SOI: 1.1/TAS DOI: 10.15863/TAS

International Scientific Journal
Theoretical & Applied Science

p-ISSN: 2308-4944 (print) e-ISSN: 2409-0085 (online)

Year: 2022 Issue: 12 Volume: 116

Published: 22.12.2022 http://T-Science.org

Issue Article

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THE USE OF EXTRA RAYS OF ULTRAVIOLET EXCILAMPS IN SYMBIOSIS BY ENRICHING THE SOIL WITH HUMIC FERTILIZERS TO SOLVE PROBLEMS WITH INFERTILE SOIL IN ORDER TO ACCELERATE THE FORTIFICATION OF FORESTS FROM SEEDLINGS TO LARGE INDIVIDUALS OF CONIFEROUS AND DECIDUOUS TREES: ALFA PROTOCOL

Abstract: *Forests in our country have always belonged to the state. With the advent of the market, the situation has not changed, however, private companies began to engage in the use of forest resources (as a rule, uncontrollably). This led to the fact that the forest was only cut down, and its restoration was almost forgotten. It was only in 2007 that the new Forest Code came into force, which regulates many issues related to the country's transition to a market economy. Separate articles of the document relate to the reproduction, restoration and cultivation of forests, measures are provided to ensure this. However, to grow new arrays of green spaces on the site of the cut-down areas, even under the condition of strict compliance with the provisions of the code, is a laborious task, stretched for many years. The developments of scientists of the Pushchino branch of the Institute of Bioorganic Chemistry of the Russian Academy of Sciences named after M.M.Shemyakin and Yu.A.Ovchinnikov will help solve it well and quickly, if, of course, their achievements are used in time and competently.*

Key words: *forest, ecosustem, gumin, exilamp, green technologies, HPV/HIV co-infection, Public health concern, meta-synthesis, Mapping analysis, Africa, Research advancement.*

Language: *English*

Citation: Shalkharov, Y., & Nalibaev, S. (2022). The use of extra rays of ultraviolet excilamps in symbiosis by enriching the soil with humic fertilizers to solve problems with infertile soil in order to accelerate the fortification of forests from seedlings to large individuals of coniferous and deciduous trees: alfa protocol. *ISJ Theoretical & Applied Science, 12 (116)*, 705-713.

Soi: http://s-o-i.org/1.1/TAS-12-116-59 ***Doi***: crossref https://dx.doi.org/10.15863/TAS.2022.12.116.59

Scopus ASCC: *1100.*

Introduction

The scientific direction, which is being developed by the staff of the forest technologies group of the Institute, allows you to create high-quality planting material, not only ordinary trees, shrubs, but also plants with certain, sometimes unusual, properties. The head of the group, Candidate of Biological Sciences Konstantin SHESTIBRATOV, answers the questions of the correspondent of "Search".

– Konstantin Alexandrovich, in the opinion of many, the use of wood is mainly associated with the production of paper. The question may arise: is it so necessary in the era of the Internet and the rapid development of digital technologies? This means that the need for wood will not be so great.

– It's too early to draw such conclusions. Recently, the volume of wood use has only been increasing. And the paper produced from cellulose is still needed, even in larger volumes than before. Wood raw materials are also used for the manufacture of plastic, filters, composite and nanomaterials. New areas of its application are emerging. In particular, bioenergy is gaining momentum, it uses liquid and gaseous fuels, including motor fuels, which are obtained from plant matter.

Picture 1.

Therefore, forests are being cut down at a high rate, and there is almost no reproduction. In the old Soviet system, when there was a planned economy, the restoration of green areas, harvesting and processing of wood were in the hands of the state. Then the situation got complicated. Companies that are not directly interested in its restoration began to cut down the forest. The surviving forestry enterprises continue to produce planting material, but its selling price is a penny. For example, a pine seedling costs only two rubles, which is several times lower than the cost price. This situation is explained by the fact that the old regulations are still in force in the industry.

It is clear that the rules of the game need to be radically changed. This is what the new Forest Code is designed to do. However, it will take a long time, perhaps more than a dozen years, until it will work in full force.

