ATMOSPHERIC DRY TOLERANCE OF DENDROLOGICAL PLANTS AND WAYS OF IMPLEMENTATION IN URBAN AND PERIURBAN GREEN SPACES

TOLERANȚA LA SECETA ATMOSFERICĂ A UNOR PLANTE DENDROLOGICE ŞI MODALITĂȚI DE IMPLEMENTARE ÎN SPAȚIILE VERZI URBANE ŞI PERIURBANE

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Abstract. *The impact of climate change increasingly depends on the measures and how affected areas, especially urban ones, manage to adapt by improving urban plans, increasing areas with green spaces, and adapting infrastructure to encourage the use of means of non-polluting transportation. But in the case of dendrological plants, atmospheric drought and pedological drought affect the normal development of vital processes due to cell dehydration, which in the short term leads to wilting of plants, and in the long term, can even lead to their death. All the properties of plant tissues to survive stressors are in fact plant resistance. In this sense, in landscaping in addition to the already known functions (sanitary, utilitarian, decorative), it is imperative to use resources rationally by proposing the use of dendrological and floricultural species as adapted to these stressful environmental conditions. This paper addresses the issues of high drought and its effects on plants, some aspects of the assortment of dendrological plants with drought tolerance suitable for the Iasi area and a proposal to implement these studies in the periurban landscape of Iasi by arranging a square in the peri-urban area of Iasi.*
Keywords: drought, tolerance, dendrological plants, square

Rezumat. *Impactul schimbărilor climatice depinde tot mai mult de măsurile şi modul în care zonele afectate, în special cele urbane, reuşesc să se adapteze prin îmbunătățirea planurilor de urbanism, prin creşterea suprafețelor cu spații verzi, precum şi adaptarea infrastructurii în sensul încurajării utilizării de mijloace de transport non-poluante. Însă în cazul plantelor dendrologice, seceta atmosferică, cât şi cea pedologică, afectează desfăşurarea normală a proceselor vitale din cauza deshidratării celulelor, ceea ce duce pe termen scurt la ofilirea plantelor, iar pe termen lung, poate să ducă chiar la moartea acestora. Totalitatea însuşirilor țesuturilor vegetale de a supraviețui factorilor de stres reprezintă de fapt rezistența plantelor. În aceast sens, în amenajările peisagere pe lângă funcții a resursele prin propunerea spre utilizare a unor specii dendrologice şi floricole cât mai adaptate la aceste condiții de mediu stresante. Lucrarea de față abordează aspectele privind problematica ridicată de secetă şi efectele acesteia asupra plantelor, unele aspecteprivindsortimentul de plante dendrologice cu toleranță la secetă pretabile zonei Iaşi precum şi o propunere de implementare a acestor studii în peisajul periurban ieşean prin amenajarea unui scuar în zona periurbană a municipiului Iaşi.*
Cuvinte cheie: secetă, toleranță, plante dendrologice, scuar

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INTRODUCTION

Against the background of rising global temperatures, light intensity, dry air currents, ozone concentration in the troposphere and last but not least the increase in CO2 concentration, the leaves are strongly heated which causes an intensification of sweating that causes an imbalance between water absorption through the roots and perspiration. Submesophilic species that have medium water requirements are tolerant of the humidity regime, xerophilous species have low requirements and euryphilic species have a relatively large amplitude to water. In Romania, there are mainly mesophilic species that have the ability to regulate their water needs within certain limits. The deficit of water in the atmosphere severely reduces the normal growth and development of woody plants. Cell division, elongation and differentiation are processes that ensure normal growth and development. At any stage of development, if the wood plant goes through an episode of drought, it will lose its turgidity, there will be disorders of enzymatic activity, slowing down photosynthetic processes (Hossain, 2016).

Throughout life, dendrological plants have to cope with various stressors. Moreover, there are multicellular organisms that have developed different forms of response to drought adapting to the new conditions, these forms of response being: "*escape*", "*avoidance*" and "*tolerance*". *Tolerance* is therefore a strategy associated with most perennials, knowing that some of them have borrowed certain xeromorphic features such as hairs that reduce the temperature of the leaves, while evapo-perspiration reflects a greater amount of light minimizing water loss. Because the largest amount of water is assimilated through the roots, the change in processes at their level is defined as a major factor in plant tolerance, especially if tolerance is seen as the ability of the plant to have resources to support normal leaf development during the vegetation period. The accumulation of reserves in the roots, the induction of antioxidant processes, the closure of the stomata are some of the mechanisms involved in drought resistance (Jenks, 2007).

