PLANT SPECIES IN NATURA 2000 HABITATS IN GEORGIA

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Tbilisi, 2019

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Natura 2000 habitats as conservation units are based on species composition and plant community types including as well abiotic factors (EUR27). Sampling is then confined within those boundaries. Ecologists based in different countries, educated in different traditions, tend to view communities differently: Europeans tend to see communities as distinct and discrete entities. This book describes biodiversity of plant species for Natura 2000 habitats and the conservation opportunities of their different species of plants in Georgia. Some species of plants are as crop wild relatives, endangereds, endemics, edificatory, the economically potential species - recreational, ornamental and medicinal plants and other, indicators, umbrellas, invasives, flagships and relict species. The plant species we have now as the use for food, medical, decorative and protect these plants. The aim to develop habitat classification in countries of European continent based on the standards of the EUR27 version of the Interpretation Manual includes descriptions of new habitats, which are characteristics to concrete countries. Natura 2000 - a network of priority habitats identified in Georgia, but has not been approved and has not developed a plan for their protection. Georgia is a country hosting highly diverse habitat types. Georgia is a country hosting highly diverse habitat types. Some of those are identical to the habitats, which are already included in the Annex I of the Interpretation Manual v. EUR27. An author is Prof. Dr. Maia Akhalkatsi, Botanical Institute, Ilia State University, Tbilisi, Georgia.

Contents

1. INTRODUCTION

According to the Natura 2000 habitat as conservation units are based on species composition and plant community types including as well abiotic factors **(EUR27).** After determining the species composition will be determined the dominant species or species that determine the type of community. The dominant species name identifies Community name. Before is using special terminology. For example-Festucetum, etc. and Brometum etc., are now simply bring the dominant species name Festuca supina's community.

Creation is of the national habitat list and approval of the priority habitats. Selection of public is on interest habitats (SCI). Determination is of specific habitats for conservation (SAC). Environmental manipulation and management of land is in order to preserve the species. To keep the plant species that has caused the animal species to survive. Plant communities and plant cover change shall not affect the food reduction. Landowner's interest is to preserve and develop natural resources in order to maintain the environment of wild species. The increase of plant and animal populations of wild species allows it to extract natural resources in health care, for example. Food and medicinal plant are collection and hunting animals. Protection of plant and animal species for food and multiplication, for example, plants for planting, seeding, disease protection, etc. Protection is of vegetation cover, for example, soil erosion; reduce the influence of climate change, vegetation replaced by those of recovery, etc.

Habitat conditions scientific study means assessment of their diversity: Biodiversity hot spots, rare, endemic and endangered species. Species phytosociological rate: density, frequency, percentage cover, richness, Simpson, Shannon-Wiener indices; Evennes; Natural hazards of habitat cause of species extinction and mutational changes. Habitat threats cause damage of species to the reproductive and geographic isolation. Global disasters cause species extinction to such: global climate change is determined by the number of species sensitive to changes in habitat. Human impact influences habitat damage. Habitat degradation is connected to biodiversity loss factors as a result of the reduction depends on the species. Habitat fragmentation affects pollination between plant species and animal species restriction area.

Habitat loss depends on species extinction rates in the past and the future of the likely range of speeds. Restoration of degraded habitat has vegetational fluctuation impact on biodiversity: pioneer species ◊climax species.

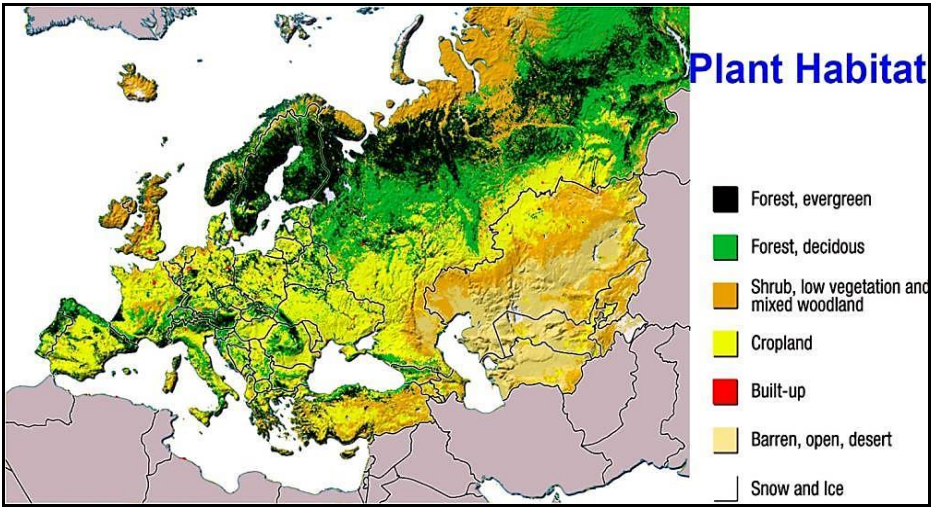
A community is a group of populations that coexist in space and time and interact directly or indirectly. The plant community is simply all of the plants occupying an area which an ecologist has circumscribed for study. Previous Terminology: Association – a particular community type (e.g., oak hickory), found in many places and with a specific species composition and physiognomy; Formation – originally used to refer to a large regional climax community. In practice, the boundaries of plant communities are usually defined operationally (i.e., based upon the abundance of the most common species). Sampling is then confined within those boundaries. Ecologists based in different countries, educated in different traditions, tend to view communities differently: Europeans tend to see communities as distinct and discrete entities. North Americans tend to see communities as entities that blend together continuously.

The primary issues surrounding the nature of plant communities divide roughly into those of pattern and process. The issues of pattern focus on how species and communities are distributed over the landscape. Are boundaries abrupt or gradual? How predictable are the patterns? The issues of process focus on what processes (e.g., competition, herbivory, history) actually function in natural communities and which of these are most important in determining the observed patterns. Do some processes predominate? Do processes vary among communities? Are communities static or dynamic?

1. Communities structure is a population process;
2. Communities are sections of continuous gradients;
3. Communities show some directionality & predictability;
4. Communities are strongly influenced by historical effects;
5. Communities do not develop to a stable climax;
6. Communities are dynamic & influenced by disturbance.

It represents the natural environment in which there live organisms, or the physical environment, which creates a species population in the surrounding environment. Populations: Groups of similar individuals who tend to mate with each other in a limited geographic area.

Habitat is an ecological or environmental area, with live plants or other organisms of a particular species **(Map 1).**



Map 1. Plants are in Natura 2000 habitats in Europian areas. Georgia has mountains with forests and alpine meadows.

This can be as simple as a field of flowers, which is separated from another field by a hill or other area where none of these flowers occur. Landscape comprises the visible features of the land, such as terrestrial form, water reservoirs. Live cover is vegetation, urban elements and types of land use, buildings and other structures. Ecotope is the most ecologically diverse small space of the landscape classification system and landscape mapping as it be displayed as a small stretch. It is used to detect differences in landscape structure of the internal environmental mapping process. It includes both biotic and abiotic factors: vegetation, soils, hydrology, and etc. Ecoregion and the same bioregion is ecologically and geographically defined area that is smaller than the ecozone, but larger than an ecosystem. It covers the different communities. Ecoregion is used for comparison of biodiversity with other ecoregions **(Akhalkatsi, Tarkhnishvili, 2012).**

The earth contains atmosphere (air), lithosphere (earth), hydrosphere (water), and biosphere (life). Biosphere: The sum of all living things taken in conjunction with their environment. In essence is

life occurs, from the upper reaches of the atmosphere to the top few meters of soil, to the bottoms of the oceans **(Akhalkatsi, Kimeridze, 2017).**

Ecosystem is with the relationships of smaller groups of organisms with each other and their environment. Scientists often speak of the interrelatedness of living things. Since, according to Darwin's theory, organisms adapt to their environment, they must also adapt to other organisms in that environment.We can discuss the flow of energy through an ecosystem from photosynthetic autotrophs to herbivores to carnivores. These two basic types of community contain eight smaller units known as biomes. A biome is a large-scale category containing many communities of a similar nature, whose distribution is largely controlled by climate Terrestrial Biomes: tundra, grassland, desert, taiga, temperate forest, tropical forest. The tundra and desert biomes occupy the most extreme environments, with little or no moisture and extremes of temperature acting as harsh selective agents on organisms that occupy these areas. Tropical rain forests occur in regions near the equator. The climate is always warm (between 20°C and 25°C) with plenty of rainfall (at least 190 cm/year). The temperate forest biome dominant plants include beech, maple, oak; and other deciduous hardwood trees. The shrubland biome is dominated by shrubs with small but thick evergreen leaves. Grasslands occur in temperate and tropical areas with reduced rainfall. Deserts are characterized by dry conditions. Aquatic Biomes: marine, freshwater. Conditions in water are generally less harsh than those on land. Aquatic organisms are buoyed by water support, and do not usually have to deal with desiccation. Biotopes are a homogeneous environment of the area, which creates a specific species of animal and plant associations. It is synonymous with the term - "habitat", but the difference lies in the fact that the habitat is based on the notion of the existence of the species or populations, biological communities and biotopes, i.e. biological creatures association **(Nakhutsrishvili, 2013; Akhalkatsi, 2015a).**

The classic explanation of the habitat is all the environmental factors in one particular spot, to which the organism, species, or community are normally adapted (**Evans, 2010).** According to the Natura 2000 habitat as conservation units are based on species composition and plant community types including as well abiotic factors **(EUR27).**

According to EUNIS-'s habitat classification, habitat is a place where plants and animals live in normal conditions, first of all, physical properties, and on the other hand, according to the species composition of plants and animals living there. EUNIS- habitats of protected areas does not completely match determines the priority habitats.

Emerald Network of the Bern Convention for the protection of endangered and endemic species listed in Appendices and damaged habitat types. In 2009 made the following steps: (1) has been determined by the method of GIS-17 ASCI's boundary data; (2) met and agreed on a final list of 20 species of animals and plants; (3) has been established and agreed habitats list: 1. Thorny "prigana"; 2. Tight perennial herbaceous grassland and steppes of the middle Europe; 3. The arctic alpine plants - Equisetum-Typha-Juncus slow moving water of the river; 4. Salvinia-'s coverage; 5. Near the natural wetland vegetation.

In 2010's revealed the ASCI's area - 596475.63 ha. The total of the species of the number of species and habitats is as 15 habitats. Specialist has to determine the conservation status of species in order to protect them. To implement is conservation strategies for legislation to protect habitats and species.

1.1. Biodiversity hot spots, rare, endemic and endangered species

The Convention on Biological Diversity (CBD), from the date of its adoption (1992), to carry out three main tasks: 1. Conservation of biological diversity; 2. Sustainable use of its components; and 3. The use of the genetic resources in a fair and equal distribution of income.

Biodiversity hotspots are defined in regions, where there is large number of endemic species; suffer habitat degradation and the extinction of species. The 25 biodiversity hotspots include 44% of vascular plants, 35% of terrestrial vertebrate animals. The whole area is 1.4% of the Earth's surface.

Criteria for Plants:

1. **Endangered species** are the national and/or international conservation status of the species;
2. **Endemic species** are both Georgian and the Caucasian endemic;
3. **Edificatory species** are that have species a special role to contribute in ecosystem structure;

4. **The economically potential species** are recreational, ornamental and medicinal plants and other;
5. **Indicator species** are these species that respond quickly to any changes in the environmental conditions and, therefore, their responses indicate timely information about the state of the ecosystem monitoring and management effectiveness evaluation;
6. **Umbrella species** are determines conservation of other species in the habitat conditions where there are species communities and one umbrella species will have a protection due to their conditions. E. g. Pine is an umbrella species for squirrel;
7. **Invasive species** are most of the species in this category is characterized by a fast "occupation" of new areas and the development of a strong population, which often ends elimination of local competitor species;
8. **Flagship species** are the concept of flagship species is a concept with its genesis in the field of conservation biology. The flagship species concept holds that by raising the profile of a particular species, it can successfully leverage more support for biodiversity conservation at large in a particular context (E. g. zelkova, yew, oak, pistachio tree, etc.);
9. **Relict species** are a relict plant or animal is a taxon that persists as a remnant of what was once a diverse and widespread population. Relictualism occurs when a widespread habitat or range changes and a small area becomes cut off from the whole. They are of great scientific importance of the knowledge of the history of the establishment of vegetation.

1.2. Endangered species conservation status

The IUCN Red List Categories and Criteria were first published in 1994 following six years of research and broad consultation. The 1994 IUCN Categories and Criteria were developed to improve objectivity and transparency in assessing the conservation status of species, and therefore to improve consistency and understanding among users. The 1994 categories and criteria were applied to a large number of species in compiling the 1996 Red List of Threatened Animals. The assessment of many species for the 1996 Red List drew attention to certain areas of difficulty, which led IUCN to initiate a review of the 1994 categories

and criteria, which was undertaken during 1998 to 1999. This review was completed and the IUCN Red List Categories and Criteria (version 3.1) was published (**IUCN, 2001**). The Red List Guidelines appeared in 2004 defining methods of determination of IUCN categories. In 2004 was published as "2004 IUCN".

Red List of Threatened Species:

A Global Species Assessment:

1. **Extinct (EX):** A taxon is extinct when there is no reasonable doubt that the last individual has died;
2. **Extinct in the WILD (EW):** A taxon is extinct in the wild when it is known only to survive in cultivation or as a naturalized population well outside the past range;
3. **Critically Endangered (CR):** A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered, and it is therefore considered to be facing an extremely high risk of extinction in the wild;
4. **Endangered (EN):** A taxon is endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered, and it is therefore considered to be facing a very high risk of extinction in the wild;
5. **Vulnerable (VU):** A taxon is vulnerable when the best available evidence indicates that it meets any of the criteria A to E for vulnerable, and it is therefore considered to be facing a high risk of extinction in the wild;
6. **Near Threatened (NT):** A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future;
7. **Least Concern (LC):** A taxon is Least Concern when it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category;
8. **Data Deficient (DD):** A taxon is Data Deficient when there is inadequate information to make a direct or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology

well known, but appropriate data on abundance and/or distribution are lacking.

The five criteria are:

A. Declining population (past, present and/or projected);
B. Geographic range size, and fragmentation, decline or fluctuations;
C. Small population size and fragmentation, decline, or fluctuations;
D. Very small population or very restricted distribution;
E. Quantitative analysis of extinction risk (e.g., Population Viability Analysis).

1.3. Rare and endemic species

Endemism is a special geographical location of the ecological situation, where different environmental conditions and the type of habitat and species endemic only in these habitats are common, where endemism promote the physical, climatic and biological factors. Two definitions are of endemism - palaeoendemism and neoendemism. Support stations of paleoendemic species, which previously were widely distributed and can be found in local small area. Neoendemic means of emerging species, which has not spread widely and adapted only habitat of origin (**Akhalkatsi, 2002; Nakhutsrishvili, 2013**).

Endemic species is growing in biologically isolated areas such as islands, mountain valleys or water habitats, for example. Great is Lakes environment. Endemic species are endangered or extinct where their habitat is limited to the impact of the changes taking place not only human, but to large-scale environmental changes (**Grossheim, Sosnovski, 1928; Takhtajian, 1986**).

Geographical isolation will lead to the divergence of species, but their meeting is allowed in case of reproductive breeding. Reproductive isolation is expected among individuals with different genome, and the phenological periods cause Pre-Separation of the zygote time, so the postzygotic barriers (**Sosnovski, 1933; Dolukhanov, 1989**).

Endemic species that are geographically isolated from the similar species and it might be reproduced from other endemic species which will be introduced in the remote area of influence. Sympatric speciation occurs when populations of a species that share the same habitat become reproductively isolated from each other. This speciation phenomenon most commonly occurs through polyploidy, in which an

offspring or group of offspring will be produced with twice the normal number of chromosomes. Where a normal individual has two copies of each chromosome (diploidy), these offspring may have four copies (tetraploidy). A tetraploid individual cannot mate with a diploid individual, creating reproductive isolation. Allopatric speciation, the most common form of speciation, occurs when populations of a species become geographically isolated. When populations become separated, gene flow between them ceases. Over time, the populations may become genetically different in response to the natural selection imposed by their different environments. If the populations are relatively small, they may experience a founder effect: the populations may have contained different allelic frequencies when they were separated. Selection and genetic drift will act differently on these two different genetic backgrounds, creating genetic differences between the two new species. Parapatric speciation is extremely rare. It occurs when populations are separated not by a geographical barrier, such as a body of water, but by an extreme change in habitat. While populations in these areas may interbreed, they often develop distinct characteristics and lifestyles. Reproductive isolation in these cases is not geographic but rather temporal or behavioral. For example, plants that live on boundaries between very distinct climates may flower at different times in response to their different environments, making them unable to interbreed (**Solomon et al., 2013**).

Self-incompatibility, a genetic barrier to inbreeding in higher plants, represents a distinct case of cell-cell interaction that is amenable to molecular dissection. The essence of this barrier is the ability-mediated by the S, or self-incompatibility locus to discriminate self pollen from non-self pollen. Pollen tubes expressing S-allele recogniti-on specificity identical to that expressed in the style cease growth in the upper third of the style, whereas pollen tubes lacking S-alleles in com-mon with the style grow normally and effect fertilization. According to current models of gametophytic self-incompatibility, pollen tubes exp-ressing (presumed) S-linked proteins are recognized as inco-mepatible by stylar-expressed S-alleles (**Akhalkatsi, Kimeridze, 2016**).

Cytoplasmic male sterility is inherited from the mother plant defect grains of dust is generated, which causes the mitochondrial DNA of new genes involved, which leads to the dysfunction of energy occurs and leads to male sterility. Such individuals produce offspring hybrids.

1.4. Violations of the hybrid zygote

Habitat degradation is the process that leads to loss of function of the natural habitat and species adapted to cause problems for him. During this process, organisms that lived up to experience the quantitative reduction and habitat damage or leave the area, or their extinction, which results in reduction of biodiversity (**Akhalkatsi, 2015a**).

Deforestation is as road and pipelines creation, excessive grazing, wetland drainage, fires, air, soil and water pollution, radiation exposure, oil production, the invasion of alien species and so forth. Habitat is drastic change depending on the human's living environment and agriculture. Habitat division and geographic isolation prevents the connection between species due to isolation zone. The procedure must be carried out in order to preserve the natural habitat of many ecosystem services:

1. Must be preserved intact habitat sites;
2. Education of natural habitats and biodiversity importance;
3. The family planning program in the fast-growing population in the regions;
4. Agricultural products crop growing program;
5. Look for consistency and to restore habitat corridors of fragmented habitats;
6. Determination of the settlement of the human population (urban) places.

Vegetation change is possible, subject only to the dominance of particular species, or vitality and, therefore, can not exert a significant change in the overall structure of the vegetation. But when the number of species extinction occurs and the spread of other species retrieve a specific host, this amendment is substantial in terms of population biology and is considered as replaced by succession process. Succession defined as a change of species within the community, which may be the cause of the plant (endogenous factor), or negative impacts on the environment factors (exogenous factor).

In the first case, change the location of vegetation changes in the community where the species will be better adapted to the environment. In the second case, it is possible to completely change the vegetation cover and anthropogenic impacts and occur is new types of community disasters. Endogenous succession (phytogenic or autogenic succession)

is due to changes in vegetation communities in the invasion of new species and a wide distribution. Or, on the whereabouts of the changes is such as. The humus layer change in soil erosion, or microclimate (**Akhalkatsi, 2015a; Akhalkatsi, Kimeridze, 2016**).

Endogenous succession is growing and progressive. Exogenous succession (xenogenic or allogenic succession) is due to a natural disaster, or as a result of anthropogenic impact factors. It is possible to be both progressive and regressive, or declining. Endo-exogenous succession is the mixed type of an impact on him, both endogenous and exogenous factors. This type of climatic and natural factors considered edaphic factors and periodic fires. Anthropogenic factors of importance for the mixed grazing, mowing fertilization, irrigation, landscaping and so forth (**Dierschke, 1994**).

Primary progressive succession of the disaster resulting is from the empty grounds and community resettlement process plants. Secondary succession of the rapid change is in the community, which basically means to restore the land to its previous Seed Bank communities, which will be caused by changes in the environment for some. Regressive succession means a significant loss of vegetation or negative impact in light of the disaster, when a complex community of species richness was significantly reduced. Cyclic secondary progressive and regressive succession of succession repeated changes when there is a recurring disaster, for example. Periodic fires, storms, forest clear cutting, parasites epidemic, forest extinction, and so forth. Digressive succession occurs within the complex structure of the vegetation, the vegetation type is not changed, but there is a regeneration of the affected area, for example. Cut sections of forest, ground water resulting from changes in vegetation change and so forth. It belongs to the secondary succession (**Akhalkatsi, Kimeridze, 2017**).

Microsuccession, when the process is limited by the development of the communities, for example, some on tree in the forest. Logical succession, when there is a blank space to be filled by vegetation; Regional succession, which occupies a large area, landscape succession. Current succession is continued for lasts several years; Long century's succession includes historical periods. The first stage of the pioneering community has begins replaced by those of the series. It is characterized by a combination of species and the number of drastic changes in a short time. Logical community's vegetation type

resembles the pioneer communities, but the species composition of a strong and sustained time. The dynamics of the series, the last step is replaced by those who have a relatively stable biological equilibrium of the environment. There are long-menopausal and communities. The final step for menopausal community is balanced with microclimatic region, for example. Forest is communities. It forms zonal vegetation. The final step is in the long communities, which are more or less stable equilibrium with its environment and adapted to any particular extreme factors. For example are saline soils, arid climate, wet meadows and others. Secondary recovery process is model developed by beech forest meadow (*Galio-odorati Fagetum*) on the example of Central Europe (**Dierschke, 1988**).

Similar changes is in the cultural landscape is associated and artificial regeneration of the forest. The structure of the forest is in 25-50 years, the achievement of the optimum phase is in 120-170 years (**Map 2**).

Map 2. A - Beech forest meadow is in Georgia. In Eastern Georgia it is found from 300-400 to 2250 meters a.s.l. **B** – Beech forest has mainly one species of *Fagus orientalis*.

On the first herbal-pioneer stage (4-5 years), characteristic of the forest, but many species have appeared and quickly grew only light amateur. The second stage - blueberry and raspberry bushes (3-4 years) in the form of a pea. Primary forest stages encountered 10 meters of trees, shrubs and grasses light amateur, who dominated the forest grasses. Georgia coniferous forests describe the change of the birch, poplar and birch-poplar Trialeti ridge. The river is Tedzami, Tana, and Nedzvi Algeti. Northern Exposure slopes (**Nakhutsrishvili, 2013**). Similar changes are more like digressive succession, when a cover of vegetation within the change occurs. This time there is a rise in social progress and not vegetation or regression. You can not change and only in species composition of vegetation changes (**Ellenberg, 1979**).

1.5. Natura 2000 habitats of importance to Georgia

Georgia signed the CBD in 1994. The state program to assess the biodiversity in the country was started in 1996. The assessment was done by the local Environmental NGO - Noah‘s Ark Centre for the Recovery of Endangered Species ―NACRES, in partnership with the MoE and the United Nations Environment Program (UNEP). NBSAP was launched since 1998. The process was supported by the Global Environment Facility (GEF) and coordinated by the MoE and three national NGOs - NACRES, the Georgian Protected Areas Programme (GPAP), and The Centre for Sustainable Use of Forest Resources (**Akhalkatsi, Tarkhnishvili, 2012**).

The strategic plan to maintain and restore Georgia‘s species, habitats and genetic diversity was based on methodology of *in situ* and *ex situ* conservations and through sustainable use of biological resources, which is a right way for maintenance of biodiversity. However, the problem is ignorance of habitat type classification to be necessary for determination of priority and sensitive habitats, which should be protected as pilot areas. The establishment of special areas for conservation (SAC) should be associated with sensitive habitats.

The classification and creation of the list of Georgian habitats (**Akhalkatsi, 2010; Akhalkatsi, Tarkhnishvili, 2012**) based on the directives of Natura 2000 (92/43/EEC and 79/409/EEC) and Interpretation manual (**EUR27**) was made in 2010 in the framework of the GIZ project - Sustainable Management of Biodiversity, South

Caucasus and revised in 2012. The description of each habitat types is composed by sections: 1) General description of distribution area and environmental conditions; 2) Species of plants and animals including dominant, rare and endemic species; 3) Corresponding categories in other countries of Europe; 4) Associated habitats, which occupy adjacent territories; 5) Bibliography. Habitat names are presented (**Table 1**).

Table 1. Natura 2000 habitat names in Georgia.

N	Natura 2000 habitats	Number of habitat types
1	Coastal and halophytic habitats	10
2	Coastal sand dunes and inland dunes	3
3	Freshwater habitats	5
4	Temperate heath and scrub	2
5	Sclerophyllous scrub (Matorral)	5
6	Natural and semi-natural grassland formations	11
7	Raised bogs and mires and fens	6
8	Rocky habitats and caves	9
9	Forests	27

The total number of natural, rural and urban habitats of Georgia is 65. Among them only 21 habitat types are identical to listed in Annex I of Directive 92/43/EEC, 44 different habitat types are present in Georgia, and 25 are priority types. The syntaxonomic list of the vegetation units Georgia is 147 with 66 sub-types of forest habitats. Natura 2000 habitats defined in 2012 (**Akhalkatsi, Tarkhnishvili, 2012**).

The priority habitats ensure the conservation of vulnerable areas such as marine, terrestrial and freshwater habitats, wetlands, floodplains and forests with relic and endemic umbrella species including arid open woodlands, Colchic mixed and subalpine birch forests, etc., which in turn helps to safeguard the animals and plants needed these places to survive. A diverse range of priority habitats should be protected, including as well meadows, estuaries and cave systems and this benefits a huge variety of wildlife species throughout

the Georgia. It is not only natural habitat types, but also semi-natural ones, which depend on management of humans (e.g. certain types of grasslands, urban and rural habitats). Habitat types recorded in Georgia is essential for the sake of vegetation mapping and nature conservation.

2. COASTAL AND HALOPHYTIC HABITATS

2.1. Open sea and tidal areas

2.1.1. Sandbanks which are slightly covered by sea water all the time (1110; PAL. CLASS.: 11.125, 11.22, 11.31, 11.333)

Sandbanks which are slightly covered by sea water all the time are with Palearctic Classification in Black sea areas. "Slightly covered by sea water all the time" means that above a sandbank the water depth is seldom more than 20 m below chart datum. Sandbanks are elevated, elongated, rounded or irregular topographic features, permanently submerged and predominantly surrounded by deeper water. They consist mainly of sandy sediments, but larger grain sizes, including boulders and cobbles, or smaller grain sizes including mud may also be present on a sandbank. Banks where sandy sediments occur in a layer over hard substrata are classed as sandbanks if the associated biota are dependent on the sand rather than on the underlying hard substrata. The Black sea coast sandy-stone strip starts from Abkhazia and ends in Guria-Ajara. Biotic elements are mainly represented by algae, invertebrate sea animals and plankton. Temporary visitors also include sea mammals, such as, a dolphin, fish and sea birds.

Plant species: Phytoplankton - diatoms are more widely represented. The following of them species are mass distributed: *Nitzschia longissima, N. seriata, Rhizosolenia alata, R. calcar-avis,* and *Thalassiosira parva.* **Green algae:** *Chaetomorpha linum, C. aerea, C. crassa, Cladophora cristallina, C. dalmatica, C. laetevirens, Enteromorpha intestinalis, E. linza, E. prolifera, Ulva rigida, Urospora penicilliformis,* etc. **Brown algae:** *Cystoseira barbata;* **Red algae:** *Bangia fuscopurpurea, Ceramium rubrum* and *Callithamnion corymbosum.*

Plants: *Bangia fuscopurpurea, Callithamnion corymbosum, Ceramium rubrum, Chaetomorpha linum, C. aerea, C. crassa,*

Cladophora cristallina, C. dalmatica, C. laetevirens, Cystoseira barbata, Enteromorpha intestinalis, E. linza, E. prolifera, Nitzschia longissima, N. seriata, Rhizosolenia alata, R. calcar-avis, Thalassiosira parva, Ulva rigida, Urospora penicilliformis.

2.1.1.1. Indicator plant species, the brown algae, *Cystoseira barbata* (Stackhouse) C. Agardh, Sargassaceae

The thallus is 15-20 cm tall-each branch ends with a conic foot (sole) in most cases the basement branches are joined together in a common base. The stem is narrow enough, 3-5 mm thick, cylindrical, the final side is smooth and unequal. The main branches are alternatively or chaotically branched from the stem, very long, cylindrical shape, plenty of small branches whose number gradually decreases, leaving a few singular cylindrical small branches, much shorter than the initial ones **(Milkova et al., 1997).**

The receptacles are spare-shaded or cylindrical 0.2-1 cm long, strongly stressed on the scaphidia surface and with phyliphorm sterile tops. Gathered in dense instalments on the lateral surface of the branches: often in the receptacles the (air) bladders are metamorphozed and are distributed close the top branches **(Bologa, 1979).**

Brown algae are in World level in Black Sea Region level. It is as - EN. Perennial; fond of light; the reproduction occurs at a depth of 0.5-5 m. Almost is disappeared. On the Romanian littoral, in the southern zone Tuzla-Vama Vech, the biomass of *Cystoseira* has decreased from 5400 t fresh weights in 1971 to 755 t in 1973 and 120 t in 1979. The first destructive came from the freezing of the sea water during the 1971/1972 winter when shifting floating ice destroyed about 80% of the stock of Cystoseira reaching 900 t in 1972. Currently are only isolated tufts **(Ozdemir et al., 2006).**

There are hard frosts, hydrotechnical construction, silting of the rocky bottom by suspended matter, lowering of light energy penetration through the water column by increased turbidity and eutrophication. Rocky bottoms on pebbly grounds in sublittoral areas at 0.5-10 m depths. Present also in the Azov and Mediterranean Seas. Species are belonging to inferior northern area. Suspended particles are diminution of light penetration. Reduce eutrophication and pollution from point and non-point sources; declaration and protection of the southern sector

of the Romanian littoral (May 2-Vama Veche) as a natural submarine park.

The small branches are uniformly distributed along the main branches or come together as brooms nearest their tops. In winter and spring there are many bladders on branches. *Cystoseira* are numerous on the surface of the branches and bladders **(Figure 1).**

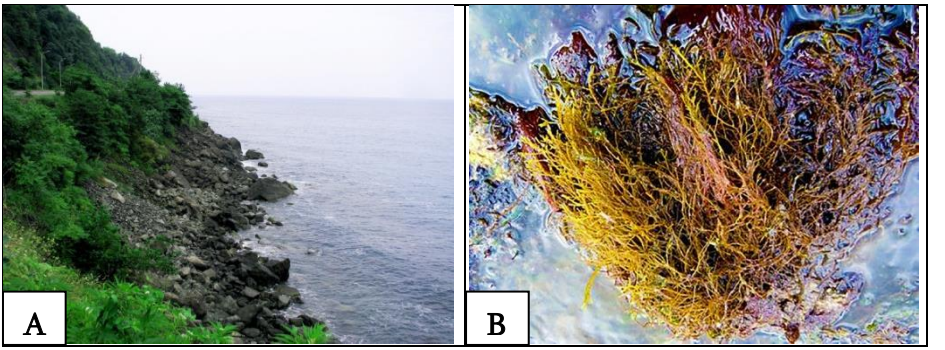


Figure 1. A. Black Sea in Adjara near the Turkey with the algae species; **B.** *Cystoseira barbata* is indicator algae species in Blach Sea. **Photo: Maia Akhalkatsi.**

2.1.2. Estuaries (1130; PAL. CLASS.: 13.2, 11.2)

Downstream part of a river valley, subject to the tide and extending from the limit of brackish waters. River estuaries are coastal inlets where, unlike 'large shallow inlets and bays' there is generally a substantial freshwater influence. The mixing of freshwater and sea water and the reduced current flows in the shelter of the estuary lead to deposition of fine sediments, often forming extensive intertidal sand and mud flats. Where the tidal has current end are faster as than flood tides, most sediments deposit to form a delta at the mouth of the estuary. River Rioni creates the largest estuary. Estuaries of rivers Chorokhi and Enguri are outstanding as well. All other rivers join the Black Sea in the form of a more narrow line.

There are duckweed (*Lemna minor*), Spirodela (*Spirodela polyrhiza*), floating fern (*Salvinia natans*), nicely blooming frog-bit

(*Hydrocharis morsus-ranae*) in standing waters of river Khobi estuary as well as water-milfoil (*Myriophyllum spicatum*), small leaf and broad leaf water vine (*Potamogeton crispus, P. natans, P. perfoliatus, P. pusillus*), water lily (*Nymphaea candida*), yellow water lily (*Nuphar luteum*), water chestnut (*Trapa colchica*), vegetation of seaside sandy dunes - *Euphorbia peplis, Cakile maritima, Salsola tragus, Eringium maritimum*, etc.

Plant species: *Lemna minor, Spirodela polyrhiza, Salvinia natans, Hydrocharis morsus-ranae, Myriophyllum spicatum, Potamogeton pusillus, P. natans, P. crispus, P. perfoliatus, Nymphaea candida, Nuphar luteum, Trapa colchica, Zostera* spp., *Chara* spp., *Eleocharis* spp., *Euphorbia peplis, Cakile maritima, Salsola tragus, Eringium maritimum.*

2.1.2.1. Endemic plant species, Colchic water nut, *Trapa colchica* Albov, Lythraceae

Endemic species - both Georgian and the Caucasian endemic; Colchic water-nut -*Trapa colchica* Albov (=*Trapa natans* L.) - Vulnerable (VU), VUA1a4+B1b (i, ii) c (i, ii); Water up to 60 cm deep. It is in flower from Jun to July. The flowers are hermaphrodite. Suitable for: light, medium and heavy soils. Suitable pH: acid and neutral soils. It cannot grow in the shade. It can grow in water (**Figure 2**).

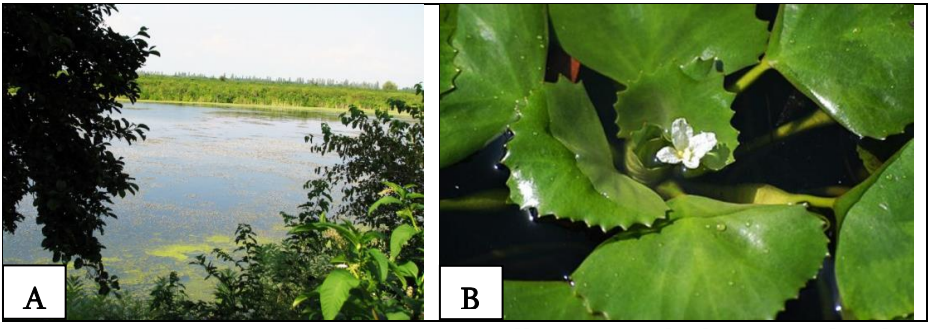


Figure 2. A. Estuaries are in river valley near Black Sea and it has water plants; **B**. *Trapa colchica* **is** endemic species Georgian and the Caucasian. **Photo: Maia Akhalkatsi.**

Trapa colchica is a rare species of water chestnut recorded at four locations on wetland areas of Abkhazeti, Samegrelo, Guria and Adjara,

West Georgia. The wetland habitat of the species is declining by bog reclamation and land development on Colchis lowland leading to continuing decline of the population not exceeding 200 mature individuals with none of the existing subpopulations containing more than 50 mature individuals. Therefore, the species is qualified for Critically Endangered. The raw seed contains toxins but that these are destroyed in the cooking process.

Seed - raw, cooked or dried and ground into a powder. A sweet floury are agreeable flavour, similar to sweet chestnuts (*Castanea* spp.). The seed contains up to 50% starch according to one report, 16% starch, 3% protein in another report and 15% protein, 7.5% fat in a third. One report says that the raw nut contains toxins that are destroyed by cooking the seed. Seed - harvest in late summer and store overwinter in a jar of water in a cold but frost-free place. The seed quickly loses its vitality if it is allowed to become dry. Sow in spring, placing one seed in each pot and submerging them under a few centimetres of water.

A water plant is growing in water up to 60 cm deep. Requires a sunny position is in slightly acidic water. Dislikes calcium is rich water. Prefers is a rich soil. Plants are hardy in all but the coldest parts of Britain.

A perennial, but it is best grown as an annual in Britain. Some botanists regard this species as the only genuine member of the genus, all other species considered to be no more than a part of this one highly polymorphic species. Occasionally cultivated for its edible seed, there is at least one named variety. 'Suzhou' is a form with red-coloured fruit. Right plant is as wrong place. We are currently updating this section. Please note that a plant may be invasive in one area but may not in your area so it’s worth checking. It is in the **Red Data Book of the Georgia (1982).**

Research on population numbers, range, trends, threats and conservation measures is needed, as well as site based actions, such as maintenance and conservation of the sites, and species based actions, such as creation of a genome resource bank at the Caucasian Regional Seed Bank at Tbilisi Botanical Garden and Institute of Botany. Increasing public awareness is also important.

