



RESEARCH ARTICLE

INTRODUCTION RESULTS OF TREES AND SHRUB PLANTS OF NORTH-AMERICAN FLORA IN AZERBAIJAN

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ABSTRACT

The carried research work on the introduction gives us wide perspectives for the use of new species and sorts of trees and shrubs in the greening of our republic. The main successful adaptation of exotics in planting is a comprehensive assessment of plants capacity in the new environment. Introduced plants must be resistant to adverse environmental factors, characterized by rapid growth and distinguish with their high decorative qualities. There are carried out more introduction works at the Institute of Dendrology of ANAS regarding to them. This article presents the results of studying some bioecological peculiarities of the North - American species in the dry subtropical conditions of Absheron. It was revealed that the studied species successfully grow and bear fruit in terms of Azerbaijan. Carried researches show that these plants have wide benefits for their use in landscaping as the style of landscape design. Thus, the considered materials allow us to conclude that, in the dry subtropics of Azerbaijan successfully cultivated trees and shrubs of the subtropical, temperate - warm and temperate bioclimatic vegetation zones of the North American region.

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INTRODUCTION

The experiences of many years in introduction at the Institute of Dendrology of ANAS allow us to consider the North America's flora as the largest hotbeds for introduction in replenishment of our dendroflora. Flora of North America is the richest floristic area in the world by the species composition. There are grown 850 species of trees plants, which belongs to 124 genus. Trees plants of North American flora are successfully introduced in many botanical and geographical areas.

MATERIAL AND METHODS

This article presents the results of studying some bioecological peculiarities of North America species introduced in dry subtropical conditions of Absheron. Phenological observations are carried out according to the methods of I.N.Yelagina (Elagina and Lobanov, 1979) and conventional techniques of Main Botanical Garden of Russian (Method of phenological observations in the botanical gardens of the USSR, 1979).

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Growth and development studied by methods Larina (1967), Molchanova and Smirnova (1967). In the observation period considered temperature, relative humidity, and amount of precipitation - as the meteorological factors which play an important role in plant development.

RESULTS AND DISCUSSIONS

Trees and shrubs of the flora of high decorative and adaptable features from the end of the XVIII century to the beginning of the XIX century had been brought to Russia. And since the second half of the XIX century in some cities of Azerbaijan, in parks and gardens had been singly planted (*Robinia pseudoacacia* L., *Acer negunda* L., *Gleditsia triacanthos* L., *Fraxinus pensylvanica* Marsh., *Catalpa bignonioides* Walt. et.c.). At that time works on the introduction and acclimatization of trees and shrubs in the new soil and climatic conditions were not held widely. In 1926, by the initiative of the famous botanist and academician I.N.Vavilov after the opening of the branch of the Institute of Applied Botany Department and the study of new plants in Mardakan settlement in Absheron were carried out extensive research and development in the direction of introduction of ornamental trees, shrubs, technical and medicinal plants from the flora of

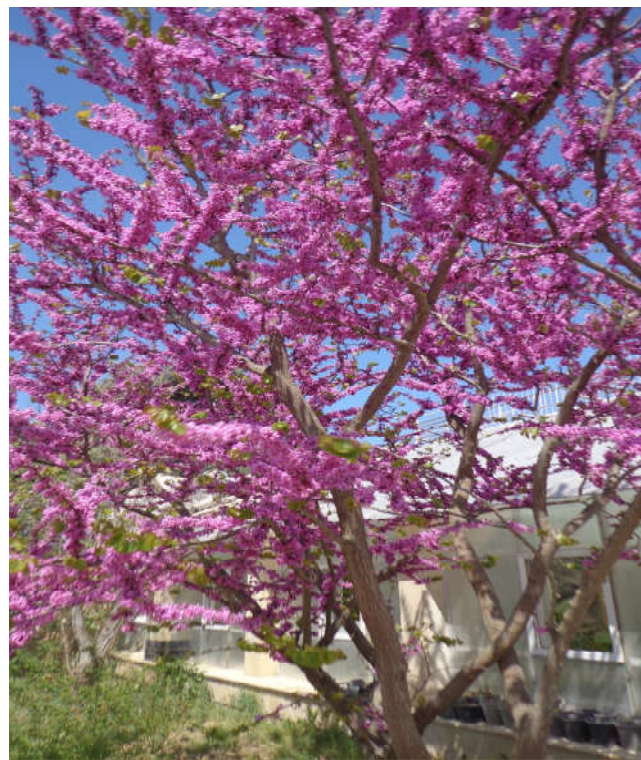
Asia, Africa, America, Australia and the Mediterranean. In this study, species of flora of North America had taken a special place. A.D.Strebkova had noted existence of 30 species in dry subtropical regions of Azerbaijan of trees and shrubs from 206 species used in landscaping to the North American flora during 1930th-40th and in subsequent years, G.D. Kostechkova added it to 50 species from 275 species. In the 1950th P.A.Shutov, D.G.Alekberova had noted of 187 species of trees and shrubs used in landscaping of Absheron peninsula pointed belonging to 37 species of North American flora (5). Research carried by U.M. Agamirov in the 1980th years there was revealed that in the Botanical Garden of ANAS have been introduced up to 1000 species of trees and shrubs, of which 114 species belonging to 19 families, 29 genus belong to the North American flora. According to further researches in the greening of Azerbaijan and in the collections of research institutions (of the Central Botanical Garden and the Institute of Dendrology) identified belonging to 153 species related to 62 families, 61 genus to the flora of North America (6), including 23 species of gymnosperms, angiosperms 130 species. It presented the highest species of the genera: pine, cypressus (8 species), Crataegus (33 species), Fraxinus (9 species), other genera consist of 1-5 species.

