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Growth-Development Peculiarities of Some Rare and Endangered Plants in Nature and Culture

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Abstract

The article covers information on the following species of rare endemic and relict plants of the narrow local area that are included in the "Red Data" book of Georgia: *Taxus baccata* L.*, Pinus pityusa* Stev.*,, Acer ibericum* M. Bieb.*,, Betula litwinowii* Doluch., *Berberis iberica* Stev. & Fisch.ex DC., *Ostrya carpinifolia* Scop., *Diospyros lotus* L., *Quercus dshorochensis* K.Koch., *Q. Hartwissiana* Steven., *Q.imericna* Steven ex Woronow, *Q.macranthera* Fisch. & C.A.Mey.ex Hohen, *Pterocarya pterocarpa* (Michx) kunth., *Punica granatum* L., *Amygdalus Georgia* Desf., *Pyrus sachokiana* Kuth., *Populus euphratica* Oliv, *Ulmus suberosa* Michx., *Zelkova carpinifolia* (Pall.,) K.Koch. Their biological peculiarities, duration of flowering and fruit-bearing, the similarity of seeds and their quality have been studied under the conditions of arid zone. The paper also gives a description of cambiogenetic growth nature that is a secondary meristem of 1-3-year-old spurs of these plants from the beginning till the end of their vegetation.

Contents

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1 Introduction

The flora of Georgia has always attracted the attention of botanists. It is rich in ancient relic, endemic, medicinal or decorative plants. In the last decades, in terms of the dramatically increased anthropogenic impacts and intensification of natural disasters, the assessment of the functions of natural flora and the modern state of ecosystems is of particular practical importance. As a result of the agricultural actions of humans, in most cases, irreversible changes take place in natural landscapes. Lowering soil water level, increasing salinity, pollution of ambient air (gas, strong toxicants and solid dust particles), increasing carbon dioxide gas content, the variability of radiation and temperature regime in the area (Ogu & Orjiakor, 2017; Parraga *et al.,* 2017). All this contributes to the destabilization of the links in bio-geocenosis, which leads to the disruption of the equilibrium formed in its structure.

First of all, this is expressed in variations of the rate and direction of the processes involved, resulting in a partial or profound conversion of the life cycle of plant ubiquitous synapses in phytocenoses, and eventually a change in its floristic composition (Ermayanti *et al.,* 2016; Sulistiawati, 2018). Conservation of those useful plants genome of natural flora (decorative, medicinal, nutrient, etc.), that are primarily facing destruction, is very important. Maintaining **ex-situ** of bio-diversity, their intensification and sustainable usage in the ecosystem is necessary, which is desirable to occur in the area of origin of genetic resources.

2 Materials and Methods

The aim of our research was the study of some of the rare and endangered plants listed in The Red Book of Georgia: *Taxus baccata* L., *Pinus pityusa* Stev., *Acer ibericum* M.Bieb., ,*Betula litwinowii* Doluch. , *Berberis iberica* Stev.& Fisch. ex DC., *Ostrya carpinifolia* Scop.,*Diospyros lotus* L., *Quercus dshorochensis* K.Koch*., Q. Hartwissiana* Steven., *Q.imeretina* Steven ex Woronow*., Q.macranthera* Fisch & C.A.Mey ex Hohen., *Pterocarya pterocarpa* (Michx.) Kunth*., Punica granatum* L., *Amygdalus Georgia* Desf*., Pyrus sachokiana* Kuth*., Populus euphratica* Oliv., *Ulmus suberosa* Michx. , *Zelkova carpinifolia* (Pall.) K.Koch*. and etc*. Gagnidze (2005); study of their bio-ecological peculiarities, identification of growth-development restricting factors and establishment of the regularities of their development under subarid conditions of eastern Georgia.

Phenological observations were carried out in the eastern regions of Georgia in order to solve the problem. The periods of flowering and fruit-bearing, seed quality (determining arising ability), frost-resistance, duration of cambium action in 1-3 years old sprouts had been studied according to E. Lobjhanidze and Yatsenko-Khmelevski's methodical instructions (Tsitsvidze, 1973; Lobzhanidze, 1961; Yatsenko, 1954). The age of the plant, lightning, trunk exposition and vegetative conditions were considered while taking the samples (3-5 cm length parts of 1-3-year-old sprouts) every five days within the periods of bud opening and apical growth ending, and once in 10 days in other vegetative periods. 5-year data has been processed using variational statistics method.