2.1.3. Coastal lagoons (1150*; PAL. CLASS.: 21)

Lagoons are expanses of shallow coastal salt water, of varying salinity and water volume, wholly or partially separated from the sea by sand banks or shingle, or, less frequently, by rocks. Salinity may vary from brackish water to hypersalinity depending on rainfall, evaporation and through the addition of fresh seawater from storms, temporary flooding of the sea in winter or tidal exchange. This type of habitat is near village Grigoleti.

Species: Phytoplankton is widely represented by diatoms from which the following species are most widely distributed: *Thalassiosira parva, Nitzschia seriata, Nitzschia longissima, Rhizosolenia alata,* and *Rhizosolenia calcar-avis.* **Sea algaes - Green algae** species are *Chaetomorpha linum, C. aerea, C. crassa, Cladophora cristallina, C. dalmatica, C. laetevirens, Enteromorpha intestinalis, E. linza, E. prolifera, Ulva rigida, Urospora penicilliformis,* etc. **Brown algae** - *Cystoseira barbata*. **Red algaes** - *Bangia fuscopurpurea, Ceramium rubrum* and *Callithamnion corymbosum*. **Fresh water algaes are Cyanophyta or blue-green algaes** - *Anabaena flos-aquae, Anabaena variabilia, Gloeocapsa turgida, Merismopedia glauca, Microcystis grevillei, Microcystis pulverea, Oscillatoria brevis, Oscillatoria limosa, Oscillatoria tenuis,* and *Spirulina subtilissima.* **Cillariophyta - Siliceous algaes - diatoms**: *Cyclotella kuetzingiana, Cyclotella meneghiniana, Caloneis bacillum, Cocconeis placentula, Cymbella ventricosa, Gomphonema acuminatum, Navicula cryptocephala, Nitzschia amphibia, Nitzschia dissipata, Pinuularia viridis, Synedra ulna.* Chlorophyta - **Green algaes** - *Cladophora glomerata, Oedogonium* sp., *Pediastrum boryanum, Scenedesmus acuminatus, Scenedesmus obliquus, Scenedesmus quadricauda, Spirogyra* sp., *Ulotrix zonata.*

Plant species:*Enteromorpha intestinalis, Urospora penicilliformis, Ulva rigida, Enteromorpha linza, E. prolifera, Cladophora laetevirens, Chaetomorpha linum, Ch. aerea, Ch. crassa, Cladophora cristallina, C. dalmatica, Cystoseira barbata, Bangia fuscopurpurea, Ceramium rubrum, Callithamnion corymbosum, Thalassiosira parva, Nitzschia seriata, Nitzschia longissima, Rhizosolenia alata, Rhizosolenia calcar-avis, Euphorbia peplis, E. paralias, Cakile maritima, Salsola tragus, Silene euxina, Digitaria ciliaris, Polygonum littorale, Calystegia*

soldanella, Satchys maritima, Eringium maritimum, Trapa colchica, Lemna minor, Salvinia natans, Utricularia vulgaris, Myriophyllum spicatum, Potamogeton pectinatus, Anabaena flos-awuae, Anabaena variabilia, Gloeocapsa turgida, Merismopedia glauca, Microcystis grevillei, Microcystis pulverea, Oscillatoria brevis, Oscillatoria limosa, Oscillatoria tenuis, Spirulina subtilissima, Cladophora glomerata, Oedogonium sp., *Pediastrum boryanum, Scenedesmus acuminatus, Scenedesmus obliquus, Scenedesmus quadricauda, Spirogyra* sp., *Ulotrix zonata.*

2.1.3.1. Indicator species of plants, Sea Lettuce - *Ulva rigida* C. Agardh, Ulmaceae

Indicator species – *Ulva rigida* are species that respond quickly to any changes in the environmental conditions Thalli thin, sheet-like, as turfs, tufts or solitary blades, variable in shape, to 10 cm in height (**Figure 3**).

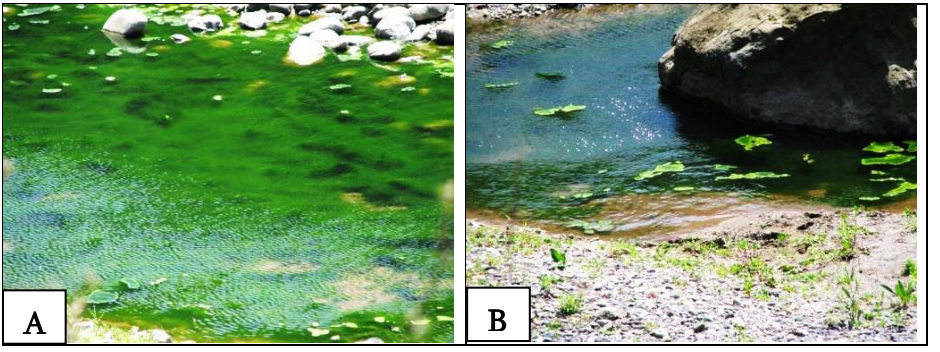


Figure 3. A. Coastal lagoons have algae species in River Chorokhi near of Black Sea**; B.** *Ulva rigida* is commonly found in River Chorokhi near Coastal lagoons with Black Sea ago. **Photo: Maia Akhalkatsi.**

Blades ruffled or flat, with small microscopic teeth on margins. Blades unperforated or perforated with few to many small holes. The blades are two cells thick; the two layers easily separate into single cell layers. Holdfasts comprised of small, tough rhizoids. *U. fasciata* is similar but has few or no rhizoids, has larger, square cells, and does not

separate easily into two sheets. Bright grass green is to dark green, gold at margins when reproductive. May it be colorless when stressed?

Ulva rigida is commonly found on intertidal rocks, in tidepools, and on reef flats. Often abundant in areas of fresh water runoff high in nutrients such as near the mouths of streams and run-off pipes. Cells rounded rectangular, 11-17 μm wide, 15-22 μm long, somewhat elongated, in ordered rows or randomly arranged. Blades of two cells are thick with clear space between cell layers (**Littler, Mark, 2000**).

Ulva rigida is commonly found in areas where nutrients are high, wave forces low and herbivory reduced. It is tolerant of stressful conditions, and its presence often indicates fresh water input or pollution. *Ulva* species are early-successional algae, quickly taking over new substrate on boulders that are cleared by storm disturbance. *Ulva* and *Enteromorpha* species are generally the first macroalgae to colonize newly opened substrate in intertidal areas with high nutrients. Their opportunistic success can be attributed to their simple morphologies and fecundity. In *Ulva* species, between 20 and 60 percent of their overall biomass can be allocated monthly to reproduction **(Barescut et al., 2009).**

The alga's reproductive success is partly due to the reproductive cells' photosynthetic ability. The zoospores' and gametes' ability to photosynthesize subsidizes their motility and rapid growth once attached to the substrate. In Hawai'i, *U. fasciata,* or *Limu palahalala* is a popular seaweed for consumption. Preparation methods include chopped in salads with other limu varieties, boiled in soups, or as a relish.

2.1.4. Large shallow inlets and bays (1160; PAL. CLASS.: 12)

The coastal areas, where fresh and sea waters do not get mixed. It is only affected by the tide, which brings in deposit rock layer from the sea bed and constantly changes the structure of the sea bed. This has an impact on the benthos communities.

Species: Phytoplankton represented by diatoms, including the widespread species *Thalassiosira parva, Nitzschia seriata, Nitzschia longissima, Rhizosolenia alata, Rhizosolenia calcar-avis*;

Green sea algaes - *Enteromorpha intestinalis, Urospora penicilliformis, Ulva rigida, Enteromorpha linza, E. prolifera,*

Cladophora laetevirens, Chaetomorpha linum, Ch. aerea, Ch. crassa, Cladophora cristallina, C. dalmatica, etc.;

Brown algae - *Cystoseira barbata*; **Red algaes** - *Bangia fuscopurpurea, Ceramium rubrum and Callithamnion corymbosum.*

Plant species: *Enteromorpha intestinalis, Urospora penicilliformis, Ulva rigida, Enteromorpha linza, E. prolifera, Cladophora laetevirens, Chaetomorpha linum, Ch. aerea, Ch. crassa,Cladophora cristallina, C. dalmatica, Bangia fuscopurpurea, Ceramium rubrum, Callithamnion corymbosum, Thalassiosira parva, Nitzschia seriata, Nitzschia longissima,Rhizosolenia alata, Rhizosolenia calcar-avis.*

2.1.4.1. Invasive plant species red algaes - *Ceramium rubrum* C. Agardh, Ceramiaceae

Invasive species - *Ceramium rubrum* most of the species in this category is characterized by a fast "occupation" of new areas and the development of a strong population, which often ends elimination of local competitor species (**Figure 4**).

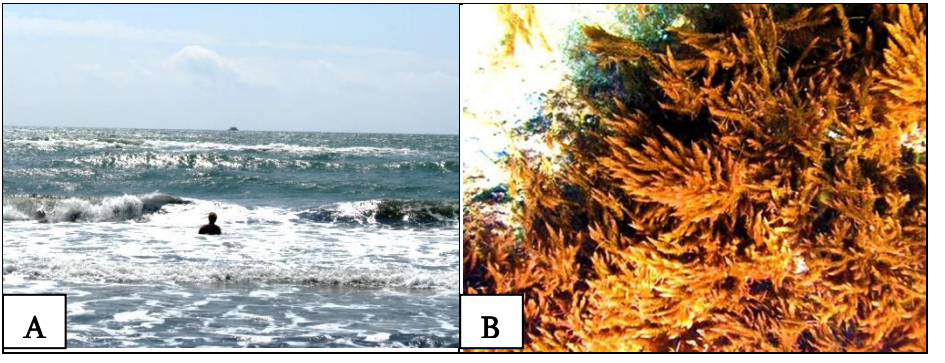


Figure 4. A. Large shallow inlets and bays of the Black Sea in Guria Village Ureki; **B.** *Ceramium rubrum* is invasive species in this category of new areas and the development of a strong population. **Photo: Maia Akhalkatsi**.

Australian plants were referred to *C. rubrum* by early authors and by Harvey on herbarium sheets as *C. rubrum* australe, but were

separated as a distinct species, *C. flagelliferum*, by **Kützing (1849)**. These names were discussed by **Womersley (1978)**.

While Australian specimens referred to *C. rubrum* are relatively uniform, it is closely related to *C. pusillum* Harvey, differing in being larger with dichotomous or irregular and often proliferous branching, by the nodal cortical bands uniting relatively close to the apices with the cells usually dovetailing together, by the inner cortical cells becoming elongate in older parts with the outer cortical cells varying from a largely complete cover to rows along the larger inner cells but not forming distinct rosettes and except often around the periaxial cells, by the tetrasporangia usually developing from any inner cortical cell as well as the periaxial cells and thus on older parts appearing scattered, and by being generally a species of calm to moderate (often deeper) water movement.

While no one of the above features clearly distinguishes *C. rubrum* from *C. pusillum*, overall assessment of them permits ready separation of nearly all specimens of these taxa. The nodal cortication joins and with numerous short proliferous branchlets with divergent apices. Pending re-examination of the Tasmanian specimens of J. Agardh, they are provisionally referred to *C. rubrum.*

Thallus medium to dark red, 5-15 (-25) cm high, branching frequent to relatively sparse, subdichotomous (especially near apices) or irregularly lateral, often with numerous small proliferous branchlets below; main branches sometimes slightly moniliform due to denser cell formation at the nodes and slightly swollen axial cells. Branches 0.5-1 mm in diameter below, 200–500 μm in diameter above, tapering only slightly until near the apices which are slightly involute to straight. Base usually are single, erect, attached by a tuft of rhizoids originating from periaxial cells; epilithic or epiphytic on seagrasses or larger algae. Structure are Axial cells L/D 0.5-1, becoming completely corticated close to the apices, with the terminal cells of both the acropetal and basipetal corticating filaments becoming angular and dovetailing together to obscure the join. Periaxial cells 7 (-8), each cutting off usually two cells acropetally and basipetally, continuing as corticating filaments often with two divisions if space permits; these inner cortical cells enlarge and elongate to L/D 3-5; in some plants short acropetal filaments from the periaxial cells project outwardly. Outer cortex present, varying from a fairly complete cover to small cells lying

largely over the margins of the inner cells but not usually forming rosettes except over the rounded periaxial cells . Hairs from the outer cortical cells often present in young parts. Rhodoplasts discoid in small cells, ribbon like in axial cells.

Gametophytes are dioecious. *Carposporophytes* 200-450 μm across, closely surrounded by 2-5 (-8) short, curved, involucral branchlets, carposporangia ovoid, 20-30 μm in diameter. *Spermatangia* covering are the surface of branches, arising first on the adaxial side. *Tetrasporangia* cut off at first from the the periaxial cells or the immediate cortical derivatives and thus in rings of 10-15 sporangia along the branches, later from any inner cortical cell and thus scattered, variable in size (30-60 μm in diameter), spherical to ovoid, more or less cruciately divided, protruding slightly to moderately within the cortex and surrounded by a rosette of outer cortical cells.

2.2. Sea cliffs and shingle or stony beaches

2.2.1. Code of Georgia: Vegetation of the Sea Cliffs (1220GE)

The coastal rock vegetation is the most common in Ajara. Perennial vascular plants are dominating. In addition, there is a high diversity of mosses and ferns, attached to a rock and forming green vegetation cover of a cliff. A characteristic species is an endemic Iris - *Siphonostylis lazica* and strong undergrowth of blackberry bush - *Rubus caucasicus.* Fern species are *Polypodium serratum, Dryopteris palaecea,* occasionally, *Osmunda regalis.* Dominating flowering plants is *Crithmum maritimum*.

Plant species*:* *Crithmum maritimum, Dryopteris palaecea, Osmunda regalis, Polypodium serratum, Rubus caucasicus, Siphonostylis lazica*.

2.2.1.1. Endemic plant species: Blackberry - *Rubus caucasicus* Focke, Rosaceae

Endemic species - *Rubus caucasicus* is both Georgia and the Caucasian endemic; *Rubus caucasicus* Focke, Rosaceae. *Rubus* genus species is 28 endemic and *Rubus caucasicus* is endemic to Georgia**.** *Rubus caucasicus* is a deciduous Shrub. The flowers are hermaphrodite and have both male and female organs. Other is pollinated by Insects.

Suitable for: light, medium and heavy soils and prefers well-drained soil. Suitable pH: acid, neutral and basic soils. It can grow in semi-shade or no shade. It prefers moist soil **(Figure 5).**

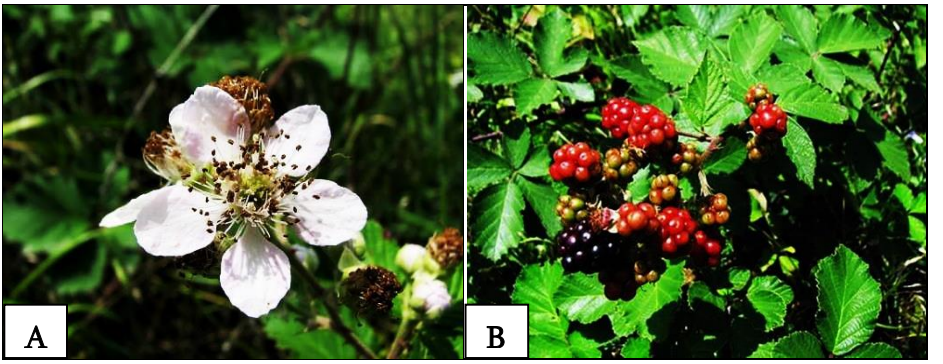


Figure 5. A. Vegetation of the Sea Cliffs has many shrubs near Black Sea in Adjara and one is - *Rubus caucasicus* as endemic species of both Georgia and the Caucasian; **B.** *Rubus caucasicus* is used for food plant. **Photo: Maia Akhalkatsi.**

Easily grown is in a good well-drained loamy soil in sun or semi-shade. This species is a blackberry with biennial stems; it produces a number of new stems each year from the perennial rootstock, these stems fruit in their second year and then dies.

Plants in this genus are notably susceptible to honey fungus. Seed requires stratification and is best sown in early autumn in a cold frame. Stored seed requires one month stratification at about 3°C and is best sown as early as possible in the year.

Prick out the seedlings when they are larg**e** enough to handle and grow on in a cold frame. Plant them out into their permanent positions in late spring of the following year. Cuttings of half ripe is wood, July/August in a frame.

Tip layering in July. Plant out in autumn. Division in early spring or just before leaf - fall in the autumn. This species is the most common in Ajara.

2.3. Salt and gypsum inland steppes

2.3.1. Code of Georgia. Salt and gypsum inland vegetation (15GE)

Halophyte complexes can be found in Meskheti, within the limits of the upper basin of river Mtkvari, Inner Kartli and Iori Plateau. Halophilic communities are developed on badlands, on various slopes of nearly all exposition, on the exhausted cortex of easy soluble, salty, gypseous basic rocks and on salty clay soil. Such places are characterized by physical and physiologic dryness and dry microclimate. According to the common position of ecotope vegetation is fluctuated within wide limits, which depends on gypseous composition and salting degree in the substrata. By the structure of vegetation and species composition it is similar to desert vegetation; it is characterized by poor flora, inlay and complexity. The vegetation of upper parts of badland slopes and rocks is actually undeveloped. It is caused by the intensive rain and wind erosion. Some are as typical desert and semi-desert plants. The common coverage of phytomass in such phytocoenose is not more than 5-10%. The halophilic vegetation coverage is about 50- 60% on proluvial-deluvial deposits of the lower parts of slopes. The mentioned type of edaphogenic desert and semi-desert flora is represented by comparatively narrower endemics and widespread species with disjuncted areas, which have a great importance in research of geographic connections and study of Georgian flora and vegetation formation history. The following species are observed on slopes *Reaumuria alternifolia* and *Camphorosma monspeliaca.* Open unconnected phytocoenose Reaumurioso-salsoleto-camphorosmetum are created by these semi-bushes. At the foot of the slope grows the goastsbeard - *Podospermum idae.* In relatively quiet places ephemeral sinusien are developed in the form of spotted fragments.

Dwarf grasses - *Eremopyrum orientale* or *Trachynia dictachya* participate in creating them whereas in certain places this is done by succulent biomorph *Gamanthus pilosus* or *Bupleurum exaltatum.* The Syrian bean-caper (*Zygophyllum fabago)* and others can be named from less constant species. From rare communities there are: *Nitraria schoberi, Atriplex tatarica, Puccinellia distans, Kochia prostrata, Sosnowskya amblyolepis, Amberboa moschata, Ceratoides papposa,* etc. Non-constant species involve: *Astragalus argillosus, Callicephalus*

nitens, black buckthorn or extremely rare species growing in dry ravines, *Rhamnus spathulifolia.*

Plants species: *Amberboa moschata, Astragalus argillosus, Atriplex tatarica, Bupleurum exaltatum, Callicephalus nitens, Ceratoides papposa, Camphorosma monspeliaca, Eremopyrum orientale, Gamanthus pilosus, Kochia prostrata, Nitraria schoberi, Pancratium maritimum, Podospermum idae, Puccinellia distans, Reaumuria alternifolia, Rhamnus spathulifolia, Sosnowskya amblyolepis, Trachynia dictachya, Zygophyllum fabago.*

2.3.1.1. Invasive plant species in Adjara near Black Sea

Invasive 3 plant species are in Adjara: 1. Sea daffodil - *Pancratium maritimum* L., Amaryllidaceae; 2. Annual blue-eyed grass - *Sisyrinchium rosulatum* E.P. Bicknell, Iridaceae; and, 3. Blue crown passion flower - *Passiflora caerulea* L. Passifloraceae (**Figure 6**).

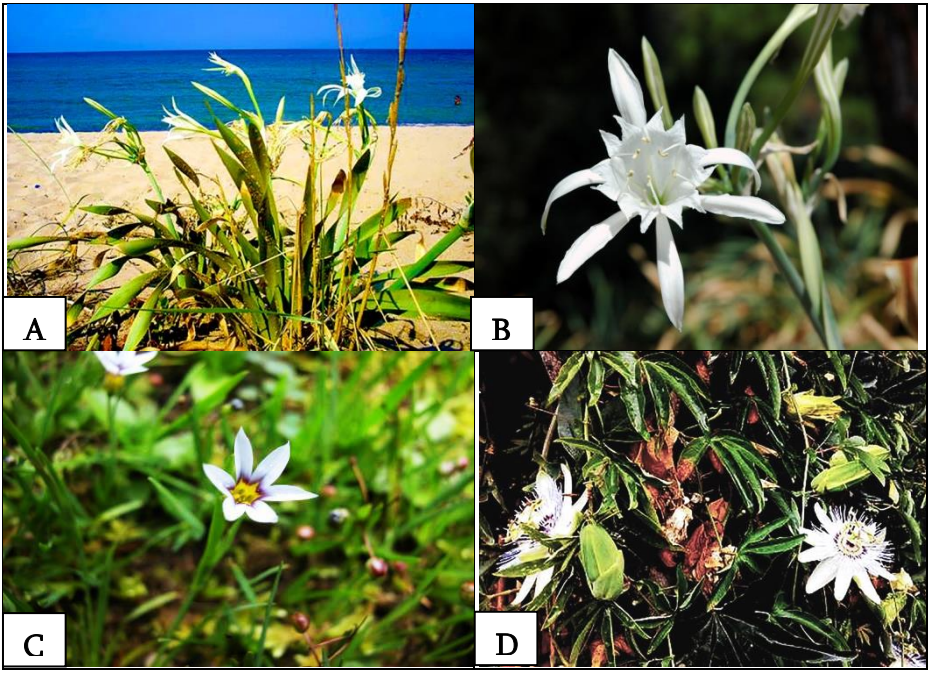


Figure 6. Black Sea in Adjara: **A. B.** *Pancratium maritimum*; **C.** *Sisyrinchium rosulatum* in meadows of city Kobuleti; **D.** *Passiflora caerulea* in Botanical Garden of city Batumi. **Photo: Maia Akhalkatsi.**

Invasive species - *Pancratium maritimum* most of the species in this category is characterized by a fast "occupation" of new areas and the development of a strong population, which often ends elimination of local competitor species. Maritime sands or just above the high tide mark, along the Atlantic coast. *Pancratium maritimum* is an evergreen Bulb growing to 0.5 m by 0.3 m. It is in leaf 12-Jan and it is in flower in June. The flowers are hermaphrodite. Suitable pH: acid, neutral and basic soils. It cannot grow in the shade. It prefers dry or moist soil. The plant can tolerate maritime exposure. Seed is of *Pancratium maritimum* best sown as soon as it is ripe in a greenhouse. Pre-soak is stored seed for 1 hour in warm water and then sow in spring in a warm greenhouse in a light sandy soil. Germination usually takes place within 1 - 3 months at 22°C. Sow the seed thinly so that the seedlings can be left undisturbed in the pot for their first two years of growth.

Give them an occasional liquid feed in the growing season to ensure they do not become nutrient deficient. When the plants become dormant in late summer, pot up the small bulbs placing 2 bulbs in each pot. Grow them on for another one or two years in the greenhouse before planting them out when they are dormant in late summer. Division of offsets is as the plant dies down in late summer. Requires is a light for very well drained sandy soil in a very sunny position. Requires is a warm sheltered position when grown outdoors in Britain. Requires a hot dry summer in order to fully ripen its bulb, it is more easily grown in a bulb frame in Britain.

Tolerates temperatures down to about -5°C, it is only hardy in the milder areas of Britain, requiring protection even there in the winter. The bulb should be planted deeply and rapid spring growth should be encouraged. Another report says that plants are easily grown outdoors in Britain but that the leaves are susceptible to frost damage and the plant does not flower well in an average British summer. The flowers have an exotic lily scent.

Sisyrinchium rosulatum is invasive species in Adjara coming from South America by Ship. Other plant species is as well generating as seed from shipd coming from other continents to Adjara, Batumi. There are about 60 genera and 1500 species, distributed in temperate and tropical regions. Among them, *Iris*, *Freesia*, *Gladiolus*, *Watsonia*, and *Tritonia* are popular ornamentals. Saffron dye is obtained from *Crocus*,

and essence of violets, used in perfumes, is extracted from the rhizomes of *Iris*. *Passiflora caerule* is a vigorous, deciduous or semi-evergreen tendril vine growing to 10 m or more, with palmate leaves and fragrant, blue-white flowers with a prominent fringe of coronal filaments in bands of blue, white, and brown. The ovoid orange fruit, growing to 6 cm, is edible but bland.

3. COASTAL SAND DUNES AND INLAND DUNES

3.1. Coastal Sand Dunes

3.1.1. Embryonic shifting dunes (2110; PAL. CLASS.: 16.211)

Primary succession of dunes starts with embryonic shifting dunes where the following species of salt-tolerant creeping and deep root plants dominate - *Convolvulus persicus, Calystegia soldanella, Samolus valerandi*, *Plantago lanceolata,* etc.

Several perennial herbaceous plants, such as, *Eryngium maritimum, Euphorbia paralias, Glaucium flavum*, and coniferous ones, such as, *Vitex agnus-castus* can also be found. The latter can be found at the border of fixed and mobile dunes as well as bordering grassy meadows of the land where *Juncus acutus* dominates.

Plants species: *Aira capillaris, Anagallis arvensis, Anthemis euxina, Arenaria serpyllifolia, Asclepias fruticosa, Calystegia soldanella, Carex colchica, Cerastium semidecandrum, Convolvolus persicus, Cynodon dactylon, Digitaria pectiniformis, Erodium cicutarium, Erophila verna, Eryngium maritimum, Euphorbia paralias, Euphorbia pubescens, Geranium dissectum, Geranium molle, Glaucium flavum, Helianthemum nummularium, Lolium rigidum, Lysimachia fortunei, Medicago minima, Pancratium maritimum, Petrorhagia saxifraga, Plantago lanceolata, Salsola tragus, Samolus valerandi, Scabiosa sosnowskyi, Scleranthus annuus, Sherardia arvensis, Silene euxina, Stachys maritima, Trifolium campestre, Verbascum gnaphalioides, Veronica serpyllifolia, Vitex agnus-castus.*

3.1.1.1. The economically potential species and medicinal plants Blue Gel - *Eryngium maritimum* L., Apiaceae

The economically potential species - *Eryngium maritimum* is as recreational, ornamental and medicinal plants and other (**Figure 7**).

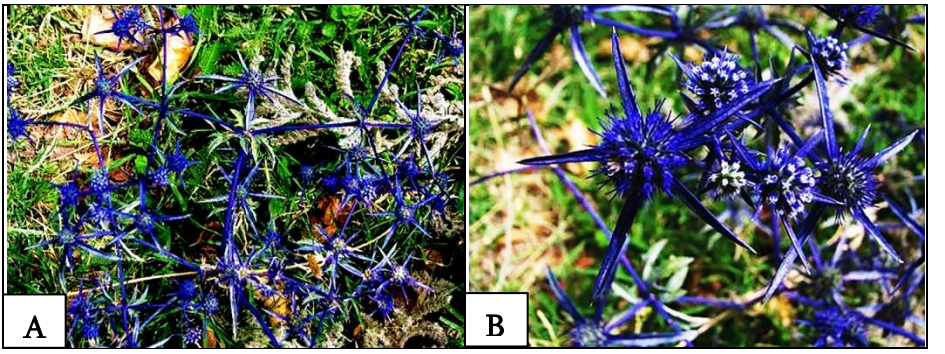


Figure 7. A. B. Medicinal plant - *Eryngium maritimum* is in medows of city Kobuleti, Adjara. **Photo: Maia Akhalkatsi.**

Eryngium maritimum is an evergreen. Perennial is growing to 0.5 m by 0.4 m. It is in leaf 12-Jan. It is in flower from Jul to October. The flowers are hermaphrodite and are pollinated by Bees, flies, beetles. The plant is self-fertile. It is noted for attracting wildlife.

Suitable for: light and medium soils, prefers well-drained soil and can grow in nutritionally poor soil. Suitable pH: acid, neutral and basic soils and can grow in very alkaline and saline soils. It cannot grow in the shade. It prefers dry or moist soil and can tolerate drought. The plant can tolerate maritime exposure.

Always seek advice from a professional before using a plant medicinally: Aphrodisiac; Aromatic; Diaphoretic; Diuretic; Expectorant; Stimulant; Tonic. Sea holly roots were collected on a large scale in the 17th and 18th centuries in England and were candied then used as restorative, quasi-aphrodisiac lozenges. The plant is still used in modern herbalism where it is valued especially for its diuretic action.

The root is to be aphrodisiac, aromatic, diaphoretic, diuretic, expectorant, stimulant and tonic.

The root promotes free expectoration and is very useful in the treatment of debility attendant on coughs of chronic standing in the advanced stages of pulmonary consumption. It is used in the treatment of cystitis, urethritis, as a means to alleviate kidney stones, and to treat enlargement or inflammation of the prostate gland.

Drunk freely, it is used to treat diseases of the liver and kidneys. Used externally as a poultice, the dried powdered root aids tissue regeneration. The root should be harvested in the autumn from plants that are at least 2 years old.

Young shoots - cooked. They are normally blanched by excluding light from the growing plant, and are then used as an asparagus substitute. They are said to be palatable and nourishing. Root is cooked. Used as a vegetable or candied and used as a sweetmeat. Palatable and nutritious, it is slightly sweet and smells of carrots.

The boiled or roasted roots are said to resemble parsnips or chestnuts in flavour. Requires is a deep well-drained soil and a sunny position. Prefers a light sandy saline soil but tolerates most soil types including lime and poor gravels. Plants are best grown in a hot dry position. Established plants are drought tolerant.

Plants are hardy to about -15°C. Sea holly has very long roots that penetrate deeply in the soil and are often several feet long. These roots are sweetly scented. The plant should be placed in its final position whilst small since it resents root disturbance. Although a sea-shore plant, it is amenable to garden cultivation. A good is bee plants.

Seed of *Eryngium maritimum* best sown as soon and it is ripe in early autumn on the surface of well-drained compost in a cold frame. The seed can also be sown in spring. Germination can be very slow, although another report says that the seed usually germinates in 5-90 days at 20°C.

When they are large enough to handle, prick the seedlings out into individual pots and grow them on in the greenhouse for their first winter. Plant them out into their permanent positions in late spring or early summer, after the last expected frosts. Division is in early spring or autumn.

Take care since the plant resents root disturbance. Root cuttings in autumn or winter. These are sea shores, preferring sand and shingle whilst avoiding acid soils. It is including in Black Sea and in Europe.

3.1.2. Fixed coastal dunes with herbaceous vegetation (grey dunes) (2130*; PAL. CLASS.: 16.221 to 16.227, 16.22B)

Sandy dunes can be found in the south of Poty, between the sea and the planted pine forest (*Pinus* spp., *Eucalyptus* spp., *Alnus barbata*). Fixed and non-fixed dunes border with each other and represent various successive stages. The border between them is sometimes covered with the humus layer. Species of plants involve grasses. E.g. *Microstegium vimineum*, swamp plants, such as *Lycopus europaeus*, *Inula auriculata*, *Hydrocotyle vulgaris*, etc.

In the narrow littoral line existing in the north of Kulevi village relict vegetation of ancient Meditteranean flora can be found, which is almost completely destroyed at the Georgian section of the Black Sea coast dunes to a heavy anthropogenic press. Sea Lilly - *Pancratium maritimum* - the species of the Red Book of Georgia can be found here which belongs to the category of high decorative plants and represents the relict of the tertiary flora.

Species of plants of a specific ecological range, such as, spurge (*Euphorbia paralias),* red-horned poppy (*Glaucium flavum),* sea thistle (*Eryngium maritimum),* woundworth (*Stachys maritima),* campion (*Silene euxina),* etc. are associated with the sea lilly. Spread of mentioned taxons within the limits of protected Kolkheti territories is extremely limited and involves only a narrow littoral line of the Black Sea coast.

Plants species: *Aira capillaris, Ajuga reptans, Arabidopsis thaliana, Arabis hirsuta, Senecio vulgaris, Digitaria pectiniformis, Euphorbia cyparissias, Euphorbia peplis, Geranium dissectum, Geranium molle, Glaucium flavum, Hydrocotyle vulgaris, Inula auriculata, Juncus acutus, Juncus articulatus, Lycopus europaeus, Lysimachia fortunei, Mentha aquatica, Microstegium vimineum, Paspalum dilatatum, Prunella vulgaris, Rhamphicarpa medwedewii, Rubus anatolicus, Sherardia arvensis, Silene pendula, Vicia hirsuta, Vicia sativa.*

3.1.2.1. Crop wild relatives (CWR) plant species, Broad Vetch – *Vicia johannis* Tamamsch., genus *Vicia* L., Fabaceae

Crop wild relatives (CWR) are determined by the exchange of gene crops and germaplazma used agricultural crop domestication ancestor species. There are 33 species of *Vicia* in Georgia. 17 of them are distributed in Samtskhe-Javakheti region: 1. *V. antiqua* Grossh. - Caucasian endemic; 2. *V. balansae* Boiss.; 3. *V. cassubica* L.; 4. *V. cordata* Wulf. ex Hoppe; 5. *V. ervilia* (L.) Willd.; 6. *V. grossheimii* Ekvtim. Caucasian endemic; 7. *V. iberica* Grossh.; 8. *V. narbonensis* L. 9. *V. pannonica* Cranz; 10. *V. peregrina* L. 11. *V. purpurea* Steven; 12. *V. sativa* L.; 13. *V. sepium* L.; 14. *V. truncatula* Fisch. ex M. Bieb.; 15. *V. variabilis* Freyn & Sint.; 16. *V. variegata* Sibth. & Sm. - Caucasian endemic; 17. *V. villosa* Roth.

One of the tentatively ancestor of cultivated *V. faba* is *V. narbonensis* distributed in different regions of Georgia. It is found between Akhaltsikhe and Abastumani and near v. Atskuri in the fields. *V. ervilia* and *V. sativa* are not cultivated nowadays, but is naturalized and is represented as weed in fields. *Vicia serratifolia* Jacq. is this species in Flora of Georgia and it is determined as *Vicia narbonensis* L., however, last investiagtions (**Bennet, Maxted, 1997**) have described it as *V. johannis,* which differs from *V. narbonensis* by color of wings of corolla (**Figure 8**).

Annual is growing to 1 m. The flowers are hermaphrodite and are pollinated by Insects. The plant is self-fertile. *V. johannis* differs from *V. narbonensis* where on the basis of the colour of the wing spot during anthesis and the presence of a terminal leaflet. The latter character separates *Vicia johannis* var. *ecirrhosa* (Popov) H.I.Schafer from the other two varieties. The overall distribution is in Europe, West Asia, and North Africa. Distribution in Samtskhe-Javakheti region - Occurs in cultivated beds in Meskheti mixed with crops in wheat and barley fields.

Grows is in thickets, damp fields and ditches. The plant prefers light, medium and heavy soils and requires well-drained soil. The plant prefers acid, neutral and basic soils. It can grow in semi-shade or no shade. It requires moist soil. It can fix Nitrogen. Succeeds in any well-drained soil in a sunny position if the soil is reliably moist throughout the growing season, otherwise it is best grown in semi-shade.

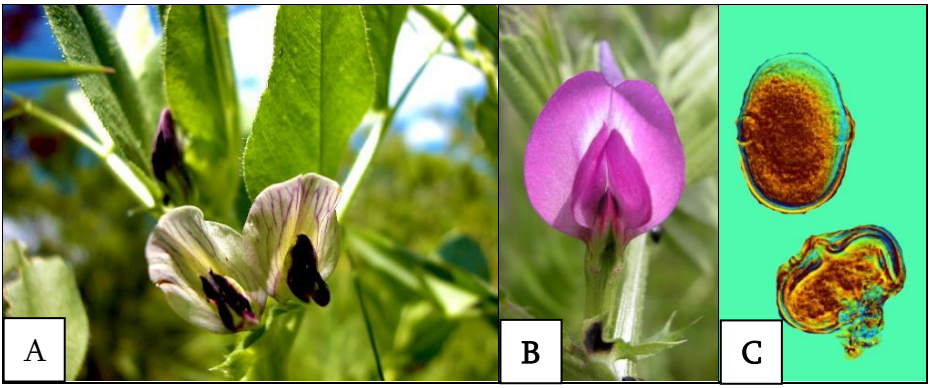


Figure 8. A. *Vicia johannis* is CWR and is in meadows of Dedoplistskaro; **B.** *Vicia purpurea* is CWR; **C.** Pollen of *Vicia purpurea* has length of the horizontal height as 35-40 μm and distanth height is 50-55 μm. **Photo: Maia Akhalkatsi.**

This species has a symbiotic relationship with certain soil bacteria; these bacteria form nodules on the roots and fix atmospheric nitrogen. Some of this nitrogen is utilized by the growing plant but some can also be used by other plants growing nearby. When removing plant remains at the end of the growing season, it is best to only remove the aerial parts of the plant, leaving the roots in the ground to decay and release their nitrogen.