MATERIAL AND METHOD

The purpose of this paper is to document the importance of using drought-tolerant dendrological species and to propose an assortment of trees and shrubs that are tolerant to droughts typical of the Iasi area. The concretization of this study is the proposal of a square arrangement with trees and shrubs with drought tolerance, but also at high temperatures and pollution typical of the periurban area near Iasi. The proposed varieties are made of resinous and deciduous species, with a compact bearing, which does not require additional maintenance costs, aiming to create a self-sustaining system with a superior decorative value.

The area proposed for development consists of a land with an area of 2,704 square meters located on Dascălilor Street, Dancu locality, in the periurban area of Iaşi.

RESULTS AND DISCUSSIONS

Native and cultivated dendrological plants in the Iaşi area are part of zone 6b according to the **Plant Hardiness Zone Map** and are considered to have a greater or

lesser capacity to adapt their physiological and biological processes to overcome these periods. Thus, depending on the time of year when it occurs, drought affects dendrological plants differently. Studies have shown that drought in the spring will affect coniferous species more because it causes active evapo-perspiration in a period when the substrate is cold or frozen and fails to absorb the necessary water through the roots. Deciduous trees, on the other hand, because they have not yet entered the vegetation, are rarely affected. Droughts in the first part of summer have effects on deciduous and coniferous tree species because during that period they record the highest water consumption. To compensate, they deplete the water supply in the soil, they will "give up" the flowers and some of the leaves, and summer droughts lead to wilting, stop the maturation processes, weaken vitality and will be prone to disease and pest invasion.

According to the studies carried out by researchers from the University „Al. I. Cuza ", in the Iaşi area, during a year there are between 10 ÷ 13 dry periods and 3 ÷ 4 periods of drought. Thus, it was found that during a year there can be very severe droughts (over 30 days) with different distribution during a year (Stângă, 2009).That is why, following our research (Dirr, Warren, 2019), we propose a local and exotic assortment made up of species that are tolerant to atmospheric drought (tab. 1).

Table 1

Proposal of dendrological species from zone 6b adapted to atmospheric drought

Species	Popular name	Origin area
Acer ginnala	Manchurian Maple	China, Korea, Japan
Acer negundo	American maple	North America
Acer saccharinum	Silver maple	North America
Acer tataricum	Tartar maple	Central Europe, Asia
Betula albosinesis	Chinese red birch	China
Catalpa speciosa	Catalpa Great	Central and NorthAmerica
Celtis occidentalis	Celtis	Central America
Corylus colurna	Turkish hazelnut	Eastern Europe, Asia
Crategus crus-galii	Hawthorn	North America
Crategus laevigata	English hawthorn	Europe, North Africa
Elaeagnus angustifolia	Russian olive, Willow	Southern Europe, Asia
Fraxinus americana	American ash	Nova Scotia, North America
Fraxinus pennsylvanica	Pennsylvania Ash	Nova Scotia, North America
Ginkgo biloba	Ginkgo	China
Gelditsia triacanthos var. inermis	Wild carob	Central and North America
Juniperus chinensis	Chinese juniper	North America
Juniperus scopulorum	Mountain Juniper	Canada, United States
Koelreuteria paniculata	Coelreuteria	China, Japan, Korea
Morus alba	White mulberry	China
Ostrya virginiana	Iron tree	North America, Canada
Picea pungens	Stinging spruce	North America
Pinus nigra	Austrian black pine	Southern Europe, Turkey
Pinus ponderosa	Yellow pine	North America, Canada
Platanus x acerifolia	London platan	North America, Europe

Populus deltoides	Oriental poplar	United States
Chaenomeles sinensis	Chinese quince	China
Ptelea trifoliata	Ptelea	United States
Quercus coccinea	Scarlet oak	United States
Quercus frainetto	Garneau	Romania, Hungary, Italy
Quercus imbricaria	Shingle oak	United States
Robinia pseudoacacia	Acacia	South America
Tilia cordata	Lime lime, hill lime	Europe, Russia
Thuja orientalis	Biota, Oriental Thuja	Korea, China, Eastern Russia
Ulmus parviflora	Lace elm	China, Korea, Japan

The objective of this paper is to present a proposal for the reconversion of an unused land, on an area of 2,704 square meters in the urban area of Dancu, Iasi, in a square green space, designed to spend time outdoors and improve the quality of the environment of community life (fig. 1).

The arrangement was designed in a geometric style so as to integrate into the general landscape. To eliminate the monotony it was systematized in two areas consisting of two platforms between which there is a difference of 0.45 m. Access to the first platform located at - 0.45 m is through a set of three steps built on the east side and the southern one.

