3. Маурер В. М. Декоративне розсадництво: навч. посіб. / В. М. Маурер.– Вінниця: Нова Книга, 2007. – 264 с.
4. Рева Л. М. Вегетативне розмноження деревних та кущових рослин у природних умовах / Л. М. Рева – К.: Наук. думка, 1965. – 211с.

Охарактеризована эффективность использования ростовых веществ для стимулирования корнеобразования на летних черенках Spiraea japonica 'Shirobana' и Symphoricarpos chenaultii 'Hancock'.

Вегетативное размножение, укоренение, полуодревесневшие (зеленые) черенки, стимуляторы роста, ростовые вещества.

The article describes the effectiveness of application of growth substances to stimulate root formation on green cuttings Spiraea japonica 'Shirobana' and Symphoricarpos chenaultii 'Hancock'.

Vegetative propagation, rooting, green cuttings, growth substances, growth promoters

UDC 630*231

ETIOLOGYANDPATHOGENESISOF THE WIDESPREAD DESICCATION OFTREESAND PLANTATIONS

V.M. Maurer, A.P. Pinchuk PhD in Agricultural Science

We examined the etiology and pathogenesis of the widespread desiccation of forest plantations. We classified factors and causations that contribute to the weakening and desiccating of woody plants and recommended a model that explains the pathogenesis and the phenomenon of mass extinction of trees in forest lands.

Etiology, pathogenesis, widespread desiccation, etiofactors, trees, forest plantations.

First of all, it should be noted that there was a massive drying out of trees in plantations observed earlier in the nineteen than twentieth centuries [2, 5-7, 13]. Over time, the frequency of this desiccation has been increased due to the number of artificially developed forest. This event reached a large scale overall. For some species, particularly oak, it became more common with trees of different ages (11, 33 and 100-year), which coincides with cycles linked to increased solar activity [1, 5, 6, 8].A particular concern of forester sais steady increase in the area of desiccated and degraded plantation sand the substantial increase in solid and sanitary selective logging. In some regions of the country such as the Carpathians, the mass drying of spruce approached

the level of disaster. In professional circles, there is a wide variety of opinions (often polar) on its cause sand appropriateness. There is also varying opinions about the organization a land silvicultural measures to reduce the loss of forest industry and its effect on the national economy. There fore, more than ever, the need for timely synthesis of the view sand current perspectives on the causes (etiology) and pathogenesis (the study of the mechanism of the disease, its flow and the final result) for the drying plants is needed.

Objectives: The necessity for greater knowledge about the essence of this negative phenomenon and the study of strategies and tactics to reduce the size and scope of this phenomenon is also crucial.

Material and method. During the research, we analyzed the main scientific publications of the last century [2, 5, 6, 7, 8, 13]. Those studies highlighted different aspects of the phenomenon of mass extinction of forest-forming trees. The scientists used the results of their research with the drying groves within the green zone in Kyiv for the last 80years of the last century [5, 6, 8]. To achieve this goal, both general scientific methods of knowledge (analysis, synthesis, comparison) and conventional forestry techniques were utilized in their studies and evaluation [4].

Considering the problem of massive drying, remember that drying trees in plantations are also found in natural forests and are integral in the genesis of both natural and artificial plants. There fore, each case must clearly identify the etiology and pathogenesis of adverse events, which are the mass extinction of trees, or natural processes, which are destruction associated with competition, differentiation and drying in the plantation forests.

The doctrine of the etiology of diseases and the causes of death of biological objects has a long history, which has supporters for both monofactor and polyfactor theories. The monofactor concept originates from the word monokauzalizm which means one factor; and the polyfactor concept derives from kondicionalizm which is manyfactors. In recent years, there is a new trend. This trend is called constitutionalism, which seeks in finding the causes of diseases, determining their extent and analyzing these factors as part of a whole system in which they appear and develop. For example, in medical practice in determining the etiology of the disease is as know as "risk factors". This approach allows physicians to identify conditions from among possible defined causes that promote or directly are related to the appearance of the disease. Typically, these circumstances are the first signs that contribute to the development of the disease. They canals be seen as a necessary precondition, and as individual links in a chain of the pathogenesis of the disease.