Pre-soak the seed for 24 hours in warm water and then sow in situ in spring or autumn. Threat assessment - No threats detected. *Ex situ status* - Seeds are collected and kept in USDA and IPK gene banks. *In situ* status - The habitat in cultivated beds and protection measures are not necessary to undertake. This species is probably the parent of the cultivated broad bean, *V. faba*. Diminishing is of cultivated fields in Samtskhe-Javakheti region. Proposed threat might be use of herbicides in the field.

Proposed action plan objectives and targets:

1. Maintain the current populations of in Samtskhe-Javakheti region.
2. Reduce the decline of this species through appropriate habitat management.

V. johannis should be declared as species of high economic value as genetic ancestor for cultivated broad bean. Sites of population

distribution need to be maintained, which is connected with development of sustainable biofarming in the region. *Ex situ* conservation of this species will be effective to collect seeds and keep in seed banks.

3.1.3. Dunes with *Hippophaë rhamnoides* L. (2160; PAL. CLASS.: 16.251)

Places covered with woody plants can be found near Poty on fixed dunes, where *Hippophaë rhamnoides*, *Berberis vulgaris, Malus orientalis, Pyracantha coccinea, Mespilus germanica, Ruscus ponticus, Paliurus spina-christi* dominate. Thorny Scrub with climbing plants *Smilax excelsa, Clematis vitalba, Periploca graeca* can be found in Samegrelo. The coastal scrub of secondary origin is found near Sukhumi. *Paliurus spina-christi, Crataegus monogyna, Carpinus orientalis* dominate here. Existence of species of forests here speaks of the secondary origin of this community.

Plants species: *Hippophaë rhamnoides*, *Berberis vulgaris, Malus orientalis, Pyracantha coccinea, Mespilus germanica*, *Paliurus spina-christi, Crataegus monogyna, Carpinus orientalis, Trachystemon orientale, Anchusa* sp., *Polystichum lonchitis*.

3.1.3.1. The economically potential species and medicinal plants - Sea buckthorn *Hippophaë rhamnoides* L. – Elaeagnaceae

The economically potential species - *Hippophaë rhamnoides* is as recreational, ornamental and medicinal plants and other (**Figure 9**). Coasts, banks of lakes, mountain streams and brooks; riverside pebbles, pebbly springs, riverside shingle, tugais, willow and poplar woods on sands, upper limit of deciduous and lower limit of coniferous trees (up to 300-2100 m), ravines, slopes, rocks and bluffs.Grows up to middle, sometimes subalpine belt, mostly on riverbanks and in gorges. Occurs solitary or in small groups or forms thickets. 1.5 - 5 m high tall shrub, rarely tree, strongly branched, with spreading crown. Snow cover is <1-2 m. The exposition is for all directions and inclination till 10°C. Sunny edge is normal; dappled shade is in North Wall, East Wall, and West Wall. Twigs greyish and spine tipped. Suitable for: light, medium and heavy soils and can grow in nutritionally poor soil.

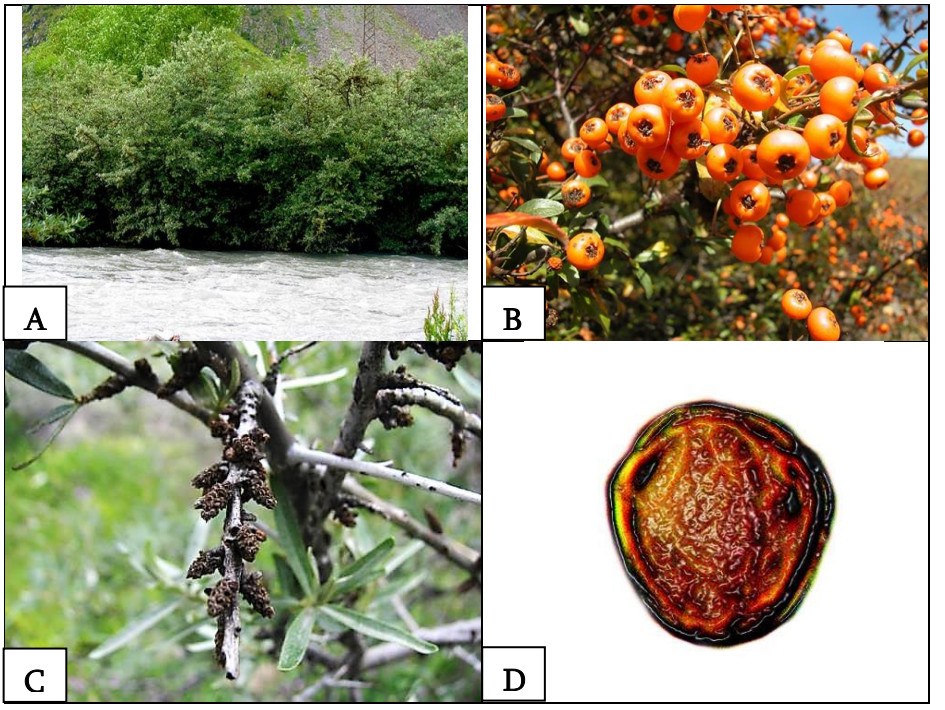


Figure 9. A. *Hippophaë rhamnoides* is near of Terek River in Kazbegi District; **B.** *Hippophaë rhamnoides* is medicinal plant with seeds. **C.** Dust seed multiplied in April and then the seeds. **D.** Pollen of *Hippophaë rhamnoides* has length of the horizontal height 23-28 μm. **Photo: Maia Akhalkatsi.**

Suitable pH: acid, neutral and basic soils. It cannot grow in the shade. It prefers dry moist or wet soil and can tolerate drought. The plant can tolerate maritime exposure. Leaves linear or linear-lanceolate, 2-8 cm long, 0.2-0.8 cm broad, subobtuse, more or less narrowed at base, subsessile, with more or less revolute margins, dark grayish-green above, silvery-white suffused with brown or yellow beneath, clothed with white and brown stellate scales; Staminate flowers in short minute spikes, 5- 8 mm long and 4-6 mm broad, with 2-parted perianth, lobes ovate-orbicular, 3-4 mm long, 3-3.5 mm broad, concave, greenish-brown, covered outside with numerous brown and sparse white stellate scales; stamens 4, half to two-thirds as long as perianth; anthers 1.5 mm long, oblong-linear, almost sessile anthers with very short filaments;

pistillate flowers 2-5 in axils of branchlets, on pedicels 0.5 mm long; perianth of pistillate flowers tubular, oblong-obovate, 2.5-4 mm long, 1-1.5 mm broad, brown, covered outside with stellate brown and few white scales, lobes obtuse, covered inside with rather long white hairs; pistil in lower part of perianth-tube; ovary glabrous, globoseovaloid, 1-2 mm long, about half length of perianth; style 0.5 mm long; stigma oblong, 0.5-1 mm long, 1-sided, exserted; ripe drupe globose, ovaloid, globose -ovaloid or short-ellipsoid, 0.8-1 cm long and 0.3-0.6 cm broad, or ellipsoid, 5-7 mm long and 3 mm broad, glabrous, orange or reddish, succulent and aromatic; stone ovoid-oblong, 4-7 mm long and 4-5 mm broad, or oblong-ellipsoid, 4-5 mm long and 1.5-2 mm broad, dark brown, sometimes almost black, lustrous. Flowering in April-May, fruits are in August-October.

A handsome ornamental plant is grown in gardens and parks, either singly or in hedges. An invaluable plant for fixing sands, landslides, railroad embankments and protection of railway lines against snow drifts. The wood is fine-grained yellow, with brownish -yellow heartwood, tough, rather hard, heavy, very durable. It is suitable for fine carpentry and turning. Used for staking grapevines. The ash has high potash content. The fruit has a sourish, aromatic flavor; the drupes are a favorite food of pheasants; they are considered by the local population to be a dainty and are made into infusions, liqueurs and jams. Young shoots and leaves produce a blackish-brown dye, and fruit a yellow dye, with iron salts. The foliage contains 10% tannin and provides tanning material. The plant is used in popular medicine. The fruit is very succulent, slightly mucilaginous; it has an agreeable sourish flavor and a pineapplelike aroma. Frozen fruit (without stones) contains up to 3.56% sugar (glucose 1.96%, fructose 1.0%), acids (including malic acid) 2.64%). The pulp contains 8% oil. The fruit is eaten raw, especially after frost; it is added to flour to make a special kind of bread; it is also made into jellies, deserts and candies. Pectin has to be added to the fruit juice for jelly making. The fruit is also used for making jam which resembles barberry jam in flavor. Reserves of sea buckthorn are considerable. It is a valuable honey plant. The vitamin C (ascorbic acid) content is as follows: in leaves 230-262 mg%, in fruit 120 mg% (according to other data 172.8-198.6 mg%)), in fruit juice 200 mg% (according to other data 500-900 mg%). The ascorbic acid is very stable and keeps well. Sea buckthorn deserves

attention as a source of vitamin C. Sea buckthorn oil was found to contain 90 mg% carotene (provitamin A). Very tolerant of maritime exposure, it can be used as a shelter hedge. It dislikes much trimming. A very thorny plant, it quickly makes an impenetrable barrier. Sea buckthorn has an extensive root system and suckers vigorously and so has been used in soil conservation schemes, especially on sandy soils.

The fibrous and suckering root system acts to bind the sand. Because the plant grows quickly, even in very exposed conditions, and also adds nitrogen to the soil, it can be used as a pioneer species to help the re-establishment of woodland in difficult areas. Because the plant is very light-demanding it will eventually be out-competed by the woodland trees and so will not out-stay its welcome. The seeds contain 12-13% of slow-drying oil. The vitamin-rich fruit juice is used cosmetically in face-masks etc. A yellow dye is obtained from the fruit. A yellow dye is obtained from the stems, root and foliage. A blackish-brown dye is obtained from the young leaves and shoots. Wood has tough, hard, very durable, fine-grained. Used for fine carpentry, turning etc. The wood is also used for fuel and charcoal. Landscape is Border, Seashore, and Specimen. Succeeds is in most soils, including poor ones, so long as they are not too dry. Grows is well by water and in fairly wet soils. Established plants are very drought resistant. Requires are a sunny position, seedlings failing to grow in a shady position and mature shrubs quickly dying if overshadowed by taller plants. Does is well in very sandy soils. Very tolerant is of maritime exposure. Plants are fairly slow growing. Although usually found near the coast in the wild, they thrive when grown inland and are hardy to about -25°C. A very ornamental plant, it is occasionally cultivated, especially in N. Europe, for its edible fruit, there are some named varieties. 'Leikora' is a free-fruiting form, developed for its ornamental value. Members of this genus are attracting considerable interest from breeding institutes for their nutrient-rich fruits that can promote the general health of the body. This species has a symbiotic relationship with certain soil bacteria. These bacteria form nodules on the roots and fix atmospheric nitrogen. Some of this nitrogen is utilized by the growing plant but some can also be used by other plants growing nearby. Plants produce abundant suckers, especially when grown on sandy soils. Dioecious is for male and female plants must be grown if seed is required. The sexes of plants cannot be distinguished before flowering, but on flowering

plants the buds of male plants in winter are conical and conspicuous whilst female buds are smaller and rounded. Plants in this genus are notably resistant to honey fungus. Seed of *Hippophaë rhamnoides* sow spring in a sunny position in a cold frame. Germination is usually quick and good although 3 months cold stratification may improve the germination rate. Alternatively the seed can be sown in a cold frame as soon as it is ripe in the autumn. Prick out the seedlings into individual pots when they are large enough to handle and grow on in a greenhouse for their first winter. Plant out in late spring into their permanent positions. Male seedlings, in spring, have very prominent axillary buds whilst females are clear and smooth at this time. Cuttings are of half-ripe wood, June/July in a frame.

This is the easiest method of vegetative propagation. Cuttings are of mature wood in autumn. Difficult are in the cuttings should be taken at the end of autumn or very early in the spring before the buds burst. Store them in sand and peat until April, cut into 7- 9 cm lengths and plant them in a plastic tent with bottom heat. Rooting should take place within 2 months and they can be put in their permanent positions in the autumn. Division is of suckers in the winter. They can be planted out direct into their permanent positions and usually establish well and quickly. Layering is in autumn. Native is to Eurasia.

4. FRESHWATER HABITATS

4.1. Standing water

4.1.1. Code of Georgia: Natural lakes and ponds (316GE)

Four sub-types of bank vegetation exist, dependent on the geographic region where a pond, reservoir, or lake is located.

Sub-types (316GE-01): There is dense marsh vegetation around the Lake Paliastomi, dominated by *Phragmites australis, Juncus acutus* and *Juncellus serotinus*. Dominant species of perennial grassy vegetation are *Inula auriculata, Lythrum salicaria*. Common and widespread *Kosteletzkya pentacarpa* (Malvaceae) is considered to be a Tertiary relict species. Climbing forms represented by *Galium elongatum* and *Calystegia sepium*. The invasive bush *Amorpha*

fruticosa (originally from SE North America) is a common species of flooded planes, banks and marshes.

Sub-types (316GE-02): Other vegetation community type of the vicinity of Lake Paliastomi consists of graminoid vegetation with a combination of monocotyle and dicotyle dominant herbs. Reedbed (*Phragmites*) along a narrow coastal line is up to 2 meters high. A circle of lower vegetation is comprised of *Molinia* spp., *Cladium* spp., *Rhynchospora* spp., and broadleaved species, including *Centaurium* spp., *Lysimachia* spp. and *Hypericum tetrapterum. Hydrocotyle vulgaris* and *H. ranunculoides* dominate in ground vegetation. *Andropogon capillipes* is an invasive species (originally from North America).

Sub-types (316GE-03): Vegetation of lakes of the Javakheti Plateau in Southern Georgia varies among the lakes. Banks of some (e.g. Sagamo lake) are bare. Banks of large lakes Khanchali and Madatapa are covered with dense bank vegetation. The dominating species are *Sagittaria sagittifolia, Heleocharis palustris. Potamogeton pectinatus, P. crispus, Myriophyllum spicatum, Polygonum amphibium* are more common than *Nuphar luteum, Nymphaea alba*.

Sub-types (316GE-04): In the outskirts of Tbilisi, on the banks of lakes Udzo and Lisi, reedbed is comprised of *Phragmites australis, Scirpus tabernaemontani, Bolboschoenus maritimus, Carex vesicaria, C. rostrata,* and *C. diluta*. Marsh vegetation is represented by *Lysimachia dubia, Lythrum salicaria, Pulicaria uliginosa, Ranunculus lingua* and a number of other species.

Plants species: 316GE-01. *Amorpha fruticosa, Apium graveolens, Calystegia sepium, Carex vesicaria, Chenopodium* sp., *Cyperus badius, Digitaria ischaemum, Erigeron canadensis, Galium elongatum, Hydrocotyle vulgaris, Inula auriculata, Juncellus serotinus, Juncus acutus, Kosteletzkya pentacarpa, Lythrum salicaria, Phragmites australis,Phytolacca americana, Rubus anatolicus, Rumex crispus, Scirpus lacustris;* **316GE-02.** *Andropogon virginicus, Centaurium erythraea, Cladium mariscus, Erigeron crispus, Hydrocotyle ranunculoides, Hydrocotyle vulgaris, Hypericum tetrapterum, Juncus acutus, Lycopus europaeus, Lysimachia vulgaris, Molinia caerulea, Phragmites australis, Potentilla erecta, Rumex sanguineus, Sagittaria sagittifolia, Scirpus lacustris, Sparganium angustifolium;* **316GE-03.** *Sagittaria sagittifolia, Heleocharis palustris, Potamogeton pectinatus,*

P. crispus, Myriophyllum spicatum, Polygonum amphibium, Nuphar luteum, Nymphaea alba; **316GE-04.** *Phragmites australis, Scirpus tabernaemontani, Bolboschoenus maritimus, Carex vesicaria, C. rostrata, C. diluta, Lysimachia dubia, Lythrum salicaria, Pulicaria vulgaris, Ranunculus lingua*.

4.1.1.1. Edificatory plant species, Spiraea - *Spiraea hypericifolia* L., Rosaceae

Edificatory species - *Spiraea hypericifolia* are that have a special role to contribute in ecosystem structure. Grows from lowland to subalpine belts in shrublands 100-2100 m. Shrub 50-150 cm high; Snow cover is <0.3 m. The exposition is for all directions and inclination till 30°C. Sunny edge is normal; dappled shade is in North Wall, East Wall, and West Wall. Steppe and forest -steppe zone where, together with other steppe shrubs, it forms thickets; also gully slopes and open, often also stony slopes; in mountain regions of Caucasus in the shrub zone, on open slopes, in juniper woods, and on mountain riverbanks; in the Caucasus in shrubthickets on mountain slopes, penetrating to alpine meadows where it grows as a small, low, much branched shrub, often with broader leaves **(Figure 10).**

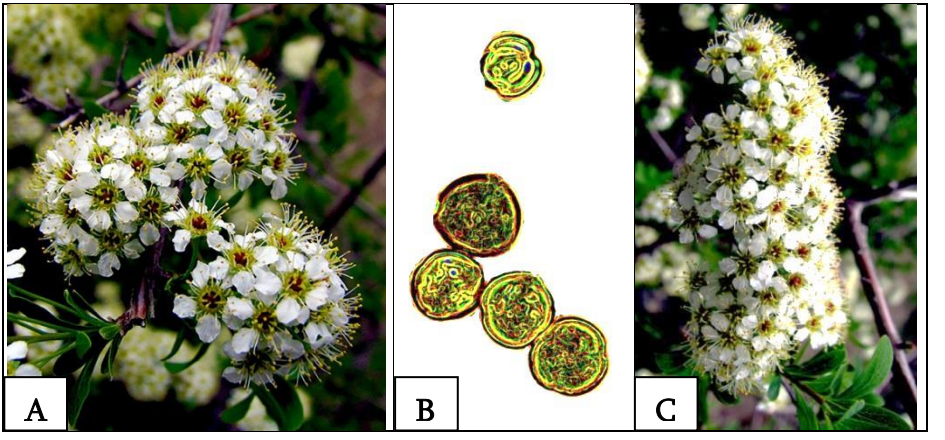


Figure 10. A. *Spiraea hypericifolia* is near city Tbilisi; **B.** Pollen of *Spiraea hypericifolia* has length of the horizontal height as 15-18 μm; **C.** *Spiraea hypericifolia* is shrub. **Photo: Maia Akhalkatsi.**

Branches light brown, often long, virgate, with numerous, crowded sessile umbels; young shoots glabrous or tomentose pubescent; Leaves glabrous or short hairy when young. Leaf is obovate, oblong-elliptic or lanceolate, obtuse or rarely acute, entire.

Leaves of sterile shoot tipped in 2-5 teeth, leaf blade narrows to a wedge-shaped base. leaves 10-25 mm long, 1.5-8 mm broad, glabrous or puberulent when young, oboval, oblong elliptic or lanceolate, obtuse or acute, entire, those on sterile shoots sometimes with 2-5 teeth at the apex, cuneately tapering to short, 1.5-5 mm petiole; Flowers white, inflorescences 4-10 flowers clustered into umbel. pedicels glabrous or slightly pubescent, 5-15 mm long, to 18 mm long in fruit; flowers 5-8 (9) mm in diameter, with oboval or ovate petals and triangular sepals 1.3-l.2 as long as follicles, the latter glabrous or pubescent. Fruit is glabrous or pubescent follicle, dehiscent on one side. Flowering in April - June, fruits from July.

Used for fastening of sands; ornamental and nectariferous. *Spiraea* species are used as food plants by the larvae of many *Lepidoptera* species, including the Brown-tail, the Small Emperor Moth, the Grey Dagger, the Setaceous Hebrew character, and the moth *Hypercompe indecisa*. Seeds of *Spiraea hypericifolia* we have no information for this species but suggest sowing the seed as soon as it is ripe in a cold frame if possible.

It is likely to require stratification before it germinates, so stored seed should be sown in a cold frame as early in the year as you receive it. Prick out the seedlings into individual pots when they are large enough to handle, and grow them on in a cold frame for their first winter. Plant them out in late spring or early summer of the following year.

Cuttings are of half-ripe wood, July/August in a light sandy soil a frame. A cutting is of mature wood of the current season’s growth, 15 cm long, October/November in an outdoor frame. Another report says that September is a good time to do this. Division is of suckers in early spring. They can be planted out straight into their permanent positions. Native is to Eurasia.

4.2. Running water

4.2.1. Alpine rivers and the herbaceous vegetation along their banks (3220; PAL. CLASS.: 24.221 and 24.222)

Sedge (*Carex oreophila*) and other such characteristic species as *Swertia iberica, Pedicularis crassirostris* appear in the alpine zone on the bank of the stream. In the places of melting snow we can encounter *Bellevalia paradoxa, Scilla rosenii, Corydalis erdelii, C. emanuelii,* etc. On the banks of those rivers that start at the glacier the following communities can be found: *Caltha polypetala, Cardamine uliginosa, Parnasia palustris, Alchemilla tredecimloba, Heracleum apiifolium, Primula auriculata, Cirsium simplex, Papaver oreophilum, Saxifraga sibirica, Vicia varriegata, Chamaenerion hirsutum.*

The following can be found of the moistened sandy ground of quartz - *Juncus bufonius, Sagina saxatilis.* On the banks of the stream in marshy places there are - *Juncus alpigenus, J. atratus, Carex canescens, C. stellulata, C. contigua, C. leporina, C. rigida, Eriphorum latifolium,* and *Heleocharis palustris.*

Plants species: *Carex oreophila, Swertia iberica, Pedicularis crassirostris, Bellevalia paradoxa, Scilla rosenii, Corydalis erdelii, C. emanuelii, Caltha polypetala, Cardamine uliginosa, Parnasia palustris, Alchemilla tredecimbosa, Heracleum apiifolium, Primula auriculata, Cirsium simplex, Papaver oreophilum, Saxifraga sibirica, Vicia varriegata, Chamaenerion hirsutum, Juncus bufonius, Sagina saxatilis, Juncus alpigenus, J. atratus, Carex canescens, C. stellulata, C. contigua, C. leporina, C. rigida, Eriphorum latifolium, Heleocharis palustris.*

4.2.1.1. Endangered species the national and/or international conservation status of the species *Orchis coriophora* L., Orchidaceae

Endangered species of *Orchis* are the national and/or international conservation status of the species. The following species occurs - *Orchis coriophora* L.; *Orchis mascula* subsp. *longicalcarata* Akhalkatsi, H. Baumann, R. Lorenz, Mosulishvili & R. Peter; *Orchis morio* subsp. *caucasica* (K. Koch) E.G. Camus, Bergon & A.Camus; *Orchis palustris*

subsp. *pseudolaxiflora* (Czerniak.) H. Baumann & R. Lorenz; *Orchis ustulata* L. Target species is *Orchis coriophora* (**Figure 11**).

Figure 11. A. *Orchis coriophora* is in meadiws of Meskheti 1000-1800 m. **B.** *Orchis coriophora* height as 15-25 cm. **Photo: Maia Akhalkatsi.**

Bulb is growing to 0.3 m. It is in flower from June to July. The plant prefers ligh, medium and heavy soils. The plant prefers acid, neutral and basic soils. It cannot grow in the shade. It requires moist soil.

Medicinal uses are demulcent and nutritive. Salep is very nutritive and demulcent (**Grieve, 1984**). Used in the treatment of cancer. It has been used as a diet of special value for children and convalescents, being boiled with water, flavoured and prepared in the same way as arrowroot. Rich in mucilage, it forms a soothing and demulcent jelly that is used in the treatment of irritations of the gastro-intestinal canal. One part of salep to fifty parts of water is sufficient to make a jelly. The tuber is from which salep is prepared, should be harvested as the plant dies down after flowering and setting seed.

Drink is prepared from root. Root - cooked. It is a source of 'salep', a fine white to yellowish-white powder that is obtained by drying the tuber and grinding it into a powder. Salep is a starch-like substance with a sweetish taste and a faint somewhat unpleasant smell. It is said to be very nutritious and is made into a drink or can be added to cereals and used in making bread etc.

Requires has a deep rich soil. Easily is grown in full sun in a moist sandy loam (**Grey, 1938**). Orchids are, in general, shallow-rooting plants of well-drained low-fertility soils. Their symbiotic relationship with a fungus in the soil allows them to obtain sufficient nutrients and be able to compete successfully with other plants.

They are very sensitive to the addition of fertilizers or fungicides since these can harm the symbiotic fungus and thus kill the orchid. This symbiotic relationship makes them very difficult to cultivate, though they will sometimes appear uninvited in a garden and will then thrive.

Transplanting can damage the relationship and plants might also thrive for a few years and then disappear, suggesting that they might be short-lived perennials. Plants can succeed in a lawn in various parts of the country. The lawn should not be mown early in the year before or immediately after flowering.

Plant out bulbs whilst the plant is dormant, preferably in the autumn. Plants seem to be immune to the predations of rabbits. Cultivated plants are very susceptible to the predation of slugs and snails. The flowers have an abominable bug-like smell. The flowers of the commoner sub-species, *O. coriophora* subsp. *fragrans*, however, are sweetly scented.

Seed of *Orchis coriophora* are surface sows, preferably as soon as it is ripe, in the greenhouse and do not allow the compost to dry out. The seed of this species is extremely simple; it has a minute embryo surrounded by a single layer of protective cells. It contains very little food reserves and depends upon a symbiotic relationship with a species of soil-dwelling fungus. The fungal hyphae invade the seed and enter the cells of the embryo.

The orchid soon begins to digest the fungal tissue and these acts as a food supply for the plant until it is able to obtain nutrients from decaying material in the soil. It is best to use some of the soil that is growing around established plants in order to introduce the fungus, or to sow the seed around a plant of the same species and allow the seedlings to grow on until they are large enough to move. Division of the tubers as the flowers fade.

This species produces a new tuber towards the end of its growing season. If this is removed from the plant as its flowers are fading, the shock to the plant can stimulate new tubers to be formed. The tuber should be treated as being dormant, whilst the remaining plant should

be encouraged to continue in growth in order to give it time to produce new tubers (**Cribb, Bailes, 1989**).

Division can also be carried out when the plant has a fully developed rosette of leaves but before it comes into flower. The entire new growth is removed from the old tuber from which it has arisen and is potted up, the cut being made towards the bottom of the stem but leaving one or two roots still attached to the old tuber. This can often be done without digging up the plant. The old tuber should develop one or two new growths, whilst the new rosette should continue in growth and flower normally.

4.2.2. Code of Georgia: Alpine rivers and their ligneous vegetation (323 GE)

There are 4 sub-types of this habitat.

Sub-types (323GE-01): On river banks covered with silt or mud thin scrub can be found - hawthorn (*Crataegus kyrtostyla*), oriental hornbeam (*Carpinus orientalis*), sea buckthorn (*Hippophaë rhamnoides*) and Jerusalem thorn (*Paliurus spina-christi*).

Sub-types (323GE-02): The sandy bank of the riparian is covered with vegetation of thick undergrowth type. *Agrostis verticillata, Calamagrostis glauca, Juncus articulatus, J. bufonius, Pulicaria uliginosa,* etc. can be found from the grasses.

Sub-types (323GE-03): Riverside rock vegetation is under the influence of floods during which it can completely disappear and then revive again. Mainly the following annual plants can be found: *Carex capillaris, Agrostis verticillata, Chamaenerion hirsutum, Verbascum gnaphalodes.* However, grasses and perennial dicotyledons given below also take part in creating this community: *Poa glauca, Cyperus fuscus, Pycreus flavescens, Heleocharis palustris, Fimbristylis bisumbellata, Juncus articulatus, J. tenageia;* as for dycotyledons - *Pulicaria dysenterica, Mentha aquatica, Eupatorium cannabinum.*

Sub-types (323GE-04): Boggy places on the banks of rivers, streams and narrow mountain valleys are covered with triangular rush (*Juncus bufonius*), which expel primary hydrophillic vegetation: *Glyceria plicata, Carex remota, Alopecurus arundinaceus*. The following are named together with triangular rush: *Deschampsia caespitosa, Iris sibirica, Filipendula ulmaria,* etc. Real marshes can be

found in the coastal line of the lower stream of river Mtkvari. Marshes here are covered with grasses and moor-grass - *Calamagrostis arundinacea, Beckmannia eruciformis, Typha minima, T. laxmannii, Sparganium microcarpum, Cladium mariscus,* etc. *Iris carthaliniae* grows on less moist places.

Plants species: *Agrostis verticillata, Alopecurus arundinaceus, Beckmannia eruciformis, Calamagrostis arundinacea, Calamagrostis glauca, Carex capillaris, Carex remota, Carpinus orientalis, Chamaenerion hirsutum, Cladium mariscus, Crataegus kyrtostyla, Cyperus fuscus, Deschampsia caespitosa, Eupatorium cannabinum, Filipendula ulmaria, Fimbristylis bisumbellata, Glyceria plicata, Heleocharis palustris, Hippophaë rhamnoides, Iris carthaliniae, Iris sibirica, Juncus articulatus, J. bufonius, J. tenageia, Mentha aquatica, Paliurus spina-christi, Poa glauca, Pulicaria dysenterica, Pulicaria uliginosa, Pycreus flavescens, Sparganium microcarpum, Typha minima, T. laxmannii, Verbascum gnaphalodes.*

4.2.2.1. The economically potential species and medicinal plants - *Viola* L., Violaceae

The economically potential species are recreational, ornamental and medicinal plants and other for *Viola* L. The following species occurs - *V. odorata* L.; *V. suavis* M. Bieb.; *V. oreades* M. Bieb.; *V. parvula* Tineo (*V. sosnowskyi* Kapell.); *V. kitaibeliana* Schult.; *V. pyrenaica* Ramond ex DC.; *V. reichenbachiana* Jord. ex Boreau (*V. sylvestris* Lam.); *V. pumila* Chaix.

Perennial are growing to 0.1 m by 0.15 m. It is in flower from February to April, and the seeds ripen from April to June. The plant prefers light, medium and heavy soils and requires well-drained soil. The plant prefers acid, neutral and basic soils. It can grow in semi-shade or no shade. It requires moist soil. *V. odorata* is usually used as medicinal plant, but almost all wild species are collected instead of it when available for local population (**Figure 12**). Sweet violet has a long and proven history of folk use, especially in the treatment of cancer and whooping cough (**Grieve, 1984**). It also contains salicylic acid, which is used to make aspirin. It is therefore effective in the treatment of headaches, migraine and insomnia.

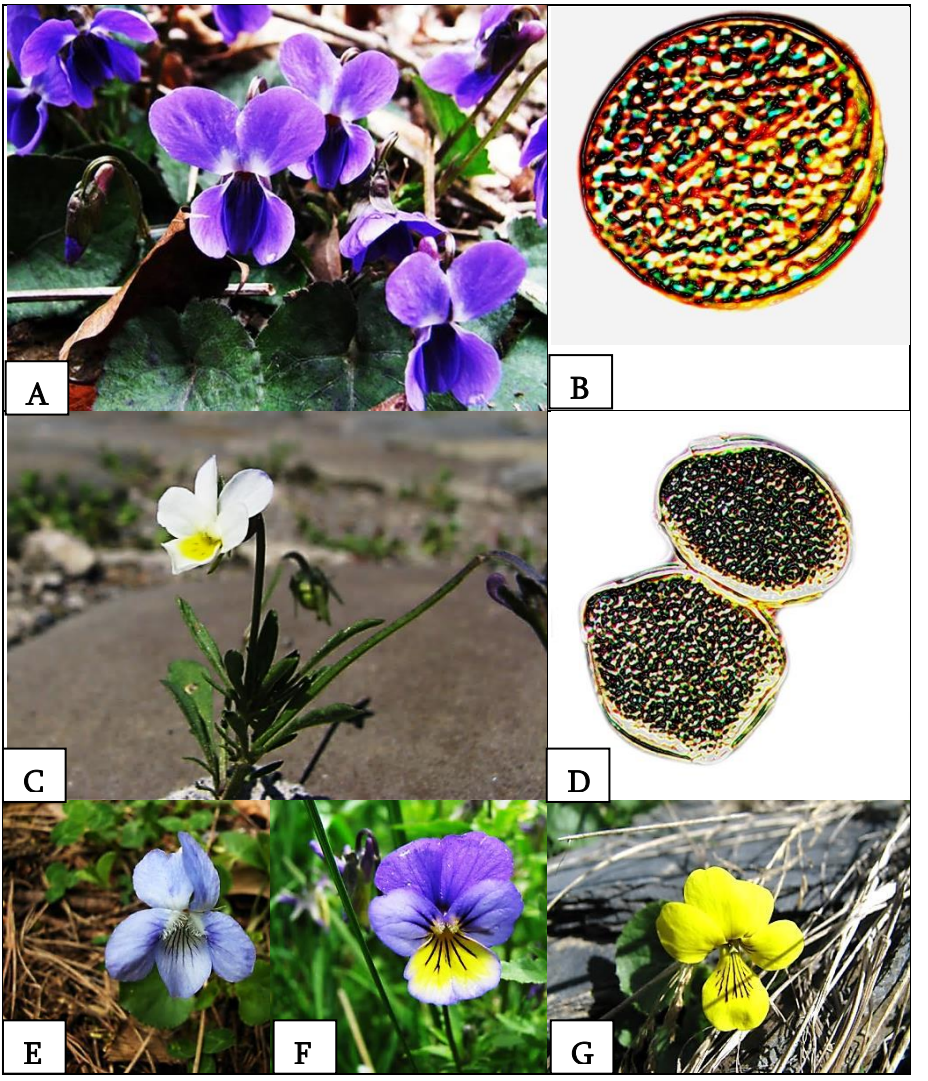


Figure 12. A. *Viola odorata* (LC), near v. Sakire, Borjomi distr. and flowering in March; **B.** There are the pollen of *V. odorata* with diameters 90 and 95 μm for grains; **C.** *V. parvula* is in arid areas; **D.** The pollen of *V. parvula* has diameters 90 and 95 μm for grains; **E.** *V. suavis* (LC), Zekari Pass, v. Abastumani, Adigeni distr.; **F-G.** Two different flowers of species *V. oreades* are in one area, Goderdzi Pass, Adigeni distr. **Photo: Maia Akhalkatsi.**

The whole plant is anti-inflammatory, diaphoretic, diuretic, emollient, expectorant, and laxative (**Grieve, 1984**). It is taken internally in the treatment of bronchitis, respiratory catarrh, coughs, asthma, and cancer of the breast, lungs or digestive tract (**Bown, 1995**). Externally, it is used to treat mouth and throat infections. The plant can either be used fresh, or harvested when it comes into flower and then be dried for later use. The roots is a much stronger expectorant than other parts of the plant but they also contain the alkaloid violine which at higher doses is strongly emetic and purgative (**Grieve, 1984**).

An essential oil from the flowers is used in aromatherapy in the treatment of bronchial complaints, exhaustion and skin complaints. Young leaves and flower buds - raw or cooked. Usually is available all through the winter. The leaves have a very mild flavour, though they soon become quite tough as they grow older. They make a very good salad, their mild flavour enabling them to be used in bulk whilst other stronger-tasting leaves can then be added to give more flavour. Essentials are ground cover and litmus. An essential oil from the flowers and leaves is used in perfumery. 1000 kg of leaves produces about 300–400 g absolute (**Uphof, 1959**).

The flowers are used to flavour breath fresheners. A pigment extracted from the flowers is used as litmus to test for acids and alkaline. Plants can be grown as a ground cover when spaced about 30 cm apart each way. They make an effective weed-excluding cover.

Succeeds in most soils but prefers a cool moist well-drained humus-rich soil in partial or dappled shade and protection from scorching winds. When grown in the open it prefers a moderately heavy rich soil. Plants have done very well in a hot dry sunny position on our Cornish trial grounds. Tolerates is sandstone and limestone soils. Plants are hardy to about -20°C.

The plants will often self-sow freely when well-sited. They can also spread fairly rapidly at the roots when they are growing well Responds well to an annual replanting in rich loose leafy soils. All members of this genus have more or less edible leaves and flower buds, though those species with yellow flowers can cause diarrhoea if eaten in large quantities. Seed of *Viola* are best sown in the autumn in a cold frame. The seed requires a period of cold stratification and the germination of stored seed can be erratic.

Prick out the seedlings into individual pots when they are large enough to handle and plant them out in the summer. Division is in the autumn or just after flowering. Larger divisions can be planted out direct into their permanent positions, though we have found that it is best to pot up smaller divisions and grow them on in light shade in a greenhouse or cold frame until they are growing away well. Plant them out in the summer or the following spring.