– Apparently, the experience of other countries was also taken into account when preparing the code. How are things there?

– Wood is in demand everywhere, and serious attention is paid to the restoration of forests abroad. If we take the Scandinavian countries that are similar to Russia in terms of climatic conditions, for example Finland, then there the profit from forestry is about 20% of the gross income of the whole country. Many houses are heated by wood using modern technologies. In highly efficient installations (these are not Russian furnaces, in which 50% of the heat goes to the sky), wood chips and pellets are used – pellets from pressed sawdust, branches, leaves – everything that goes to waste during harvesting and processing of forest materials. They burn well, emit a lot of energy.

– How long does it take to restore the cut down forest?

– A lot depends on how to approach it. You can wait 200 years until the plantings accumulate the necessary mass of wood. And you can achieve this in 30 years. To achieve a quick result, we need good agricultural equipment, a breeding base, a competent system of planting and subsequent care for them. Each country has its own peculiarities. The practice cannot be transferred to Russia, for example, from Brazil, where the maximum forest growth is. Even the experience of Finland cannot be used directly, adaptation to our conditions is required. We cannot do without our own scientific base. The Academy of Sciences, in particular our institute, is able to provide great help. We have a methodological base, starting from which it is possible to develop new directions.

– Tell us about your group, about the research you are conducting.

Picture 2.

– Our group is young, organized in 2006. We started with three people: there were two other students besides me. Today there are 23 people in the team. Areas of activity – transgenosis and microcloning of plants. On the basis of the group, an innovative enterprise “Microclone” was created in 2009, from which we practically have no income, but it allows us to work out new technologies. The range of research is constantly expanding. Not so long ago, an open area appeared on the territory of our institute, where we test transgenic plants. Unfortunately, we are still engaged in such plants exclusively for science, since it is still forbidden to grow them in Russia, although it is possible to consume them. Of the transgenic ones, we grow only two breeds: aspen and birch. We are working on the quality and volume of wood, as well as resistance to herbicides.

We have achieved the most significant results in such an area as clonal micropropagation. It implies the cultivation of plant material on artificial media. We reconstruct different growth conditions, taking into account physiological and biochemical aspects, which allows us to get a full-fledged organism from cells. To do this, a meristem is used – an actively growing tissue that is contained in the kidneys, sinuses of plants, at the tips of the roots. The meristem can be called the progenitor of all tissues. By cultivating it, we manage to preserve all the original properties. Although it is not an easy task to make cells, tissue multiply, grow without loss of morphogenic potential, that is, the ability to get a mature plant. Simply making the cell grow without preserving its properties and type is not a problem, it can be done with high doses of growth regulators. But it will be an amorphous, “callus" tissue. It is necessary to experimentally select the procedure of actions, evaluate the biochemical composition of tissues and, based on these data, calculate the necessary conditions for the development of plants. First, there is a long-term work on the selection of a nutrient medium. There is a classic composition used for tobacco. But we work mainly with wood species. These are much more complex, unpredictable objects. In addition, since the development of the plant goes in phases, it is necessary to alternate environments. First, a kidney is laid, from which a shoot is formed. Then stems with leaves are grown. After cutting the cuttings, we proceed to the final stage – the formation of the root. Phytohormones cytokinins and a large amount of sugars, mineral components are needed for kidney laying. Rooting requires auxin growth regulators and a carbohydrate-poor nutrient medium. And for the intermediate stage (stem elongation), phytohormones are usually not needed.

Our goal is to have meristemic tissue, to obtain clone progeny, for example, several thousand plants, which in the future, while maintaining their properties, will be able to adapt and grow in natural conditions.

– So, you "breed" plants on a completely different principle, not the way they reproduce in nature, when both stems and roots grow from the seed at the same time.

– In natural conditions, the growth process, of course, occurs differently. The plant develops according to a pre-programmed program. The influx of nutrients for the development of stems is provided by the root system. We have everything we need in the environment. Photosynthesis also does not occur under artificial conditions, or, as we say, in vitro. Chlorophyll, which makes plants green, is synthesized, but does not perform its function. The source of energy and carbohydrates is sucrose. And the root system does not fully perform its nutritional functions. It is necessary in order for the plant to take root easier in natural conditions. Then, based on these primary roots, the real ones will grow.