Over the years of the research, the scientists attempted to explain the nature of the etiology and pathogenesis of the desiccation and degradation of forests, and they identified two models. A study in 1981 attempted to explain the nature of the etiology and pathogenesis of desiccation and degradation of forests through a process the author calls a chain model (Houston, 1981) [14]. This model explains the process of mass extinction from alternating influence of various factors. Initially, stress factors weaken healthy trees, so that they

become vulnerable to a second stage which is damage by pests and vulnerability to pathogens that leads to the process of desiccation.

The second model is known as spiral and was developed by M. Manion (Manion, 1991) [15]. It divides all the causes of tree withering into three groups of factors that act in parallel-series. First of all, weakening factors influence trees and plantations over extended periods of time. Those factors are gradually weakening the trees but the symptoms of degradation are not apparent. Then the stress factors of the second group begin their influence. They, the author believes, do not consistently impact the tress but their affect initiates the desiccation of weakened trees and plants. Desiccated trees and plantings are subject to the harmful factors of the third group of causes that are mainly biotic, and this leads to their final death.

None of these existing scientific concepts give an exhaustive answer on the etiology and pathogenesis that lead to the deterioration and desiccation of forests. There is no scientific evidence-based method of afforestation and existing preventive measures that would help to lessen the massive desiccation of forests or to reduce its size and scope.

Results and discussion. The basic terms used to develop concepts on the causes and pathogenesis of mass extinction of oak trees and the construction of a model of negative effects are:

- The law of passing sequence of phases (stages) of forest stands during their genesis (change of the forest or forest change), which is often ignored in practice. An example is the creation of coniferous forest plantations in areas wherein nature they should be preceded by planting pioneer species;
- An axiom on the harmony of the natural processes of forest ecosystems, the foundation of which is the principle of adequacy, the essence is determined from the forest science postulate: "... in order to success fully maintain forest stands in a certain environments, its composition and form must be harmonious with the complexity of the natural environment" [10];
- A quote by professor Z.S. Holovyanko that healthy fluids of woody plants are "poison" for pests and pathogens[2];
- The professor H.F. Morozova's assertion is "...any kind of intrusion into the woods, even the most rational, will always be a violation of the dynamic equilibrium, which is found in nature and natural forests in particular. This imbalance appears primarily in the weakening of the biologically sustainability of plantations"[9];
- A definition by the academician M.A. Golubets that the most powerful disturbing factors in forest ecosystems are anthropogenic factors. These factors define and modify the composition, structure and form of forest plantation sand affect their systemic connection sand functional properties [3].

In the compilation of data about the etiology and pathogenesis features, we took into account the massive desiccation of trees and the intensity of forest management in Ukraine in the nineteenth to twenty first centuries. This is a strategy of active forest restoration. Forest plantations dominated and still continue to dominate in the strategy's structure. A large portion of artificially restored and newly established plantations, in some years, reached 80% of all

the techniques used. Based on the basic observations, it is not difficult to show the impact of anthropogenic factors (positive or negative) on the biological stability. It is most evident inartificial plantations, both directly and indirectly. The direct use included various methods of propagation (seeding, planting), using specific planting material (seeds, seedlings with un damaged and injured root system), and justified or unjustified introduction of mixing types (wood, wood-shadow or tree-shrub). Lastly, the indirect affect through the adjustment of abiotic and biotic factors within forest ecosystems.

Professor P.G. Kalnogo and his colleagues conducted long-term studies in 1970 to 1980 on the causes and characteristics of the drying stands of oak in the Polissya and Forest-Steppe of Ukraine [8, 11]. This study supported Kalnogo's concept of etiology and pathogenesis on the desiccation of forests which is an adverse natural phenomena. We divided all factors that cause the desiccation of forests by their characteristics, their sequential impact, and their specific values into three groups:

1. Circumstances leading to weakening and other risk factors for disease;
2. Etiofactors or root causes of desiccation;
3. Catalysts for tree and woodland death.