5. SCRUBS

5.1. Temperate heath and scrub

In general, there are three types of scrub: 1) Deciduous; 2) Evergreen and 3) Dwarf. Dry place grove of Jerusalem thorn belongs to deciduous scrub; "Makvisi" is evergreen scrub, which is found in Abkhazia and consists of Mediterranean species. Dwarf scrub is found in high mountains. E.g. grove is of evergreen Caucasian Rhododendron.

5.1.1. Code of Georgia. Evergreen heaths of Kolkheti (40GE)

Sub-types (40GE-01): "Makvisi" in Abkhazia is the type of scrub which is widespread in the outskirts of Bichvinta and Bombori. The Mediterranean *Arbutus andrachne, Cistus creticus* and *Hippophaë rhamnoides* are the dominant species.

Sub-types (40GE-02): Boxwood thick undergrowth (***Buxus colchica***) was initially part of evergreen understory characteristic to the Kolkhic forest. After cutting down the forest, laurel/bay scrub appeared. It is similar to the Colchic forest understory with the box.

Sub-types (40GE-03): The genuine planted forest of the bay (*Laurus nobilis*) is preserved on the extremely limited territory near village Kheta, on Urta Mountain in Samegrelo. It is the remnant of the relict forest of mioscene period. At present it is almost devastated as a result of the strong anthropogenic impact. Compatible species is *Arbutus andrachne.*

Plants species: *Arbutus andrachne, Cistus creticus, Hippophaë rhamnoides, Buxus colchica, Laurus nobilis.*

5.1.1.1. Indicator plant species Greek Strawberry Tree - *Arbutus andrachne* L., Ericaceae

Indicator species – *Arbutus andrachne* these are species that respond quickly to any changes in the environmental conditions and, therefore, their responses indicate timely information about the state of the ecosystem monitoring (**Figure 13**).

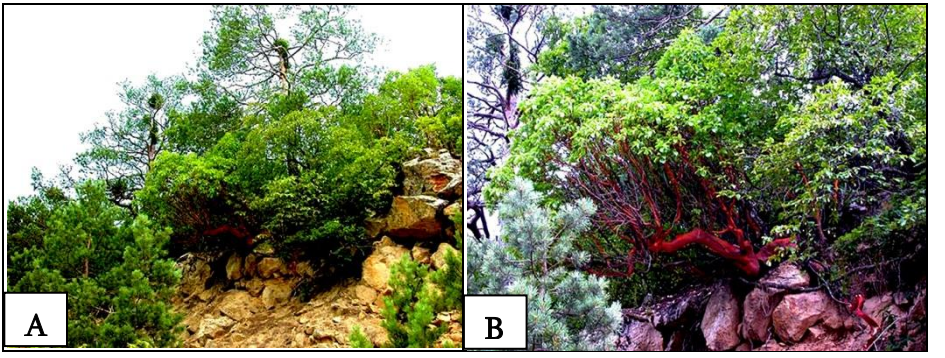


Figure 13. A. *Arbutus andrachne* is in Adjara and Abkhaseti. **B.** *Arbutus andrachne* is tree with 5 m. **Photo: Maia Akhalkatsi.**

Evergreen plant and height is 5 m. Its branches are bent, smooth bark, red. Soft red bark is sometimes removed timber and leaves the wintering period. Young bare twig. Leaf color is green, the bottom side molego color, 7-10 cm long, and 5-6 cm wide. Leaf has elongated, naked and evergreen. Leaf is form or elliptical, tip obtuse, sometimes slightly. Leaf base narrowed. Leaf edges small hands gearing. Petiole is 1.4-3 cm long. Inflorescence is glandular-fur sagvelaa. Inflorescence is axis 2-5 mm. The flowers are small in size glandular stem, 6-10 mm in length. Sum deeply 5 excommunicated rounded shape plots. Crown is yellowish white color, 5-toothed, spherical or spherical-pots. Stamen is 10 mm, crown miles hidden, dusty yarn shorter. Advanced foot, fur lining. Samtvreebi two kentseruli holes open and have 2 pkhisebri plugs. Shepusulia kenkrisebri is fruit, mravaltesliani kurkaa, 1-1.5 cm in diameter. Net wrinkled. Flowering from April until the end of August, and the seeds are maturing. 2n=26. "Makvisi" Abkhazia is called a scrub, which is common in the vicinity of Bichvinta and

Bombora. Dominant species is in the Mediterranean *Arbutus andrachne*, Cistus creticus and Hippophaë rhamnoides. Stand clear bay (*Laurus nobilis*) is preserved in a very small area of the village. Kheta is near Mount Urta, Zugdidi. It Miocene period is relict forest waste. Currently, a strong anthropogenic impact is almost destroyed. Concurring species is *Arbutus andrachne*. Georgian oak (*Quercus iberica*) monodominant forest is near the sea include *Arbutus andrachne* Abkhazia and Adjara. Evergreen shrubs of *Arbutus andrachne* in Colchis on the Black Sea near the mountain slope.

5.1.2. Alpine and Boreal heaths (4060; PAL. CLASS.: 31.4)

Low or dwarf sprawling scrub widespread in the alpine and subalpine areas, with dominating genera of Ericaceae: *Rhododendron, Epigaea, Arctostaphylos, Erica*, with the inclusion of *Vaccinium, Dryas, Daphne, Empetrum, Juniperus.*

Sub-types (4060-01): Subalpine shrubland of Caucasian Rhododendron (*Rhododendron caucasicum*): evergreen dwarf shrubland, which creates subalpine scrub throughout the Caucasus, from the upper forest line (1800-1900 m. a.s.l.) to the upper border of the alpine zone (2300-2900 m).

This type of vegetation covers slopes of the northern exposition. The life cycle of the plant is linked with the dynamics of the snow cover, which makes this species extremely sensitive to the climate change.

Characteristic species are: *Vaccinium myrtillus, V. vitis-idaea, Arctostaphylos uva-ursi* subsp. *caucasica, Empetrum caucasicum, Daphne glomerata, Pyrola minor, P. rotundifolia, Anemone fasciculata, Calamagrostis arundinacea.* Occasionally *Juniperus sabina, Salix kazbegensis* are also found.

In Abkhazia, grove of the Rhododendron is not found on granite rather than limestone soils. In this area, the rowan (*Sorbus boissieri, Geranium sylvaticum, Anemone aurea, Trollius patulus*) grows along with the grove of evergreen Rhododendron.

In Svaneti, the Rhododendron is commonly associated with a fern *Athyrium alpestre.* Mountain wild garlic (*Allium victorialis)* creates association together with mountain blueberry and the grove of evergreen azaleas in small and central Caucasus.

Sub-types (4060-02): Mountain avens (***Dryas caucasica***): This type of scrub is rare and holds a small territory on rocky and stony slopes at the northern and north-west exposition, at the height of 2000 – 2600 meters a.s.l. Typical to limestone and moistened slopes with incline up to 20-50 degrees.

Strongly affected is by a negative impact of excessive grazing and climatic changes. Characteristic species are: *Daphne glomerata, Vaccinium vitis-idaea, Selaginella helvatica, Deschampsia flexuosa, Primula amoena, Polygonum viviparum, Leontodon danubialis,* and *Parnassia palustris.*

Sub-types (4060-03): Crowberry – blueberry (*Vaccinium* and *Empetrum* can be found together) tickets are typical for the Alpine belt, where there are growing on the thin-layer rocky biotope. This co-community belongs to the *Empetrum-Vaccinium* scrub type of western-eastern European high mountains.

Sub-types (4060-04): Juniper thicket (*Juniperus* spp.) dwarf juniper shrubs (*Juniperus hemisphaerica* and *J. sabina*) are found throughout the Caucasus Mountains.

In western Caucasus, juniper shrubs intrude in the grove of evergreen Rhododendrons (*Rhododendron*). *Woronowia speciosa* (=*Geum speciosum*) is a species typical to the community of juniper of limestone habitat.

The juniper thicket community in Svaneti is dominated by *Juniperus depressa.* Associated species are: *Empetrum caucasicum, Vaccinium vitis-idaea, V. myrtillus, Rosa svanetica.*

Sub-types (4060-05): Azalea thicket (***Rhododendron luteum***) consists of a scrub of deciduous species of azalea with yellow flowers. Different from the grove of evergreen Rhododendrons, it does not form a bound scrub.

Species composition varies dependent on the soil type. The habitat is formed by admixture of the azaleas and subalpine grasses.

The following plants are common: *Geranium psilostemon, Achillea latiloba, Cirsium obvalatum, Campanula hemschinica.*

Plants species: *Achillea latiloba, Allium victorialis, Anemone aurea, Anemone fasciculata, Arctostaphylos uva-ursi* subsp. *caucasica, Athyrium alpestre, Calamagrostis arundinacea, Campanula hemschinica, Cirsium obvalatum, Daphne glomerata, Deschampsia flexuosa, Empetrum caucasicum, Geranium psilostemon, Geranium*

sylvaticum, Juniperus hemisphaerica, J. sabina, Leontodon danubialis, Parnassia palustris, Polygonum viviparum, Primula amoena, Pyrola minor, P. rotundifolia, Rhododendron caucasicum, Rhododendron luteum, Rosa svanetica, Selaginella helvatica, Sorbus boissieri, Trollius patulus, Vaccinium myrtillus, V. vitis-idaea, Woronowia speciosa.

5.1.2.1. The economically potential species and medicinal plants Deka – *Rhododendron caucasicum* Pall., Ericaceae

Edificatory species - *Rhododendron caucasicum* is that have a special role to contribute in ecosystem structure and medicinal plants (**Figure 14**) and it is evergreen shrub growing to 1.5 m. It is in leaf all year, in flower from June to July. It grows only on northern shaded slopes in and above treeline ecotone. The plant prefers light and medium soils and requires well-drained soil. The plant prefers acid soils and can grow in very acid soil. It can grow in semi-shade. It requires moist soil.

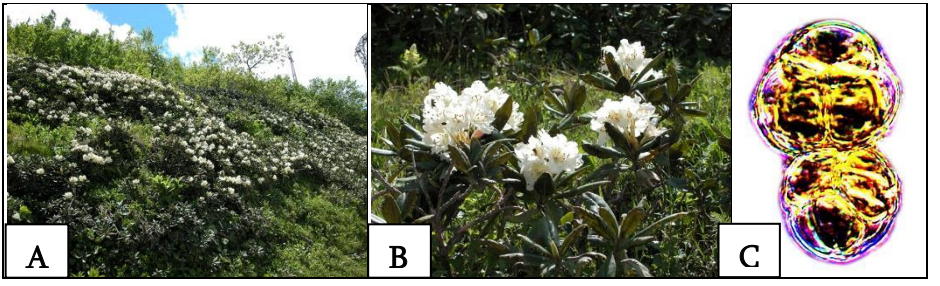


Figure 14. A. *Rhododendron caucasicum* is in treeline and alpine 2100-2900 m. **B.** *Rhododendron caucasicum* is shrub till 1-1.5 m; **C.** Pollen of *Rhododendron caucasicum* has length of the horizontal height as 45-46 μm. **Photo: Maia Akhalkatsi.**

Medicinal use is Cardiac. Tea made from the plant is used to treat heart and circulation malfunctions, but it should not be used without expert supervision because of toxicity of the plant. The flowers are analgesic, anaesthetic and sedative. They are applied externally in the treatment of arthritis, caries, itch, maggots and traumatic injuries (**Duke, Ayensu, 1985**). Edible uses are none known. Other uses are fuels. Wood is used as fuel in high mountain areas. Succeeds is in most

humus-rich lime-free soils except those of a dry arid nature or those that are heavy or clayey. Prefers is a peaty or well-drained sandy loam. A pH between 4.5 and 5.5 is ideal. Succeeds in sun or shade, the warmer the climate the more shade a plant requires (**Huxley, 1992**). Hardy is to about -15°C. It does not compete well with surface-rooting trees. Plants in this genus are notably susceptible to honey fungus **(Huxley, 1992).**

Seed of *Rhododendron caucasicum* is best sown in a greenhouse as soon as it is ripe in the autumn and given artificial light. Alternatively sow the seed in a lightly shaded part of the warm greenhouse in late winter or in a cold greenhouse in April. Surface-sow the seed and do not allow the compost to become dry **(Huxley, 1992).** Pot up the seedlings when they are large enough to handle and grow on in a greenhouse for at least the first winter. Layering is in late July. Takes is 15-24 months. Cuttings of half-ripe wood planted in August in a frame are difficult to cultivate.

5.2. Sclerophyllous scrub (Matorral)
5.2.1. Code of Georgia: Mountain xerophytic scrub (50GE1)

Xerophytic scrub is wide-spread in Samktske-Javakheti region at the altitude range 900-2200 m. a.s.l. It dominates in the river Mtkvari gorge and other gorges of Meskheti and Tetrobi limestone plateau (Javakheti).

Edificator species include milk-vetch (*Astracantha microcephala*), prickly thrift (*Acantholimon armenum, A. glumaceum)* and elements of shibliak, including Jerusalem thorn (*Paliurus spina-christi*), black buckthorn (*Rhamnus pallasii*), sumatch (*Cotinus coggygria*), berberis (*Berberis vulgaris*), thorny manna bush (*Atraphaxis caucasica*), common cotoneaster (*Cotoneaster integerrimus*), oriental hawthorn (*Crataegus orientalis*), service berry (*Amelanchier ovalis*), honey suckle (*Lonicera iberica*).

Sub-types (50GE1-01): Xerophyte scrub dominated by spiraea (*Spiraea hypericifolia*) is found in arid regions of Meskheti and Kartli, together with *Pyrus salicifolia, Cotoneaster fontanesi, Rhamnus palasii, Rh. cathartica.*

Sub-types (50GE1-02**):** In the inner Kartli, on rocky and stony slopes on the left bank of the river Mtkvari, the following plants are

dominating: *Rhamnus palasii, Astracantha microcephala, Atraphaxis spinosa, Astragalus fabaceus, A. bungeanus, Jurinea elegans, Sosnowskya amblyolepis, Trigonella striata, T. glomerata, Althaea hirsuta, Acantholimon armenum.*

Sub-types (50GE1-03**):** In the surroundings of Tbilisi, the scrub species composition is similar to other sub-types but the dominant shrub species are *Spiraea crenata, Cerasus incana, Cotoneaster* spp., *Crataegus* spp., and dominant herbs are *Crocus adamii, Iridodyctium reticulatum, Juno caucasica, Iris pumila, Fritillaria caucasica, Hypericum perforatum, Seseli grandivitattum, Inula cordata*.

Sub-types (50GE1-04**):** In ruderal places, shrub of *Spiraea hypericifolia* are found on erosion stricken grazed slopes (Svaneti). Dominant herbs are *Melica transsilvanica, Helianthemum grandiflorum, Cynanchum albowianum, Thymus serpyllum, Satureja spicigera*.

Plants species: *Acantholimon armenum, A. glumaceum, Althaea hirsuta, Amelanchier ovalis, Astracantha microcephala, Astragalus fabaceus, A. bungeanus, Atraphaxis caucasica, Atraphaxis spinosa, Berberis vulgaris, Cerasus incana, Cotinus coggygria, Cotoneaster fontanesi, Cotoneaster integerrimus, Crataegus orientalis, Crocus adamii, Cynanchum albowianum, Fritillaria caucasica, Helianthemum grandiflorum, Hypericum perforatum, Inula cordata, Iridodyctium reticulatum, Iris pumila, Juno caucasica, Jurinea elegans, Lonicera iberica, Melica transsilvanica, Paliurus spina-christi, Pyrus salicifolia, Rhamnus palasii, Rh. cathartica, Satureja spicigera, Seseli grandivitattum, Sosnowskya amblyolepis, Spiraea crenata, Spiraea hypericifolia, Thymus serpyllum,Trigonella striata, T. glomerata.*

5.2.1.1. The economically potential species and medicinal plants Common barberry – *Berberis vulgaris* L., Berberidaceae

The economically potential species - *Berberis vulgaris* is recreational, ornamental and medicinal plants and other**.** Grows is from lower up to upper montane belt 0-2300 m, in forests, edges of the forests, in gorges. Shrub is up to 2.5 m tall, rarelly higher tree. Snow cover is <0.3 m. The exposition is for all directions and inclination till 30°C. Sunny edge is normal; dappled shade is in North Wall, East Wall, and West Wall. Suitable for: light, medium and heavy soils and can grow in heavy clay

and nutritionally poor soils. Suitable pH: acid, neutral and basic soils. It can grow in semi-shade (light woodland) or no shade. It prefers dry or moist soil (**Figure 15**).

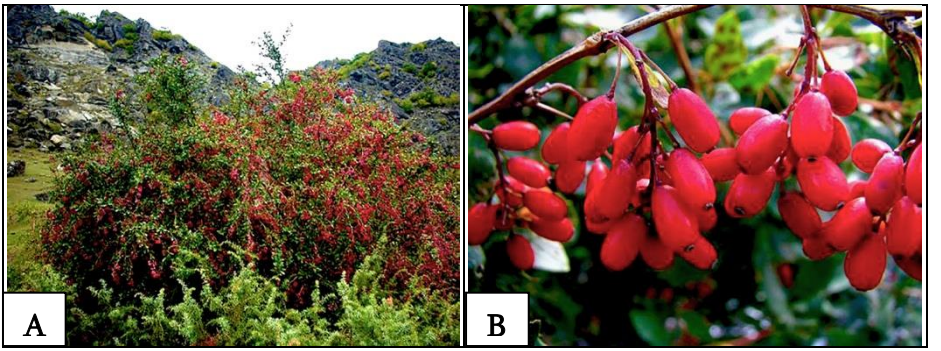


Figure 15. A. *Berberis vulgaris* is a shrub till 2.5 m. **B.** The fruits are used as medicinal plant for food. **Photo: Maia Akhalkatsi.**

Young branches greyish-green, at flowering become greyish or yellowish. Second year twigs grey with 3-pronged spine, on younger branches upper spines are single. Strongly branching, with markedly elongated branches, yellowish or yellowish -purple when young; in the second year turning gray; spines usually tripartite, 2 cm long; Leaves 4 cm long, thin, glabrous, both surfaces green, from elliptical to oblong lanceolate, obtuse, rarely acute, narrows towars the base, margins serrate, tapering into a petiole, greenish and distinctly reticular beneath; inflorescence racemiform, 6 cm long, with 15-25 flowers; pedicels 5-12 mm long; flowers clustered in multifloral drooping racemes; sepals and petals obovate; berries ellipsoidal or ellipsoidal- oblong, 12 mm long, bright red. Fruit is elliptic, usually red, rarelly yellow or rose. Flowering is in May-June. Fruits are in September-October.

Most species of *Berberis* are of economic importance, since the berries of all the species are delicious raw and as preserves. The widely cultivated *B. vulgaris* is particularly well known in this respect **(Akhalkatsi, 2015b).** Species of *Berberis* are equally important as producers of nectar and as a source of yellow dye. At the same time they are notorious as intermediate hosts of rust fungi. The wood of this species is hard, and has bright yellow sapwood. It is used in the

manufacture of cobbler's nails and tools for lathework; the berries contain malic acid, which is used in confectionery, and also both yield a good dye used to color hides and wools a lemon yellow. It is a fine nectar plant and a very striking ornamental shrub, due to the variety of its red foliage. It is notorious as the host of the aecial stage of the rust *Puccinia graminis* Pers., which in turn infects wheat and other grasses that develop in the late summer and fall. Although it is recommended that barberry be destroyed we are against this since the most dangerous form of rust and the yellow rust of grain *Puccinia glumarum*, does not develop on barberry. Fruit is raw or cooked.

Rich in vitamin C, the fruit has a very acid flavour and is mainly used in preserves, though children and some adults seem to like it raw when it is fully ripe. A refreshing lemon-like drink can be made from the fruit. The fruits are about 10 mm long. Young leaves - used as flavouring or as an acid nibble. They can be used in much the same way as sorrel (*Rumex acetosa*). The dried young leaves and shoot tips make a refreshing tea. Barberries have long been used as herbal remedy for the treatment of a variety of complaints. All parts of the plant can be used though the yellow root bark is the most concentrated source of active ingredients. The plant is mainly used nowadays as a tonic to the gallbladder to improve the flow of bile and ameliorate conditions such as gallbladder pain, gallstones and jaundice. The bark and root bark are antiseptic, astringent, cholagogue, hepatic, purgative, refrigerant, stomachic and tonic. The bark is harvested in the summer and can be dried for storing. It is especially useful in cases of jaundice, general debility and biliousness, but should be used with caution. The flowers and the stem bark are antirheumatic.

The roots are astringent and antiseptic. They have been pulverized in a little water and used to treat mouth ulcers. A team of the roots and stems has been used to treat stomach ulcers. The root bark has also been used as a purgative and treatment for diarrhoea and is diaphoretic. A tincture of the root bark has been used in the treatment of rheumatism, sciatica etc. The root bark is a rich source of the alkaloid berberine -about 6%. Berberine, universally present in rhizomes of *Berberis* species, has marked antibacterial effects. Since it is not appreciably absorbed by the body, it is used orally in the treatment of various enteric infections, especially bacterial dysentery. It should not be used with *Glycyrrhiza* species (Liquorice) because this nullifies the

effects of the berberine. Berberine has also shown antitumour activity and is also effective in the treatment of hypersensitive eyes, inflamed lids and conjunctivitis. A tea made from the fruits is antipruritic, antiseptic, appetizer, astringent, diuretic, expectorant and laxative. It is also used as a febrifuge. The fruit, or freshly pressed juice, is used in the treatment of liver and gall bladder problems, kidney stones, menstrual pains etc. The leaves are astringent and antiscorbutic. A tea made from the leaves is used in the treatment of coughs. The plant is used by homeopaths as a valuable remedy for kidney and liver insufficiency. Other uses include malaria, and opium and morphine withdrawal.

Plants can be grown as a medium-size hedge in exposed positions but they cannot tolerate extreme maritime exposure. They are very tolerant of trimming but can also be left untrimmed if required. A good quality yellow dye is obtained from the roots, bark and stem. As well as being used on cloth, it is also used to stain wood. The unripe fruit is dried and used as beads. Wood is soft, very hard, fine grained yellow. Used for carving, toothpicks, mosaics etc. It is also used as a fuel. Prefers a warm moist loamy soil but it is by no means fastidious, succeeding in thin, dry and shallow soils. Prefers is a light rich rather dry soil according to another report. Grows is well in heavy clay soils. Succeeds in full sun or light shade but requires a moist soil when grown in the shade of trees. Hardy is to about -35°C. A very ornamental plant, the barberry was at one time cultivated for its edible fruit, there are several named varieties. 'Dulcis' the fruit of which is sweet or slightly sour. 'Asperma' is a seedless form that was often used in France to make a jam. An alternate host is of 'black-stem rust' of wheat so it has been extensively grubbed up from its habitats. Hybridizes freely with other members of this genus, though it usually breeds fairly true to type. Can be pruned back quite severely, it resprouts well from the base.

Seed of *Berberis vulgaris* is best sown as soon as it is ripe in a cold frame, when it should germinate in late winter or early spring. Seed from over-ripe fruit will take longer to germinate, whilst stored seed may require cold stratification and should be sown in a cold frame as early in the year as possible. The seedlings are subject to damping off, so should be kept well ventilated. When the seedlings are large enough to handle, prick them out into individual pots and grow them on in a

cold frame. If growth is sufficient, it can be possible to plant them out into their permanent positions in the autumn, but generally it is best to leave them in the cold frame for the winter and plant them out in late spring or early summer of the following year. Germination averages out at about 90%. Cuttings are of half-ripe wood, July/August in a frame. Cuttings are of mature wood of the current season's growth, preferably with a heel, October/November in a frame. Suckers is removed in late autumn/early winter and planted out in situ or potted up and planted out in late spring. Native is to Central Europe, Mediterranean, Caucasus.

5.2.2. Code of Georgia: Scrub dominated by *Paliurus spina-christi* Mill., Rhamnaceae (50GE2; 40C0; PAL. CLASS.: 31.8B7)

Jerusalem thorn scrub (*Paliurus spina-christi*) is widespread in Georgia **(Figure 16),** mostly in the eastern part of the country, in valleys of Mtkvari, Iori, and Alazani. Scrub has plants resistant to drought: *Ephedra procera, Rhamnus pallasii, Pistacia mutica, Atraphaxis spinosa, Caragana grandiflora, Cotoneaster nummularia.*

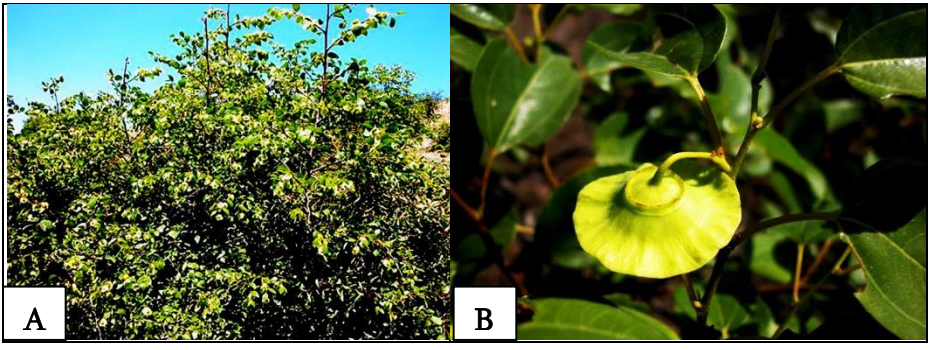


Figure 16. A. *Paliurus spina-christi* is a shrub in arid areas. **B.** The flower is protected from water. **Photo: Maia Akhalkatsi.**

The dominant plant is Jerusalem thorn (*Paliurus spina-christi*). Externally similar is to the deciduous Ponto-Sarmatic scrub, which can be found in the Ponto and Sarmat regions of the Sub-Euxine province of the Black Sea and Turkey.

Dominant plants, besides the Jerusalem thorn, are *Rhamnus pallasii, Cotinus coggygria, Cerasus incana, Lonicera iberica, Pyrus*

salicifolia, Amygdalus georgica, Colutea orientalis, Caragana grandiflora, Ephedra procera, Juniperus foetidissima, Punica granatum, Rhus coriaria.

Plants species: *Paliurus spina-christi, Rhamnus pallasii, Cotinus coggygria, Cerasus incana, Lonicera iberica, Pyrus salicifolia, Amygdalus georgica, Colutea orientalis, Caragana grandiflora, Ephedra procera, Juniperus foetidissima, Punica granatum, Rhus coriaria*.

5.2.2.1. Crop wild relatives (CWR) species Barbed Goatgrass - *Aegilops triuncialis* L., Poaceae

Crop wild relatives (CWR) are determined by the exchange of gene crops and germaplazma used agricultural crop domestication ancestor species - *Aegilops triuncialis* (barbed Goatgrass). Family of Poaceae Barnh. with genus *Aegilops* L., 2 varieteis - *Aegilops triuncialis* var. *persica* and *Aegilops triuncialis* var. *triuncialis* (**Akhalkatsi, 2015c**).

Synonyms: *Aegilops squarrosa* L., *A. triaristata* Willd., *A. ovata* L. subsp. *triaristata* (Willd.) Jav., *Triticum triunciale* (L.) Raspail (**Figure 17**).

Annual is herbaceous plant, 20-45 cm high. Stems are in most cases erect. Leaves are linear, flat. Blades, ligules and the upper part of sheaths are ciliate.

Ears are (3) 3.5-7 cm long (not counting awns), with 4-5 (less frequently with 3 or 6) fully developed spikelets; under fruits would break at their base and fall off entirely.

At the bottom of the ear there are 2-3 rudimentary spikelets. Cartilaginous-leathery, with 7-13 broad veins, scabrous or shortly pilose, acuminated with 2-3 awns slightly deviated from the ear axis. Glumes of the apical spikelet are 4.5-6 mm long.

Ribs of the ear axis are often covered with sharp knobs only, without longer prickles. Kernels do not accrete to palea. Wind- and self-pollinated are plant.

Autochore and propagated are by seed. Blossoms in May; bears fruit in June. 2n=28.

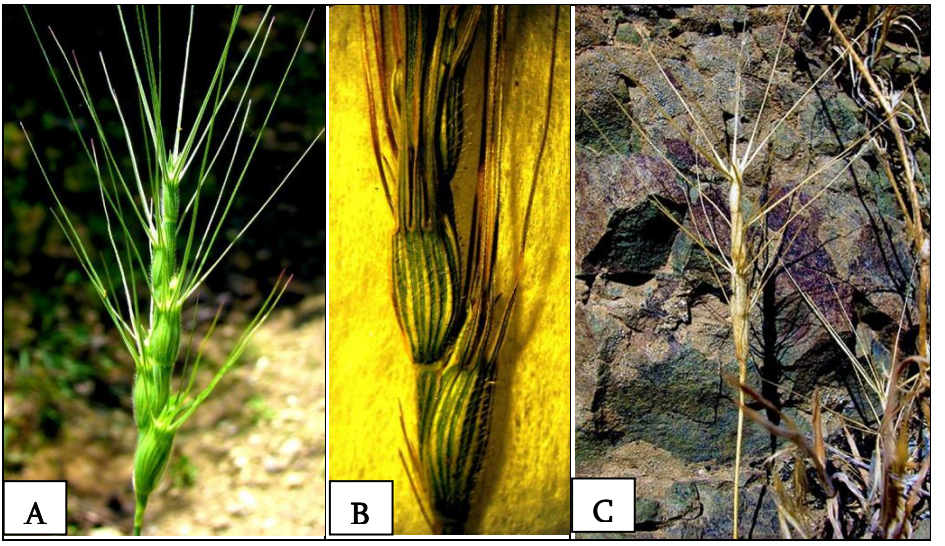


Figure 17. A. *A. triuncialis* is distributed in Samtskhe-Javakheti; **B.** Ears are 3 pieces with 3.5-7 cm long; **C.** *Aegilops triuncialis* growing to 20-45 cm high. **Photo: Maia Akhalkatsi.**

The overall distribution - Crimea, Caucasus (Daghestan, Eastern and Southern Transcaucasia, Talysh), Middle Asia (river valleys of Syr-Darya and Amu-Darya in their upper course, western Tien Shan, Gissar-Darvaz, Kopet Dagh), Mediterranean region, Asia Minor and Iran. Ecdemic is in many other extratropical countries. Distribution is in Samtskhe-Javakheti region - very rare plant. Only 5 popualtions have been found. The number of individuals is much less than of *A. cylindrica*.

Annual, ephemeral plant is growing to 0.3 m. Drought-resistant. Grows is in semi-deserts, on stony and small-grained soils, gravels, near roads, as a weed on field edges and laylands, as well as over foothills reaching the lower mountain zone. Dry acid is grassland and stony habitats. Argillaceous are semi-deserts, dry hills and as a weed of cultivation. The plant prefers light, medium and heavy soils, requires well-drained soil and can grow in heavy clay soil. It cannot grow in the shade. It requires dry or moist soil. Seed - sow March/April in situ and only just cover the seed. Make sure the soil does not dry out before the

plants germinate. Seed can also be sown early March in a greenhouse and planted out in May.

Threat assessment - Status is not determined for this plant. The population and individual number is too low and it deserves obtaining the status of NT. *Ex situ* status are seeds of *A. triuncialis* from different region of Georgia are present in seed banks of USDA, ICARDA, VIR, IPK Gatersleben and Kew RBG. Seeds from Samtskhe-Javakheti are kept at the TBG&BI. *In situ* status - No information available

Fodders are plants. Consumeds are well by all kinds of livestock until the fruiting phase. This species is believed to have hybridized with primitive forms of *Triticum* spp. (Wheat) to produce some of the more modern *Triticum* spp. It could, therefore, be of value in wheat breeding programmes. Barbed goat grass is spread by seed dispersal only. Therefore, any method that reduces seed spread will reduce the spread of the plant. Population disturbances and habitat fragmentation is expected when road construction works are undertaken. 1. Maintain the current populations of *A. triuncialis* in Samtskhe-Javakheti region. 2. Reduce the decline of this species through appropriate habitat management. *A. triuncialis* should be declared as species of high economic value as genetic ancestor for hexaploid bread wheat**.** The territory where *A. triuncialis* is distributed in Samtskhe-Javakheti does not needs special conservation measures to be undertaken. The conservation measures of this species should be directed on establishment of *ex situ* seed collections and public education on importance of this plant as ancestor of the bread wheat. The local population and governmental bodies responsible for the nature protection should be informed about high conservation value of this species. The popualtions of this species will be is species is crossed with winter wheat producing viable hybrids. The genome is used in molecular systematic studies.

5.2.3. Code of Georgia: Tragacanthic scrub (50GE3)

At middle elevations are in the arid parts of Meskheti, Kartli, and Kakheti, this community sub-type involves 199 species of vascular plants. In Meskheti, the habitat is found along the river Mtkvari (900-1300 m. a.s.l.) and gorges of the rivers Uraveli, Otskhe, Potskhovi, Kvabliani and Tsinubnistskali. Tragacanthic vegetation is inclined into

the pine forest near village Damala. Dominating shrubs and grasses are *Astragalus arguricus, A. raddeanus, Onobrychis sosnowskyi, Vicia akhmaganica, Salvia compar, Scutellaria sosnowskyi,* and *Psephellus meskheticus*. In some areas Tragacanthic communities are intruded into the oak forest. In such areas, the following species are found together with the dominant plants: *Dianthus calocephalus, Silene brotherana, Erysimum caucasicum, Coronilla orientalis, Satureja spicigera, S. laxiflora, Teucrium polium, T. nuchense, T. orientale, Sideritis comosa, Bupleurum exaltatum, Convolvulus lineatus, Campanula hohenacker,* etc. Tragacanthic communities of high mountains have 157 species of vascular plants on the Javakheti plateau (villages Azavreti, Aragva, Kartsakha), in the river Paravani gorge, and near villages Niali and Busmareti in the southern-east of Meskheti region, in the river Kazamretistskali gorge, and in Ziareti mountain. Milk-vetch – *Astracantha microcephala* and *A. caucasicus* are the aedificator species in these areas. In the central Greater Caucasus, (Stepantsminda district) Tragacanthic communities with *Astracantha denudata* are dominating. The scrub grows in the subalpine zone, at the altitude 1800-2000 m. a.s.l., at the slopes of dry gorges. The following species comprise the community: *Elytrigia gracillima, Allium albidum, Allium ruprechtii, Alopecurus vaginatus, Artemisia chamaemelifolia, A. marschalliana, A. splenders, Asperula albovii, Astragalus kazbeki, Berberis vulgaris, Bromopsis riparia, Campanula hohenackeri, Carex buschiorum, Dianthus cretaceus, Ephedra procera, Festuca sulcata, Juniperus hemisphaerica, Koeleria cristata, Melica transsilvanica, Myosotis arvense, Onosma armeniaca, Oxytropis cyanea, Scutellaria leptostegia, Spiraea hypericifolia, Stipa caucasica, Stipa tirsa.*

Plants species: *Allium albidum, A. ruprechtii, Alopecurus vaginatis, Artemisia chamaemelifolia, A. marschalliana, A. splenders, Asperula albovii, Astracantha microcephala. A. denudatus, A. caucasicus, Astragalus arguricus, A. raddeanus, A. kazbeki, Berberis vulagaris, Bromopsis riparia, Bupleurum exaltatum, Campanula hohenackeri, Carex buschiorum, Convolvulus lineatus, Coronilla orientalis, Dianthus calocephalus, D. cretaceus, Elytrigia gracillima, Ephedra procera, Erysimum caucasicum, Festuca sulcata, Juniperus hemisphaeriaca, Koeleria cristata, Melica transsilvanica, Myosotis arvense, Onobrychis sosnowskyi, Onosma armeniaca, Oxytropis cyanea, Psephellus meskheticus, Salvia compar, Satureja spicigera, S.*

laxiflora, Scutellaria leptostegia, S. sosnowskyi, Sideritis omosa, Silene brotherana, Spiraea hypericifolia, Stipa caucasica, S. tirsa, Teucrium polium, T. nuchense, T. orientale, Vicia akhmaganica.

5.2.3.1. Edificatory plant species *Allium* L., Liliaceae

Edificatory species of *Allium* is that have a special role to contribute in ecosystem structure: *A. albidum* Fisch. ex M. Bieb.; *A. atroviolaceum* Boiss.; *A. fuscoviolaceum* Fomin; *A. karsianum* Fomin; *A. kunthianum* Vved.; *A. gramineum* K. Koch; *A. leucanthum* K. Koch; *A. moschatum* L.; *A. ponticum* Miscz. ex Grossh.; *A. pseudoflavum* Vved.; *A. rotundum* L.; *A. victorialis* L.; *A. vineale* L. (**Figure 18**).

Allium victorialis is grown in Tabatskhuri area and in Abul-Samsari range. But we did not find it on the territory of Samtskhe-Javakheti. One big population was found in Tskhratskaro Pass, where local population of Javakheti is collecting *A. victorialis* and prepares marinade for winter.