Picture 3.

– How much time passes from the start of work to the stage when the plant can be planted in the soil?

– It depends on the culture. Trees can take three years. The most difficult part of our work is getting a clean culture. In natural conditions, bacteria, viruses, fungi live on trees, a large bouquet of microflora, which is dangerous in artificial conditions. In a sucrose-rich environment, microbes multiply rapidly, killing plants. Therefore, we need to get sterile tissue. To do this, we take a meristem from the kidney that does not contain pathogens. We sterilize the surface with chlorine-containing and other substances, with the help of sterile instruments in especially clean conditions we transfer it to a nutrient medium.

– How do you choose "donors" to receive meristemic tissue?

The relevance of the topic. Currently, along with traditional methods of reproduction of valuable forms and varieties of forest woody plants, the method of culture of isolated organs and tissues (clonal micro-propagation of plants) is used. This problem is even more urgent in the years of accelerated reforestation of mountain forests with deciduous tree species. The advantages of this method include: the speed of production, the exclusion of viral diseases, the need for a small number of initial explants and limited space, the possibility of year-round production of planting material, its long-term preservation with minimal volumes of cold storage, the production of a large amount of planting material per year.

The need for mass reproduction of genetically improved forms of woody plants with the help of tissue culture to improve the qualitative composition of forest plantations by obtaining clone plants resistant to diseases and pests, stress and man-made factors can accelerate the reproduction of forest resources, will allow obtaining genetically improved material much earlier than under normal conditions.

In recent years, plantation crops of birch, alder, poplar with a short rotation period for the production of small-scale wood for pressing purposes, the production of construction parts and pulp have become particularly important.

The relevance of the research topic is currently increasing, due to the need to use selectively improved forms of birch, alder and poplar for plantation afforestation.

The dissertation was completed in accordance with grant No. 14213 Participant of the youth research competition, topic No. 16 "Development of biotechnology in vitro for growing planting material and creating plantation crops of fast-growing tree species in the conditions of the Central Forest", as well as in accordance with the direction of fundamental research works of the Voronezh State Forestry Academy - included in the project'5.4108.2011 "Forestry and ecological foundations of accelerated reforestation of mountain forests" of the Ministry of Education and cience of the Russian Federation.

The aim of the work was to study and analyze the growth and stability of crops of fast-growing tree species using microclonal reproduction. Development of recommendations for the creation of plantation crops of birch, alder and poplar; the use of in vitro biotechnology for the creation of clone seed plantations.

To achieve this goal , it is necessary to solve the following tasks:

1. Select valuable biotypes in stands and crops for cloning.

2. To identify the condition and productivity of plantation crops of birch, alder and gray poplar, created by traditional technologies and regenerants in vitro.

3. To study the qualitative characteristics of the wood libriform of regenerants, seedlings and cuttings of seedlings of the studied species.

4. To give a comparative economic assessment of plantation forest crops created from in vitro regenerants and seedlings.

To study the use of biotechnology in vitro in the creation of clonal forest-seed plantations of alder, birch.

6. Develop recommendations for the creation of plantation crops of birch, alder and poplar using in vitro biotechnology.

The following provisions are submitted for protection:

1. Characteristics of valuable biotypes of birch, alder and poplar for obtaining planting material in vitro;

2. Condition, productivity and growth dynamics of birch, alder and poplar crops created by in vitro regenerants and seedlings;

3. Comparative characteristics of wood fiber indicators of regenerants, seedlings and cuttings;

4. The use of in vitro biotechnology in the creation of clonal alder seed plantations;

5. Economic and economic assessment of forest crops created by in vitro regenerants and seedlings.

Scientific novelty of research:

For the first time, a comprehensive study of quantitative and qualitative indicators of plantation forest crops of birch, alder and poplar in the forest-steppe of the CDR, created by in vitro regenerants, seedlings and cuttings, was carried out. A method for creating clonal forest-seed plantations using in vitro biotechnology on the example of black alder, gray and Karelian birch is proposed.