Circumstances leading to weakening and risk factors cause the loss of immunity, reducing the biological stability and weakening of individual trees or plants in general. Depending on their origin, they can be divided into biotic factors, abiotic conditions, and human impact. The factors of anthropogenic impact primarily belong to forestry activities and in particular silvicultural work. They largely determine propagation, primary tree density, dominant tree species, composition, structure and shape of the future forest stands. All these factors have an enduring impact on the systematic relations between the various components of ecosystems and their functional properties. This approach suggests the causes of weakening, which marked the beginning of the modern degradation of forests in Ukraine. More than half of Ukrainian forests are man-made and include errors and miscalculations in reforestation and afforestation in the past. This occurred particularly due to the predominance of silvicultural priorities that emphasized profit over the best practices which would have benefitted the biology and ecology of the forest. Among the particularly significant circumstances of weakening and risk factors are:

- use for chopping wood, preparing silvicultural areas and cultivation methods. These significantly degrade conditions for the growth of planted crops in unnatural changes of the forest ecosystems from forest woody vegetation to grassy in fields, meadows, and ruderal, due to clear cutting. It should be noted that forest ecosystems are characterized by forest change rather than changes in woody formations such as grass. This decreases fertility of the upper layers of sod-podzolic and podzolic soils by applying partial cultivation furrows. This helps to prevent weeds from growing through removal of the grooves from the humus layer or mixing it;
- ignoring planting of seeds as a natural reproductive forest approach in the propagation of forests such as groves of pine, beech and spruce. It is not

always justified use to create planting material with injured root system primarily such as taproot species of oak and others;

- poor planting techniques of seedlings for permanent placement with no respect for depth of planting and unnatural transformations of the root system (flattening, bending roots, etc.);
- using seed grown plant material for reforestation and afforestation that are grown in unsuitable climatic zones. For instance, use of spruce cultures deriving from warmer, dryer lands in Transcarpathia for planting in the colder weather of the Carpathians;
- not taking into account the peculiarities of the genesis of native stands which violate the law of sequence of passing phases of forest ecosystems. It includes planting in areas without forest biomes such as more arable lands. In addition, it comprises of not planting pioneer trees such as birch, alder, and willows that restore the forest environments better than cultures of pine and spruce;
- not providing the proper environment for dominant spices during the first stages in the development of forest communities because of their low initial density in cultures or natural regeneration and formation. There fore, this is violation of the principle of adequacy and the unity of the forest and environment;
- formation of same-aged stands of the main species within indigenous forests which have trees of many different ages. The best examples of these forest stands are spruce and beech forest;
- genetically selected artificially recreated forest communities which do not occur in natural forest stands. This process uses seeds collected from individual trees and selects the best specimens from the process of inspection and removes smaller trees;
- significant reduction of biological diversity within the forest communities compared with characteristic native forest stands at the species and coenotic levels;
- excessive recreational use, hay production and grazing resulting in deterioration of water and the physical properties of soil;
- global climate change (warming) and others.

The above and similar elements that result in the weakening and other risk factors contribute to the diminishing of immunity and weakening of individual trees or whole forest communities. In the absence of the negative impact of these etiofactors that are root causes, the performance of trees and forest plantations over extended periods of time lessens greatly. There fore, it is important to identify the exact etiofactors that lead to the process of mass deterioration and death of trees. This helps to prevent, eliminate or reduce all these effects which can significantly decrease this harmful phenomenon.

The root cause or etiofactors of mass desiccation of individual trees or stands leads to the risk of lowered immunity and less biological stability. These can be abiotic, biotic and anthropogenic factors. The result of these is the beginning of a pathological process that becomes a disease that affects the bark of woody plant sand gives its life. Consequently, they are causing

different types of drying and dying trees. Among the abiotic factors the most typical are:

- Long-term greater than 45 day spring and early summer droughts for two or more consecutive years which are uncharacteristic for a particular region;
- A sharp drop or rise the ground water level due to various reasons;
- Prolonged frost sand abnormally low temperature during a woody plants growth period;
- Variations in solar activity.

