

## Invasion of Foreign Origin (Alien) Woody Plants in Seaside Adjara

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**ABSTRACT:** The researches carried during more than a century and half period from plants' introduction in Adjara Black Sea Coastline shows, that great part of thousands of exotic experienced tree plants and bushes are growing successfully, without special agro-technical measures and they create various cenotic links.

Introduction of foreign plants in Adjara coastline has started for a long time ago. Introduction of exotic plants in seaside Adjara started in 80s of XIX Century. Primarily, at the initial stage of introduction, practical direction of it was expressed mostly, which was made by volunteers interested in importing foreign plants unreasonably. For the end of nineteenth century and the beginning of twentieth century the foundation is laid down for construction of Batumi Botanical Garden and introduction of foreign plants. For the end of XX century, they were represented by more than 2000 woody taxon.

**Keywords:** Alien plant, Woody plant, Invasion, Cenosis, Adjara seaside, Black sea coastline, Adventive.

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### INTRODUCTION

Plant introduction, dividing into districts – cultivation of various species and forms, recreational meaning of alien species in Adjara Coastline caused weakening of local phytocenosis and in some cases caused degradation as well.

At present, some introduced species produces fruit and seeds in Adjara Coastline, they give self-crops and offshoots, they make roots, shoots and stems. Distribution of introduced species without the human intervention caused plants' invasion. The specific case of plant distribution was created and new communities with the participation of exotic plants were created in local cenosis. In most cases, local species have been withdrawn by the introduced ones. Elaboration of peculiarities typical for wild species by the foreign origin plants in non-typical climatic conditions, naturally, their distribution without any human intervention with both cases via seeds and vegetative ways as well, is the result of stage naturalization and final invasion (Elton, 2007).

On one hand, invasion is stipulated by enriching the flora with foreign origin species reasonably and intentionally. On the other hand, the spontaneous process of plants introduction is ongoing, which finally are represented as adventive, invasive and weed plants. In frequent cases, introduced species are represented as invasives and for this reason, it is important to review the essence of introduction. Plants introduction is Latin word and means “preamble” but in this case it means – importing the crops (Kokhno, 1980). Generally, the term “plants' introduction” is understood as intentional action of a human - to introduce the plants in certain introduction point. The term implies wild (including local flora) and cultural crops as well. The sources of plants' introduction start from the beginning of botanical scientists' actions and practical activities for plants acculturation. The plant's invasion is started from the same period as well. Such distribution (invasion) of introduced species frequently acquires the character of “ecological explosion” and the foreign species occupies a number of places during years. In parallel with it, the aborigine species are removed and lost (Bakhanova, 2009).

The botanical gardens play particular role in plants distribution. The carried works in Batumi and Sokhumi Botanical Gardens are noteworthy, as a result of which the following plants were broadly distributed at the Black Sea coastline. *Tea, Citrus, Aleurites, Eucalypts, Bamboos, Camphor tree, Persimmon, Palms, various kinds of Pines, evergreen Oaks* (Papunidze, 2003). The creation of Botanical garden, experimental stations, decorative and agro-cultural nursery supported the enrichment of foreign origin plants. From that period the interest about contents of foreign plants increase and the first researches and studies about introduced and wildered plants appear (Shavrov, 1910, Voronov, 1916). In 1915-1939 the famous researcher of Caucasian flora A. Grossheim published several articles about advent, foreign origin plants (Grossheim, 1939). In 1929–1950 Georgian advent flora was researched by A. Makashvili, who wrote some articles to study ways and roads of foreign plant migration (Makashvili, 1950). Many articles were devoted conducted researches and results particularly on Adjarian advent flora. The research results held in Batumi Botanical Garden in 1964 by Manjavidze and Matinian must be mentioned, who detected 58 wildered, foreign origin (introduced) species (Manjavidze and Matiniani 1964). V. Memiadze made special researches in Kintrishi valley (1971). He described 65 advent species of 48 genera and 19 families. Among them 2 families *Comelinaceae, Phytolaccaceae* and 32 genera represented with only advent species (Memiadze, 1971).

Dozens of articles are published about species contents, spread, growth – development, florogenesis, morphogenesis and other issues by M. Davitadze in 1970–2000 in different scientific magazines. His fundamental publications – “Advent Flora of Adjara” and “Bio-morphological Analysis of Adjara Advent Flora” are especially remarkable (Davitadze, 2001, 2002). Since 2000, special researches and description about foreign origin plants in Adjara and generally in Georgia haven’t been conducted if we don’t take into consideration the work published in 2010 “Georgian Non Local Flora”, analysis of which is mainly based on reference data (Kikhodze *et al.*, 2010).