3 Results and Discussions

The study revealed that in analyzing plants growth rate and flowering phenophases are changeable according to the peculiarities of hydrothermal mode. In eastern Georgia, the mentioned plants start vegetations in spring, when the average air temperature equals to 6-8 degrees. *Acer ibericum* 14./III, *Pterocarya pterocarpa* 27/III, *Amygdalus georgica* 31/III, *Ulmus suberosa* 10/III and others start vegetation earlier. The deviation from the average dates of the vegetation start and end, in both cases, does not exceed 5 days. The named plants finish lateral growth in height after about 1.5–2 months.

In the first decade of April *Berberis iberica* 6/IV, *Betula litwinowii* 8/IV, *Corylus colurna* 6/IV, *Ostrya carpinifolia* 5/V, *Quercus dshorochensis* 8/IV, *Q. imeretina* 3/IV, *Q.macranthera* 13/IV, *Osmanthus decorus* 3/IV, *Punica granatum* 14/IV and others start vegetation; in the second decade of April - *Diospyros lotus* 20/IV.
In eastern Georgia the studied plants start flowering in spring or at the beginning of summer. Earlier blossom: *Ulmus suberosa* 2/IV and *Pyrus sachokiana* 13/IV. *Ostrya carpinifolia* 7/IV, *Amygdalus georgica*-13/IV, and *Betula litwinowii* 15/IV blossom in April, deviation 14 days, *Pinus pityusa* 29/IV, deviation 2-5 days,

Osmanthus decorus 10/IV and others. The mentioned plants end flowering in spring or in summer. *Pyrus sachokiana* and *Ulmus suberosa* flowering in March; *Betula litwinowii* 26/IV, *Amygdalus georgica* 21/IV – in April; *Pinus pityusa*-6/V, *Ostrya carpinifolia* 7.IV, *Berberis iberica* -1/VI, *Diospyros lotus* – 2/VI, *Punica granatum*-5/VI – in June; *Osmanthus decorus*-4/VI – prolongs flowering till July.

The end of test plant flowering is so stable that annual variability or coefficient of variation doesn't exceed 4-9%. Leptopus colchicus is distinguished by the longest blossom period (5-6) month, which is characteristic for subtropical features. The rest are characterized by the habitual flowering rhythm of moderately cold zone plants. All of the studied species have a good quality seed (50-80% arising), except *Zekova carpinifolia* and *Arbutus andrachne*, their seed germination ability rarely equals to 1%. Even in their natural area, they have such a low rate (about 5%), indicating the danger of extinction. However, from the age of 35 *Ostrya carpinifolia* is characterized by abundant self-development, which is the guarantee for their protection and survival.

To evaluate the preparation of plants for winter, duration of vegetation and cambial growth, or duration of secondary meristem cell division is very important. Cambial or secondary meristem growth has been studied in the 1-3-year-old lateral branches of 23 species (Susila *et al.,* 2019; Sulistiawati *et al.,* 2017). The research results are presented in table №1. Cambial growth becomes active in spring, in April. This process mainly starts with the beginning of vegetation. Cambium activation before the bud opening is mainly typical for Quercus (Lobzhanidze, 1961). However, the difference is so slight that it's not essential. The following plants start cambial growth in the first decade of April: *Acer ibericum*-9/IV, *Berberis iberca*- 9/IV, *Leptopus colchicus*-1/IV, *Ostrya carpinifolia*-2/IV, *Quercus imeretina*- 5/IV, *Q. macranthera*-10/IV, *Betula litwinowii* -16IV, *Osmanthus decorus*- 17/04, *Pyrus sachokiana*- 15/IV, *Populus euphratica*-16/IV, *Punica granatum*- 20/IV, *Quercus hartvissiana* -23/IV, *Ulmus suberosa*- 16/IV, *Zelkova carpinifolia*-17/IV.

The rest of the species take transitional places among them. The beginning of cambium action has been so different over the years that, due to different hydrothermal modes, the variation coefficient of some species equaled to 20-64%. Cambial growth and annual ring formation was ceased in September-October. *Betula litwinowii* – 4/IX, *Pyrus sachokiana*- 9/IX, *Quercus macranthera*- 8/IX, stop cambium active action and annual ring production earlier than others; *Pinus pityusa*-3/X, *Quercus dchorochensis*-1/X – are the last ones to stop active action of cambium and annual ring production, in October; *Acer ibericum, Amygdalus georgica, Berberis iberica, Crataegus pontica, Diospyros lotus. Ostrya carpinifolia. Osmanthus decorus, Populus euphratica*, *Pterocarya pterocarpa, Quercus imeretina,Q.harthwissiana, Swida armazica* – in the third decade of September. The following species are distinguished by longest growth: *Arbutus andrachne*- growth duration – 172 days; *Diospyros lotus* –176 days; *Leptopus colchicus*- 191 days; *Ostrya carpinifolia*-175 days; *Osmanthus decorus*-171 days; *Quercus dchorochensis*- 170 days; *Swida armasica*- 172 days, *Taxus baccata*- 170 days, etc.