It grows on subalpine meadows. It is in leaf from October to August, in flower from June to July, and the seeds ripen from August to September. The plant prefers light and medium soils. The plant prefers acid, neutral and basic soils. It cannot grow in the shade. It requires dry or moist soil (**Nadirashvili, Gvaladze, Akhalkatsi, 2006**).

Almost all species of *Allium* have medicinal properties. Most valuable species is *A. vineale*. The whole plant is antiasthmatic, blood purifier, carminative, cathartic, diuretic, expectorant, hypotensive, stimulant and vasodilator. A tincture is used to prevent worms and colic in children, and also as a remedy for croup (**Moerman, 1998**).

The raw root can be eaten to reduce blood pressure and also to ease shortness of breath. Although no other specific mention of medicinal uses has been seen for this species, members of this genus are in general very healthy additions to the diet.

They contain sulphur compounds (which give them their onion flavour) and when added to the diet on a regular basis they help reduce blood cholesterol levels, act as a tonic to the digestive system and also tonify the circulatory system. Flowers, leaves and root are used raw or cooked. Rather stringy, they are used as a garlic substitute.

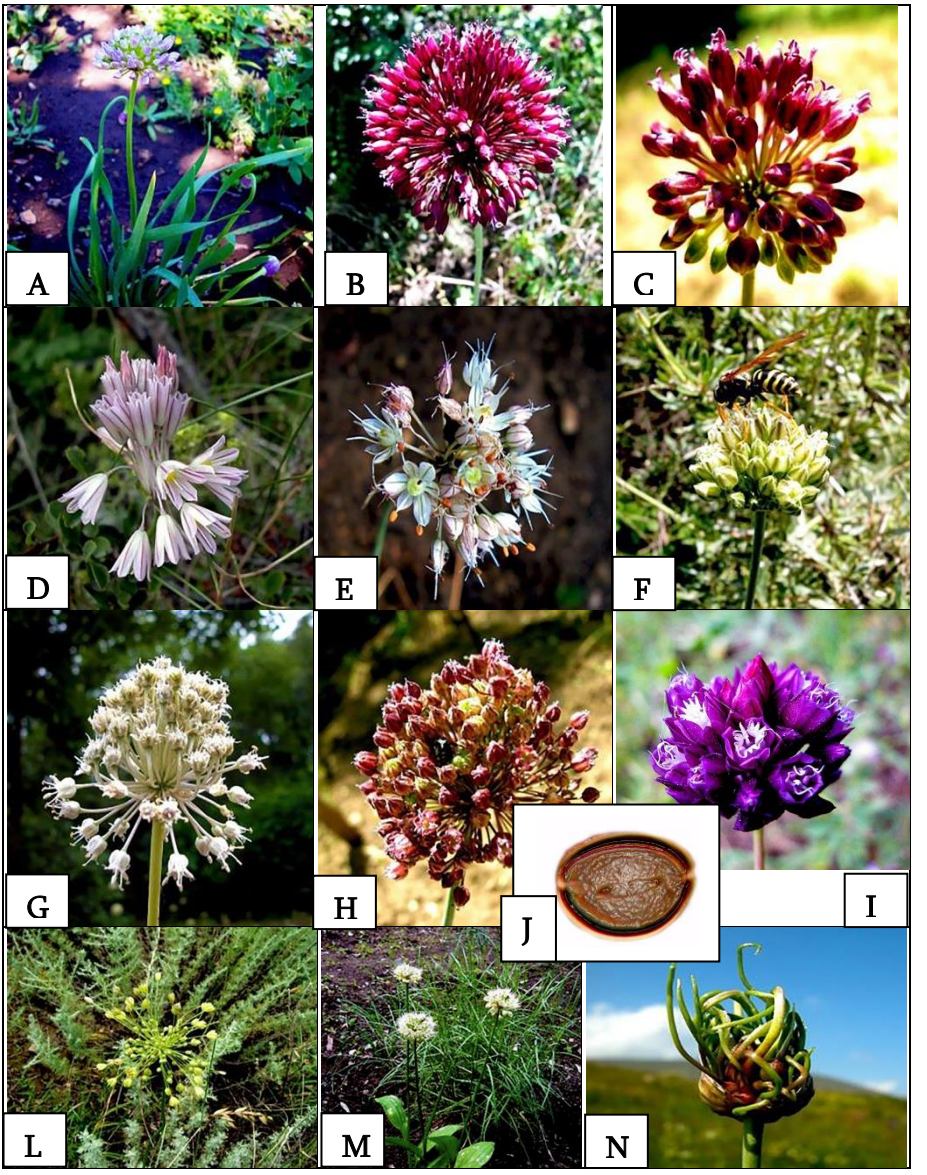


Figure 18. A. *Allium albidum*; **B.** *A. atroviolaceum*; **C.** *A. fuscovioleaceum*; **D.** *A. karsianum*; **E.** *A. kuntheanum*; **F.** *A. gramineum*; **G.** *A. leucanthum*; **H.** *A. ponticum*; **I.** *A. rotundum***; J.** Pollen is for *A. rotundum* and it has length of the horizontal height is 30-32 μm and distanth height is 40-43 μm; L. *A. pseudoflavum* **M.** *A. victorialis*; **N.** *A. vinneale*. **Photo: Maia Akhalkatsi.**

The leaves are available from late autumn until the following summer, when used sparingly they make a nice addition to the salad bowl. Bulb is used as flavouring. Rather small, with a very strong flavour and odour. The bulbs are 10–30 mm in diameter. Bulbils are raw or cooked. Rather small and fiddly, they have a strong garlic-like flavour. Other uses are Repellent. The juice of the plant is used as a moth repellent. The whole plant is said to repel insects and moles. The juice of the plant can be rubbed on exposed parts of the body to repel biting insects, scorpions etc. Prefers is a sunny position in a light well-drained soil. The bulbs should be planted fairly deeply. Grows well with most plants, especially roses, carrots, beet and chamomile, but it inhibits the growth of legumes. This plant is a bad companion for alfalfa, each species negatively affecting the other. Members of this genus are rarely if ever troubled by browsing deer. Plants do not need any encouragement. They are more than capable of propagating themselves. Bulbils are produced in abundance in the summer and are the main means by which the plant spreads.

5.2.4. Code of Georgia: Phryganoidic scrub (50GE4)

Ephedra procera and *Tanacetum argyrophyllum* are dominating shrub species. In Meskheti, near the village Khertvisi, tickets of *Ephedra procera* are particularly dense. Other characteristic species of this community are Caucasian forest cypress (*Cytisus caucasicus*), broad-leaved yellow acacia (*Caragana grandiflora*), clove (*Dianthus calocephalus*), Italian sainfoin (*Hedysarum turkewiczii*), Meskheti sainfoin (*Onobrychis meskhetica*), germander (*Teucrium polium*), Sosnovski thyme (*Thymus sosnowskyi*), woundworts (*Stachys atherocalyx, S. iberica*), fescue (*Festuca valesiaca*), Hohenaker creeping bellflower (*Campanula hohenackeri*), creeping bellflower (*C. raddeana*), garlic-leaved bellflower (*C. alliariifolia*), Sosnowski fragrant wormwood (*Artemisia sosnowskyi*), feather grass (*Stipa capillata*), feather grass (*S. pulcherrima*), crested hair-grass (*Koeleria cristata*); *Elytrigia elongatiformis, E. trychophora, E. caespitosa, Agropyron repens* var. *subulatus, Valerianella plagiostephana.*

Plants species: *Tanacetum argyrophyllum, Ephedra procera Cytisus caucasicus, Caragana grandiflora, Dianthus calocephalus, Hedysarum turkewiczii, Onobrychis meskhetica, Teucrium polium,*

Thymus sosnowskyi, *Stachys atherocalyx*, *S. iberica*, *Festuca valesiaca*, *Campanula hohenackeri*, *C. raddeana*, *C. alliariifolia*, *Artemisia sosnowskyi*, *Stipa capillata*, *S. pulcherrima*, *Koeleria cristata Elytrigia elongatiformis*, *E. trychophora*, *E. caespitosa*, *Agropyron repens* var. *subulatus*, *Valerianella plagiostephana.*

5.2.4.1. Indicator plant species *Ephedra* L., Ephedraceae

Indicator species of *Ephedra* it these are species that respond quickly to any changes in the environmental conditions. There are only two species of *Ephedra* in Georgia - *E. procera* Fisch. & C.A.Mey. and *E. distachya* L. Only one - *E. procera* is distributed in Meskheti (**Figure 19**).

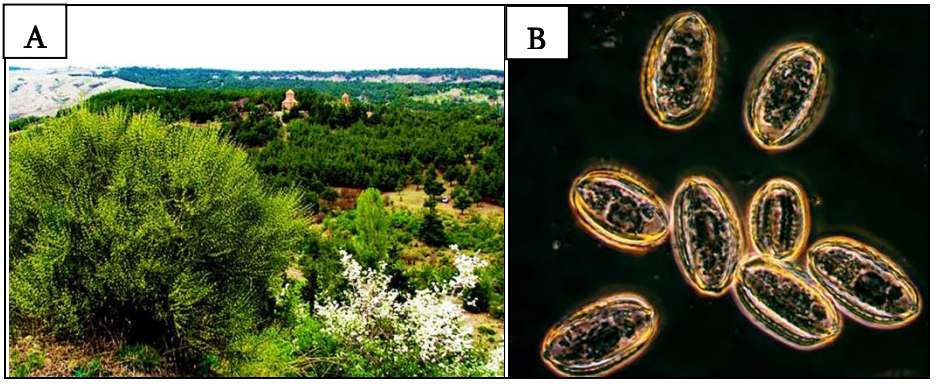


Figure 19. A. *Ephedra procera* is in city Tbilisi on mount Tabor**; B.** Pollen of *Ephedra procera* has length of the horizontal height as 21-32 μm and distanth height as 45-55 μm. **Photo: Maia Akhalkatsi.**

An evergreen shrub is growing to 1.8 m. It is in leaf all year, in flower from June to July. The flowers are dioecious and individual flowers are either male or female, but only one sex is to be found on any one plant so both male and female plants must be grown if seed is required. The plant not is self-fertile. The plant prefers light and medium soils and requires well-drained soil. The plant prefers acid, neutral and basic soils. It cannot grow in the shade. It requires dry or moist soil and can tolerate drought. Medicinal uses are depurative and

diuretic. The stems of most members of this genus contain the alkaloid ephedrine and are valuable in the treatment of asthma and many other complaints of the respiratory system. The stems are depurative and diuretic (**Uphof, 1959**). The whole plant can be used at much lower concentrations than the isolated constituents - unlike using the isolated ephedrine, using the whole plant rarely gives rise to side-effects (**Chevallier, 1996**).

The stems can be used fresh or dried and are usually made into a tea, though they can also be eaten raw. The young stems are best if eating them raw, though older stems can be used if a tea is made. The stems can be harvested at any time of the year and are dried for later use.

Fruit are raw. A sweet flavour, but fairly boring. The fruit is about 8 mm in diameter. Other uses have a Ground cover. Plants can be used for ground cover, spaced about 60 cm apart each way. Local population periodically collects big amount of green mass for private pharmaceutical manufacturers. Requires are a well-drained loamy soil and a sunny position. Established plants are drought resistant and are also lime tolerant (**Huxley, 1992**). One report says that this species is frost-tender, but this is not our experience. Plants do not flower profusely or regularly in Britain. Our plants have been producing reasonable crops since 1991. It is Dioecious. Male and female plants must be grown if seed is required.

Seed of the *Ephedra* are best sown as soon as it is ripe in the autumn in a greenhouse (**Huxley, 1992**). It can also be sown in spring in a greenhouse in sandy compost. Prick out the seedlings into individual pots as soon as they are large enough to handle and grow them on for at least their first winter in a greenhouse. Plant out in the spring or early summer after the last expected frosts and give some protection in their first winter. Division is in spring or autumn. It is layering. Protection measure is cultivation, establishment of managed reserves.

5.2.5. Code of Georgia: Shibliak (50GE5)

Widely is distributed in Georgia, most typical for Kartli and Kakheti arid foothills. The habitat is largely degraded as a result of overgrazing.

Besides, it is under a strong anthropogenic pressure in the areas near roads and industrial landscapes.

Edificator species are: *Paliurus spina-christi, Berberis vulgaris, Cotynus coggygria, Punica granatum, Spiraea hypericifolia, Crataegus orientalis, Rhamnus palasii, Athrapaxis spinosa, Ephedra procera, Pyrus salicifolia, Cornus mas*. **Plants species:** *Tanacetum argyrophyllum, Ephedra procera, Cytisus caucasicus, Caragana grandiflora, Dianthus calocephalus, Hedysarum turkewiczii, Onobrychis meskhetica, Teucrium polium, Thymus sosnowskyi, Stachys atherocalyx, S. iberica, Festuca valesiaca, Campanula hohenackeri, C. raddeana, C. alliariifolia, Artemisia sosnowskyi, Stipa capillata, S. pulcherrima, Koeleria cristata, Elytrigia elongatiformis, E. trychophora, E. caespitosa, Agropyron repens* var. *subulatus, Valerianella plagiostephana.*

5.2.5.1. The economically potential species and medicinal plants Wormwood - *Artemisia* L., Asteraceae

The economically potential species - *Artemisia* are as recreational, ornamental and medicinal plants and other. The following species of *Artemisia* are occurring: *A. absinthium* L.; *A. scoparia* Waldst. & Kit.; *A. annua* L.; *A. chamaemelifolia* Vill.; *A. armeniaca* Lam.; *A. vulgaris* L.; *A. incana* (L.) Druce; *A. fragrans* Willd. (**Figure 20**).

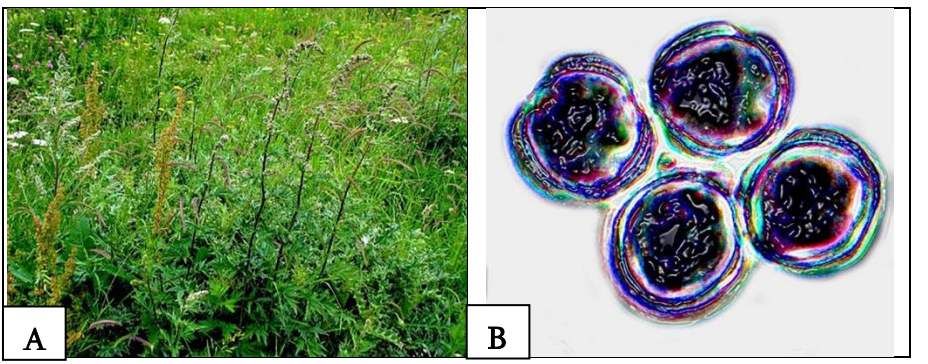


Figure 20. A. *Artemisia vulgare* is in city Kazbegi; **B.** Pollen of *Artemisia vulgare* has length of the horizontal height as 21-23 μm. **Photo: Maia Akhalkatsi.**

Artemisia absinthum is very abundant in Meskheti and as well in Javakheti. It is growing mainly in ruderal places near settlements and in road sides. Therefore it was not reasonable to precede population analysis and mapping of this species.

It is grown on ruderal placed, cultivated beds and dry slopes. Perennial is growing to 1 m by 0.6 m. It is in flower from July to August. The plant prefers light and medium soils, requires well-drained soil and can grow in nutritionally poor soil.

The plant prefers acid, neutral and basic soils and can grow in very alkaline soil. It can grow in semi-shade or no shade. It requires dry or moist soil and can tolerate drought.

Medicinal uses are anthelmintic, antiseptic, antispasmodic, carminative, cholagogue, emmenagogue, febrifuge, homeopathy, hypnotic, and stimulant, stomachic, tonic and vermifuge. Wormwood is a very bitter plant with a long history of use as a medicinal herb. It is valued especially for its tonic effect on the liver, gallbladder and digestive system, and for its vermicidal activity (**Grieve, 1984**).

It is an extremely useful medicine for those with weak and under-active digestion. It increases stomach acid and bile production, improving digestion and the absorption of nutrients. It also eases wind and bloating and, if taken regularly, helps the body return to full vitality after a prolonged illness (**Grieve, 1984**).

The leaves and flowering shoots are anthelmintic, anti-inflammatory, antiseptic, antispasmodic, antitumor, carminative, cholagogue, emmenagogue, febrifuge, hypnotic, stimulant, stomachic, tonic and vermifuge (**Grieve, 1984**).

The plant is harvested as it is coming into flower and then dried for later use. Use with caution, the plant should be taken internally in small doses for short-term treatment only, preferably under the supervision of a qualified practitioner. It should not be prescribed for children or pregnant women.

See also the notes above on toxicity. The extremely bitter leaves are chewed to stimulate the appetite. The bitter taste on the tongue sets off a reflex action, stimulating stomach and other digestive secretions. The leaves have been used with some success in the treatment of anorexia nervosa.

The plant is applied externally to bruises and bites. A warm compress has been used to ease sprains and strained muscles.

A homeopathic remedy is made from the leaves. It is used to stimulate bile and gastric juice production and to treat disorders of the liver and gall bladder.

Condiment is in these areas. Leaves are occasionally used as flavouring. Caution is advised, prolonged use is known to have a detrimental effect - see the notes above on toxicity.

This herb was at one time the principal flavouring in the liqueur 'Absinthe' but its use has now been banned in most countries since prolonged consumption can lead to chronic poisoning, epileptiform convulsions and degeneration of the central nervous system.

Other uses are repellent and strewing. The fresh or dried shoots are said to repel insects and mice, they have been laid amongst clothing to repel moths and have also been used as a strewing herb.

An infusion of the plant is said to discourage slugs and insects. The plant contains substances called sesquiterpene lactones, these are strongly insecticidal. Succeeds in any soil but it is best in a poor dry one with a warm aspect.

Established plants are very drought tolerant. Plants are longer lived, hardier and more aromatic when they are grown in a poor dry soil. Easily grown in a well-drained circumneutral or slightly alkaline loamy soil, preferring a sunny position prefers a shady situation according to another report (**Grieve, 1984**).

Tolerates is pH in the range 4.8 to 8.2. Wormwood is occasionally grown in the herb garden, there are some named forms.

The growing plant is said to inhibit the growth of fennel, sage, caraway, anise and most young plants, especially in wet years. Wormwood is a good companion for carrots, however, helping to protect them from root fly. The scent of the plant attracts dogs.

Members of this genus are rarely if ever troubled by browsing deer. Seed of the *Artemisia absinthum* are surface sow from late winter to early summer in a greenhouse.

The seed usually germinates within 2 - 26 weeks at 15°C. When they are large enough to handle, prick the seedlings out into individual pots. They can be planted out in the summer, or kept in pots in a cold frame for the winter and then planted out in the spring.

6. NATURAL AND SEMI-NATURAL GRASSLAND FORMATIONS

6.1. Natural mountain grasslands

6.1.1. Code of Georgia: Subalpine tall herbaceous vegetation (61GE01)

Subalpine tall herbaceous vegetation is widespread in the subalpine zone at the treeline ecotone (2350-2500 m). Characteristic climatic conditions of the habitat are optimal temperature of air and soil, high humidity of air and high sun radiation. Tall herbaceous vegetation consists of plants of 3-4 meters the majority of which is dicotyledons. They are characterized by short tap root or rhizome. The overall number of species in this habitat is about 90 and the community itself involves 70 species.

Sub-types: There are three plant communities: 1) *Heracleum mantegazianum, H.grossheimii, H. sosnowskyi*, etc. 2) *Senecio platyphyllus, Inula grandiflora*, etc. 3) *Rumex alpinus, Senecio othonae*, etc.

Plants species: *Aconitum nasutum, A. orientale, A. adzharica, A. pachyptera, A. tatianae, Angelica purpurascens, Anthriscus nemorosa, Cephalaria gigantea, C. procera, Cicerbita bourgaei, Campanula latifolia, Chaerophyllum maculatum, Cicerbita deltoidea, C. macrophylla, C. olgae, C. petiolata, C. prenanthoides, Cirsium aggregatum, C. albowianum, C. buschianum, C. czerkessicum, C. gagnidzei, C. kuznetsowianum, C. oblongifolium, C. svaneticum, C. sychnosanthum, Delphinium bracteosum, D. dasycarpum, D. dzavakhischvilii, D. fedorovii, D. flexuosum, D. ironorum, D. osseticum, D. pyramidatum, D. speciosum, D. thamarae, Doronicum macrophyllum, Euphorbia macroceras, Gadelia lactiflora, Geranium kemulariae, Heracleum aconitifolium, H. asperum, H. cyclocarpum, H. grossheimii, H. mantegazzianum, H. ponticum, H. sosnowskyi, H. wilhelmsii, Inula magnifica, Knautia montana, Ligusticum alatum, L. arafoe, L. physospermifolium, Lilium georgicum, L. kesselringianum, L. monadelphum, L. szovitisianum, Milium effusum, M. schmidtianum, Petasites albus, Prenanthes abietina, Pyrethrum macrophyllum, Senecio othonnae, S. phatyphylloides, S. pojarkovae, S. propinquus, S.*

rhombifolius, S. similiflorus, Telekia speciosa, Tephroseris cladobotrys, T. subfloccosus, Valeriana alliariifolia, V. colchica, V. tiliifolia, Veratrum lobelianum.

6.1.1.1. Endangered plant species ragworts and groundsels - *Senecio* L., Asteraceae

Endangered species of *Senecio* are the national and/or international conservation status of the species. The following species of *Senecio* occur in Subalpine - *S. viscosus* L.; *S. vernalis* Waldst. & Kit.; Caucasian endemic *S. propinquus* Schischk.; *S. rhombifolius* (Adams) Sch. Bip.; *S. thyrsophorus* K. Koch; *S. pseudoorientalis* Schischk.; *S. grandidentatus* Ledeb.; *S. lorentii* Hochst.; *S. othonnae* M. Bieb.; *S. taraxacifolius* (M. Bieb.) DC. Target species is *Senecio rhombifolius* (Adams) Sch. Bip. (**Figure 21**).

Figure 21. A. *Senecio rhombifolius* is medicinal plant on subalpine meadows and forest high areas. **B.** *Senecio rhombifolius* is flowering in August. **Photo: Maia Akhalkatsi.**

Perennial is growing to 1.8 m by 1.5 m. It is in flower from July to August. The plant prefers light, medium and heavy soils. The plant prefers acid, neutral and basic soils and can grow in very alkaline soil. It can grow in semi-shade or no shade. It requires moist or wet soil.

Groundsel is a medicinal plant that is deserving of greater attention. It contains alkaloid platyphyllin used in pharmaceutical industry for treatment of cardio-vascular disease. Contains is as well alkaloid

seneciphyllin effectively lowering blood pressure. Therefore it was harvested in big amount for the market and exported in Russia. This species is cultivated in parts of Russia for use in the pharmaceutical industry.

An easily grown plant, it succeeds in a sunny position in most moderately fertile well-drained soils. Prefers a damp to wet soil and also succeeds in partial shade. A very ornamental plant, it is not fully hardy in the colder areas, tolerating temperatures down to about -10°C.

Seed of the *Senecio rhombifolius* is sow spring in a greenhouse. Only just cover the seed. When they are large enough to handle, prick the seedlings out into individual pots and grow them on in the greenhouse for their first winter. Plant them out into their permanent positions in late spring or early summer, after the last expected frosts. Division is in spring. Root cuttings in early spring.

6.1.2. Code of Georgia: Subalpine meadows (61GE02)

Subalpine meadows (1800-2700 m) are distinguished by a great floristic and phyto-sociological variety.

Sub-types (61GE02-01): Grass meadows:

1. *Bromopsis variegata, Agrostis tenuis, A. planifolia* community holds both dry and moist habitats. Appropriate species of the community are *Trifolium ambiguum, Lotus caucasicus, Alchemilla sericata,* etc. It is distributed in whole Caucasus Mountain up to the altitude of 2700 meters. It is used for mowing.
2. *Hordeum violaceum* community holds the lower part of the subalpine zone (2000 – 2200 m). Together with barley, tall herbaceous vegetation elements can be found here - *Heracleum asperum, Anthriscus nemorosa, Seseli transcaucasica*.
3. *Calamagrostis arundinacea* community holds moist slopes and is associated with the subalpine scrub of Caucasian evergreen Rhododendron. It can be common in places emerging as a result of cutting down the forest. It also creates the grass cover in the high mountain oak (*Quercus macranthera*) forest and is associated with the fescue-grass (*Festuca varia*) communities. *Festuca djimilensis* dominates in the westerns Caucasus Mountain in this community.
4. *Poa longifolia* community occupies the forest edges, openness and moist slopes. The typical place is in Lagodekhi natural reserve.

Related species are: *Calamagrostis arundinacea, Festuca varia, Agrostis planifolia, Geranium ibericum, Stachys macrantha,* etc.

5. *Deschampsia caespitosa* community is common on the river banks and flooded places. Typical plants are: *Equisetum arvense, Carex canescens, C. hirta, C. irrigua, Parnassia palustris*, etc.
6. Fescue-grass *(Festuca varia)* meadows hold the biggest part of the subalpine zone. It is distributed on grazed northern slopes in the mountainous part of southern Georgia where they create the first stage of succession. *Calamagrostis arundinacea* communities ruined as a result of intensive grazing are replaced by fescue-grass meadows. Their species are large and other ones can also be observed on placed between them: *Helictotrichon adzharicum, H. pubescens, Agrostis planifolia, Carex meinshauseniana, Stachys macrantha, Polygonum carneum*, etc.
7. *Festuca ovina* meadows hold the southern slope. It is low, with the low rate of cover and limited composition of species. Characteristic species are: *Koeleria albovii, Bromopsis riparia, Agrostis tenuis, Carex buschiorum, Pulsatilla violacea,* and *Thymus collinus*.

Sub-types (61GE02-02): Herbal and grass-herbal meadows:

1. *Trollius patulus* meadows are typical in forests, thinned out planted forests and long crevices, sub-dominant species being *Ranunculus caucasicus*. As a result of strong grazing, only this species is preserved on the meadows whereas *Trollius patulus* is to become extinct.
2. *Geranium* spp. - 1) *Geranium gymnocaulon* communities can mainly be found in the alpine zone of western Caucasus mountain. It rarely comes to the subalpine zone. 2) *Geranium platypetalum* community is widely distributed both in small and big Caucasus. It is not found in south Kolkheti but is observed in stony and moraine places. 3) *Geranium ibericum* holds the forest, slopes of average incline and the straight place. The sub-dominant species is *Calamagrostis arundinacea, Inula orientalis, Rhododendron caucasicum*.
3. *Inula orientalis* community is created by the pure growth. However, this species can be found in another community as well. For example are *Geranium ibericum* and *Stachys macrantha*. In west Georgia *Inula grandiflora* community can be found.
4. *Scabiosa caucasica* community on small Caucasus is rich with various species: *Helictotrichon pubescens, Inula orientalis, Agrostis*

planifolia, Stachys macrantha, etc. They are also widely distributed on Javakheti mountain plateau.

5. *Stachys macrantha* community is the typical variant of the subalpine meadow. It is represented in the central and eastern parts of great Caucasus Mountain.
6. *Anemone fasciculate* community occupies the slope of optimal moistness and a straight place. It is replaced by *Hedysarum caucasicum* on sunny and dry places.
7. Subalpine meadow *Veratrum lobelianum* is found in the western and central parts of Great Caucasus and small Caucasian mountians. It is a toxic plant which can not be grazed and, therefore, is preserved in intensively grazed places. It can be found in *Trollius patulus* and *Ranunculus caucasicus* communities.
8. *Pulsatilla violacea* community is widely represented in small Caucasus Mountains and Javakheti. It creates small fragments in central Caucasus on slopes of Northern exposition. Here it is associated with the following species: *Festuca ovina, Koeleria albovii, Carex buschiorum*. *Pulsatilla aurea* and *P. albana c*an be found in north-western Kolkheti
9. *Astragalus captiosus* creates community on grazed southern slopes in central Caucasus.

Plants species: *Agrostis planifolia, A. tenuis, Alchemilla retinervis, Alchemilla sericata, Anemone fasciculata, Anthriscus nemorosa, Anthoxanthum odoratum, Anthyllis variegata, Astragalus captiosus, Stachys macrantha, Bromopsis riparia, B. variegata, Bupleurum polyphyllum, Calamagrostis arundinacea, Campanula bellidifolia, Campanula collina, Campanula trautvetteri, Carex aequivoca, Carex buschiorum, Carum alpinum, Carum carvi, Centaurea cheiranthifolia, Cerastium arvense, C. cerastoides, C. purpurascens, Cirsium obvallatum, Coeloglossum viride, Cirsium simplex, Cruciata glabra, Draba hispida, Equisetum palustre, Euphrasia hirtella, Festuca varia, Galium verum, Genatiana aquatica, Carex meinshauseniana, Gentiana septemfida, Geranium ruprechtii, Helictotrichon pubescens, Hordeum violaceum, Inula orientalis, Koeleria caucasica, K. cristata, K. gracilis, Leontodon hispidus, Ligularia sibirica, Linum catharticum, Lotus caucasicus, Minuartia circassica, M. imbricata, M. oreina, Myosotis alpestris, M. sylvatica, Pastinaca armena, Pedicularis armena, Phleum pratense, Ph. phleoides, Plantago caucasica, Poa longifolia, Poa*

pratensis, Polygala alpicola, Polygonum alpinum, P. carneum, Potentilla crantzii, P. recta, Primula amoena, Pulsatilla violacea, Pyrethrum roseum, Ranunculus acutilobus, R. caucasicus, R. oreophilus, Rhinanthus minor, Rumex acetosa, Scabiosa caucasica, Seseli transcaucasica, Silene ruprechtii, S. vulgaris, Taraxacum confusum, Thesium procumbens, Thymus nummularius, Tragopogon reticulatus, Trifolium ambiguum, T. repens, Veronica gentianoides, Vicia alpestris, V. grossheimii.

6.1.2.1. The economically potential species and medicinal plants Colchis – *Colchicum* L., Colchicaceae

The economically potential species of *Colchicum* are ornamental and medicinal plants and other. 4 species are found distributed in Georgia *Colchicum szovitsii* Fisch. & C.A.Mey., *C. umbrosum* Steven, *C. speciosum* Steven and *C. woronowii* Bokeriya. *C. szovitsii* is flowering in the spring; *C. umbrosum* and *C. speciosum* are flowering in autumn (**Figure 22**).

It is grown in subalpine meadows on sunny sites. It is in flower from September to October. Seeds ripen underground in a bulb. Fruit and leaves appear next year in March and seed dispersal takes place in June-July. The plant prefers light, medium and heavy soils and requires well-drained soil. The plant prefers acid, neutral and basic soils. It can grow in semi-shade or no shade. It requires moist soil.

Medicinal uses are analgetic, antirheumatic, cathartic, emetic and homeopathy. Naked Ladies was considered too poisonous to use medicinally in the ancient time and it was not until research in the 18th century that the plant was discovered to be of value in the treatment of gout (**Stuart, 1979**). In modern herbalism it is still used to relieve the pain and inflammation of acute gout and rheumatism, although frequent use has been known to encourage more frequent attacks of the complaint (**Stuart, 1979**). Both the corm and the seeds are analgesic, antirheumatic, cathartic and emetic (**Grieve, 1984**). Leukemia has been successfully treated with Naked Ladies, and the plant has also been used with some success to treat Bechet's syndrome, a chronic disease marked by recurring ulcers and leukemia (**Chevallier, 1996**).

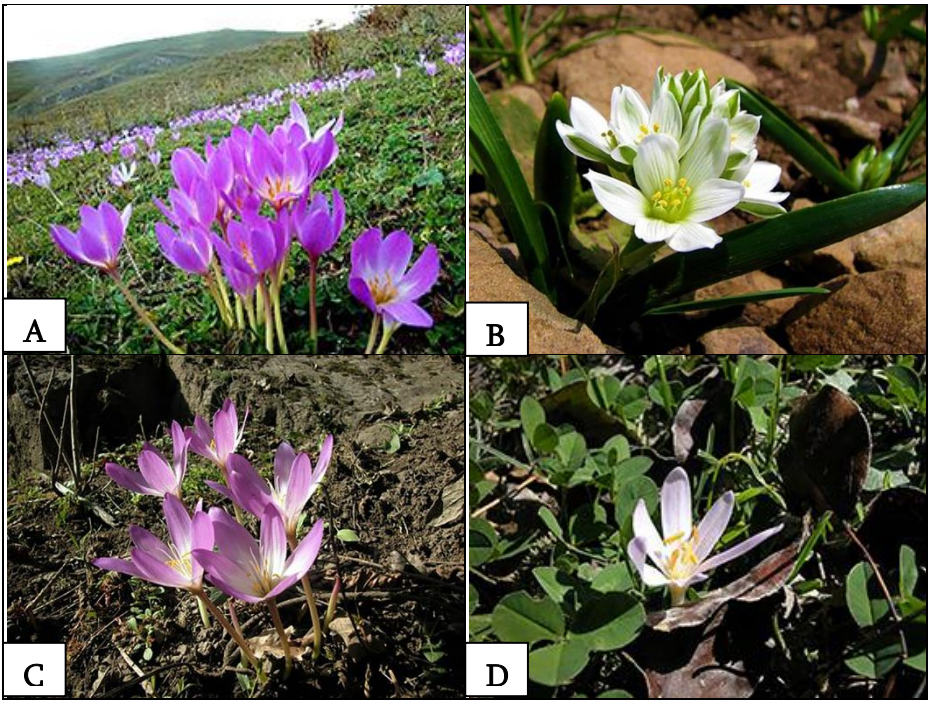


Figure 22. A. *Colchicum szovitsii* in Meskheti; **B.** *C. speciosum* above city Bakuriani; **C.** *C. woronowii* in Adjara mountains; **D.** *C. umbrosum* in Meskheti. **Photo: Maia Akhalkatsi.**

The seeds are harvested in early summer, the corms in mid to late summer when the plant has fully died down. The fresh bulb is used to make a homeopathic remedy. Edible uses are none. Other uses have plant breeding. The poisonous alkaloid "colchicines" is extracted from this plant and used to alter the genetic make-up of plants in an attempt to find new, improved varieties (**Polunin, 1969**). It works by doubling the chromosome number.

Habitat degradation, collected in the wild for medicinal purpose and for flower market. Prefers is a rich well-drained loam in a sunny position. Tolerates partial shade but dislikes dry soils. Tolerates is a pH in the range 4.5 to 7.5. Plants are hardy to about -20°C (**Huxley, 1992**). The dormant bulbs are fairly hardy and will withstand soil temperatures down to at least -5°C (**Matthews, 1994**). The Naked Ladies is easily grown in grass and can be naturalized there. It also grows well amongst

shrubs and by woodland edges. Plant the corms about 7-10 cm deep in July. The flowers are very attractive to bees and butterflies.

Seed of the *Colchicum szovitsii* is best sown as soon as it is ripe in early summer in a seed bed **(Matthews, 1994)**. Germination can be very slow, taking up to 18 months at 15°C. It is best to sow the seed thinly so that it is not necessary to transplant the seedlings for their first year of growth. Apply a liquid fertilizer during their first summer, however, to ensure they get sufficient nourishment. Prick out the seedlings once they are dormant, putting perhaps 2 plants per pot, and grow them on in a greenhouse or frame for at least a couple of years. Plant them out into their permanent positions when they are dormant. The seedlings take 4-5 years to reach flowering size. Division of the bulbs is in June/July when the leaves have died down. Larger bulbs can be planted out direct into their permanent positions, though it is best to pot up the smaller bulbs and grow them on in a cold frame for a year before planting them out. The plant can be divided every other year if a quick increase is required.

Protection measure is cultivation, establishment of managed reserves, insertion in the RDB Georgia.

6.1.3. Siliceous alpine and boreal grasslands (6150; PAL. CLASS.: 36.11, 36.32, 36.34)

Alpine meadows are distributed between 2500-2900 m a.s.l. in the Caucasus Mountains. Special type is of vegetation accurs on alpine snowbeds, which is covered by snow much longer than adjacent habitats.

Sub-types (6150-01) Alpine meadows. Alpine meadows occupy slopes of all expositions in high mountains at the altitude of 2500-2900 meters. The following plant communities are described:

1. Fescue-grass *Festuca varia (=F. woronowii)* communities can be found on inclined slopes of southern exposition. They are more frequently found in eastern Caucasus. Fescue-grass meadows are mainly in subalpine zones. However, they reach the alpine zone as well if climatic and relief conditions are favourable for their distribution.
2. *Nardus stricta* communities are widely distributed in the whole Caucasus. They occur on slopes of all expositions. Secondary mat-

grass communities emerge on extensively grazed meadows where they replace primary communities. Mat-grass - Fescue-grass mixed community Festucetum variae can be found in central and western Caucasus. Mat-grass is adapted to moist areas and is the indicator of identifying moist areas on the meadow. Frequently, it follows the deepened crevice where the level of moisture is higher than on the even place.