Table 1. North-American district

Floristic zones	Amount of Introducents
Appalachian	94
Atlantic	13
North American prairie	1
The area of the Rocky Mountains	
Sitkano-Oregon	11
Rocky Mountains	5
The area of Malerinskaya	
California	15
Sonar	8
Rocky Mexican	3

Floristic and phyto-geographical analysis of exotic species showed that the Atlantic-North American floristic region is more promising for the introduction. Most of the good growth and development of North American trees and shrubs are in the foothills and mid-mountain areas. The good growth and development of more North American trees and shrubs are on the foothills and mid-mountain areas. Typical subtropical representatives of the botanical province of south Atlantic states differ in the local condition with high adaptability (Table 1). By F.M.Mamedov from 400 species of trees and shrubs introduced in Absheron 25.5% belong to the North American flora (*Cupressus arizonica* E.L.Greene, *Chamaecyparis lawsoniana* Parl., *Cercis siliquastrum* L., *Liriodendron tulipiferum* L., *Mahonia aquifolium* Nutt., *Maclura aurantiaca* Nutt., *Gleditsia triacanthos* L., *Rhus aromatica* Ait., *Cupressus lusitanica* Mill., *Agave americana* L., *Acca sellowiana* Berg. et.c.). Recently the new species have been added to the list of exotic introduced species: *Juniperus virginiana* L., *Thuja plicata* D.Don., *Rhus typhina* L., *Tecoma radicans* Juss., *Symphoricarpos albus* Bl. et.c.). During a certain time some of the introduced species from the inability to adapt to the high temperature and drought have been gradually died in Absheron (*Fraxinus oregona* Nutt. *Fraxinus velutina* Torr., *Rhus taxicodendron* L., *Gymnocladus dioicus* (L.) C.Koch, *Liquidambar styraciflua* L. et.c.). In carried research studies of Azerbaijan dendroflora in 2010-2015. we found exotic trees plants about 60% of the total number of species of woody flora, among which 28.5% are from the Flora of North America

(*Picea glauca* Voss, *P.punges* Engelm., *Pinus strobus* L., *Chamaecyparis lawsoniana* Parl., *Juniperus virginiana* L., *Thuja occidentalis* L., *Th.plicata* D.Don., *Robinia pseudoacacia* L. et.c.). Currently, in the book "Dendroflora of Azerbaijan" has been given the information about 1116 species belonging to 92 families, 266 genera grown in natural and cultural environments, including of 660 species of 87 families, 230 genera grown in Absheron and in surrounding areas (6). This work presents the results of the introduction of the North America trees plants in the condition of Azerbaijan including the Institute of Dendrology.