The decisive role in creation of cenosis has woody plants. The cenosis created by woody species at Adjara Black Sea Coastline determine the development of grass cover. It implies foreign (alien, adventive, invasive, weeds, ruderal, etc.) and local origin plants.

## MATERIALS AND METHODS

We have conducted researches and descriptions in seaside Adjara in 2013-2017 years. The main goal of the research was to identify specific composition of woody plants of foreign origin, which have the ability

to distribute naturally, without human intervention and create cenotic links.

The researches have been carried from Sarpi to river Cholokhi territory in seaside Adjara on the following objects: natural, second-hand and artificial cenosis; railway and the habitats of adjacent territories; controlled access highways and adjacent habitats, parks, gardens, abandoned green facilities, abandoned degraded tea plantations; landfills-ruderal places; seashore left fallow sand-sandy soils; cemeteries and adjacent territories; water channels, construction sites, streets.

The research material was the plants of foreign origin spread over these objects.

For the purpose of identification, the specific composition, background (recognistic) descriptions were made. The main attention was paid to dissemination and distribution peculiarities, in order to identify how far the species, distribute naturally, without human intervention. For species identification various guide books have been applied and internet resources as well (Dmitrieva, 1990, Averis 2013, Thorogood, 2014). Classification is represented in line with World Plant Data Base ([www.theplantlist.org](http://www.theplantlist.org)). Each specie has indication of plant life form and place of origin.

## RESULTS AND DISCUSSION

As a result of carried researches and descriptions in Coastline totally 31 families, 51 genera, 71 species are identified (Table 1, Table 2, Table 3), which are adopted to soil climatic conditions, which are characterized by natural dissemination (vegetatively and generatively) abilities, without human intervention. Therefore, the mentioned species are disseminated, distributed and turned wild. New cenotic links are created with the participation of local species in some cases, cenosis are represented with woody plants of only foreign origin, as they are characterized by rapid growth abilities and high fertility.

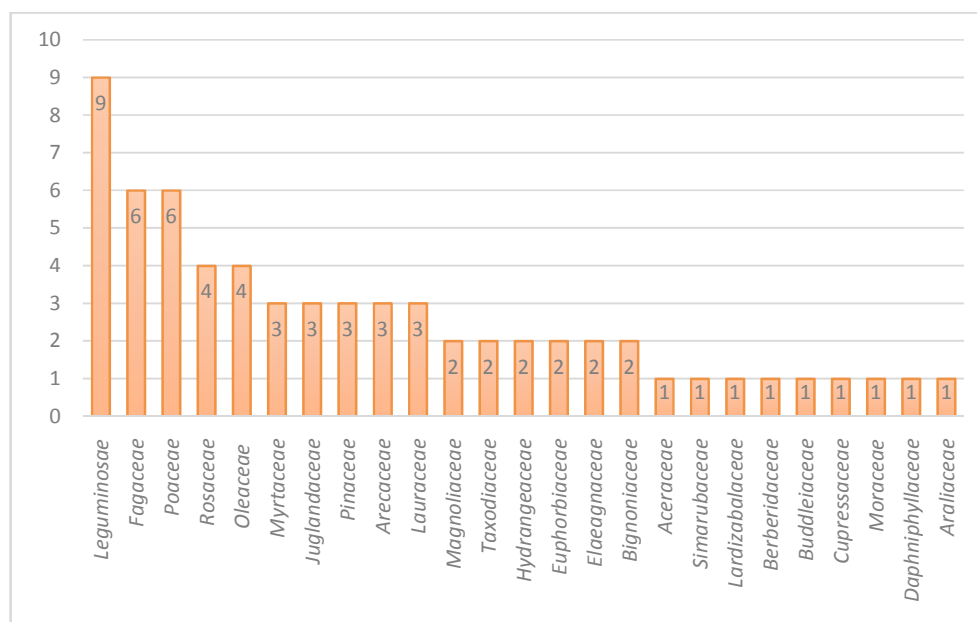
The families distinguished for multiplicity of species: *Leguminosae* – 9 species, *Poaceae* and *Fagaceae* represented with 6-6 species (Table 1, Fig. 1), *Rosaceae* and *Oleaceae* with 4-4 species, and *Myrtaceae, Juglandaceae, Pinaceae, Arceaceae* and *Lauraceae* 3-3 species (Table 2, Fig. 1). The rest with 2-2 and one species (Table 3, Fig. 1).

