is spread wildly in Georgia – ***Picea orientalis* Link.**

We have studied the bio-ecology of the following species of Genus ***Pinus*** and Genus ***Picea*** spread in eastern Georgia. ***Picea abies* Karst., *Picea alba* Britt, *Picea pungens* Engelm., *Picea morinda* Link. *Pinus eldarica*, *P. Griffithii*, *P. cembra*, *P. Pallasian*, *P. pinea*, *P. sabiniana*, *P. silvestris*, *P. sosnovskyi*, *P. Strobos*.**

### 2. Materials and methods

The aim of our research was the study of bio-ecological peculiarities of the listed species of

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genus *Pinus* and *Picea* introduced in Georgia; summarizing the issues of their introduction-acclimatization. For this reason, the observation has been conducted on the selected specimens since 2000. The phenology and phenometry has been conducted on the selected plants systematically, once or twice in the decade. 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. For this purpose we took the patterns from the twigs once in every ten days from the early spring to the late autumn, then placed them in 60-70 % alcohol (Yatsenko, Chmielewski, 1954; Lobzhanidze, 1961; Tsitsvidze, 1973), and observed the dividing of the cells of secondary meristem and development of annual cycle through a microscope. Transverse veneer was taken with safranin and the process of new wood cells development was determined; we conducted the research according to the methodical instructions by Yatsenko-Khmelevski, 1954, Lobzhanidze E., 1961, and Tsitsvidze A., 1973.

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. For this purpose in the third decade of each month, the analyzing samples were taken every morning. By the influence of chemicals on the diametrical slices, we studied carbohydrate content. Starch content was determined by the Potassium iodide (starch stained in blue), sugar – by alpha-naphthol, and concentrated sulfuric acid (stained in purple), and fats with the help of Sudan III (color – orange) (Japaridze, 1953). We used a five-point system (1 – very small, 2 – small, 3 – satisfactory, 4 – much, 5 – too much).

### 3. Results

The research revealed that under the conditions of eastern Georgian, the studied species begin growth in spring, when the average daily temperature is 5-10°, and end at different times, depending of the endogenic and exogenic factors, in May-June in lateral and in June-July – in top branches.

Besides, we have noticed that on *Pinus griffithii* and *Pinus strobus*, the growth is more intensive at night, than in the day. It mostly refers to the sprout lengthening. For example, for 10 days from April 20<sup>th</sup> to April 30<sup>th</sup> the growth of *Pinus griffithii* and *Pinus strobus* during the night was 2,5 cm and during the day – 1,8cm. In addition, revealed that the sprout growth is not continuous, resting period 2-3 days, rarely – 4days, after about 8-15 days of growing.

*Pinus eldarica* is very perspective for eastern Georgian conditions, so in this region, there are more than hundred hectares of cultivated forests with *Pinus eldarica*. Almost all forms are used in greenery of parks and gardens, street plantations, road greenery, alley formation, etc. *Pinus eldarica* forms a well-developed trunk, fruit-bears abundantly, and in most cases, reproduces by self-sowing. However, in recent years, trees in groups or individually are drying. In our opinion, this may be caused by the breach of water balance in soils or humidity, and pests. Therefore, we believe that it would be reasonable to cultivate it not in pure (only *Pinus eldarica*) but in forms of mixed plantation.

Seed fullness of *Pinus cembra* is 3-5 %. Such a low quality is because the cold zone plants require long-term effect of low temperature for normal development of generative organs. That is why; lime content in soil, short days and relatively warm winter is restrictive for their growth-development here. Therefore, this species is almost useless for greenery and foresting of eastern Georgian regions (in oak belt and lower).

*Pinus pallasiana* begins the bud opening in the first decade of April. The growth duration is 60-65 days; cambium activity period – 150-160 days, seed fullness – 60-80 %. Two peaks of maximal starch content in the branches were observed in summer, and relatively lower- in August-September. Starch content decreased in January, when the air temperature equaled – 9,5°. At this time, fat content was maximal and equaled 5 points. Sugar content increased from autumn to January and in February, it decreased to 2 points from 3.

*Pinus pallasiana* is distinguished by the good growth and development in Tsinandali Park, as well as in other regions of Kakheti. Therefore, it is widely cultivated throughout Kakheti. In Telavi *Pinus pallasiana* culture is artificially cultivated on approximately 6 hectares.