Picture1. *Cercis siliquastrum* L. In period of flowering



Diagram 1. Vital plants forms from North-American flora. 1-trees; 2-ivies; 3-shrubs plants

At the Institute of Dendrology "Flora of North America" covers a wide space that includes in the north-eastern and central part zone. Plants grown from seeds and previously planted adult plants occupied the main place in the living collection: *Gleditsia macrocarpa* L., *G. triacanthos* L., *Robinia pseudoacacia* L., *Sabal adansoni* Guerns, *Juniperus virginiana* L., *Yucca filamentosa* L. et.c. The regular planting of trees and shrubs in relation to various environmental factors gives naturalness for exposure. Recently there are have been included

to the collection as a result of the expansion of international exchange of seeds by new species belonging to the flora: *Celtis mississippiensis* Bosc., *Chilopsis linearis* (Gav.) Sweet, *Amorpha fruticosa* L., *Mahonia aquifolium* Nutt., *Carya pecan* (Marshall) Engler et Graebner et.c. According to recent studies in this exhibition includes 62 species belonging to 16 families, 26 genera and it consists of 15.4% of the total number of species. These species are highly adaptive feature to the local conditions. By the species composition as the main part of the collection consists of rich deciduous (40%), the certain part of conifers (20%), and the central part of the mixed trees and shrubs (40%). 13.0% (11 species) of the Flora of North America consists of coniferous, deciduous plants in 87.0% (51 species). As living forms 28 species (45.2%) are trees, 24 species are (38.7%) shrubs, 4 species are (6.5%) ivies (Diagram1). Species belonging to the genus *Opuntia* (Cactus family) consist of 8.1% of the total collection. After 2000, there are appeared in the cultural flora many trees and shrubs species and they are widely used in landscaping, owing to study the biological and ecological features of these species: (*Mahonia aquifolium* Nutt., *Quercus rubra* L., *Ribes aureum* Purcsh, *Spiraea alba* Du Roi, *Acer negundo* L., *Rhus typhina* L., *Hydrangea arborescens* L., *Symphoricarpos albus* (L.) Blake, *Fraxinus lanceolata* Borkh. Et.c.).



Picture 3. *Rhus aromatica* Ait.

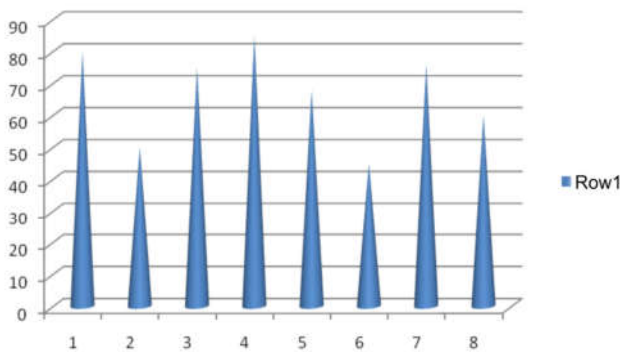
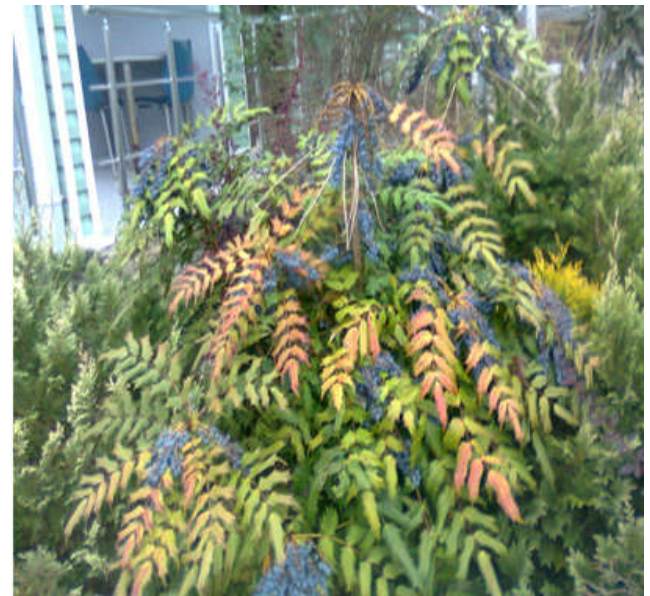
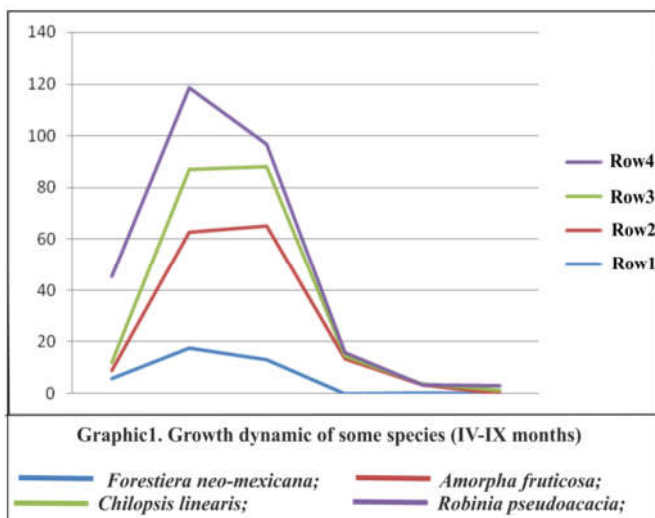