In the studied plants, leaf fall starts in October-November and finishes in October-December. Unlike others, Arbutus andrachne is an evergreen plant, which starts leaf fall after the bud opening or the new leaves appearance, at the end of July (31/VII). This rate quite stable; Over the years, deviation from the average date is rarely more than 5 days. In November leave fall finishes in *Acer ibericum* 22/X - deviation from the average date – 5-6 days; *Berberis iberica*-24/XI, *Amygdalus georgica* 25/XI, *Crataegus pontica* 3/XI, *Pyrus sachokiana* 4/XI, *Ulmus suberosa* 15/XI, in October - *Betula litwinowii* 7/X; the latest, in December - *Diospyros lotus* 6/XII, *Leptopus colchicus* 6/XII, *Quercus harthvissiana* - 4.XII, *Quercus imeretina* -16/XII, *Quercus macranthera*-17/XII , *Pterocarya pterocarpa* -14/XII, *Punica granatum* -18/XII. Leaf fall is an inherited mark in plants. In some cases, its acceleration is caused by the autumn drought and especially, by the low air temperature (8^0-10^0). *Quercus dshorochensis, Quercus hartvissiana*, *Q. imeretina*, *Q.macranthera* and *Ostrya carpinifolia* maintain dried leaves almost until spring. Their leaf stems stay connected to the plant, indicating tropical or subtropical features.

Table 1
Species terms in the beginning and ending on the duration

Species	Beginning			Ending			
	M	±2m	V%	M	±2 m	V%	Duration in days
Acer ibericum	9/1V	13	35	22/1X	7	2	155
Amygdalus georgica	19/1V	5	64	20/1X	3	1.4	154

Arbutus ndrachne	21/ IV	10	4	10/ X	15	3	172
© Berberis iberica	9/ IV	5	10	22/1X	5	3	155
© Betula litwinowii	16/IV	9	20,5	4/1X	4	3	167
© Corylus colurna	13/iv	8	19	15/1X	2	2	142
Crataegus pontica	14/ IV	9	29	22/1X	5	3	161
Diospyros lotus	26/IV	3	5	21/1X	9	5	176
O Leptopus olchicus	1/ IV	6	20	9/X	6	3	191
Ostrya carpinifolia	2/IV	10	35	24/1X	10	5	175
O Pinus pityusa	14/IV	5	5	3/X	9	10	176
Osmanthus decorus	17/IV	10	22	22/1X	6	3	171
O Pyrus sachokiana	15/IV	6	14	9/1X	10	5	147
Populus euphratica	16/IV	4	9	26/1X	11	6	161
Pterocarya pterocarpa	14/IV	8	19	29/1X	5	4	168
Punica granatum	20/IV	9	5	20/1X	6	3	153
Quercus dshorochensis	8/IV	3	8	1/X	9	5	170
O Q.imeretina	5/IV	9	26	24/1X	7	4	164
Q.macranthera	10/IV	3	9	8/1X	2	2	150
Q.harthwissiana	23/1V	4	8	25/1X	2	1	155
O Swida armasica	4/1V	7	18	24/1X	6	4	172
Taxus baccata	13/1V	7	17	19/1X	2	2	170
Ulmus suberosa	16/1V	11	27	13/!x	10	6	149
elkovacarpinifolia	17/1V	8	18	16/1X	5	4	151

Marks:
© Caucasus endemic
O Georgian endemic
M - an Arithmetic average of beginning-ending
±2m -- Deviation from the arithmetic average in both directions in days
V% - Variation coefficient

4 Conclusion

Thus, the research revealed that all studied species are characterized by good growth-development in eastern Georgia. Conservation of these useful plants genome of natural flora (decorative, medicinal, nutrient, etc.), that are primarily facing destruction, is very important. Therefore, maintaining **ex-situ** of bio-diversity, their intensification and sustainable usage in the ecosystem is necessary, which is desirable to occur in the area of origin of genetic resources.

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