Oak is rich genus with species – *Quercus* with 6 species, *Eucalyptus, Ligustrum* and *Pseudotsuga* with 3-3 species, *Acacia, Aleurites, Cinamomum, Eleagnus, Juglans, Liriodendron, Phyllostachys, Pinus, Spirea* with 2-2 species, and the rest genus are represented with one species.

Adjara invasive woody plants are divided into the following geo-elements according to arealogic and florogenetic analysis (Fig. 2).

**Table 1: The alien invasive woody species in seaside Adjara, distinguished families with a wide range of species.**

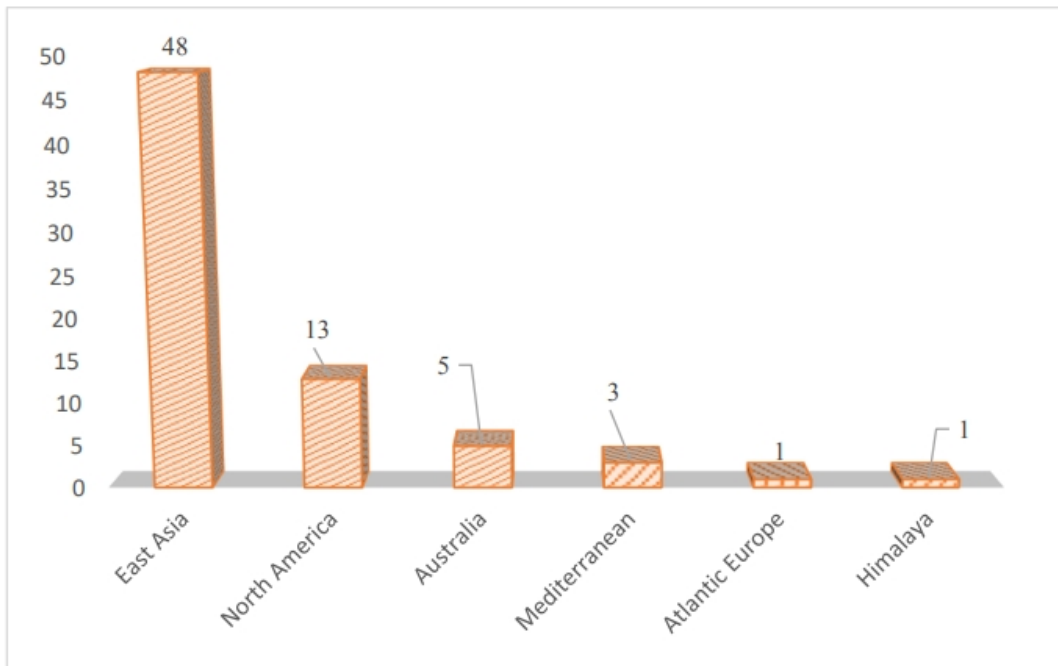
S. No.	Species	Life form	Family	Origin
1.	<i>Amorpha fruticose</i> L.	Deciduous Shrub	<i>Leguminosae</i>	N. America
2.	<i>Lespedeza bicolor</i> Turcz.	Deciduous Shrub	<i>Leguminosae</i>	East Asia
3.	<i>Gleditschia triacanthos</i> L.	Deciduous tree	<i>Leguminosae</i>	N. America
4.	<i>Pueraria montana</i> var. <i>lobata</i> (Willd.) Sanjappa & Pradeep	Deciduous liana	<i>Leguminosae</i>	East Asia
5.	<i>Robinia pseudoacacia</i> L.	Deciduous tree	<i>Leguminosae</i>	N. America
6.	<i>Wisteria sinensis</i> (Sims) Sweet.	Deciduous liana	<i>Leguminosae</i>	East Asia
7.	<i>Acacia dealbata</i> Link.	Evergreen tree	<i>Leguminosae</i>	Australia
8.	<i>Acacia melanoxylon</i> R.Br.	Evergreen tree	<i>Leguminosae</i>	Australia
9.	<i>Albizia julibrissin</i> Durazz.	Deciduous tree	<i>Leguminosae</i>	Transcauc.,China
10.	<i>Phyllostachys edulis</i> (Carrière) J. Houz.	Bamboo	<i>Poaceae</i>	East Asia
11.	<i>Phyllostachys bambusoides</i> Siebold & Zucc.	Bamboo	<i>Poaceae</i>	East Asia
12.	<i>Pleioblastus argenteostriatus</i> (Regel) Nakai	Bamboo	<i>Poaceae</i>	East Asia
13.	<i>Pseudosasa japonica</i> (Steud.) Makino	Bamboo	<i>Poaceae</i>	East Asia
14.	<i>Pseudosasa hindsii</i> (Munro) C.D.Chu & C.S.Chao	Bamboo	<i>Poaceae</i>	East Asia
15.	<i>Pseudosasa humilis</i> (Mitford) T.Q. Nguyen.	Bamboo	<i>Poaceae</i>	East Asia
16.	<i>Quercus acuta</i> Thunb.	Evergreen tree	<i>Fagaceae</i>	East Asia
17.	<i>Quercus acutissima</i> Carruth.	Deciduous tree	<i>Fagaceae</i>	East Asia
18.	<i>Quercus glauca</i> Thunb.	Evergreen tree	<i>Fagaceae</i>	East Asia
19.	<i>Quercus myrsinaefolia</i> Blume.	Evergreen tree	<i>Fagaceae</i>	East Asia
20.	<i>Quercus palustris</i> Muench.	Deciduous tree	<i>Fagaceae</i>	N. America
21.	<i>Quercus falcate</i> Michx	Deciduous tree	<i>Fagaceae</i>	N. America