The practical significance and implementation of the results of the work consists in the development of recommendations for the use of in vitro biotechnology in plantation breeding of fast-growing tree species. Experimental cultures with in vitro regenerants were laid on the fires of the Educational and Experimental Forestry.

Approbation of the work. Research materials were presented:

- at the congress of VOGiS (Moscow, 2009);

at international meetings, conferences, symposiums (Krasnoyarsk, 2005, 2011; Voronezh, 2006, 2010, 2012; Alushta (Kiev), 2008; Petrozavodsk, 2011);

- at republican and regional conferences (Voronezh, 2005, 2007, 2010, 2011; Novocherkassk, 2010).

Personal contribution of the author. The work is the result of research conducted by the author himself with the direct participation as the responsible executor of the grant of U.M.N.I.K. and the executor of the topic of fundamental research on the reforestation of mountain forests. The dissertation uses experimental data obtained by the author at all stages of the work: the choice of direction, the development of a program and methods for conducting the entire complex of field and laboratory research, processing and analysis of the data obtained, preparation of publications.

Publications. Based on the materials of the dissertation, the author published (personally and co-authored) 17 papers with a total volume of 3.5 sq., including one article in the journal recommended by the Higher Attestation Commission

The structure and scope of the dissertation. The dissertation work consists of an introduction, 7 chapters, conclusions and recommendations and is presented on 164 pages, including 27 tables, 32 figures, appendices, a list of references of 229 titles, including 34 in foreign languages.

1. The state of knowledge of the problem

The development of plantation forestry in the Central Chernozem region of Russia using traditional technologies and biotechnologies is one of the urgent problems of the region's economy, especially with the solution of the problem of accelerated reforestation of mountain forests. The works of scientists of foresters are devoted to this problem: A.I. Pisarenko, I.M. Shutov, V.K. Popov, I.V. Sukhov, A.P. Tsarev, N.S. Rusin, A.I. Chernodubov, V.P. Besschetnova, S.S. Veretennikov, A.P. Dotsenko, V.A. Morozov, N.V. Kupriyanov, A.R. Rodina, V.A. Chevidaeva, S.A. Rodina, S.D. Smirnova, G.I. Redko, Yu.P. Efimova, E.V. Titova, A.I. Sivolapova, A.B. Zhigunova, E.M. Romanova, E.A. Kalashnikova, D.A. Shabunina, S.S. Bagaeva, A.P. Maksimenko, I.A. Markova, etc.

The use of microclonal reproduction in the forest-cultural practice of the Central Park began to be introduced from the beginning of the 90s of the XX century (G.P. Butova, T.M. Tabatskaya, O.S. Mashkina, Yu.N. Isakov, A.I. Sivolapov, T.A. Blagodarova and later V.A. Sivolapov, etc.).

2. Natural and climatic conditions and forest fund of the research area

The Voronezh Region is located in the central strip of the European part of Russia. This is the largest area of the Central Chernozem region. Its territory is 52.4 thousand km2.

The climate in the region is temperate continental with an average annual temperature from +5 ° C in the north of the region to +6.5 ° C in the south. Its main features are: a large annual temperature range, a relatively mild winter with partial thaws and snowfalls, a sunny long summer, moderate and not quite stable humidification with a predominance of summer precipitation. Long dry periods are characteristic, contributing to the formation of outbreaks of mass reproduction of various harmful insects. The continentality of the climate increases from the northwest to the southeast. At the same time, the sum of positive temperatures increases from 2700 in the north to 3200 in the south. In most of the region, the average annual precipitation is 450-550 mm, but over the years this figure can vary from 200 to 900 mm. The average annual maximum temperature is +34.5, and the minimum is 27...-31° C. In summer, dry winds are frequent, coming to us from Central Asia. On average, droughts occur twice every ten years. Recently, the climate has become more unpredictable and contrasting. More dangerous natural phenomena began to occur (abnormal droughts, frost, severe rains-severe frosts, hurricane winds, heavy heavy rains).