Less significant root causes of mass deterioration and death of trees and forest are the biotic and anthropogenic factors. Biotic factors such as insect damage may be extremely destructive/

Among anthropogenic factors leading to the mass withering trees are the adverse changes in the environment and in habitat conditions due to professional errors during forest operations. These errors lead to the disruption of the homeostatic relationships between the individual components of forest ecosystems such as excessive liquefaction, untimely logging, farming and high recreational use.

It should be noted that the aforementioned root causes leading to desiccation, affect weakened trees and plantings to much greater extent than healthy growing in the same conditions. Thus, during the drying of trees in groves within the green zone in Kyiv in the late 1970s there was a sharp drop in groundwater and an uncharacteristic early spring and summer long drought that caused a mass desiccation of oak trees with out taproots in plantations established as seedlings, and planted at close 60 cm densities, whereas in natural forest stands and seed crops established by sowing acorns, which have inherent tap roots, there was no observing of mass extinction.

Catalyst factors contribute to the mass desiccation of forest-forming species. It should be noted these factors do not alone cause the massive desiccation of forests and even in the weakening of trees. They do, however, significantly accelerate the disease process. Among these catalyst factors are:

- Damaged by pathogens such as myco and microorganisms and systemic functional disorders like traheomikozy, honey agaric, root and pine sponges;
- A set of secondary threats from insects that are mainly tree damaging;
- Weakening and interruption of the natural homeostatic relationships that exist between the individual components of forest ecosystems. This is due to the loss of much of the attributes, characteristics and properties of forest ecosystem.

Conclusions

An understanding and use the above factors which affect the etiology and pathogenesis of widespread desiccation of trees and forest-forming plant species will greatly mitigate the effects of this phenomenon. There should be proactively applied science-based forest management plans that prevent the

above listed circumstances of weakening and risk. This will prevent the manifestation and root causesof tree desiccation and death and minimize the negative consequences of this pathogenesis and, subsequently, preserve a valuable resource at a lower environmental and social cost.

References

1. Воропанов П.В. Оценка материнских деревьев: монография / П.В. Воропанов; отв. ред. Н.А. Обозов; Брянский технологический ин-т. – Брянск :Брянское отд-ние Приокского кн. изд-ва, 1973. – 104 с.
2. Головянко З.С. Причины усыхания сосновых насаждений /З.С. Головянко. – К.: Изд-во АН УССР. – 1949.–43 с.
3. Голубець М.А. Вступ до геосоціосистемології / М. А. Голубець. – Львів: Поллі, 2005. – 199 с.
4. Гурский А.В. Методы оценки состояний древесных насаждений и прогноз их роста и долговечности / А.В. Гурский // Бюллетень Главного ботанического сада. – 1955. – №21. – С. 16–24.
5. Кальной П.Г. К вопросу о причинах усыхания дуба черешчатого в зеленой зоне г. Киева / П.Г. Кальной, В.М. Маурер // Лесной журнал. – 1978. – №5. – С. 4.
6. Кальной П.Г. Про біологічну стійкість насаджень дуба в посушливі роки / П.Г. Кальной, В.М. Маурер // Лісове господарство, лісова і деревообробна пром-сть. – 1978. – №4. – С. 2.
7. Маурер В.М. Лісовідновлення на засадах екологічно орієнтованого лісівництва як основа біологічної стійкості лісів / В.М. Маурер, Ю.О. Колодій // Науковий вісник НАУ. – К., 2005. – Вип. 83. – С. 52–58.
8. Маурер В.М. Повышение биолого-экологической устойчивости насаждений дуба черешчатого в зеленой зоне г. Киева лесокультурными методами: автореф. дис. на соискание ученой степени канд. с.-г. наук: 06.03.01 / В.М. Маурер. – К., 1980. –26 с.
9. Морозов Г.Ф. О лесоводственных устоях / Г.Ф. Морозов. – М.: Гослесбумиздат, 1962. – 28 с.
10. Морозов Г.Ф. Учение о лесе / Г. Ф. Морозов. - [6-е изд.]. – М. ; Л. : Сельхозгиз, 1931. – 428 с.
11. Пат. 62077 Україна, МПК A01G 23/00 Спосіб оздоровлення садивного матеріалу з відкритою кореневою системою та підвищення приживлюваності лісових культур за рахунок оптимізації коренелистової кореляції сіянців шпилькових порід / Маурер В.М., Бровко Ф.М., Пінчук А.П. та ін.; заявник і власник Національний університет біоресурсів і природокористування України. - № u201100915; заявл. 27.01.2011; опубл. 10.08.2011, Бюл. № 15/2011.
12. Причини всихання соснових насаджень Бориспільського ДЛГ та шляхи покращення їх стану/ В.М. Маурер, М.М. Кочерга, М.І. Гордієнко [та ін.] // Проблеми АПК: пошук, досягнення: Тези наук. конф. професорсько-викладацького складу та аспірантів, 23-25 березня, 1994 року. – К., 1994. – С. 27–28.
13. Шинкаренко И.Б. О некоторых причинах притупления и усыхания молодняков сосны в Изюмском бору / И.Б. Шинкаренко // Лесоводство и агромелиорация. – К.: Урожай, 1968. – Вып. 14. – С.20–26.
14. Houston D.R. Stress triggered tree diseases: The diebacks and declines / D.R. Houston // USDA Forest Service, Northeastern Forest Experiment Station–1981. – P. 41-81.
15. Manion P.D. Tree Disease Concepts Prentice-Hall Inc / P.D. Manion //: Tree Disease Concepts, 2nd edn. Englewood Cliffs, NJ: Prentice Hall, Inc. – 1991. –402 p.