3. *Carex tristis* community is widely distributed in the alpine zone of Caucasus. It occupies embossed slopes where in winter there is a significant influence of wind and the sweeping of the snow cover takes place. It is associated with *Festuca supine. Alchemilla caucasica* and *Kobresia capilliformis* can also be found.
4. *Kobresia capilliformis* community can be found in the central and western parts of Caucasus. They are observed on limestone and weeds in central Caucasus. In stony places *Kobresieta schoenoidis* is observed.
5. *Festuca djimilensis* belongs to the number of shrub-like grass of herbal-grass meadows. Mainly, they are found in the subalpine zone. However, it reaches the alpine zone as well. It is mostly common in the Caucasus.
6. *Bromopsis variegata* is distributed on the southern slopes of the Alpine zone. In Kolkheti dry meadows are observed on limestone. *Sesleria anatolica* is the species characteristic to this meadow, which is characterized by the creeping root.
7. *Geranium gymnocaulon* community in western Caucasus is intruded from the subalpine zone and reaches the upper border of vegetation of dense cover. Sometimes, it goes into the subnival zone.
8. *Sibbaldia semiglabra* community is the same as the one of *S. parviflora*. The composition of its species is very poor.

Sub-types (6150-02) Alpine snowbed habitats. Alpine snowbeds can be found in straight places between large stones and moraines at the upper border of the alpine zone, where snow melts late and vegetation is late. It constists of the following grasses: *Poa alpina, Phleum alpinum, Festuca supina,* etc. and herbal species: *Campanula biebersteiniana, Carum caucasicum, Veronica gentianoides, Gnaphalium supinum, Pedicularis crassirostris, P. armena, Poa alpina, Taraxacum stevenii, Sibbaldia semiglabra*, etc. Growth similar to alpine snowbeds are observed in the zone of melting snow and the

side of the glacier, where *Carum caucasicum* sometimes creates a pure growth. Often it is associated with other species *Taraxacum stevenii, Campanula biebersteiniana, Plantago saxatilis, Minuartia aizoides*, etc. It also rarely contains *Ranunculus oreophilus, R. baidarae, Primula algida, Gentiana djimilensis (=G. pyrenaica), G. angulosa, G. nivalis, Minuartia aizoides, Cerastium cerastoides. Pedicularis crassirostris, P. nodrmanniana, Primula auriculata, Poa alpina,* etc. can be found at the side of the stream.

Plants species: *Alchemilla caucasica, Bromopsis variegata, Campanula biebersteiniana, Carex tristis, Carum caucasicum, Festuca djimilensis, F. supina, F. varia, Gentiana djimilensis (=G. pyrenaica), G. angulosa, G. nivalis, Geranium gymnocaulon, Cerastium cerastoides, Gnaphalium supinum, Kobresia capilliformis, Minuartia aizoides, Nardus stricta, Pedicularis crassirostris, P. armena, P. nodrmanniana, Phleum alpinum, Plantago saxatilis, Poa alpina, Primula algida, P. auriculata, Ranunculus oreophilus, R. baidarae, Sibbaldia semiglabra, Taraxacum stevenii, Veronica gentianoides.*

6.1.3.1. Endemic plant species Gentian - *Gentiana* L., Gentianaceae

Endemic species of *Gentiana* are both Georgian and the Caucasian endemic**:** *Gentiana angulosa* M.Bieb. (=*Gentiana verna* subsp. *pontica* (Soltok.) Hayek), *Gentiana kolakovskyi* Doluch.(=*Gentiana septemfida* subsp. *kolakovskyi* (Doluch.) Halda), *Gentiana lagodechiana* (Kusn.) Grossh. (=*Gentiana septemfida* Pall.), *Gentiana oschtenica* Woronow, *Gentiana paradoxa* Albov, *Gentiana rhodocalyx* Kolak., *Gentianella biebersteinii* (Bunge) Holub. The following species are found: *G. cruciate* L.; *G. pyrenaica* L. *(=G. dschimilensis* K. Koch*); G. aquatica L.; G. gelida* M. Bieb.*; G. septemfida* Pall.; Target species is *Gentiana septemfida* Pall. (**Figure 23**).

Indicator species are that respond quickly to any changes in the environmental conditions and, therefore, their responses indicate timely information about the state of the ecosystem monitoring and management effectiveness evaluation; Umbrella species determines conservation of other species in the habitat conditions where there are species communities and one umbrella species will have a protection due to their conditions.

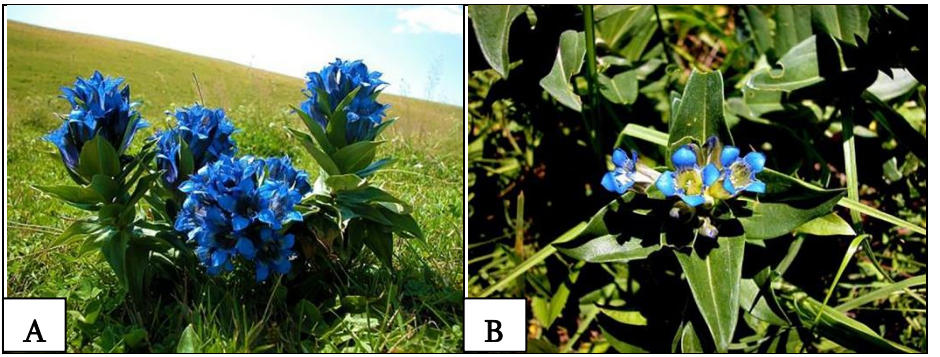


Figure 23. A. *Gentiana septemfida* is madicinal plant and used for cancer disease; **B.** *Gentiana cruciata* has only 4 petals. **Photo: Maia Akhalkatsi.**

E.g. the pine is an umbrella species for squirrel; Species that have a special role to contribute in ecosystem structure. The economically potential species - recreational, ornamental and medicinal plants and other; Perennial is growing to 0.4 m. It is in flower from July to October. Grows is on subalpine and alpine meadows. The plant prefers light, medium and heavy soils and requires well-drained soil. The plant prefers acid, neutral and basic soils. It can grow in semi-shade or no shade. It requires moist soil. It is used in folk medicine for treatment of uterine fibroids. It is antiseptic and regulates digestive system.

Edible uses are none known. Other uses are as none known.Local population collects in big amount for traditional use in folk medicine. In general, gentians require a moist well-drained soil in a sheltered position, a certain minimum of atmospheric humidity, high light intensity but a site where temperatures are not too high. They are therefore more difficult to grow in areas with hot summers and in such a region they appreciate some protection from the strongest sunlight. Plants are hardy to at least -20°C (**Phillips, Rix, 1991**). A moisture loving plant, preferring to grow with full exposure to the sun but with plenty of underground moisture in the summer, it grows better in the north and west of Britain. Plants are intolerant of root disturbance.

Seed of the *Gentiana septemfida* is best sown as soon as it is ripe in a light position in a cold frame. It can also be sown in late winter or early spring but the seed germinates best if given a period of cold

stratification and quickly loses viability when stored, with older seed germinating slowly and erratically. It is advantageous to keep the seed at about 10°C for a few days after sowing, to enable the seed to imbibe moisture (**Phillips, Rix, 1991**). Following this with a period of at least 5-6 weeks with temperatures falling to between 0 and -5°C will usually produce reasonable germination. It is best to use clay pots, since plastic ones do not drain so freely and the moister conditions encourage the growth of moss, which will prevent germination of the seed (**Kohlein, 1991**). The seed should be surface-sown, or only covered with a very light dressing of compost. The seed requires dark for germination, so the pots should be covered with something like newspaper or be kept in the dark. Pot up the seedlings into individual pots as soon as they are large enough to handle and grow on in light shade in the greenhouse for at least their first winter. The seedlings grow on very slowly, taking 2-7 years to reach flowering size. When the plants are of sufficient size, place them out into their permanent positions in late spring or early summer. Protection measures are Cultivation.

6.1.4. Alpine and subalpine calcareous grasslands (6170; PAL. CLASS.: 36.12, 36.41 to 36.43, 36.37, 36.38)

Alpine and subalpine meadows can be found on alkali soils. Characteristic species: *Dryas, Gentiana, Alchemilla, Anthyllis, Aster, Astragalus, Draba, Globularia, Helianthemum, Phyteuma,* etc. Mainly, distributed is in the western Caucasus, on limestone mountain tracts.

Sub-types (6170-01): Meadows with the participation of *Sesleria anatolica, Brachypodium rupestre* and *Carex pontica* and can be found on the Bzifi gorge of Abkhazia limestone massif.

Sub-types (6170-02): *Woronowia speciosa* (=*Geum speciosum*) community is characteristic to western Caucasus (Kolkheti limestone). Usually, these communities cover the slopes with strong karstic relief. *Woronowia speciosa* is associated with *Carex pontica*. This community is extremely damaged due to grazing and its area is limited. It is replaced by the meadows of tangled thorny undergrowth (*Nardus stricta*).

Sub-types (6170-03): *Geranium gymnocaulon - Woronowia speciosa - Inula magnifica* is an extremely specific community, which consists of only these species and can be found in Kolkheti.

Plants species: *Sesleria anatolica, Brachypodium rupestre, Carex pontica, Woronowia speciosa, Nardus stricta, Geranium gymnocaulon, Woronowia speciosa, Inula magnifica*.

6.1.4.1. Edificatory plant species Savin juniper - *Juniperus* L., Cupressaceae

Edificatory species have a special role to contribute in ecosystem structure *Juniperus communis* L. var. *depressa* Pursh. - Juniper, *J. sabina* L. - Savin Juniper, Cupressaceae. These species growing in the entire forest zone to the forest steppes, on forest edges, in pine groves, moorlands, rocks and pastures. Erect, small trees or shrubs 1-5 m. *J. communis* var. *depressa* is distributed in alpine zone of Central Caucasus 1500-2800 m a.s.l.. Snow cover is <1 m. The exposition is for all directions and inclination till 30°C. Sunny edge is normal; dappled shade is in North Wall, East Wall, and West Wall. Sometimes forming extensive thickets; growing in the zone of alpine meadows and pastures. Suitable for: light, medium and heavy soils, prefers well-drained soil and can grow in heavy clay and nutritionally poor soils. Suitable pH: acid, neutral and basic soils and can grow in very acid and very alkaline soils.

It can grow in semi-shade or no shade. It prefers dry or moist soil and can tolerate drought. The plant can tolerate maritime exposure (**Figure 24**).

J. sabina is alpine species from 1800 to 2800 m a.s.l.. Growing on wind-blown sand, chalk, rocks, exposed southern slopes, and stony slopes of hills and low mountains, more often in the steppe than in the forest belt. Snow cover is <3 m.

The exposition is for all directions and inclination till 70°C. Sunny edge is normal; dappled shade is in North Wall, East Wall, and West Wall. Suitable for: light, medium and heavy soils and prefers well-drained soil. Suitable pH: acid, neutral and basic soils and can grow in very alkaline soils. It cannot grow in the shade.

It prefers dry or moist soil and can tolerate drought. The plant can tolerate maritime exposure.

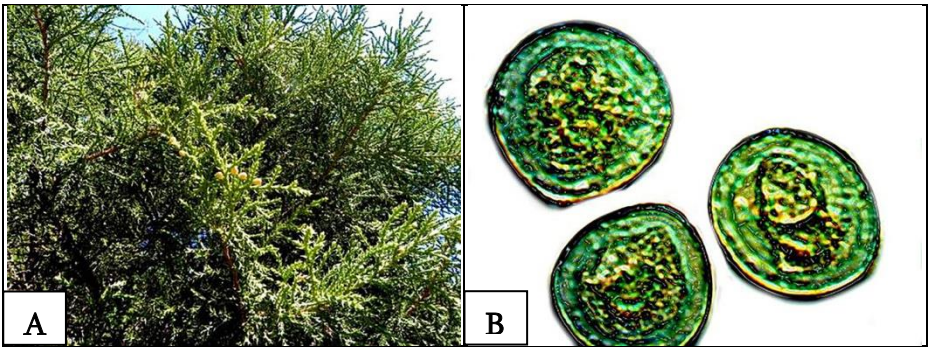


Figure 24. A. *Juniperus communis* var. *depressa* is in many areas of Georgia; **B.** Pollen of *Juniperus communis* var. *depressa* has length of the horizontal height as 115-120 μm**. Photo: Maia Akhalkatsi.**

Evergreen trees or shrubs are with needle-like leaves, three each in a whorl, or with opposite and decussate, scale-like leaves, young shrubs sometimes with juvenile needle like leaves. Female cones (galbuluses) maturing in two to three years, globose, with fleshy fused scales (**Adams, Pandey, 2003**). Seeds are one to eight in each cone, oblong-ovoid, wingless. *J. communis* var. *depressa* is a prostrate shrub with decumbent rooting branches; bark dark gray; branchlets yellowish- red; leaves straight, short, linear- subulate, 8-10 mm long and 1.5 mm broad, pruinose above, keeled beneath, the keel decurrent onto the bark of the branch and forming there an inflated pyriform resiniferous gland; male cones shorter than leaves; fruit black, pruinose, subsessile, shorter than leaves; seeds 2 or 3, trigonous, light brown, wrinkled. 2n = 22. *J. sabina* is trailing shrub, dioecious, low, procumbent shrubs, 0.5-0.8 m high; female cones blackish-brown, 5-8 mm wide; young shoots green; 7.2, n=22. Branches partly decumbent, partly ascending; leaves strongly odoriferous; acicular leaves lance-linear, spiny-pointed; leaves on adult plants about 1.2 mm long, scale-like, sometimes needlelike on low branches, 2.5-8 mm long. Imbricated leaves lustrous, rhombic to rhombic-lanceolate, acute to subobtuse, with a keel and an oval gland on the black; aments ovaloid, with round scales, pale yellow; fruits solitary, profuse, small, 6-8 mm long and 5-6 mm broad, rounded-ovate, brownish, pruinose, of 4-6 scales; seeds mostly 2, though

occasionally 1, 3, 4, or 6, ovoid, prominently keeled on the abaxial side.

Wood reddish, agreeably scented, used for lathework and sculpture, e. g., for furniture decoration. The fruit contains sugar and essential oil, used as diuretic and also in the liqueur industry (for export). Dry distillation of the wood yields empyreumatic juniper oil. *Oleum cadinum* is used against skin irritants. The resin gives sandarac and is used for the production of white varnish. Suitable is for low hedges. Of medicinal value are the green branchlets Summitates Sabinae (Herba Sabinae, Ramuli Sabinae, Frondes Sabinae), containing 2-5 and up to 17% of volatile Savin oil, sabinol CioHi5(OH), used as emmenagogue and abortive agent. The action is so strong that in Germany, where it is considered to be a beautiful ornamental shrub, it is banned from general-purpose gardens, as being toxic.

Fruit is raw or cooked. It is usually harvested in the autumn when fully ripe and then dried for later use. There is a soft, mealy, sweet, resinous flesh. The fruit is often used as flavouring in sauerkraut, stuffings, vegetable pates etc, and is an essential ingredient of gin. The aromatic fruit is used as a pepper substitute according to one report. An essential oil is sometimes distilled from the fruit to be used as flavouring. Average yields are around 1%. The cones are about 4-8 mm in diameter and take 2-3 years to mature. Some caution is advised when using the fruit; see the notes above on toxicity. The roasted seed is a coffee substitute. A tea is made by boiling the leaves and stems. A tea made from the berries has a spicy gin-like flavour.

Juniper fruits are commonly used in herbal medicine, as a household remedy, and also in some commercial preparations. They are especially useful in the treatment of digestive disorders plus kidney and bladder problems. The fully ripe fruits are strongly antiseptic, aromatic, carminative, diaphoretic, strongly diuretic, rubefacient, stomachic and tonic. They are used in the treatment of cystitis, digestive problems, chronic arthritis, gout and rheumatic conditions. They can be eaten raw or used in a tea, but some caution is advised since large doses can irritate the urinary passage. Externally, it is applied as a diluted essential oil, having a slightly warming effect upon the skin and is thought to promote the removal of waste products from underlying tissues. It is, therefore, helpful when applied to arthritic joints etc. The fruits should not be used internally by pregnant women since this can

cause an abortion. The fruits also increase menstrual bleeding so should not be used by women with heavy periods. When made into an ointment, they are applied to exposed wounds and prevent irritation by flies. The essential oil is used in aromatherapy. Its keyword is 'Toxin elimination'.

A decoction of the branches is used as an anti-dandruff shampoo. The essential oil distilled from the fruits is used in perfumes with spicy fragrances. In hot countries the tree yields the resin 'Sandarac' from incisions in the trunk. This is used in the production of a white varnish. The stems were at one time used as a strewing herb to sweeten the smell of rooms. The whole plant can be burnt as an incense and fumigant. It was used during epidemics in the belief that it would purify the air and cleanse it of infection. Fresh or dried juniper branches also make a good insect repellent. Many forms of this species are good ground cover plants for sunny situations. Forms to try include 'Depressa Aurea', 'Dumosa', 'Effusa', and 'Repanda'. 'Prostrata' can also be used. The bark is used as cordage and as tinder. Wood has strong, hard, fragrant, very durable in contact with the soil and very close-grained, but usually too small to be of much use. It makes an excellent fuel.

Landscape is Specimen. An easily grown plant, it succeeds in hot dry soils and in poor soils. Succeeds in most soils so long as they are well drained, preferring a neutral or slightly alkaline soil. Does well is in chalky soils. Grows is well in heavy clay soils. Tolerates has pH range from 4 to 8. Succeeds in light woodland but dislikes heavy shade. Established plants are very tolerant of drought. Although the fully dormant plant is cold-tolerant throughout Britain, the young growth in spring can be damaged by late frosts. All parts of the plant are very aromatic. Juniper is a very polymorphic species that has a long history of culinary and medicinal use. It is frequently grown in the ornamental and herb garden; there is a huge range of cultivars of widely diverse habits. At least some forms tolerate maritime exposure; there is a thriving colony in an exposed position at Land's End in Cornwall. The fruits take 2-3 years to ripen on the plant. Plants are usually very slow growing, often only a few centimetres a year. Resists honey fungus. Plants are sometimes attacked by rust; this fungus has an aecidial stage on hawthorn (*Crataegus* spp.) Dioecious is in areas. Male and female plants must be grown if seed is required.

The seed requires a period of cold stratification. The seed has a hard seedcoat and can be very slow to germinate, requiring a cold period followed by a warm period and then another cold spell, each of 2-3 months duration. Soaking the seed for 3-6 seconds in boiling water may speed up the germination process. The seed is best sown as soon as it is ripe in a cold frame. Some might germinate in the following spring, though most will take another year. Another possibility is to harvest the seed 'green' (when the embryo has fully formed but before the seed coat has hardened). The seedlings can be potted up into individual pots when they are large enough to handle. Grow on in pots until large enough, and then plant out in early summer. When stored dry, the seed can remain viable for several years. Cuttings are of mature wood, 5 – 10 cm with a heel, September/October in a cold frame. Plant out in the following autumn. Layering is in September/October. Takes is 12 months.

J. sabina leaves are used as an insect repellent; a decoction of them is used against lice. An essential oil from the leaves and shoots has strong diuretic properties and is also used in perfumery. Yields of around 4% are obtained; this oil is also used as an insecticide. A good dense ground cover plant, though it is slow to cover the ground. The species type eventually forms a high ground cover, but there are many named forms that are lower-growing. Plants should be spaced about 1.2 metres apart each way. The taller forms of this species make a good hedge.

Landscape is Alpine garden, Erosion control, Ground cover, Massing, Rock garden. Succeeds in most soils if they are well drained, preferring a neutral or slightly alkaline soil. Prefers is a limestone soil. Succeeds is in poor soils and in light shade. Established plants are drought tolerant, succeeding in hot dry positions. Tolerates is maritime exposure. A very ornamental plant, there are many named varieties. All parts of the plant have a powerful pungent smell. Plants can be dioecious or monoecious. Male and female plants must be grown if fruit and seed are required. The plant is sometimes attacked by rust; this is a fungus with an aecidial stage on the leaves of pear trees. Plants are resistant to honey fungus.

The seed requires a period of cold stratification. The seed has a hard seedcoat and can be very slow to germinate, requiring a cold period followed by a warm period and then another cold spell, each of

2-3 months duration. Soaking the seed for 3-6 seconds in boiling water may speed up the germination process. The seed is best sown as soon as it is ripe in a cold frame. Some might germinate in the following spring, though most will take another year. Another possibility is to harvest the seed 'green' (when the embryo has fully formed but before the seedcoat has hardened). The seedlings can be potted up into individual pots when they are large enough to handle. Grow on in pots until large enough, and then plant out in early summer. When stored dry, the seed can remain viable for several years. Cuttings are of mature wood, 5 – 10 cm with a heel, September/October in a cold frame. Plant out in the following autumn. Layering is in September/October. Takes is 12 months.

Geographic distribution is on these areas: *J. communis* var. *depressa* in Caucasus, Bulgaria, Crimea, Turkey, Iran and Talysh mountains. *J. sabina* is in Caucasus: in the mountains of the Greater Caucasus and on Adzhar-Imeretian and Trialeti ranges, avoiding Armenia and Talysh. Es well in Europe, Asia: Sibiria, Mongolia, Altai.

6.2. Natural and semi-natural dry grasslands

6.2.1. Code of Georgia: semi-desert vegetation (62GE01)

Semi-desert vegetation holds a great part of the arid region of eastern and southern Georgia where scrub is less represented and herbal vegetation is more observed. However, separate species of shrubs are mixed to this community.

Dominant species of these communities are: *Anabasis aphylla, Salsola ericoides, S. dendroides, S. glauca, Gamanthus pilosus, Suaeda microphylla, Petrosimonia brachiata, Aellenia glauca, Kalidium caspicum.* Existence of ephemeres and ephemeroids are characteristic to the semi-desert: *Tulipa eichleri, Allium atroviolaceum, Poa bulbosa, Colpodium humile, Bromus japonicus, Alyssum desertorum, Helianthemum salicifolium,* etc. Scrub is represented by *Nitraria schoberi*. Eroded and washed down slopes are thinly covered by grasses and herbal plants - *Festuca sulcata, Stipa szovitsiana, Artemisia fragrans,* etc.

Sub-types (62GE01-01): Community of *Artemisia fragrans* can be monodominant of this species or represented by the domination of two species of *Artemisieto-Salsoletum dendroides. Eremopyrum orientale*

and *Lepidium vesicarium* dominate from annual epehemers. *Stizolophus coronopifolius* is commonly found.

Sub-types(62GE01-02):*Artemisia fragrans-Caragana grandiflora* community is created with the participation of about 24-26 species. Characteristic species are: *Alopecurus myosuroides, Lepidium vesicarium.* Rare species are *Spergularia diandra, Calendula persica, Tetradiclis tenella, Aizoon hispanicum.* Characteristic species are: *Salsola ericoides, S. dendroides,* etc. On the Eldar valley this community includes the following species: *Poa bulbosa, Bromus japonicus, Rostraria glabriflora, Medicago minima, Torularia contortuplicata.*

Sub-types (62GE01-03): *Artemisia fragrans - Bothriochloa ischaemum* community is widely distributed on the Eldar valley, at grey-brown soil and stony places. Vegetation cover is 30-50 %. Replacement of buckle with Bluestem indicated reduction of salt in the soil in these places, which can be caused by washing out of the eroded soil due to excessive grazing. Characteristic species are *Poa bulbosa, Trachynia distachya, Lappula patula, Medicago minima, Velezia rigida,* etc.

Sub-types (62GE01-04): Buckle (*Artemisia fragrans*) community with ephemeres: *Adonis aestivalis, Astragalus hamosus, Koelpinia linearis, Medicago minima, Queria hispanica,* etc. can be found in Gardabani region (lower Kartli).

Sub-types (62GE01-05): Buckle (*Artemisia fragrans*) community on Iagluja (Lower Kartli) contains the following species: *Salsola dendroides, Bothriochloa ischaemum, Limonium meyeri,* etc. Also, the following rare species are typical: *Iris iberica, Iridodychtium reticulatum, Juno caucasica, Tulipa biebersteinii, T. eichleri, Gagea* spp.

Plants species: *Adonis aestivalis, Aellenia glauca, Aizoon hispanicum, Allium atroviolaceum, Alopecurus myosuroides, Alyssum desertorum, Anabasis aphylla, Artemisia fragrans, Astragalus brachyceras, Bothriochloa ischaemum, Bromus japonicus, Calendula persica, Caragana grandiflora, Colpodium humile, Eremopyrum orientale, Festuca sulcata, Gagea* spp., *Gamanthus pilosus, Helianthemum salicifolium, Iridodychtium reticulatum, Iris iberica, Juno caucasica, Kalidium caspicum, Koelpinia linearis, Lappula patula, Lepidium vesicarium, Limonium meyeri, Medicago minima,*

Petrosimonia brachiata, Poa bulbosa, Queria hispanica, Rostraria glabriflora, Salsola dendroides, Salsola ericoides, S. glauca, Spergularia diandra, Stipa szovitsiana, Stizolophus coronopifolius, Suaeda microphylla, Tetradiclis tenella, Torularia contortuplicata, Trachynia distachya, Tulipa biebersteinii, T. eichleri, Velezia rigida.

6.2.1.1. Endemic plant species Yellow Star-of-Bethlehem - *Gagea* Salisb., Liliaceae

Endemic species of *Gagea* are as both Georgian and the Caucasian endemic: *Gagea caroli-kochii* Grossh., *Gagea chanae* Grossh., *Gagea charadzeae* Davlian.,*Gagea commutate* K.Koch, *Gagea eleonorae* Levichev, *Gagea helenae* Grossh., *Gagea sarmentosa* K.Koch, *Gagea sulfurea* Miscz. Caucasian endemic species is described for Javakheti - *Gagea alexeenkoana* Miscz. We have found another Caucasian endemic in Meskheti - *G. chanae* Grossh. More widespread species *G. anisanthos* K. Koch is found both in Meskheti and Javakheti.

It grows on dry slopes with arid vegetation. Bulb is growing to 0.03 m. It is in flower from March to April. The plant prefers light, medium and heavy soils. The plant prefers acid, neutral and basic soils. It can grow in semi-shade (light woodland) or no shade. It requires moist soil (**Akhalkatsi, 2009; Figure 25**).

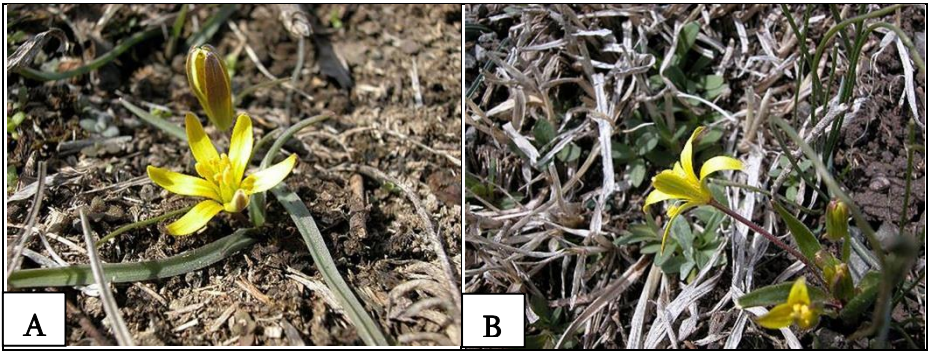


Figure 25. A. *Gagea chanae* is endemic species in Georgia and Caucasus; **B.** *G. anisanthos* is not endemic and it is found both in Meskheti and Javakheti. **Photo: Maia Akhalkatsi.**

In folk medicine is used as diuretic. Edible plant in many countries.leaves and roots are cooked. A famine food, it is only used in times of scarcity. Young leaves - cooked. Requires is a moist soil, preferring one on the alkaline side of neutral, and succeeding in sun or shade. The dormant bulbs are fairly hardy and will withstand soil temperatures down to at least -10°C.

Seed of *Gagea* sow spring in a greenhouse. Sow the seed thinly so that there is no need to transplant them, and grow the seedlings on in the same pot in the greenhouse for their first year or two. Give an occasional liquid feed to ensure they do not become nutrient deficient. Pot up the small bulbs when the plants are dormant, placing 2-3 bulbs in each pot. Grow them on for another year or two in the greenhouse before planting them out when they are dormant. Insertion is in the RDB Georgia.

6.2.2. Code of Georgia: Steppe Vegetation (62GE02)

Vegetation of the steppe is distributed in the zone of the front of the mountain (300-700 meters a.s.l.) in eastern Georgia. It is the continuation of the vegetation of the semi-desert in the arid region from the sea level in relation with the altitude. On the other hand, it borders with arid open woodlands. Bluestem - *Bothriochloa ischaemum* is the dominant species in the steppe. It is widely distributed in both hemispheres of the world.

Sub-types (62GE02-01): *Glycyrrhizieto - Bothriochloëta* is widespread in the lowlands (500-600 m) and rich with the species. 65 species are found on 100 m^2. Characteristic species are: *Koeleria cristata, Phleum phleoides, Medicago caerulea, Bromus japonicus, Trifolium campestre, Vicia angustifolia, Crucianella angustifolia, Arabidopsis thaliana, Androsace elongata.*

Sub-types (62GE02-02): *Bothriochloëta xeroherbosa* can be found on the slopes of the eastern and western exposition (600-700 meters a.s.l.). *Teucrium chamaedrys, Galium verum, Picnis strigosa, Scorzonera biebersteinii, Inula britannica, Aster ibericus, Stachys atherocalyx* can be found from vegetation. From pulses the following can be found: *Onobrychis kachetica, 0. cyri,* and *Astragalus brachycarpus.* Grasses ar represented by *Festuca sulcata.* Species blooming in early spring are - *Arabidopsis thaliana, Anthemis*

candidissima, Crocus adamii, Merendera trigyna, Muscari caucasium, Gagea commutata. Endemic plants are: *Polygala transcaucasica, Aster ibericus, Cephalaria sosnowskyi, Thymus tiflisiensis,* etc.

Sub-types (62GE02-03): *Bothriochloëta ephemerosa* can be found on the south stony slopes. The following are to be mentioned from ephemers: *Alyssum campestre, Callipeltis cucullaria, Sideritis montana, Meniocus linifolius, Ziziphora capitata, Trigonella spicata. Juno caucasica, Allium atroviolaceum,* etc. are geophytes.

Sub-types (62GE02-04): *Festuceta-Bothriochloëta* is more localized on the slopes of hills. *Festuca sulcata* is associated with Bluestem. Fragments of these communities are found in Iagluja (lower Kartli).

Sub-types (62GE02-05): *Bothriochloëta pratoherbosa* is less xerophytic community which can be found in the depression where there are soils similar to the black earth. Besides Bluestem *Agropyron cristatum, A. pectinatum, Elytrigia repens* can be found.

Sub-types (62GE02-06): *Stipeto-Bothriochloëta* communities are widespread on the hill summit and northern slopes. They are mainly found on stony slopes. The soil is grey-brown, thin and lacks salt. Existence of certain shrubs – *Paliurus spina-christi, Rhamnus pallasii,* etc. is characteristic. From grasses – vegetation species the following can be found - *Stipa tirsa, S. lessingiana, S. pulcherrima, S. capillata*, and *Phleum phleoides.* There are as well a lot of ephemeroids.

Plants species: *Bromus japonicus, Carex bordzilowskii, Dactylis glomerata, Festuca sulcata, Glycyrrhiza glabra, Medicago caerulea, Phleum phleoides, Stipa capillata, Trifolium arvense, Trisetum pratense, Stipa lessingiana, Botriochloa ischaemum, Festuca sulcata, Stipa pulcherrima, Koeleria macrantha, Phleum phleoides, Cleistogenes bulgarica, Medicago coerulea, Astragalus brachycarpus, Inula germanica, Stachys iberica, Galium verum, Thalictrum minus, Leontodon asperrimus, Filipendula vulgaris, Thymus tiflisiensis, Potentilla recta, Picris strigosa, Veronica multifida, Pimpinella aromatica, Bilacunaria microcarpa, Tragopogon pusillus, Seseli grandivittatum, Campanula hohenackeri, Cephalaria media, Crucianella angustifolia, Xeranthemum squarrosum, Trigonella spicata, Bromus japonicus, Linus nodiflorum.*

6.2.2.1. Endemic plant species Yellow Star-of-Bethlehem - *Gagea* Salisb., Liliaceae

Endemic species of *Crocus* are both Georgian and the Caucasian endemic: *Crocus autranii* Albov, *Crocus kotschyanus* K. Koch, *Crocus scharojanii* Rupr., *Crocus suworowianus* K. Koch. Only one species was described for Meskheti in the litarature - *C. speciosus* M. Bieb., We have found two more species - *C. adamii* J. Gay and *C. reticulatus* Steven ex Adams in Meskheti. One species of *Crocus* is *C. vallicola* Herb. It is growing on Goderdzi pass on the boundary of Adjara and Meskheti (**Figure 26**).

Endemic species of *Crocus* are both Georgian and the Caucasian endemic: *Crocus autranii* Albov, *Crocus kotschyanus* K. Koch, *Crocus scharojanii* Rupr., *Crocus suworowianus* K. Koch. Only one species was described for Meskheti in the litarature - *C. speciosus* M. Bieb., We have found two more species - *C. adamii* J. Gay and *C. reticulatus* Steven ex Adams in Meskheti.

One species of *Crocus* is *C.vallicola* Herb. It is growing on Goderdzi pass on the boundary of Adjara and Meskheti. *Crocus speciosus* M. Bieb. is growing in upepr mountai belt in Meskheti range above v. Atskuri. However, we were not able to reach this population and monitor it. For cultivation it is desirable to use cultivated species of this genus *C. sativus* L. which is a valuable market species and easy to cultivate. *C. sativus* is cultivated plant. The wild species are growing of meadows in steep or gentle slopes covered with grasses. Corm is growing to 0.1 m by 0.1 m. It is in leaf from October to May, in flower in October. The plant prefers light and medium soils, requires well-drained soil and can grow in nutritionally poor soil. The plant prefers acid, neutral and basic soils and can grow in very alkaline soil. It can grow in semi-shade or no shade. It requires dry or moist soil.

Medicinal uses are abortifacient, anodyne, antispasmodic, aphrodisiac, appetizer, carminative, diaphoretic, emmenagogue, expectorant, narcotic, sedative and stimulant. Saffron is a famous medicinal herb with a long history of effective use, though it is little used at present because cheaper and more effective herbs are available **(Grieve, 1984).** The flower styles and stigmas are the parts used, but since these are very small and fiddly to harvest they are very expensive and consequently often adulterated by lesser products.