3. Objects and methods of research

The objects of research were experimental plantation crops of birch, alder and poplar, created under the leadership of V.K. Popov, A.I. Sivolalov, A.I. Chernodubov, T.A. Blagodarova from in vitro regenerants, seedlings and cuttings in the Educational and Experimental and Novousmansky forestry enterprises of the Voronezh region.

The methods of research were dendrometric, cytological, anatomical and histological, etc.

4. Obtaining planting material of hanging birch and Karelian, creation of plantation crops

Clonal micropropagation, as one of the ways of biotechnology, allows you to obtain a large amount of genetically homogeneous planting material in a short time, significantly speeding up the breeding process, reducing the time for obtaining marketable products of new varieties to 2-3 years instead of 10-12. For microclonal reproduction, the following forms were used: the small-diamond-fractured form of the hanging birch of Voronezh origin; the longitudinally fractured form of the hanging birch of Kiev origin; the high-stemmed form of the Karelian birch. Crops were created in the Kon-Kolodez forestry by rare planting (3><6 m) on uprooted cutting, in forest-growing conditions C2 - Nw. The soils are gray forest sandy loam.

The survival rate of regenerants and seedlings on the plantation was 93%. Annual regenerates in crops differed from seedlings: regenerates had a rounded crown, while seedlings had a pronounced stem.

By the end of the 6th year, the seedlings and regenerants were aligned and it is difficult to distinguish them. The plants are monitored annually.

Table - 1 Comparative characteristics of the main biometric indicators of 14-year-old birch crops created by seedlings and regenerants in vitro _ Origin Averages

landing height, m diameter, cm height to width

crown material, m crown, m

Birch Regenerants 12,7±0,33 11,3±0,31 3,1±0,10 4,1±0,14

hung up

Birch seedlings 11,1±0,45 9,3±0,40 5,9±0,24 3,5±0,14

hung up

From the data obtained, it can be seen that in vitro birch regenerates exceed seedlings by biometric indicators: diameter - 21.5% ^(4.0)>t0j05(1.96) differences are significant), height - 14.4% (1f(2.6)>1005(1.96) differences are significant), length of the green part of the crown - 84.6%, crown width -17.1% (t,£(3.0)>to,o5(l,96) differences are significant).

Table - 2 Comparative characteristics of productivity and condition of 14-year-old birch crops created by traditional methods and methods of biotechnology

Name of planting material Stock, m3/ha Weighted average condition category Technical category, %

Business Wood Woodwood

Hanging birch seedlings 85.6 1.2 (healthy) 79.8 20.2

Hanging birch regenerants 192,6 1,1 (healthy) 75,6 24,4

Karelian birch regenerants 32.8 1.0 (healthy) 100.0 -

The weighted average category of the state of the stand varies from 1.0 to 1.2 (healthy), which indicates the high viability of experimental plantation crops.

To identify the role of the origin of planting material on the growth rate of experimental crops created by seedlings and regenegants in vitro, the results of the 2011 inventory were processed by a one-factor dispersion analysis (Table 3).

Table 3 — Summary table of one-factor variance analysis of growth

Sources of variation of the Degree of Freedom Sum of Squared Deviations Mean Square (a2) RF Fst

P=0.05 P=0.01

Intergroup 1 82.36 82.36 9.66 3.9 6.9

Vnugrigroup 112 955,6 8,53

Total 113 1038.0 -

The dispersion analysis of the influence of the factor of origin of planting material on the intensity of growth in diameter showed the reliability of the results. The null hypothesis is rejected with probability (P=0.99) regarding the influence of the origin of the planting material on the growth in diameter of regenerants and seedlings. At 15 years of age, the average diameter at a height of 1.3 m in regenerants is larger than in seedlings by 1.7 cm. Since /-f > Fst there is no doubt about the reliability of the indicators found. The influence of the studied factor is not high d) 2 = 8%. In the conditions of sandy loam forest soils of the Kon-Kolodez forestry in 15 years, the average diameter of birch trees in seedlings is 10.0

± 0.29 cm, in regenerants - 11.7 ± 0.32, which confirms the prospects of using regenerants in forestry practice. There is also an excess in height (Table 4).