Розглянуто етіологію та особливості патогенезу масового всихання насаджень лісотвірних порід. Наведено класифікацію причин та факторів, що зумовлюють ослаблення і всихання деревних рослин. Запропоновано модель патогенезу явища масового відмирання дерев у лісових ценозах.

Етіологія, патогенез, масове всихання, етіофактори, дерева, насадження.

Рассмотрены этиология и особенности патогенеза массового усыхания насаждений лесообразующих пород. Приведена классификация причин и факторов, обусловливающих ослабление и усыхание древесных растений. Предложена модель патогенеза явления массового отмирания деревьев в лесных ценозах.

Этиология, патогенез, массовое усыхание, етиофакторы, деревья, насаждения.

УДК 630*232.4:582.623.2(477.82)

СУЧАСНИЙ СТАН ТА ШЛЯХИ ІНТЕНСИФІКАЦІЇ ПЛАНТАЦІЙНОГО ЛІСОВИРОЩУВАННЯ ТОПОЛІ НА ВОЛИНІ

В. М. Маурер, кандидат сільськогосподарських наук
І. С. Шилін, аспірантка*

Наведено обсяги та охарактеризовано технологію створення плантацій тополі у Волинській області. Окреслено шляхи оптимізації та інтенсифікації плантаційного лісовирощування в регіоні.

Плантаційне лісовирощування, тополя, технологія створення, здерев'янілі живці, живцеві саджанці.

Зважаючи на лісодефіцитність і складну енергетичну ситуацію в державі, особливо актуальним питанням наразі є збільшення обсягів виробництва товарної деревини на ринках України як для забезпечення власних потреб, так і для експорту. Вирішення цієї проблеми можливе екстенсивним (за рахунок лісорозведення) та інтенсивним шляхами. У другому випадку пріоритетна роль належить плантаційному лісовирощуванню. Доцільність створення плантаційних культур полягає в тому, що вони дозволяють скоротити вік рубки головного користування, не втративши продуктивності. Саме тому, останнім часом лісогосподарський комплекс світу та України переходить до технологій інтенсивного вирощування деревини. У той же час, у зв'язку з різким подорожчанням енергоносіїв в енергетичному

* Науковий керівник – кандидат сільськогосподарських наук, професор В.М. Маурер