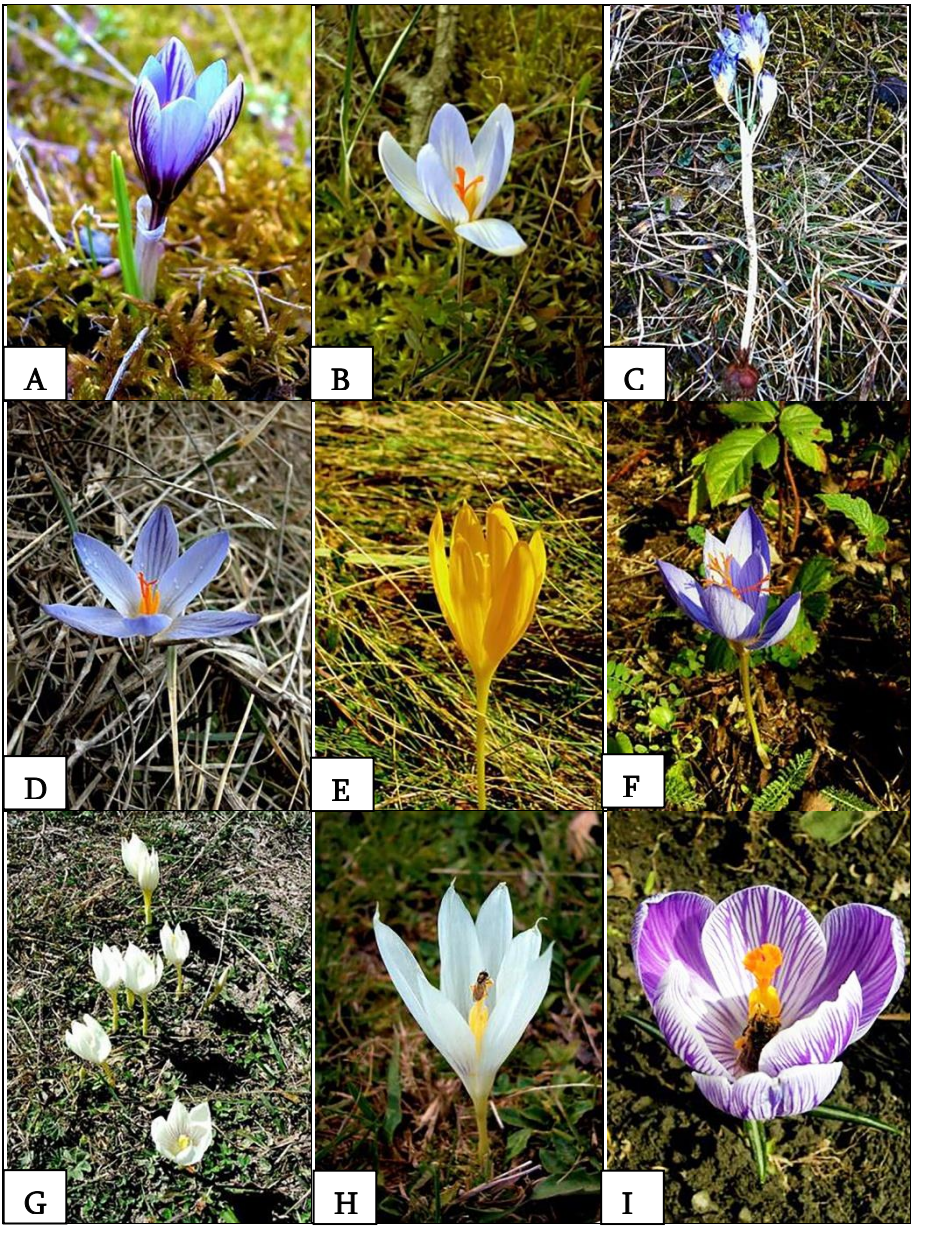


Figure 26. A., B. - *Crocus adamii*, **C.** – *Crocus biflorus*; **D.** – *Crocus reticulatus*, **E.** – *Crocus scharojanii*, **F.** – *Crocus speciosus*, **G.-H.** – *Crocus valicolla*, **I.** - *Crocus albiflorus.* **Photo: Maia Akhalkatsi.**

The styles and stigmas are anodyne, antispasmodic, aphrodisiac, appetizer, carminative, diaphoretic, emmenagogue, expectorant, sedative and stimulant **(Grieve, 1984).**

They are used as a diaphoretic for children, to treat chronic haemorrhages in the uterus of adults, to induce menstruation, treat period pains and calm indigestion and colic **(Grieve, 1984).**

A dental analgesic is obtained from the stigmas. The styles are harvested in the autumn when the plant is in flower and are dried for later use **(Grieve, 1984),** they do not store well and should be used within 12 months. This remedy should be used with caution, large doses can be narcotic and quantities of 10 g or more can cause an abortion. From the flower extracts of *Crocus speciosus* nine flavonol glycosides have been isolated. One of these products is a new flavonol glycoside identified as kaempferol 3-O-alpha-(2.3-di-O-beta-D-glucopyranosyl) rhamnopyranoside **(Norbaek, Kondo, 1999).**

Edible uses are Colouring; Condiment; and Tea. The flower styles are commonly used as flavouring and yellow colouring for various foods such as bread, soups, sauces, rice and puddings **(Grieve, 1984).** They are an essential ingredient of many traditional dishes such as paella, bouillabaisse, risotto milanese and various other Italian dishes. The styles are extremely rich in riboflavin. Water is soluble.

Yields per plant are extremely low; about 4000 stigmas yield 25 g of saffron. Saffron is the world's most expensive spice, it takes 150,000 flowers and 400 hours work to produce 1 kilo of dried saffron. About 25 kilos of styles can be harvested from a hectare of the plant.

Fortunately, only very small quantities of the herb are required to impart their colour and flavour to dishes. Because of the cost, saffron is frequently adulterated with cheaper substitutes such as marigold flowers and safflower. The flower styles are used as a tea substitute. Root is cooked. The corms are toxic to young animalsso this report of edibility should be treated with some caution. Other uses are Dye. The yellow dye obtained from the stigmas has been used for many centuries to colour cloth **(Grieve, 1984).** It is the favoured colouring for the cloth of Indian swamis who have renounced the material world. A blue or green dye is obtained from the petals.

Prefers is a well-drained sandy or loamy soil that is free from clay. Prefers is a sunny position **(Grieve, 1984).** Grows is well on calcareous soils and on hot sheltered stony banks. Plants are very frost hardy. They

also thrive in areas with poor summers, though they usually fail to flower in such conditions. Plants produce less saffron when grown on rich soils. Saffron has been cultivated for over 4000 years for the edible dye obtained from the flower stigmas. There is at least one named form. 'Cashmirianus' comes from Kashmir and has large high quality corms. It yields about 27 kilos of rich orange stigmas per hectare. When inhaled near to, the flowers have a delicate perfume. Unlike most members of this genus, the flowers do not close of a night time or in dull weather. The flowers are only produced after hot, dry summers. Plants tend to move considerably from their original planting place because of their means of vegetative reproduction, it is therefore wise not to grow different species in close proximity. Any planting out is best done in late spring or early summer. Plants take 4-5 years to come into flowering from seed.

Seed of *Crocus speciosus* is according to some reports this species is a sterile triploid and so does not produce fertile seed. However, if seed is obtained then it is best sown as soon as it is ripe in a cold frame. Stored seed can be sown in the spring in a cold frame. Germination can take 1-6 months at 18°C. Unless the seed has been sown too thickly, do not transplant the seedlings in their first year of growth, but give them regular liquid feeds to make sure they do not become deficient. Divide the small bulbs once the plants have died down, planting 2-3 bulbs per 8 cm pot. Grow them on for another 2 years in a greenhouse or frame and plant them out into their permanent positions when dormant in late summer. It takes 3 years for plants to flower from seed. Division of the clumps in late summer after the plant has died down. The bulbs can be planted out direct into their permanent positions.

6.2.3. Code of Georgia: Mountain Steppe Vegetation (62GE03)

Mountain steppes that are specific to southern Georgia are distributed in the Javakheti volcanic mountain plateau. Stepe vegetation is represented by various plant communities. The most characteristic species of grass-herbal polydominant steppes are: sheep fescue - *Festuca ovina,* fescue - *F. sulcata,* feather grass - *Stipa tirsa, S. pulcherrima,* bluestem - *Bothriochloa ischaemum,* dropwort - *Filipendula vulgaris,* sickleweed - *Falcaria vulgaris,* bedstraw - *Galium cruciatum,* crested hair-grass - *Koeleria cristata,* Trialeti

Lucerne - *Medicago hemicycla,* Timothy grass - *Phleum phleoides,* milkworth - *Polygala anatolica,* Caucasian thyme - *Thymus caucasicus,* etc.

Besides, secondary meadows can also be found here that are developed in the places occupied by old primary forests. Similar to primary communities, such meadows are created for the variants of polydominant various grass in which the following participate: common bent grass - *Agrostis planifolia,* yarrow - *Alchemilla erythropoda,* false-brome - *Brachypodium sylvaticum,* brome - *Bromopsis variegata,* smallreed - *Calamagrostis arundinacea,* red cornflower - *Centaurea salicifolia,* cock's foot - *Dactylis glomerata,* bird's foot trefoil - *Lotus caucasicus,* sheep clover - *Trifolium ambiguum,* grey clover - *T. canescens,* etc. Communities consisting of such mono-dominant species as *Nardus stricta* (thorny undergrowth), *Anemone fasciculata* (narcissus anemone), *Agrostis planifolia* (common bent growth), *Brachypodium sylvaticum* (false-brome), *Bromopsis variegata* (brome), etc. can be mentioned from mono-dominant meadows.

Vegetation created as a result of transformation of natural herbal vegetation of Javakheti plateau is represented by various modifications of meadows turned into steppes and mountain polydominant steppes. The following participate in creating meadows turned into steppes: sedge - *Carex humilis,* multi-coloured fescue - *Festuca valesiaca,* sheet fescue - *F. ovina,* dropworth - *Filipendula vulgaris,* milkwort - *Polygala anatolica,* feathergrowth - *Stipa tirsa,* etc. Further secondary meadows dominant species of the forest are: common bentgrass - *Agrostis planifolia,* yarrow - *Alchemilla erythropoda,* checked brome - *Bromopsis variegata,* small reed - *Calamagrostis arundinacea,* cock's foot - *Dactylis glomerata,* cranesbill - *Geranium sylvaticum,* bird's foot trefoil - *Lotus caucasicus,* Caucasian butter cup - *Ranunculus caucasicus,* grey clover - *Trifolium canescens,* etc. Southern slopes are occupied by polydominant steppes in the creation of which mainly grasses participate: sheep's fescue *Festuca ovina,* checked fescue - *F. valesiaca,* feather grass - *Stipa pulcherrima, S. tirsa,* and crested hair-grass - *Koeleria cristata,* timothy grass - *Phleum phleoides*. The following are represented from various herbs - dropwort - *Filipendula vulgaris,* crusiate - *Cruciata laevipes,* Trialetian alfalfa - *Medicago hemicycla,* Thyme - *Thymus rariflorus,* etc.

Plants species: *Agrostis planifolia, Alchemilla erythropoda, Anemone fasciculata, Bothriochloa ischaemum, Brachypodium sylvaticum, Bromopsis variegata, Calamagrostis arundinacea, Carex humilis, Centaurea salicifolia, Cruciata laevipes, Dactylis glomerata, Falcaria vulgaris, Festuca ovina, F. sulcata, F.valesiaca, Filipendula vulgaris, Galium cruciatum, Geranium sylvaticum, Koeleria cristata, Lotus caucasicus, Lotus caucasicus, Medicago hemicycla, Nardus stricta, Phleum phleoides, Polygala anatolica, Ranunculus caucasicus, Stipa pulcherrima, S. tirsa, Thymus caucasicus, Thymus rariflorus, Trifolium ambiguum, Trifolium canescens*.

6.2.3.1. Endemic and medicinal plant species meadow anemone - *Pulsatilla* Adans., Ranunculaceae

Endemic species of *Pulsatilla* is both Georgian and the Caucasian endemic. According to **L. Kemularia-Natadze (1970)** three species of Pasqueflower are endemics *Pulsatilla aurea* (N.Busch) Juz., *Pulsatilla georgica* upr., *Pulsatilla violacea* Rupr., Althougth, other authors consider *P. georgica* as synonim of *P. violacea* **(Cherepanov, 1995).** Target species is *Pulsatilla violacea* (=*P. georgica* Rupr., **Figure 27**).

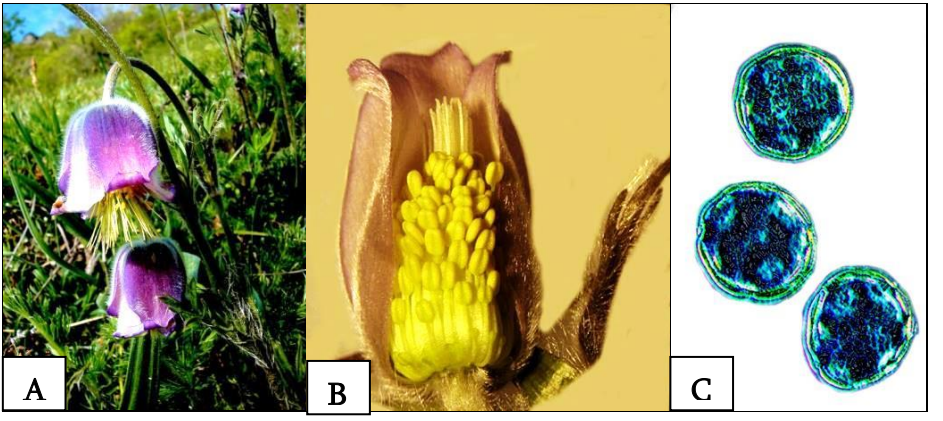


Figure 27. A. *Pulsatilla violacea* is in Kazbegi district; **B**. Flower has many stamens and anther has much pollen; **C**. Pollen of *Pulsatilla violacea* has length of the horizontal height as 36-39 μm. **Photo: Maia Akhalkatsi.**

Ornamental plant is in flower from April to May, and the seeds ripen from May to June. Perennial is growing to 0.25 m. The plant prefers light and medium soils and requires well-drained soil. The plant prefers acid, neutral and basic soils and can grow in very alkaline soil. It cannot grow in the shade.

Medicinal uses are alterative, antispasmodic, diaphoretic, diuretic, emmenagogue, expectorant, homeopathy, nervine, ophthalmic and sedative. Pasque flower is considered by herbalists to be of highly valuable modern curative use as a herbal simple **(Grieve, 1984).** The plant contains the glycoside ranunculin, this is converted to anemonine when the plant is dried and is the medicinally active principle in the plant **(Stuart, 1979).**

The whole plant is alterative, antispasmodic, diaphoretic, diuretic, emmenagogue, expectorant, nervine and sedative **(Grieve, 1984).** It is taken internally in the treatment of pre-menstrual syndrome, inflammations of the reproductive organs, tension headaches, neuralgia, insomnia, hyperactivity, bacterial skin infections, septicaemia, and spasmodic coughs in asthma, whooping cough and bronchitis. Externally, it is used to treat eye conditions such as diseases of the retina, senile cataract and glaucoma.

This remedy should be used with caution; excessive doses cause diarrhoea and vomiting. It should not be prescribed to patients with colds. See also the notes above on toxicity. The plant is harvested soon after flowering; it is more poisonous when fresh and so should be carefully preserved by drying **(Stuart, 1979; Grieve, 1984).** It should not be stored for longer than 12 months before being used.

Other uses are Dye and Ground cover. It requires dry or moist soil and can tolerate drought. A green dye is obtained from the flowers **(Brown, 1995).** Plants can be grown to form a ground cover, they are best spaced about 30 cm apart each way. Requires is a well-drained humus rich gritty soil in a sunny position. Lime is tolerant. Prefers is lime. Grows is best in a well-drained chalky soil in a dry warm situation. Established plants are fairly drought tolerant **(Huxley, 1992).**

A very hardy plant is tolerating temperatures down to about -20°C. A very ornamental plant, there are many named varieties. The plant has become rare in its natural environment, due partly to over-collecting

and partly to habitat loss. Large plants transplant badly. A greedy plant is inhibiting the growth of nearby plants, especially legumes.

Seed of *Pulsatilla* is best sown as soon as it is ripe in early summer in a cold frame. The seed usually germinates in about 2-3 weeks. Sow stored seed in late winter in a cold frame. Germination takes about 1-6 months at 15°C.

When they are large enough to handle, prick the seedlings out into individual pots and grow them on in the greenhouse for at least their first winter. Plant them out into their permanent positions in the spring. Root cuttings, 4 cm long taken in early winter, potted up in a mixture of peat and sand.

They can also be taken in July/August, planted vertically in pots in a greenhouse or frame. Some care is needed since the plant resents root disturbance **(Huxley, 1992).**

6.2.4. Code of Georgia: Vegetation of urban and rural areas (62GE04)

Vegetation of village settlements and cultivable land is extremely interesting from the point of view of plants of economic importance. In this habitat there are various species of aborigine, invasive and adventive cosmopolitan plants related to wild relatives of cultural plants and those used in traditional (people's) and scientific medicine, including, Chicory - *Cichorium intybus*, meliot - *Melilotus officinalis*, yarrow - *Achillea milllefolium,* agrimony – *Agrimonia eupatoria*, creeping couch-grass - *Agropyron repens,* white briony - *Bryonia dioica,* shepherd's purse - *Capsella bursa-pastoris,* greater calistine - *Chelidonium majus,* European dodder - *Cuscuta europaea,* henbane - *Hyoscyamus niger,* mother of nettle - *Lamium album,* forest mallow - *Malva sylvestris,* mint – *Mentha arvensis,* great plantain - *Plantago major,* chickweed - *Stellaria media,* dandelion - *Taraxacum officinale,* coltsfoot - *Tussilago farfara,* nettle -*Urtica dioica,* etc.

These plants are distributed on the territories of the city and village settlements, roadsides and transformed habitats. Most of them, as pioneer plants, create primary successions on eroded slopes as a result of industrial activities and construction works.

Plants species: *Achillea milllefolium, Aegilops tauschii, Agrimonia eupatoria, Agropyron repens, Avena barbata, A. fatua, Beta*

corolliflora, Brassica elongata, Bryonia dioica, Capsella bursa pastoris, Chelidonium majus,Cichorium intybus, Coriandrum sativum, Cornus mas, Corylus avellana, Cuscuta europaea, Cydonia oblonga, Ficus carica, Fragaria vesca, Hyoscyamus niger, Juglans regia, Lamium album, Lathyrus spp., *Onobrychis* spp., *Linum austriacum, Malus oriantalis, Malva sylvestris, Medicago* spp., *Melilotus officinalis, Mentha aquatica, Mentha arvensis, Mespilus germanica, Morus alba, Plantago major, Prunus cerasifera, Punica granatum, Pyrus caucasica, P. salicifolia, Raphanus rapinastrum, Rubus* spp., *Satureja spicigera, S. laxiflora, Setaria viridis, Solanum nigrum, Stellaria media, Taraxacum officinale, Tussilago farfara, Urtica dioica, Vicia* spp.

6.2.4.1. Crop wild relatives (CWR) species Barley tribe - *Aegilops cylindrica* Host., Poaceae

Crop wild relatives (CWR) are determined by the exchange of gene crops and germaplazma used agricultural crop domestication ancestor species. *Aegilops cylindrica* is a member of the Grass family as Barley tribe. Synonyms: *Triticum cylindricum* (Host) Ces., Pass. & Gibelli; *T. caudatum* var. *cylindricum* (Host) Ach. & Graebner; *Aegilops caudata* subsp. *cylindrica* (Host) Hegi; *A. cylindrica* var. *cylindrica* (Host) Fiori; *Cylindropyrum cylindricum* (Host) A. Love **(Figure 28).**

CWR-'s wheat in Georgia represented *Aegilops* species, which are distributed in many regions of the habitat in the dry slopes of the foothills **(Akhalkatsi, 2015c).** There are a total of 8 species of the genus *Aegilops* - in Georgia: *Aegilops cylindrica* Host; *A. tauschii* Coss. (=*A. squarrosa* L.); *A. triuncialis* L.; *A. biuncialis* Vis.; *A. kotschyi* Boiss.; *A. columnaris* zhuk.; *A. ovata* L. (=*A. triaristata* Willd.); and *A. umbellulata* Zhuk. Among them is *A. tauschii*, which is considered the ancestor of wheat (*Triticum aestivum* L.; Genome constitution = AABBDD) and the D genome donor, therefore, considered to be the origin of the wheat and the hybridization tetraploidad *T. turgidum* and diploid - *A. tauschii* (**Kihara 1944; McFadden and Sirs 1946).** According to the literature **(Sakhokia, 1941, 1944)** and herbarium in the type 2 - *Aegilops*-'s are *A. cylindrica* and *A. tauschii*; Other CWR - those kinds of - *A. triuncialis* L., *A. umbellulata* and *A. ovata* described **Berishvili et. al. (2002).**

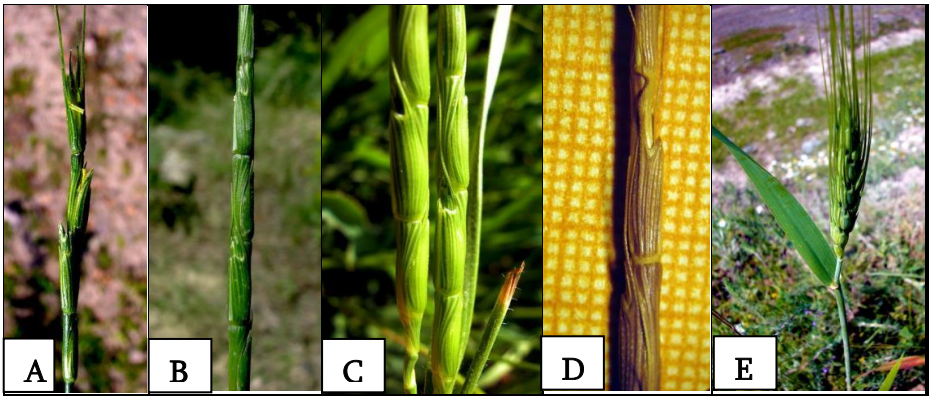


Figure 28. A. B. C. D. *Aegilops cylindrica* with different numbers of flowers; **E.** Hybrid of *A. cylindrica* is as CWRs and wheat variety as *T. aestivum* is done from this in Meskheti. **Photo: Maia Akhalkatsi.**

The actual distribution of the total allocation includes the following regions - Eastern Europe (South), Crimea, the Caucasus, Central Asia, Central Europe (South), the Mediterranean region (east), Asia Minor, Iran.

It is a winter annual or biennial herbaceous plant. It grows 15-30 cm tall on erect stems, which branch at the base to give the plant a tufted appearance. The root system is shallow and fibrous. Leaves are linear, flat, 3-8 mm wide sparsely pubescent or smooth, but scabrous because of minor denticles along the veins. Ears are elongated, cylindrical and gradually converging at the top, 7-12 cm in length. Each ear consists of 6-11 spikelets and breaks off entirely or disintegrates into segments. There are 1-2 rudimentary spikelets at the base of the ear. The ear axis is flexible; spikelets are cylindrical, oblong in cross-section, with 3-4 flowers. Glumes are lanceolate, 6-9 mm long, with 7-9 thin veins, denticulated along the veins. Lateral spikelet glumes are bifurcate in the upper part, topped by a triangular denticle with a broad base and narrow point, often stretched into an awn-shaped appendage. Bidentate from above, the lemma is either longer than the glumes by 0.5-1.5 mm or equal to the glumes in length. Near the apical spikelet the lemma is, like the glumes, awn-shaped with 2 denticles at the sides.

Kernels accrete to palea. Generally two flowers are present on each spikelet; however, researchers have reported up to five florets per

spikelet. At two to five spikelets per spike and one to three seeds per spikelet, one plant, without competition, can generate more than 100 spikes and ca. 3000 seeds. On average though, in a wheat crop, jointed goat grass will produce about 130 seeds per plant **(Devillers, Devillers-Teschuren, 1996).**This is a self-pollinating plant. Pollen grains are spherical, fine, and smooth. Blossoms in May; bears fruit in July. Autochore is in areas. Propagated is by seed. The most distinguishing characteristic is the 5-10 cm jointed cylindrical, seed head. 2n=28.

The overall distribution comprises the following geographical regions - Eastern Europe (south), Crimea, Caucasus, Middle Asia (south coastal areas of Balkhash, Dzungarian Ala Tau, Tarbagatai, Tien Shan, Pamir-Alai, and Kopet Dagh), Central Europe (south), Mediterranean region (east), and Asia Minor, Iran. Distribution in Samtskhe-Javakheti region - We have found large populations covering roadsides in Akhaltsikhe depression from Borjomi distr. up to Turkish border. The populations are very abundant **(Akhalkatsi, 2009).**

A. cylindrica is ephemeral winter-hard plant. It is drought-resistant, can grow in areas of less than 250-500 mm of annual precipitation. Salt is resistant. Grows is on open slopes with stony and fine-grained soils, sands and gravels, near roads and on weedy sites, sometimes in weeded meadows and mountain steppes; from the plains to the middle mountain zone, within the limits of 100-2000 m above sea level.

In Samtskhe-Javakheti occurs from 800 to 2000 m a.s.l. Seeds of jointed goat grass usually germinate from mid-September to November. Generally jointed goat grass seeds have an intermediate level of persistence, remaining viable in the soil for 3 to 5 years. The seeds are polymorphic, meaning that part of the seeds germinate early while the rest of the seeds may persist for several more years. Recently harvested seeds are still dormant, requiring a postharvest ripening before dormancy is broken.

Seed dormancy is directly related to how long the seed will survive in the soil. Field studies show that in drier areas of less than 350 mm of annual rainfall, jointed goat grass seeds will survive for a minimum of 5 years. Contrastingly, in regions with more annual rainfall seeds do not survive in the soil for longer than 3 or 4 years **(Ogg et al., 1998).** Threat assessment is no threats are detected currently and no necessity to protect this species occurs. *Ex situ* status - Seeds from different region of Georgia are present in seed banks of USDA, ICARDA, VIR,

IPK Gatersleben and Kew RBG. Seeds from Samtskhe-Javakheti are kept at the TBG&BI. *In situ* status is not protected. The plant is consumed well by all kinds of livestock before the fruiting phase. Yields are high-quality hay. Owing is to the similarity of *A. cylindrica* to the crop, *Triticum aestivum*. It may be used by wheat breeders in hybridization with wheat varieties. The hybrids with cultivated wheat are found in Meskhti near fields on road-sides.

A. cylindrica is secondary genetic relative for wheat used in molecular systematics to understand wheat phylogenetics and domestication events. It is used as gene source for disease resistance and pest resistance. Jointed goat grass is spread by seed dispersal only. Therefore, any method that reduces seed spread will reduce the spread of the plant.

Population disturbances and habitat fragmentation is expected when road construction works are undertaken. Maintain the current populations of *A. cylindrica* in Samtskhe-Javakheti region to declare it as plant of high conservation value by governmental organizations such as MEPNR. Reduce the decline of this species through appropriate habitat management and lagislative basis.

A. cylindrica should be declared as species of high economic value as secondary genetic relative for wheat, which contributed to the hexaploid wheat by D genome**.** The purpose of the plant is consumed as well as all types of cattle earlier phase. Income is level. Because of the similarity of *A. cylindrica* has *Triticum aestivum*- the harvest. May be used by wheat breeders and breeding of wheat varieties. Hybrids and cultivated with wheat fields can be found close to the Meskhetian road side.

A. cylindrica is secondary genetic relative of wheat used in the molecular structure and to understand, and the domestication of wheat pilogenetikis result.

It is used as a source of genes and disease resistance is the resistance. Current factors, the loss of which would reduce the spread of grass seed only manage. This is why, any method that reduces the spread of seed for sowing and reduces the spread of vegetation. Residents have violations and habitat fragmentation, most likely, when the road construction work is carried out. The territory where

A. cylindrica is distributed in Samtskhe-Javakheti does not needs special conservation measures to be undertaken. The conservation

measures of this species should be directed on establishment of ex situ seed collections and public education on importance of this plant as ancestor of the bread wheat. The local population and governmental bodies responsible for the nature protection should be informed about high conservation value of this species. This species is crossed with winter wheat producing viable hybrids. The genome is used in molecular systematic studies. The proposed action plan goals and objectives. The current population of the region to declare

A. cylindrica-on and make it as a plant of high conservation value governmental organizations, such as the Ministry of Environment.

This corresponds to a reduction of habitat management and legal basis. *A. cylindrica*-s policy and legislation must be declared species of high economic value, as a secondary genetic related species of wheat, which contributed to the wheat D genome hexaploids.

6.2.5. Code of Georgia: Vegetation of Pastures (62GE05)

Subalpine and alpine meadows are mainly used for summer pastures for sheep and livestock. Grass, sedge and polydominant grass-herbal meadows are characteristic to this type of vegetation. Grass-herbal communities are characterized by a great variety. Namely, in each community more than 30 species are presented.

We encounter grass-herbal meadows with the following dominant species: sheep fescue - *Festuca ovina,* colourful brome - *Bromopsis variegata,* Alpine meadow-grass - *Poa alpina,* crested hair-grass - *Koeleria caucasica,* and mat-grass - *Nardus stricta* or colourful fescue - *Festuca woronowii*. In this community the following are associated: butter cup - *Ranunculus oreophilus*, Ajara brome - *Bromopsis adjaricus,* sheep clover - *Trifolium ambiguum,* clover - *T. trichocephalum, T. alpestre,* mountain betony - *Stachys macrantha,* narcissus anemone - *Anemone albana,* Caucasian gentian - *Gentianella caucasea,* Alpine aster - *Aster alpinus,* Alpine timothy grass - *Phleum alpinus,* gentian-type Buxbaum's speed well - *Veronica gentianoides,* etc.

The following are dominant species in sedge meadows: sedge - *Carex humilis* an *C. brevicollis*; As for associated species, they are as follows: crested hair-grass – *Koeleria caucasica,* Caucasian decampane - *Inula glandulosa,* Alpine forget-me-not - *Myosotis alpestris,* sedge -

Carex tristis, Alpine meadow grass - *Poa alpina,* Alpine dropwort - *Phleum alpinum,* lousewort - *Pedicularis caucasica,* whitlow-grass - *Draba nemorosa,* mountain scabious - *Scabiosa caucasica,* checkweed - *Cerastium purpurescens,* etc.

The following are dominant species on meadows composed of herbs: sheep clover - *Trifolium ambiguum,* to which the following are associated: sedge - *Carex humilis,* Ajara brome - *Bromopsis adjaricus,* Alpine meadow-grass - *Poa alpina,* Arenaria - *Arenaria steveniana,* yarrow - *Achillea setacea,* oats - *Avena versicolor,* colourful brome - *Bromopsis variegata,* Fischer's cornflower - *Centaurea fischeri,* centaury - *Gentiana septemfida.* etc. Species participating in creating the polydominant various grass meadow are: sibbaldia - *Sibbaldia procumbens,* fox-tail - *Alopecurus vaginatus,* colourful brome - *Bromopsis variegata,* Alpine timothy grass - *Phleum alpinum,* sheep clover - *Trifolium ambiguum,* sheep fescue - *Festuca ovina,* lady-s bedstraw - *Galium verum,* mountain betony - *Stachys macrantha,* etc. Those represented on polydominant Alpine meadows are: sheep fescue - *Festuca ovina,* Alpine creeping cinquefoil - *Potentilla alpestris,* centaury - *Gentiana septemfida,* caraway - *Carum caucasicum,* hare's foot clover - *Trifolium repens,* Alpine aster – *Aster alpinus,* woodrush - *Luzula spicata,* creeping bellflower - *Campanula collina,* creeping cinquefoil - *Potentilla gelida,* etc. Indicator of degradation of pastures weed plant agaric is distributed on almost the whole territory of pastures. This is a poisonous plant which is not grased by domestic animals and, therefore, it is widely distributed on subalpine and alpine meadows.

Plants species: *Achillea setacea, Alopecurus vaginatus, Anemone albana, Arenaria steveniana, Aster alpinus, Bromopsis variegata, B. villosula, Campanula collina, Carex brevicollis, C. humilis, C. tristis, Carum caucasicum,Centaurea cheiranthifolia, Cerastium purpurescens Colpodium versicolor, Draba nemorosa, Festuca ovina, F. varia, Galium verum, Gentiana caucasica, G. septemfida, Inula glandulosa, Koeleria caucasica, Luzula spicata, Myosotis alpestris, Nardus stricta, Pedicularis caucasica, Phleum alpinum, Poa alpina, Potentilla alpestris, P. gelida, Ranunculus oreophilus, Scabiosa caucasica, Sibbaldia procumbens, Stachys macrantha, Trifolium ambiguum, T. trichocephalum, T. alpestre, T. repens, Veratrum lobelianum, Veronica gentianoides.*

6.2.5.1. Crop wild relatives (CWR) species Oats - *Avena* L., Poaceae

Crop wild relatives (CWR) are determined by the exchange of gene crops and germaplazma used agricultural crop domestication ancestor species. Family is Poaceae Barnh. Has genus *Avena* and it has total 8 species of oats are known in Georgia: 1. *Avena sterilis* L.; 2. *A. trichopylla* C. Koch; 3. *A. ludoviciana* Durieu; 4. *A. meridionalis* (Malz.) Roshev. (*A. fatua* subsp. *meridionalis* Malz.); 5. *A. fatua* L.; 6. *A. sativa* L.; 7. *A. barbata* Pott ex Link; 8. *A. eriantha* Durieu. Characteristics: *Avena barbata* Pott. ex Link - Slender oat; Taxonomy: Family Poaceae Barnhart., genus *Avena* L.; Synonyms: *Avena strigosa* subsp. *barbata* (Pott ex Link) Thell. (**Figure 29**).

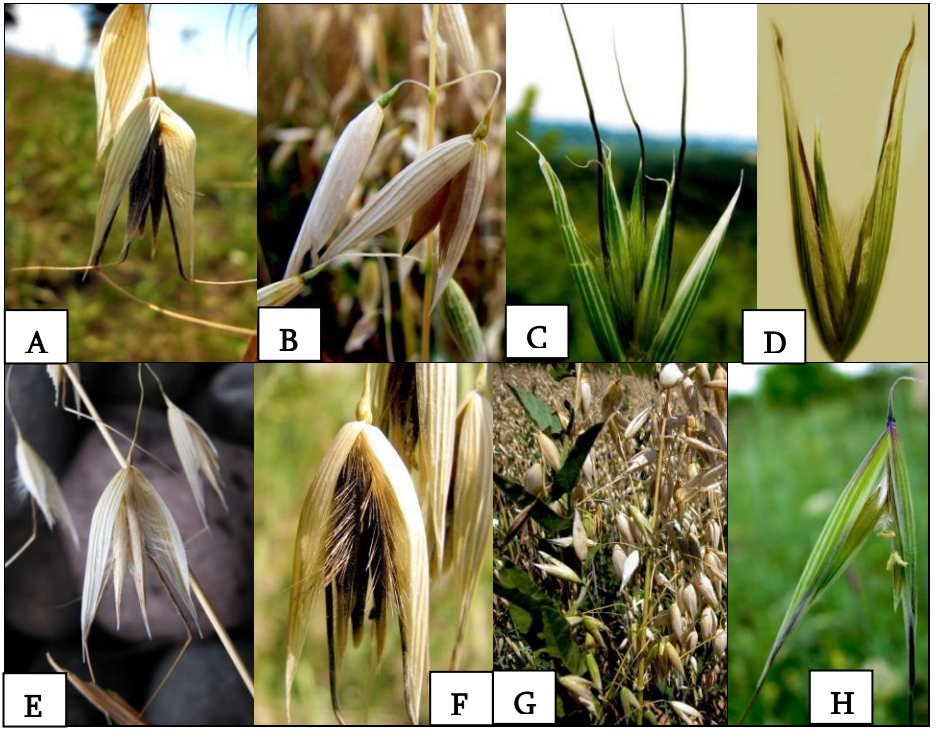


Figure 29. A. *Avena sterilis*; **B**. *Avena trichopylla*; **C**. *Avena ludoviciana*; **D**. *Avena meridianalis*; **E**. *Avena barbara*; **F**. *Avena. fatua*; **G.** *Avena sativa*; **H.** *Avena eriantha*. **Photo: Maia Akhalkatsi.**

4 wild species – *A. barbata*; *A. fatua*; *A. ludoviciana*; *A. meridionalis*; and cultivated *A. sativa*, are distributed in Samtskhe-Javakheti. Wild species are growing as weeds and in natural habitats and play big role in species formation processes (**Akhalkatsi, 2009; Akhalkatsi, 2015b).**

Two species of oats – *A. fatua* and *A. ludoviciana* are considered as close relatives of cultivated oats on the base of chromosome number and species specific fungal disease. These species are weedy plants mixed with grain corns in the field. *A. barbata* and *A. sterilis* form separate group and are considered as well as close relative plants of *A. sativa*.

They differ by chromosome number and fungal species but play a role in formation of different varieties of oats by hybridization with cultivated species. We have found representatives of both groups both in Meskheti and Javakheti. Population of *A. barbata* occurs on dry rocky slope near v. Atskuri. Number of individuals is not high, total 12 plants have been found.

They are well developed and form normal seeds. Grazing impact was low. Although, the location is under anthropogenic pressure and might cause diminishing of individual number. Seeds should be collected and kept in the seed banks. *A. fatua* and *A. ludoviciana* were found on Javakheti Plateau (**Figure 30**).

These plants were remained on field margins after mowing of wheat field. There were not yet having ripe seeds and were well developed. Populations were not threatened and were spread all along the edges of the fields. Seeds of both species should be collected and kept in the seed bank. Annual is herb and stems glabrous, (35) 40-100 cm tall. Panicle diffuse, 6.0-25.0 cm long.

Spikelets 2.0-3.0 cm long, 2 flowers per spikelet. Spikelet's axis fragile, articulated under each flower in the spikelet. Glumes are equal to each other in size and have 9-10 ribs.

Lemma is hairy (or, more rarely, glabrous) with two thin awns, 1.5-6.0 mm long, at the top and one thick, articulate awn at the back. Self is pollinated. Blossoms in April-May; seeds ripen June-July. The seed ripens in the latter half of summer and, when harvested and dried, can store for several years. 2n = 24, 28, 32.

The overall distributions are in Crimea, Caucasus, and Turkmenia. Distribution is in Samtskhe-Javakheti region. Only one population have

been found in Akhaltsikhe distr., v. Atskuri. Occurs is on stony slopes, in loams, in sands, in meadows, along riversides and as a ruderal plant in fields. Also occurs in plains and at the lower mountain level and in cultivated beds.