At the age of 30-40 *Pinus sosnovskyi* is 15-18m in height; stem diameter is 28-30cm; fruit-bears regularly (seed fullness is 80-90 %) and reproduces by self-sowing as well.

Well-developed specimens of *Pinus pinea* exist in Tbilisi, as well as in Tsinandali Park, where two of its centenarian trees are characterized with good growth-development (diameter – 75-88 cm, height – 18-20 m). *Pinus pinea* is perspective for eastern Georgian regions and from the decorative viewpoint, great attention should be paid to its widespread planting in greenery.

At the age of 70, *Pinus sabiniana* reaches 16m in height and 50cm in diameter in Tsinandali Park. It fruit-bears abundantly and hardly ever dies from droughts. This species loves light, does not stand against darkening, slightly demanding to the soils, adapts well to grey-brown soils of neutral and weak alkaline reactions; is not damaged by the frosts.

In Tsinandali Park, 59-60 years old *Pinus silvestris* grows up to 20m and 30-32cm diameter; pollinates in late April and mid-May. In eastern Georgia, it is hardly ever cultivated. It loves light, cannot stand darkening and saline soils.

Various forest cultures of *Pinus sosnovskyi* covers several hundred hectares in eastern Georgia and has been included in the artificial forest cultivation assortment for a long time. 30-40 years old specimens, existing in Telavi, are 15-18m in height, 28-30cm in stem diameter, fruit-bear regularly (seed fullness -80-90 %) and reproduce by self-sowing as well.

*Pinus strobus* is characterized with a good growth-development in Tbilisi, Telavi, Tsinandali Park. About 90-100 years old specimen reaches 20-21m in height and 70-75 cm in width; fruit bears abundantly; seed fullness is 30-40 %; sometimes provides self-sowing as well. It begins growing in May. Growth duration is 40-45 days; duration of cambium activity – 145-150 days. It grows so well in Kakheti that may be widely cultivated in decorative gardening and forest cultures.

*Picea abies* and *P. pungens* start growing in May and last approximately 33-39 days. *Picea abies* is characterized with withered crown.

The growth of *Picea orientalis* and *P. Pungens* starts in April-May and finishes in June, or rarely in July or August and lasts for 46-70 days. They are characterized with withered crown.

The maximal amount of starch in the branches of *Picea excels* Link is in April, and the maximal amount of fats is from October to February. Sugar content increases from the end of September, perhaps due to the day shortening and the fall of temperature to 5-8°, i.e. preparation for winter is presented as a hereditary sign.

#### 4. Conclusion

The researches revealed that endogenous rhythm of the studied plants is well adapted to the climate of eastern Georgia and isn't damaged by the frost, grows well and gives the seed able to rise. All of them are very interesting plants and it's preferable to use them widely in the parks and gardens of eastern Georgia.

The regularity of accumulation-transformation of carbohydrates correlates to the annual development cycle. Maximal starch content was revealed in autumn – September-October and in spring –April-May. Starch transformation into sugar begins in autumn, before the frosts.

However, despite above mentioned, during the last 6 years reddening of needles, young sprout drying, stem damage by pests in artificial and natural groves of pine forests is observed in all regions of eastern Georgia. During the last 2 years, massive drying of pine groves takes place.

We suggest conducting fitopatologic research, identifying the pests causing the damage and planning the measures against them.

#### References

- Japaridze, 1953 – Japaridze L.I. (1953). Workshop on macroscopic plant chemistry. Moscow.
- Lobzhanidze, 1961 – Lobzhanidze E. (1961). Cambium and Formation of Annual Wood Ring. Metsniereba, Tbilisi.
- Nadiradze, 2011 – Nadiradze T. (2011). Adaptation results of introduced woody plants in Tsinandali arboretum. Biodiversity of Georgia (Proceedings of the Conference) Tbilisi, pp. 251-254.
- Nadiradze, Tsitsvidze, 1992 – Nadiradze T., Tsitsvidze (1992). Dendropark of Tsinandali. Tbilisi.
- Tsitsvidze et al., 2004 – Tsitsvidze A., Gigauri G., Gagoshidze G. (2004). Dendrology. Tbilisi.
- Tsitsvidze, 1973 – Tsitsvidze A. (1973). The Peculiarities of growth and development of coniferous plants in Adjara. Tbilisi.
- Yatsenko, Chmielewski, 1954 – Yatsenko, L. Chmielewski (1954). Fundamentals and Methods of anatomical studies of wood. Moscow-Leningrad.