The dispersion analysis of the influence of the factor of origin of planting material on the intensity of growth in height showed the reliability of the results. The null hypothesis is rejected with probability (P= 0.95) regarding the influence of the origin of the planting material on the height growth of regenerants and seedlings.

Table 4 - Final table of odagafactor dispersion analysis of the growth of birch crops in height created by seedlings and regenegants in vitro_

Sources of variation of the Degree of Freedom Sum of squared deviations Mean Square (c2) RF F*

P=0.05 P=0.01

Intergroup 1 2.1 26.1 6.07 4.2 7.6

Intragroup 28 121 4.3

Total 29,147 5,06

References:

1. Aeshina, E.H., & Velichko, H.A. (2008). Regeneration of Juniperus sibirica V. In vitro Text. V.N. Sukachev Institute of Forest SB RAS, Krasnoyarsk, Russia. *"Conifers of the boreal zone"*, No. 3 4, pp.333 - 336.
2. Ananyeva, L.I., Nikulin, S.S., Garshina, S.I. (2000). Sorption purification of industrial waters of meat processing enterprises Text. Izd. vuzov. *Food Technology*, No. 4, pp. 113-115.
3. (1983). *A.c. № 1021346. Tillage device* (Deryuzhkin, R.I., Nartov, P.S., Posmetyev V.I., Sukhov I.V., Semenov V.I.). Author's svid., Byul. No. 21, 1983.
4. (1990). *A.C. No. 1581238 Method of combating root-springing aspen in cuttings* (Deryuzhkin, R.I., Sukhov I.V.). Byul. No. 28, 1990. 4 p.
5. (1990). *A. S. No. 1597386 USSR, MKI, 12. Method of microclonal reproduction of Karelian birch* / Butova T.P., Tabatskaya T.M., Skrobova L.L. Byul. No. 37, publ. 7.10.1990.
6. (2001). *A.C. No.34777 Voronezh alder* / T.A. Blagodarova. Registered in the State Register of Breeding Achievements approved for use from 5.06.2001.
7. (2007). *A.C. for selection achievement No. 44340 Priyarsky Poplar* / A.I. Sivolapov, Voronezh State Forestry Academy. According to application No. 9464178,2007.
8. Akhmadullin, I.S. (2011). Examination of birch trees of the Republic of Tatarstan for the purpose of selection of clones for microclonal reproduction by in virto method Text. *Vestn. Kazan State University*, No. 4. pp.112 -114.
9. Bagaev, S.N. (1987). Reproduction of Karelian birch Text. *Lesn. x-vo.*, No. 9, pp. 40 - 41.
10. Bakulin, V.T. (1966). Triploid clone of aspen in the forests of the Novosibirsk region. *Genetics*, No. 11, pp. 58-68.
11. Bakulin, V.T. (2010). *Fragrant poplar in Siberia Text.* (p.110). Novosibirsk: Academic publishing house "Geo".
12. Bander, B.JI. (1959). Karelian birch in the Karelian ASSR Text. *Tr. Latv. agricultural farm. akad.*, Issue VIII, pp. 353 - 365.
13. Barsukova, T.L. (1989). Anatomical structure of shoots of Karelian birch Text. *Izv. vuzov. Lesn. zhurn.*, No. 5, pp. 14-17.
14. Bellegarde, A.L. (1971). *Steppe afforestation Text.* (p.336). Moscow: "Lesn. prom-st".
15. Blagodarova, T.A. (1995). *Selection of black alder (Alnus glutinosa (L) Gaertn.) for breeding in the Central Chernozem region:* Abstract of the dissertation of the Candidate of Agricultural Sciences. (p.19). Voronezh.
16. Blagodarova, T.A., & Popov, V.K. (1994). *Selection in natural populations and the creation of black alder cultures in the Central Forest Text.* Selection and its use in improving forest species: Collection of scientific tr. (pp.97-104). Voronezh: NIILGiS, Kvadrat.
17. Blagodarova, T.A., Nikulin, S.S., & Sivolapov, V.A. (2005). *The value of quaternary ammonium salt for rooting green cuttings of gray alder Text*. Fruit-growing, seed-growing, introduction of woody plants. Materials of the VIII International Scientific Conference. Krasnoyarsk: SibSTU, (4th edition).
18. Blagodarova, T.A., & Sivolapov, V.A. (2010). *Selection of alder in TSCHO Text.* Achievements and problems in forest genetics and breeding (to the 40th anniversary of NIILGiS): collection of scientific tr. (pp.199-210). Voronezh: NIILGiS.
19. Bogdanov, P.L. (1960). *Selection and hybridization of poplars. Distant hybridization of plants and animals.* (pp. 209-220). Moscow.
20. Borodin, A.M. (1983). *Program forests.* Text. (p.239). Moscow: Lesn. prom-st.
21. Butova, G.P. Tabatskaya, T.M., & Skrobova, L.L. (1991). *The use of tissue culture methods for reproduction and genetic improvement of forest woody plants Text.* Genetics and selection in forestry. (pp.41-49). Moscow.