Fig. 1. Area proposed for development (*Source-Google Earth Pro*)

It was framed on the perimeter by dendrological species that have the role of filtering the air, braking the air currents and antiphonic because the southern and eastern sides separate the arrangement of two traffic arteries. Species like *Acer negundo* 'Sensation', *Corylus colurna, Koelreuteria paniculata* 'Fastigiata' are provided on the southern side, and on the eastern side the perimeter was marked with a flat strip of *Cotoneaster dammeri*. In the western part, an alignment consisting of *Ulmus parviflora* 'Everclear' is proposed, with the role of separating the buildings from the area of the green space.The points of attraction of this square are given by the built elements and the vegetation used. Thus, the central area was punctuated by a specimen of *Platanus x acerifolia* 'Liberty', species known for its resistance to stressors since the beginning of the industrial era in Great Britain, which is why this specimen was proposed for planting on the side of the street. In the same line, but positioned more discreetly, a concrete and stone shade is proposed that offers the visitor the opportunity to shelter from direct sunlight.

A specimen of *Betula albosinesis* is proposed centrally and will have the role of filtering the air, raising the relative humidity and relative shading during the growing season. The access roads are guided by flat strips on which they have been planted with shrubslike *Juniperus squamata* 'Blue Carpet', *Potentilla fruticosa* 'McKay White', *Perovskia atriplicifolia* 'Blue Spire' and *Ilex x meserve.* When choosing these species, the resistance to high temperatures, atmospheric drought, pollution but, just as important, the decorative value were taken into account. The second platform is at ± 0.00 and is framed on the three outer sides with alignments of *Ginkgo biloba* 'Golden colonnade' at Eastand Northand of *Ulmus parviflora* 'Everclear' at West. The two platforms are separated by a planter with *Juniperus communis* 'Repanda'.

Centrally, on the same line as the platan, there is a pedestrian fountain framed by a grassy surface. The spots placed in the same perimeter with the water games will highlight the specimen of *Morus alba* 'Chaparral' positioned in the middle and which attracts through the weeping port. On the opposite side, there is a pergola of the same material and style as the shade, as it offers the possibility to relax for visitors in summer. Here, too, the routes are led by flatbands on which the same species are found as in the case of the first platform. In directing the routes, but also of the gaze, the main role is taken over by the artesian fountain.

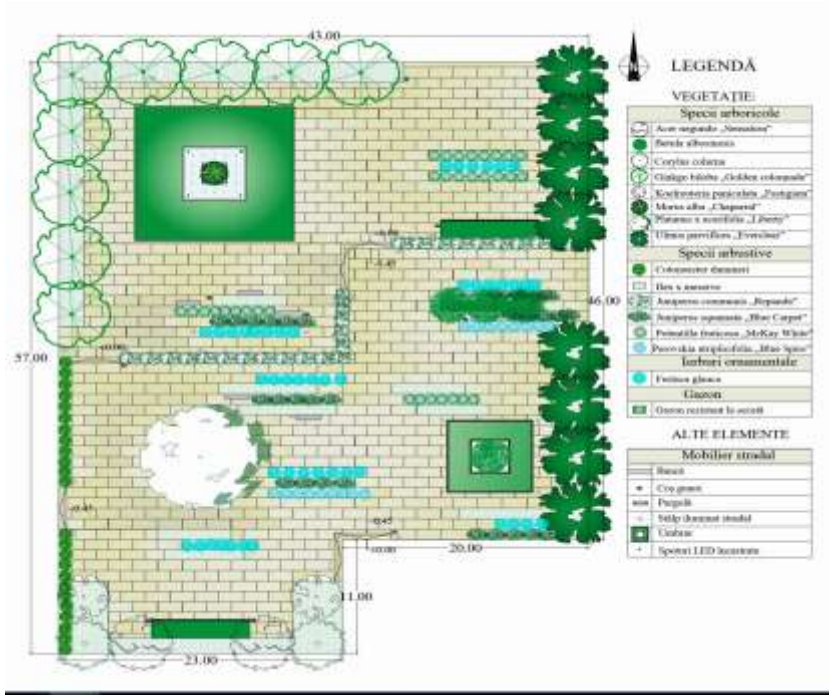

Fig. 2. The proposal for arranging the square *(original)*

Fig. 3.Landscaping proposal (3D overview) *(original)*

The challenge, therefore, in creating an urban or peri-urban green space is to choose species that have the capacity to manage dry periods and to fulfill their sanitary, utilitarian and aesthetic functions in a way that does not create the impression that the landscape characteristic of the area has changed.

CONCLUSIONS

1. The paper presents a proposal for an assortment of tree and shrub species that show tolerance to the typical dry periods for the Iaşi area.

2. The square type arrangement proposed in this paper fulfills the sanitary, utilitarian and decorative functions in minimum maintenance conditions.

3. The species proposed in this arrangement (14 species of trees and shrubs) intervene in the landscape through the special aesthetic value, corroborated with the adaptive peculiarities of drought and pollution tolerance, creating an area with great potential for visiting.

4. The cost of arrangement was approx. 283,025 lei, of which approx. 45,000 lei for the dendrological material.

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