**Fig. 1.** A range of invasive woody species distributed in seaside Adjara according to families.

**Table 2: The alien invasive woody species in seaside Adjara, families with a three and four species.**

S. No.	Species	Life form	Family	Origin
1.	<i>Eriobotrya japonica</i> (Thunb.) Lindl.	Evergreen tree	Rosaceae	East Asia
2.	<i>Rosa multiflora</i> Thunb.	Deciduous Shrub	Rosaceae	East Asia
3.	<i>Spiraea cantoniensis</i> Lour.	Deciduous Shrub	Rosaceae	East Asia
4.	<i>Spiraea japonica</i> L. f.	Deciduous Shrub	Rosaceae	East Asia
5.	<i>Ligustrum japonica</i> Thunb.	Evergreen Shrub	Oleaceae	East Asia
6.	<i>Ligustrum lucidum</i> Ait.	Evergreen Shrub	Oleaceae	East Asia
7.	<i>Ligustrum sinense</i> Lour	Deciduous Shrub	Oleaceae	East Asia
8.	<i>Mallotus japonica</i> (L.f.) Müll. Arg.	Deciduous tree	Oleaceae	East Asia
9.	<i>Eucalyptus cinerea</i> F. Muell. ex Benth.	Evergreen tree	Myrtaceae	Australia
10.	<i>Eucalyptus globulus</i> Labill.	Evergreen tree	Myrtaceae	Australia
11.	<i>Eucalyptus viminalis</i> Labill.	Evergreen tree	Myrtaceae	Australia
12.	<i>Carya cordiformis</i> (Wangenh.) C. Koch.	Deciduous tree	Juglandaceae	N. America
13.	<i>Juglans ailanthifolia</i> Carr.	Deciduous tree	Juglandaceae	East Asia
14.	<i>Juglans ailanthifolia</i> v. <i>cordiformis</i> (Maxim.) Rehd.	Deciduous tree	Juglandaceae	East Asia
15.	<i>Pinus pinaster</i> Aiton	Evergreen tree	Pinaceae	Mediterranean
16.	<i>Pinus taeda</i> L.	Evergreen tree	Pinaceae	N. America
17.	<i>Cedrus deodara</i> Loud.	Evergreen tree	Pinaceae	Himalayas
18.	<i>Chamaerops humilis</i> L.	Palm tree	Arecaceae	Mediterranean, N. Africa
19.	<i>Phoenix canariensis</i> Chabaud.	Palm tree	Arecaceae	Canary Islands
20.	<i>Trachycarpus fortunei</i> (Hook.) Wendl.	Palm tree	Arecaceae	East Asia
21.	<i>Cinnamomum glanduliferum</i> (Wall.) Meisn.	Evergreen tree	Lauraceae	East Asia
22.	<i>Cinnamomum japonicum</i> Sieb. et Nakai	Evergreen tree	Lauraceae	East Asia
23.	<i>Laurus nobilis</i> L.	Evergreen tree	Lauraceae	West Cauc., Mediter.



**Fig. 2.** A range of invasive (feral) woody species distributed in seaside Adjara according to their origin.

Table 3: The alien invasive woody species in seaside Adjara, families with a one and two species.