22. Bukvareva, E.H., & Aleshchenko, G.M. (2005). *Optimal diversity in natural populations and communities.* Modeling results Text. Proceedings of the Second Congress of the Society of Biotechnologists. Russia. Moscow, October 13-15, 2004 / Edited by R.G. Vasilova. (pp. 13-19). Moscow: "Delta".
23. Bychenkova, E.A. (1967). *Organogenesis in the primary culture of some woody plants and the influence of a number of physiologically active substances on it Text*. Messages on the anatomy and physiology of woody plants. (pp.39-42). L..
24. Verezhnikov, V.N., Nikulin, S.S., Poyarkova, T.N., & Garshin, A.P. (1997). Prospects of isolation of synthetic rubbers from latex by organic coagulants. *Bulletin of the Tambov University*, Vol.2, issue 1, pp. 47-52.
25. Veresin, M.M. (1963). *Forest seed production Text.* (p.158). Moscow: Goslesbumizdat.
26. Veresin, M.M., Mamyrin, M.A., Shemyakin, I.Ya., & Yakubyuk, N.Ya. (1963). *Centenary experience of afforestation in Savalsky forestry Text.* (p.162). Moscow: "Goslesbumizdat".
27. Veresin, M. (1971). *Voronezh Forests Text*. (p.224). Voronezh: "Central Chernozem Book Publishing House".
28. Veresin, M.M., & Tsarev, A.P. (1974). On the results of variety testing of poplars in the Voronezh region Text. Genetics, selection and introduction of forest breeds. *Topics. collection of scientific tr.* Issue 1. Voronezh, pp. 31-42.
29. Veresin, M.M., & Tsarev, A.P. (1974). On the results of variety testing of poplars in the Voronezh region Text. Genetics, breeding and introduction of forest breeds. *Collection of scientific tr.* Voronezh: VNIILM, pp. 31-42.
30. Veresin, M.M., Efimov, Yu.P., & Arefyev, Yu.F. (1985). *Handbook of forest breeding seed production Text.* (p.245). Moscow: Agropromizdat.
31. Veretennikov, S.S., & Kupriyanov, N. V. (1987). Plantation cultivation of spruce Text. *Lesn. x-vo.* No. 2, pp.69-70.
32. Vodin, A.B. (2007). *Phenological forms of Siberian cedar according to the timing of the start of pollen departure Electronic resource.* GO VPO "Siberian State Technological University". Electronic Library Retrieved from http://scholar.google.com/
33. Voronin, I.V., Senkevich, A.A., & Bugaev, V.A. (1975). *Economic efficiency in forestry and agroforestry production* Text. (p.176). Moscow: "Forest industry".
34. Gavrilova, I.A. (1971). *Comparative assessment of anatomical features of wood of some species and hybrids of poplars*. Text.: Abstract. dis. cand. biol. nauk: (p.23). L..
35. Groshev, I.V. (1995). Application of polyalisbrolites based on N.N-dietil-N.N-*dillylamonyl chloride in the production of fiberboard for wastewater treatment.* Abstract of the diss. for the application of the uch. step. Candidate of Technical Sciences. (p.21). MINSK.
36. Globa-Mikhaylenko, D.A., & Commercial, E. N. (1995). Industrial breeding of oak changeable Text. *Lesn. x-vo.*, No. 4, p. 33.
37. Gorobets, A.I., & Loginova, L.A. (2004). Productivity and technical characteristics of the vine on the willow plantation of the Semiluksky nursery. *Nature management: resources, technical support: Inter-university collection of scientific works.* Issue 2, Edited by prof. F.V. Posharnikov. (pp.18-22). Voronezh: VGLTA.
38. Davydov, M.V. (1960). *Black alder of the European part of the USSR.* Text. Publishing house of the Ukrainian Academy of Agricultural Sciences, (p.113). Kiev.
39. Davidov, M.V. (1976). Features of the growth of black walnut plantations Text. *Forestry*, No. 8, pp. 43-45.
40. Danchenko, A.M. (1992). *Biology of fruiting and fundamentals of birch seed production* Text. (p.126). Krasnoyarsk.
41. Dotsenko, A.P. (1986). Reforestation on an industrial basis Text. *Lesn. x-vo,* No. 1, pp. 37-39.
42. Dreiman, E. (1978). Results of vaccinations of Karelian birch Text. *Scientific tr. LSHA*. Riga, Issue 164, pp. 31-35.
43. Zhukov, A.B. (1958). The basic principles of creating pure and mixed cultures Text. *Forest. household*,- No. 2, p.118.
44. (1986). *Laying and cultivation of timber plantations of spruce and pine* Text.: method, recommendations of LenNIILH, BelNIILH, UkrNIILH; comp. I.V. Shutov, (p.105). L..
45. Evdokimov, A.P. (1989). Biology and culture of Karelian birch Text. (p.226). L.: LSU.
46. Egorova, T.A., Klunova, S.M., & Zhivukhina, E.A. (2008). Fundamentals of biotechnology: textbook Text. (p.208). Moscow: Publishing center "Academy".
47. Ermakov, B.S. (1975). *Growing seedlings by cuttings.* Text. (p.152). Moscow: "Lesn. prom-st".
48. Ermakov, V.I. (1986). *Mechanisms of birch adaptation to the conditions of the North Text.* (p.144). L.: Nauka.
49. Efimov, Yu.P. (1997). *Genetic and breeding assessment of objects of permanent forest seed base* Text. Genetics and breeding in the service of the forest: mater. International Scientific and Production Conference. (pp.298-307). Voronezh: NIILGiS.
50. Efimov, Yu.P., & Hirov, A.A. (1983). Seed production and selection of tree species in the