Diagram 2. Seed germination. 1. *Maclura aurantiaca*; 2. *Chilopsis linearis*; 3. *Juniperus virginiana*; 4. *Catalpa bignonioides*; 5. *Gymnocladus dioica*; 6. *Rhus aromatica*; 7. *Cercis canadensis*; 8. *Symphoricarpos albus*



Mahonia aquifolium Nutt. during fruiting



Graphic 1. Growth dynamic of some species (IV-IX months)

In the laboratory of "Introduction and acclimatization of trees and shrubs" are studied the biological and ecological features of species of North America flora: reproduction, morphology, germination, growth dynamics of the terrestrial parts, the morphology of the root systems, relation with environmental factors, phenological phases of development. These species are propagated by seeds and vegetatively.

Depending on the type of seeds sown in spring and autumn they give 35-80% germination (Diag. 2). Some types of vegetative reproduction give good results (*Aqava americana* L., *Campsis radicans* (L.) Seem., *Yucca filamentosa* L., *Ribes odoratum* Wendl. Et.c.), and others. In trees and shrubs belonging to the specified flora intensive growth is observed in the air and soil humidity 85-90%, while the temperature in the air 22-28°C, in poche 18-24°C. It basically starts at the beginning of April and continues until the end of June. In July, as a result of rising temperatures and intense humidity weakens the growth of plants (Graph.1). Since mid-August, increasing humidity in some plant species promotes top growth in II phase. Duration of growing season, depending on the climate conditions lasts from early October to mid-November, 175-230 days, annual growth between species is 32,5-115,6 cm. Because of the survey revealed that the normal passage of phenological phases of development to a certain extent affected by the temperature and soil moisture and air. In early spring, there are observing the mass of leafy and flowering plants from

the flora of the Mediterranean and East Asia, the species of the flora of North America, their phenological stages are observed at 10-16 days later (after the II decade of April) (*Zanthoxylum americanum* Mill., *Forestiera neo-mexicana* Gray, *Amorpha fruticosa* L., *Cercis canadensis* L., *Juglans nigra* L. *et al.*). In species of the flora of North America phenological phases of development starts late and ends late. Mass flowering generally occurs in late April and early May. Forms normally bloom, produce high-quality fruits and seeds. This biological feature in one side or in other side are creating the green zone, or the decorative composition, on the other hand prevents early spring plants impact on the temperature changes. Plants from Flora of North America in Absheron conditions normally endure the winter, resistant to temperatures in $-10-15^{\circ}\text{C}$. There are yellowing leaves in dry and in hot summer in some species and even become defoliation in (*Forestiera neo-mexicana* Gray, *Amorpha fruticosa* L., *Rhus aromatica* Ait.). This can be prevented by irrigation and agro-technical works. In species of *Agave americana* L, *Chamaerops* L., *Trachicarpus* and in some species of *Yucca* L. are significantly increases the resistance of plants to drought by strong developed root system. Strong root development significantly increases the resistance of plants to drought.

Conclusion

Normal carrying of phenological phases of development of North America flora species in Azerbaijan, resistance to environmental factors of the environment, natural regeneration of some species is an indicator of the full adaptation of exotic species. These types can be used in landscaping, parks and

gardens, in house yards, as the design of various compositions. From the North American species *Chamaecyparis lawsoniana*, *Liriodendron tulipifera* L., *Mahonia aquifolium* (Pursh) Nutt., *Maclura Pomifera*, *Gymnocladus dioica* (L.) K.Koch, *Gleditsia macrocarpa*, *Rhus aromatica* Ait., *Cupressus lusitanica* Mill., some species of *Opuntia* (Tourn.) Mill., *Agave americana* L., *Abelia* R.Br., *Acca sellowiana* and others are acclimatized well in Azerbaijan. *Mahonia aquifolium* Nutt., *Campsis radicans* (L.) Seem., *Liquidambar styraciflua* L., *Robinia pseudoacacia* L. are present some interest for our ornamental horticulture.

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