S. No.	Species	Life form	Family	Origin
1.	<i>Aleurites cordata</i> Tumb.	Deciduous tree	<i>Euphorbiaceae</i>	East Asia
2.	<i>Aleurites fordii</i> Hemsl.	Deciduous tree	<i>Euphorbiaceae</i>	East Asia
3.	<i>Elaeagnus umbellate</i> Thunb.	Deciduous Shrub	<i>Elaeagnaceae</i>	East Asia
4.	<i>Elaeagnus pungens</i> Thunb.	Evergreen Shrub	<i>Elaeagnaceae</i>	East Asia
5.	<i>Deutzia scabra</i> Thunb.	Deciduous Shrub	<i>Hydrangeaceae</i>	East Asia
6.	<i>Hydrangea macrophylla</i> Thunb.	Deciduous Shrub	<i>Hydrangeaceae</i>	East Asia
7.	<i>Liriodendron chinense</i> (Hemsl.) Sarg.	Deciduous tree	<i>Magnoliaceae</i>	East Asia
8.	<i>Liriodendron tulipifera</i> L.	Deciduous tree	<i>Magnoliaceae</i>	N. America
9.	<i>Catalpa speciose</i> Worder	Deciduous tree	<i>Bignoniaceae</i>	N. America
10.	<i>Paulownia tomentosa</i> Tunb.	Deciduous tree	<i>Bignoniaceae</i>	East Asia
11.	<i>Cryptomeria japonica</i> L.f.	Evergreen tree	<i>Taxodiaceae</i>	East Asia
12.	<i>Taxodium distichum</i> (L.) Rich.	Deciduous tree	<i>Taxodiaceae</i>	N. America
13.	<i>Acer negundo</i> L.	Deciduous tree	<i>Aceraceae</i>	N. America
14.	<i>Ailanthus altissima</i> (Mill.) Swingle	Deciduous tree	<i>Simarubaceae</i>	East Asia
15.	<i>Akebia quinata</i> (Tunb.) Decne.	Semi-Evergr. liana	<i>Lardizabalaceae</i>	East Asia
16.	<i>Berberis levis</i> Franch.	Evergreen Shrub	<i>Berberidaceae</i>	East Asia
17.	<i>Buddleia davidii</i> Franch.	Deciduous Shrub	<i>Buddleiaceae</i>	East Asia
18.	<i>Cupressus lusitanica</i> Mill.	Evergreen tree	<i>Cupressaceae</i>	N. America
19.	<i>Cudrania tricuspidata</i> (Carr.) Bureau	Deciduous tree	<i>Moraceae</i>	East Asia
20.	<i>Daphniphyllum macropodum</i> Miq.	Evergreen tree	<i>Daphniphyllaceae</i>	East Asia
21.	<i>Fatsia japonica</i> (Tunb.) Decne et Planch.	Evergreen Shrub	<i>Araliaceae</i>	East Asia
22.	<i>Hovenia dulcis</i> Thunb.	Deciduous tree	<i>Rhamnaceae</i>	East Asia
23.	<i>Liquidambar styraciflua</i> L.	Deciduous tree	<i>Hamamelidaceae</i>	N. America
24.	<i>Lonicera japonica</i> Thunb.	Evergreen liana	<i>Caprifoliaceae</i>	East Asia
25.	<i>Rhus javanica</i> L.	Deciduous tree	<i>Anacardiaceae</i>	East Asia
26.	<i>Thea sinensis</i> L.	Evergreen Shrub	<i>Theaceae</i>	East Asia
27.	<i>Vitex trifolia</i> subsp. <i>litoralis</i> Steenis	Evergreen Shrub	<i>Lamiaceae</i>	East Asia

According to the figure 2, woody invasive (feral) species basically are created with East-Asian elements (48 species) and they make 68 % of invasive woody plants. 13 species are North-American, 5 species are Australian, 3 are Mediterranean, 1-1 species are from Himalaya and Atlantic Europe. The multiplicity (abundance) of East-Asian species depends not only at transporting-distribution of diaspora and at the adoption abilities of species, but at similar soil climatic conditions of East Asia and Adjara coastlines.

According to simple classification of plant life forms, the tree plants are represented with 41 species, bushes with 17 species, Liana with 4 species, Palm with 3 species and bamboos with 6 species. From which evergreen plants are 36 and 35 species are being deciduous ones (Table 1, Table 2, Table 3).

## CONCLUSIONS

As a result of accidental import of plants or plants' introduction in seaside Adjara totally more than 2000 taxonsof woody plants are introduced during a century and a half period, from which 31 families, 51 genuses,

71 species are invasive (feral) and are characterized with massive dissemination abilities. The mentioned species are adopted to local, soil climatic conditions, they are characterized by the ability of natural dissemination abilities, without human intervention and they create new cenotic links, with the participation of local species and in some cases, cenosis are represented by woody plants of only foreign origin.

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