Hungarian People's Republic Text. *Forestry*, No. 3, pp. 76-77.

51. Efimov, Yu.P. (2010). *Seed plantations in breeding and seed production of scots pine* Text. (p.253). Voronezh: publishing house "Istoki".
52. Ivannikov, S.P. (1971). *Breeding and use of poplars in the USSR and abroad (review)* Text. (p.105). Moscow: CBNTI.
53. Ivannikov, S.P. (1980). *Topol*. (p.85). Moscow: Forest industry.
54. Ivannikov, S.P., & Rostovtsev, S.A. (1965). Cellulose content and wood fiber sizes in different varieties of poplars. *Lesn. x-vo.*, No. 5, pp. 37 - 42.
55. Isakov, I.Yu. (2001). *The influence of the pollination method on the breeding features of the seed progeny of Betula pendula Roth, and V. Pubescens Ehrh*. Abstract of the Candidate of Agricultural Sciences. (p.19). Voronezh.
56. Kavtaradze, D.N. (2005). *Biotechnology and socially acceptable risks of managing highly complex systems* Text. Proceedings of the Second Congress of the Society of Biotechnologists of Russia. (pp.41-44). Moscow, October 13-15, 2004 / Edited by R.G. Vasilova. Moscow: "Delta".
57. Kazantseva, E.V. (1997). *Population-genetic analysis of Karelian birch and vegetative reproduction of its valuable forms* Text. Autoref. Dis. Candidate of Agricultural Sciences. (p.24). Moscow.