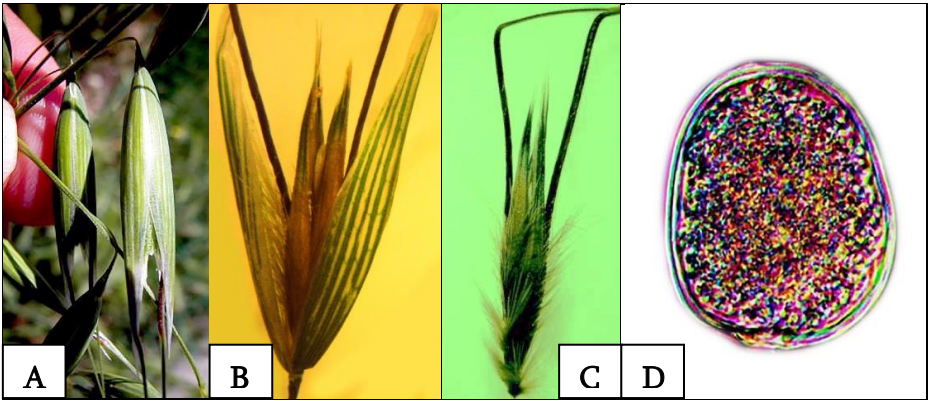


Figure 30. A.B.C. Flowers of *Avena fatua*; **D.** Pollen of *Avena fatua* has length of the horizontal height as 41-45 μm and distanth height as 52-55 μm. **Photo: Maia Akhalkatsi.**

It is in flower from June to July, and the seeds ripen from August to October. The flowers are hermaphrodite and it has both male and female organs and is pollinated by wind. The plant prefers light, medium and heavy soils, requires well-drained soil and can grow in heavy clay soil.

The plant prefers acid, neutral and basic soils. It cannot grow in the shade. It requires dry or moist soil and can tolerate drought.

Succeeds is in any moderately fertile soil in full sun. A triploid species, it is rarely cultivated for its edible seed. Oats are in general easily grown plants but, especially when grown on a small scale, the seed is often completely eaten out by birds.

Some sort of netting seems to be the best answer on a garden scale. Seed - sow in situ in early spring or in the autumn. Only just cover the seed. Germination should take place within 2 weeks. Threat assessment is no threats have been determined.

Ex situ status - The seeds are collected and kept in in seed banks of USDA, ICARDA, VIR, IPK Gatersleben and Kew RBG. Seeds from Samtskhe-Javakheti are kept at the TBG&BI. *In situ status* - No protected area are established to defence this species.

Wild relative of cultivated *Avena sativa* L. Used in breeding programs and can be crossed successfully with *A. sativa* to produce fertile hybrids resistant to all types of downy mildew. Seed - cooked.

Rather small. The seed has a floury texture and a mild, somewhat creamy flavour. It can be used as a staple food crop in either savoury or sweet dishes.

The seed can be cooked whole, though it is more commonly ground into flour and used as a cereal in all the ways that oats are used, especially as porridge but also to make biscuits, sourdough bread etc. The seed can also be sprouted and eaten raw or cooked in salads, stews etc.

The roasted seed is a coffee substitute. The straw has a wide range of uses such as for bio-mass, fibre, mulch, paper-making and thatching.

Some caution is advised in its use as mulch since oat straw can infest strawberries with stem and bulb eelworm. Grazing and road construction works in Samtskhe-Javakheti represent threats to this species. No actions currently are undertaken.

Proposed action plan objectives and targets:

1. Maintain the current populations of *A. barbata* in Samtskhe-Javakheti region.

2. Reduce the decline of this species through appropriate habitat management.

A. barbata should be declared as species of high economic value as genetic ancestor for cultivated oat**.** Site is located along highway and represents threat to the survival of the species.

The territories near roads should be assigned with special markers indicated the importance of a species. *Ex situ* conservation of this species will be effective to collect seeds and keep in seed banks.

The local population and governmental bodies responsible for the nature protection should be informed about high conservation value of this species. Future research should be done to discover new populations of this species in the region.

7. RAISED BOGS AND MIRES AND FENS

Vegetation of marshes is typical to Georgia. It covers approximately 200 hectares of the area. Marshes are especially typical on the Kolkheti lowland. However, it also occupies many areas on the volcanic upland of Javakheti and the Alpine zone in whole Caucasus. The majority of marshes is eutrophic; meso- and oligotrophic marshes are limited in the amount. Complexes of marsh vegetation are distributed on a large area of Kolkheti lowland that consists of a variety of phytocoenosis of marshy and sphagnum-herbaceous bogs. They are developed on peat covering of various capacities the depth of which is 10-12 meters in certain places **(Kimeridze, K. 1961; 1985; Kimeridze, M. 2007; Matchutadze et al., 2015).**

7.1. Meso-oligotrophic marshes with sphagnum - *Sphagnum palustre* L. (7110*)

Peaty marshes are typical on the Kolkheti lowland. However, oligotrophic peaty marshes are found on the rocky places of the subalpine zone. Vertical distributed of peaty marshes in west Georgia involves all the altitudes from the sea level to the subalpine zone. Peat marshes in the alpine zone are rare due to severe climatic conditions. However, peaty marshes in eastern Georgia can be found only above 2000 meters due to aridity of the climate.

Peaty marshes of Kolkheti are area unique biogeographical phenomenon on the whole Eurasian continent both with the terms and peculiarities of developing marshes and geobotanical contents of modern vegetation. It has a great scientific value and practical importance.

Meso-oligotrophic peaty marshes are found only in west and South Georgia. They are mainly found in the pine and fir forests and moderately moist beech forest. The following obligatory halophites are characteristic: *Scheuchzeria palustris, Carex flava, Viola palustris, Cardamine seidlitziana, Heracleum apiifolium, Sredinskya grandis, Rhynchospora alba, Drosera rotundifolia, D. intermedia, D. anglica.*

Marsh vegetation characteristic to North Eurasia is distributed in the seaside region of Ajara. For example, in Kobuleti surroundings

there are Ispani I and Ispani II. Here, in the space covered with peat moss shrubs and ferns are spread: *Rhododendron ponticum, Rh. luteum, Vaccinium arctostaphylos, Frangula alnus, Osmunda regalis,* etc. The orchid characteristic to Eurasian marshes *Spiranthes amoena* is found. The following can be found from endemic species: *Hibiscus ponticus, Heracleum apiifolium, Rhynchospora caucasica, Scirpus colchicus, Sredinskya grandis, Carex szovitsii, Cardamine seidlitziana, Primula luteola, Siphonostylis lazica, Oenanthe abchasica, Pycreus colchicus*, and *Swertia iberica.*

On Ispani I and Ispani II marshes the Imeretian sedge is quite distributed. It is created by high growing grasses - *Molinia litoralis.* This formation is quite varied typologically and is frequently associated with peat moss. It is distributed on the relatively small slopes with dominating sedge - *Carex lasiocarpa.* This sedge is typologically the same on Kobuleti marshes. In the described formation obligate halophytes - *Rhynchospora caucasica, Rhynchospora alba,* several species of peat moss, etc. participate with enough majority. On the peaty marsh of Kobuleti *Sphagnum imbricatum* and *Sphagnum palustre* mainly create sphagnum bogs. Some other species can be rarely found but their cenotic importance is relatively limited. On the total cover created by sphagnum species mainly sinusien of herbal plants are developed. Main components of this sinusia are: *Molinia litoralis, Rhynchospora caucasica, Carex lasiocarpa,* etc. *Drosera rotundifolia, Osmunda regalis, Menyanthes trifoliata, Rhynchospora alba* etc.are more rarely found.In some places there are such shrubs, as azalea *Rhododendron luteum,* Pontic rhododendron *Rhododendron ponticum, Frangula alnus,* and shrubbed *Alnus barbata,* etc.

Scrub-sphagnum bogs are represented on small area plots and developed on embossed surfaces of peat. Community Sphagnum (auriculatum, palustre) caricosum is situated in the peaty massive of Churia. *Sphagnum auriculatum, Sphagnum palustre, Carex acutiformis, Carex lasiocarpa, Rhynchospora alba, Potentilla erecta, Lycopus europaeus, Holcus lanatus, Scutellaria galericulata, Galium palustre, Calystegia silvatica, Succisella inflexa, Eupatorium cannabinum, Centaurium erythraea, Lysimachia vulgaris, Stachyspalustris, Cladium mariscus, Thelypteris palustris, Hydrocotyle vulgaris, Hypericum tetrapterum.*

Plants species: *Alnus barbata, Calystegia silvatica, Canrdamine seidlitziana, Carex acutiformis, Carex flava, C. lasiocarpa, C. szovitsii, Centaurium erythraea, Cladium mariscus, Drosera rotundifolia, D. intermedia, D. anglica, Eupatorium cannabinum, Frangula alnus, Galium palustre, Heracleum apiifolium, Hibiscus ponticus, Holcus lanatus, Hydrocotyle vulgaris, Hypericum tetrapterum, Lycopus europaeus, Lysimachia vulgaris, Menyanthes trifoliata, Molinia litoralis, Oenanthe abchasica, Osmunda regalis, Potentilla erecta, Primula luteola, Siphonostylis lazica, Pycneus colchicus, Rhododendron luteum, R. ponticum, Rhynchospora alba, R. caucasica, Scheuchzeria palustris, Scirpus colchicus, Scutellaria galericulata, Sphagnum auriculatum, S. imbricatum, S. palustre, Sredinskya grandis, Stachys palustris, Succisella inflexa, Swertia ibenica, Thelypteris palustris, Vaccinium arctostaphylos, Viola palustris.*

7.1.1. Endemic plant species Ladies tresses - *Spiranthes amoena* L., Orchidaceae

Indicator species is *Spiranthes amoena* that respond quickly to changes in the environment of all. Critically endangered orchid *Spiranthes amoena* is growing in the peat bog Ispani in the proximity of Kobuleti, Adjara, Georgia (**Akhalkatsi et al., 2004).**

This population is located far from natural area of species distribution. It is spread in Japan, Korea, Mongolia, Kazakhstan, China, Far East, Siberia, and the closest population to Georgia is located in Carpathians. In spite of this, the first finding was done in Georgia in the Batumi Botanical Garden among *Miscanthus sinensis* thickets by A.A. Dmitrieva in 80th. She identified it as *Spiranthes sinensis* (Pers.) Ames. and included in the 2nd edition of Identification Key to the Plants of Adjara (1990). In September 2001 Georgian botanist I. Matchutadze together with German colleagues discovered two wonderful populations of this plant in the peat bogs Ispani I and Ispani II **(Figure 31).**

The collected specimen from 25 September 2001 has been identified as *Spiranthes amoena* (M. Bieb.) Spreng. by R. Lorenz and H. Bauman. Ispani peat bog is third big in Georgia after Imnati and Nabada. It comprises 848 ha and is composed by two bogs – Ispani I and II. Ispani II is awarded the Ramsar Site Category and is protected.

Ispani I is more degraded. There are some drainage canals in the surrounding.

However, the natural vegetation is preserved quit well. The peat is created by mosses belonging to genus *Sphagnum* representing by three species in this bog - *S. imbricatum, S. papillosum* and *S. acutifolium*. They form convex outgrowths, which are more representative in Ispani II. Mosses are mixed with other plant species. Dominant species are *Juncus acutus, J. effusus* and *Molinia litoralis*. Shrubs are represented by - *Frangula alnus, Rhododendron luteum, R. ponticum, Vaccinium arctostaphylos,* etc. Trees are Elm (*Alnus barbata*) and pine (*Pinus pinaster*). There are many endemic and rare wetland species *Rhynchospora caucasica, Sisyrinchium septentrionale, Scirpus colchicus, Hibiscus ponticus, Pycreus colchicus,* etc. The most fascinating plant occurring in Kolkhic peat bogs is insectivorous *Drosera rotundifolia*.

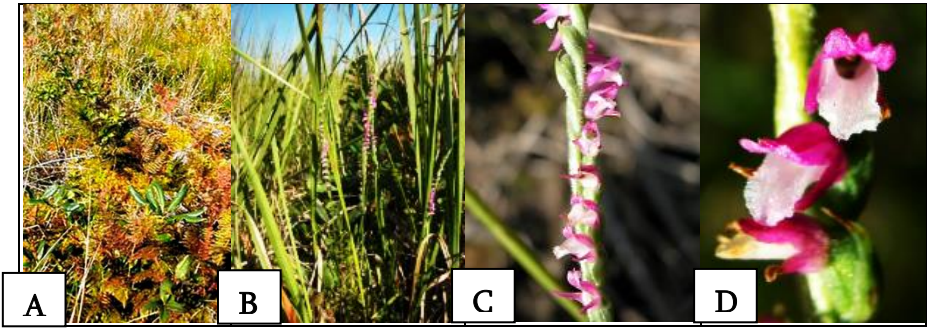


Figure 31. A. B. C. D. *Spiranthes amoena* is in the Ispani I and II marshes in Adjara. This species is quite distributed and this remains in the Kolkheti lowland. **Photo: Maia Akhalkatsi.**

The fact, that *Spiranthes amoena* is growing in Georgia isolated by thousands of kilometers from its natural area of distribution raises a question on the origin of this population. There are two hypotheses explaining their possible origin. According to one, the plants found in Ispani bogs might be invasive originated from seeds distributed from the introduced *Spiranthes* plants from the Batumi Botanical Garden.

The problematic here is that even this plant is firstly found on the territory of Botanical Garden, there is no information about introduction of this species.

The second hypothesis is considering these populations as natural. It is noteworthy, that Ispani peat bog shows many similarities to North Eurasian turf bogs by species composition. On the basis of this fact, it is considered to be a refugium remained unchanged over a period of glaciation.

Confirmation to this hypotheses might serve the occurrence of some paleo-arctic and boreal relic species such as *Osmunda regalis, Calluna vulgaris, Vaccinium arctostaphylos, Drosera rotundifolia,* etc. However, independent on the character of origin of this endangered wetland orchid the efforts should be undertaken to insure its conservation.

The main causes of orchid species rarity in Georgia, as in many other countries, originate from the narrowness and regression of natural habitats. Recent changes in traditional agro-pastoral practices in Georgia leading to an uncontrolled overgrazing of not only meadows but also of woody and shrubbery habitats induce a severe loss of orchid diversity.

Drainage and conversion of wetlands has also been a cause of a dramatic regression of many wetland orchid populations, such as *Epipactis palustris, Dactylorhiza iberica, Orchis pseudolaxiflora* and *Spiranthes amoena,* all belonging to rare species. The climate change, which might be considered as a global anthropogenic impact, exerts a definite negative influence on upon the orchid wetland habitats due to increased droughts.

The complexity in identifying threats is combined with the lack of reliable information as to how conservation measure should be applied. Orchids are habitat dependent organisms due to their complex relations to fungi and insects. Therefore, habitat disturbances exert a much more severe impact on orchids as compared to other plants.

It is noteworthy, that orchid habitats mainly have a high naturalistic value and contain a great number of other threatened rare plants. Orchids are often considered as indicators of the ecological health of a biotope.

In consequence, natural orchid habitats have been given the high priority from the conservation point of view. Special attention should

be paid to protect the typical habitats of endangered species such as wetlands.

All wetland orchids should be considered as endangered because of the high risk of its habitat disturbance due to agricultural cultivation and urbanization. Moreover, orchid species native to Georgia are not yet protected.

They are not included even in the **Red Data Book of the Georgia (1982)**. Therefore, it is necessary to take effective steps for their conservation.

7.2. Code of Georgia: Tall grass marshes (70GE01*)

Tall grass marshes can be found on the Kolkheti valley and volcanic upland of South Georgia. The upper margin of distribution is 2000 meters a.s.l..

Sub-types (70GE01-01): *Phragmites communis* - reed bed where *Phragmites australis* dominates; other species are - *Juncus acutus, Typha angustifolia, Scirpus lacustris* (*Schoenoplectus lacustris*), *Echinochloa crusgalli* (on dry hard clod of earth).

Sub-types (70GE01-02): *Typheta angustifoliae* – The dominant species of the marsh overgrown with reedmace are *Typha latifolia, T angustifolia* or *T. laxmanii.* Community of Typhetum angustifoliae Purum is found in the great peat marsh placed in the east of Paliastomi Lake. The contents of species are - *Carex acutiformis, Galium palustre, Iris pseudacorus, Lycopus europaeus, Lysimachia vulgaris, Phragmites australis, Scutellaria galericulata, Sphagnum auriculatum, Typha angustifolia.* In the nearby territory of Kulevi terminal, especially, on the banks of river Khobi the thick undergrowth (*Typha latifolia, T. angustifolia*) of marsh overgrown with reedmace is distributed. They are not of a big size and can be encountered sporadically.

Sub-types (70GE01-03): *Schoenoplecteta – Schoenoplectus lacustris* or *S. tabennaemontani* is observed in bulrush. It is characterized by high grass but less density. The height of the grass of bulrush community - Schoenoplectetum lacustris purum exceeds 2 meters.

Sub-types (70GE01-04): *Cladieta marisci* - *Cladium mariscus* dominates in Mariskusiani and can be observed in lowland places. The upper margin of its distributed is 800 meters a.s.l.. *Cladium mariscus*-

Carex acutiformis community is found in big peat marshes located in the east of the Paliastomi Lake (near the lake side). Species include - *Alnus barbata, Calystegia silvatica, Carex acutiformis, Carex lasiocarpa, Hibiscus ponticus, Inula aspera, Juncus articulatus, Lycopus europaeus, Mentha aquatica, Molinia litoralis, Phragmites australis, Sphagnum palustre, Stachys palustris, Typha angustifolia.*

Sub-types (70GE01-05): The groups with the following are rare: *Phalaroides arundinacea* and *Glyceria arundinacea*.

Plants species: *Alnus barbata, Calystegia silvatica, Carex acutiformis, C. lasiocarpa, Cladium mariscus, Echinochloa crusgalli, Galium palustre, Glyceria arundinacea, Hibiscus ponticus, Inula aspera, Iris pseudacorus, Juncus acutus, J. articulatus, Lycopus europaeus, Lysimachia vulgaris, Mentha aquatica, Molinia litoralis, Phalaroides arundinacea, Phragmites australis Schoenoplectus lacustris, S. tabennaemontani, Scirpus lacustris* (*Schoenoplectus lacustris*), *Scutellaria galericulata, Sphagnum auriculatum, S. palustre, Stachys palustris, Typha angustifolia, T. latifolia, T. laxmanii.*

7.2.1. The economically potential species and medicinal plants Lesser Bulrush – *Typha angustifolia* L., Typhaceae

The economically potential species of *Typha angustifolia* is recreational, ornamental and medicinal plants and other. Habitats have water up to 15 cm deep, avoiding acid conditions. Often somewhat brackish or sub saline water or wet soil in Georgia, growing from sea level to elevations of 1900 metres **(Akhalkatsi, Tarkhnishvili, 2012; Figure 32).**

Typha angustifolia is a PERENNIAL growing to 3 m by 3 m. It is in flower from Jun to July. The flowers are monoecious and individual flowers are either male or female, but both sexes can be found on the same plant and are pollinated by Wind. It is noted for attracting wildlife. Suitable for: light, medium and heavy soils. Suitable pH: acid, neutral and basic soils. It cannot grow in the shade. It prefers wet soil and can grow in water **(Durnikin, Eremina, 2015).**

Edible uses are as oil, flowers, leaves, oil, pollen, root, seed and stem. Roots are raw or cooked.

Figure 32. A. *Typha angustifolia* is medicinal plants and habitat is tall grass marshes in the Kolkheti valley and volcanic upland of South Georgia; **B.** The leaf and flower are different and has much pollen; **C.** Pollen of *Typha angustifolia* has length of the horizontal height as 20-30 μm. **Photo: Maia Akhalkatsi.**

They can be boiled and eaten like potatoes or macerated and then boiled to yield sweet syrup. The roots can also be dried, ground into a powder and then used as a thickener in soups etc or added to cereal flours. Rich in protein, this powder is used to make biscuits etc. Young shoots in spring - raw or cooked. An asparagus substitute. Base is of mature stem - raw or cooked. It is best to remove the outer part of the stem. Young flowering stem - raw, cooked or made into a soup. It tastes like sweet corn. Seed - cooked. The seed is very small and fiddly to harvest, but it has a pleasant nutty taste when roasted. Edible oil is obtained from the seed. Due to the small size of the seed this is probably not a very worthwhile crop. Pollen is raw or cooked. A protein rich additive to flour used in making bread, porridge etc. It can also be eaten with the young flowers, which makes it considerably easier to utilize. The pollen can be harvested by placing the flowering stem over a wide but shallow container and then gently tapping the stem and brushing the pollen off with a fine brush. This will help to pollinate the plant and thereby ensure that both pollen and seeds can be harvested.

Medicinal uses are: anticoagulant, diuretic, emmenagogue, haemostatic, lithontripic, and miscellany. The pollen is diuretic, emmenagogue and haemostatic. The dried pollen is said to be

anticoagulant, but when roasted with charcoal it becomes haemostatic. It is used internally in the treatment of kidney stones, internal haemorrhage of almost any kind, painful menstruation, abnormal uterine bleeding, post-partum pains, abscesses and cancer of the lymphatic system. It should not be prescribed for pregnant women. Externally, it is used in the treatment of tapeworms, diarrhoea and injuries. An infusion of the root has been used in the treatment of gravel. The stems and leaves have many uses, they make a good thatch, can be used in making paper, can be woven into mats, chairs, hats etc. They are a good source of biomass, making an excellent addition to the compost heap or used as a source of fuel etc. The hairs of the fruits are used for stuffing pillows etc. They have good insulating and buoyancy properties. The female flowers make excellent tinder and can be lit from the spark of a flint. The pollen is highly inflammable and is used in making fireworks. This plants extensive root system makes it very good for stabilizing wet banks of rivers, lakes etc.

A very easily grown plant, it grows in boggy pond margins or in shallow water up to 15 cm deep. It requires a rich soil if it is to do well. Succeeds is in sun or part shade. A very invasive plant spreading freely at the roots when in a suitable site, it is not suitable for growing in small areas. Unless restrained by some means, such as a large bottomless container, the plant will soon completely take over a site and will grow into the pond, gradually filling it in. This species will often form an almost complete monoculture in boggy soil. The dense growth provides excellent cover for water fowl. Seed of *Typha angustifolia* is surface sow in a pot and stand it in 3 cm of water. Pot up the young seedlings as soon as possible and, as the plants develop, increase the depth of water. Plant out in summer. Division is in spring. Very easy, harvest the young shoots when they are about 10-30 cm tall, making sure there is at least some root attached, and plant them out into their permanent positions.

7.3. Code of Georgia: Low grass marshes (70GE02*)

Low grass swamps are distributed up to 2300 meters a.s.l.. Communities with the horse tail - *Equisetum heleocharis, E. palustris, E. ramosissimum* dominate in the lowland and low zone of the mountain. *Hyppuris vulgaris* is a rare obligatory hellophyte.

Sparganium erectum (*S. polyedrum*) or *S. simplex* creates the most widely distributed community. *Butomus umbellatus* is rare in various places of Georgia. On Javakheti upland there is Equisetetum palustrae purum, which is developed around the surface flowing water. The substrate is with silt. The composition of species is as follows - *Equisetum palustre, Juncus articulatus, J. inflexus, Carex acuta, C. rostrata (=C. inflata), Ranunculus repens, Heleocharis palustris.*

Sub-types (70GE02-01): *Iriseta pseudacorus* – iris growth is observed in peaty massifs of Maltakva, to the west of river Gurinka. There is water between emery stone. Fragments of pure reedbed are developed on relatively more watery peaty places. On smaller plots dominates reedmace *Typha angustifolia*. The species are - *Angelica adzharica, Calystegia silvatica, Carex acutiformis, Galium palustre, Holcus lanatus, Iris pseudacorus, Lycopus europaeus, Molinia litoralis, Phragmites australis, Scrophularia nodosa, Stachys palustris, Typha angustifolia.*

Sub-types (70GE02-02): *Sparganieta polyedris* – the bur reed community is found in village Grigoleti surroundings. The following species are: *Butomus umbellatus, Iris pseudacorus, Lemna minor, Potamogeton pectinatus, Sagittaria sagittifolia, Salvinia natans, Sparganium erectum* (*S. polyedrum*), *Trapa colchica, Typha angustifolia.*

Sub-types (70GE02-03): *Cypereta longus* – in Kulevi surroundings are found together with sedge groupings - *Cyperus badius, C. longus, Scirpus lacustris, S. tabaernemontani, Juncellus serotinus.*

Sub-types (70GE02-04): *Bolboschoeneta maritimae* – seaclub-rush (*Bolboschoenus maritimus*) is commonly found in Kolkheti, on the sea side. The sensus is made in the surroundings of Kulevi.

Sub-types (70GE02-05): *Schoenoplecteta triqueter* – low bull rush is found in Maltakva surroundings, Kaparchina coast, and the peat-sandy substrate with temporary standing water. Species are- *Echinochloa crusgalli* (on dry hard clods of land), *Juncus acutus, Phragmites australis, Scirpus lacustris* (*Schoenoplectus lacustris*), *S. triqueter (Schoenoplectus triqueter), Typha angustifolia*

Sub-types (70GE02-06): *Leersieta orizoides* community dominant species is rice-like leersia - *Leersia oryzoides.* It is the type of the grass. It is distributed in Europe, Azia and America. It is a perennial plant

with the root with the hight of 1-1.5 meters. Leaves are of 28 cm long with thinly dentate leaves. It is extremely rare in high-grass marshes of Kolkheti. The species are - *Bidens tripartita, Carex acuta, Echinochloa crusgalli, Mentha arvensis, Oenanthe aquatica, Sagittaria sagittifolia, Sium latifolium, Sparganium erectum, Trapa colchica, Xanthium strumarium.*

Plants species: *Angelica adzharica, Bidens tripartita, Bolboschoenus maritimus, Butomus umbellatus, Calystegia silvatica, Carex acuta, C. acutiformis, C. rostrata (C. inflata), Cyperus badius, C. longus, Echinochloa crusgalli, Equisetum heleocharis, E. palustris, E. ramosissimum, Galium palustre, Heleocharis palustris, Holcus lanatus, Iris pseudacorus, Juncellus serotinus, Juncus acutus, J. inflexus, J. articulatus, Leersia oryzoides, Lemna minor, Lycopus europaeus, Mentha arvensis, Molinia litoralis, Oenanthe aquatica, Phragmites australis, Potamogeton pectinatus, Ranunculus repens, Sagittaria sagittifolia, Salvinia natans, Scirpus lacustris* (*Schoenoplectus lacustris*), *S. triqueter (Schoenoplectus triqueter), S. tabaernemontani, Scrophularia nodosa, Sium latifolium, Sparganium erectum* (*S. polyedrum*), *S. simplex, Stachys palustris, Trapa colchica, Typha angustifolia, Xanthium strumarium.*

7.3.1. The economically potential species and medicinal plants yellow flag –*Iris pseudacorus* L., Iridaceae

The economically potential species *Iris pseudacorus* is recreational, ornamental and medicinal plants and other. Habitats: Damp marshy areas, swampy woods and in shallow water or wet ground on the edges of rivers and ditches. Often found in shady places. Europe, including Britain, from Norway south and east to N. Africa the Caucasus and W. Asia. This species is oriented to waters (**Figure 33**).

Iris pseudacorus is a PERENNIAL growing to 1.5 m by 2 m at a medium rate. It is in flower from May to July. The flowers are hermaphrodite and it has both male and female organs and is pollinated by Bees, hoverflies.The plant is self-fertile. Suitable for: light and medium soils. Suitable pH: acid, neutral and basic soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist or wet soil and can grow in water. The plant can tolerate strong winds but not maritime exposure.

Figure 33. A. *Iris pseudacorus* is oriented to water in v. Shilda; **B.** *Iris pseudacorus* is medicinal plants. **Photo: Maia Akhalkatsi.**

Medicinal uses are – astringent, cathartic, emetic, emmenagogue and odontalgia. The fresh root is astringent, cathartic, emetic, emmenagogue and odontalgic. A slice of the root held against an aching tooth is said to bring immediate relief. It was at one time widely used as a powerful cathartic but is seldom used nowadays because of its extremely acrid nature. It can also cause violent vomiting and diarrhoea. When dried the root loses its acridity and then only acts as an astringent. Other uses are dye, essential, ink and tannin. A beautiful yellow dye is obtained from the flowers.

A good black dye is obtained from the root if it is mixed with iron sulphate. It is brown otherwise. The root is a source of tannin and has been used in making ink. A delicately scented essential oil, obtained from the roots, has been used to adulterate the oil of Acorus calamus. Container and specimen are with this species. Prefers is a humus rich soil. Succeeds is in water up to 15 cm deep. Requires is a moist soil, especially in early summer. Prefers is a position in semi-shade. Plants can be grown in quite coarse grass, which can be cut annually in the autumn. A delicately scented essential oil is obtained from the dried roots. Members of this genus are rarely if ever troubled by browsing deer or rabbits. Some named forms have been selected for their ornamental value. Special Features: Attractive foliage, Not North American native, Invasive, Naturalizing, All or parts of this plant are poisonous, Wetlands plant, Attracts butterflies, Suitable for cut flowers. Seed of *Iris pseudacorus* is best sown as soon as it is ripe in a cold

frame. Stored seed should be sown as early in the year as possible in a cold frame. A period of cold stratification improves germination time and rates. Prick out the seedlings into individual pots when they are large enough to handle and grow them on in the greenhouse or cold frame for their first year (**Wilson, 2001**). Plant out into their permanent positions in late spring or early summer. Division is in March or October. Early autumn is best. Very easy, larger clumps can be replanted direct into their permanent positions, though it is best to pot up smaller clumps and grow them on in a cold frame until they are rooting well. Plant them out in the spring.

7.4. Code of Georgia: Tussock sedge wetlands (70GE03*)

Tussock sedge swamps are distributed on seaside wet sandy ground, lagoons, channels and river sides the level of water of which varies according to the season and waters. Sedges are represented by many communities: *Cariceta dichoandrae, Cariceta acutiformis, Cariceta elatae, Cariceta caespitosae, Cariceta wilnicae* and *Magnojunceta*. *Cariceta elatae* is very rare, as well as *Cariceta caespitosae* which is found on the Javakheti high land at the height of 2000-2100 meters and Ajara mountains. *Magnojunceta* is different from tussock sedge swamps. *Juncus effusus* or *J. inflexus* dominate here. Prickly-ivy rush Juncetum acutae purum is found in Maltakva region with the following species - *Echinochloa crusgalli* (on emery stones), *Juncus acutus, Phragmites australis, Scirpus lacustris* (*Schoenoplectus lacustris*), and *Typha angustifolia.*

Sub-types (70GE03-01):*Cariceta acutiformis*-emery stone - sedge. Bush-grass is mainly settled on emery stone. The mentioned sedge is related with alder grove, which is scrubbed, on a better provided rough peat substrate. In certain parts of the association there are the following plants besides the mentioned ones: *Carex lasiocarpa, Centaurium erythraea, Potentilla erecta, Rhynchospora caucasica,* etc. Caricetum acutiformis varioherbosum community is in Kulevi peat massive, on the wide coast of a lake. Composition of species - *Alisma plantago-aquatica, Alnus barbata, Calamagrostis epigeios, Calystegia silvatica, Carex acutiformis, Galium palustre, Hibiscus ponticus, Hydrocotyle vulgaris, Hypericum tetrapterum, Inula aspera, Iris pseudacorus, Juncus effusus, Lycopus europaeus, Mentha aquatica, Osmunda*

regalis, Phragmites australis, Sphagnum auriculatum (on emery stone) *Stachys palustris, Typha angustifolia.*

Sub-types (70GE03-02): *Junceta effuses* is described in the eastern part of prickly Palistomi Lake. The species are: *Alnus barbata, Calamagrostis epigeios, Carex acutiformis, C. lasiocarpa, Drosera rotundifolia, Holcus lanatus, Juncus effusus, Menyanthes trifoliata, Molinia litoralis, Potentilla erecta, Sphagnum palustre, Thelypteris palustris.* In Kulevi the community of this type consists of the following species - *Juncus effusus, Scirpus lacustrum, Alnus barbata, Hydrocotyle* sp., *Galium palustre, Leucojum aestivum, Polygonum hydropiper,* and *Iris pseudacorus.*

Sub-types (70GE03-03): *Junceta acutae* Prickly is rush. Juncetum acutae purum is near Maltakva and on the bank of river Kaparchina. The following are noteworthy from the species - *Echinochloa crusgalli* (on emery stone), *Juncus acutus, Phragmites australis, Scirpus lacustris* (*Schoenoplectus lacustris*), and *Typha angustifolia.*

Plants species: *Alisma plantago-aquatica, Alnus barbata, Calamagrostis epigeios, Calystegia silvatica, Carex acutiformis, C. lasiocarpa, Centaurium erythraea, Drosera rotundifolia, Echinochloa crusgalli, Galium palustre, Hibiscus ponticus, Holcus lanatus, Hydrocotyle vulgaris, Hypericum tetrapterum, Inula aspera, Iris pseudacorus, Juncus acutus, J. effusus, J. inflexus, Leucojum aestivum, Lycopus europaeus, Mentha aquatica, Menyanthes trifoliata, Molinia litoralis, Osmunda regalis, Phragmites australis, Polygonum hydropiper, Potentilla erecta, Rhynchospora caucasica, Scirpus lacustris* (*Schoenoplectus lacustris*), *Sphagnum auriculatum, Sphagnum palustre, Stachys palustris, Thelypteris palustris, Typha angustifolia.*

7.4.1. The economically potential species and medicinal plants round-leaved sundew - *Drosera rotundifolia* L., Droseraceae

The economically potential species *Drosera rotundifolia* is recreational, ornamental and medicinal plants and other. Habitats: Wet and moist places in poor peaty soils, occasionally forming a floating fringe on small ponds. Europe, including Britain but excluding he Mediterranean, Caucasus, N. Asia, N. America. It is in the Ispani I and II marshes in Adjara (**Figure 34**).

Figure 34. A.B.C. *Drosera rotundifolia* is in the Ispani I and II marshes in Adjara. This species is quite distributed and this remains in the Kolkheti lowland. **Photo: Maia Akhalkatsi.**

Drosera rotundifolia is an evergreen perennial growing to 0.1 m by 0.1 m at a slow rate. It is in leaf 12-Jan. It is in flower from Juli to August. The flowers are hermaphrodite (have both male and female organs) and are pollinated by Self.

The plant is self-fertile. Suitable for: light (sandy) and medium (loamy) soils and can grow in nutritionally poor soil. Suitable pH: acid, neutral and basic (alkaline) soils and can grow in very acid soils. It cannot grow in the shade. It prefers moist or wet soil. Medicinal uses are antibacterial, antibiotic, antispasmodicm, demulcent, expectorant, Homeopathy, hypoglycaemic and warts. The sundew has a long history of herbal use, having been popular for its fortifying and aphrodisiac effects. It relaxes the muscles of the respiratory tract, easing breathing and relieving wheezing and so is of great value in the treatment of various chest complaints **(Bekesiova et al., 1999).**

The plant has become quite rare and so it should not be harvested from the wild. The flowering plant is antibacterial, antibiotic, antispasmodic, antitussive, demulcent, expectorant and hypoglycaemic. The plant is used with advantage in the treatment of whooping cough, exerting a peculiar action on the respiratory organs. It is also used in the treatment of incipient phthisis, chronic bronchitis and asthma.

Externally, it has been used to treat corns, warts and bunions.The plant is harvested in the summer and can be dried for later use. Use with caution. Internal use of this herb causes a harmless colouring of the urine.

An extract of the plant contains plumbagin, which is antibiotic against a wide range of pathogens. Because of their protein digesting enzymes, the leaf juice has been used in the treatment of warts and corns. The entire fresh plant, harvested when it is starting to flower, is used to make a homeopathic remedy. It is used mainly in the treatment of coughs and is specific for whooping cough.

Prefers is a sandy peaty soil, succeeding in poor soils and bogs. Requires is a sunny position. An insectivorous plant, it can survive in nitrogen poor soils because it gets the nutrients it needs from insects.

The upper surfaces of leaves are covered with hairs that secrete a sweet sticky substance.This attracts insects, which become smeared with it and unable to escape - the plant then exudes a digestive fluid that enables it to absorb most of the insect into its system.

Seed of *Drosera rotundifolia* is best sown thinly as soon as it is ripe into pots of a free-draining soil with some charcoal added and with a layer of finely chopped sphagnum moss on top. Surface sow and keep the compost moist.

The seed usually germinates in 1-2 months at 20°C. Grow the plants on in the pots for their first growing season, making sure that the soil does not become dry. Divide the plants in the autumn, grow them on in the greenhouse for the winter and plant them out into their permanent positions in late spring.

7.5. Code of Georgia: Short rhizome sedge marshes (70GE04*)

Vegetation of eutrophic swamps includes plants with short rhizomes which is characteristic to the subalpine zone. Several communities reach the alpine zone. For example, *Cariceta daciae* (=*Cariceta transcaucasicae*). *Cariceta kotschyana* is typical to the alpine zone. It can be found at the altitude of 2000-2900 meters a.s.l.. *Blysmus compressus* is the dominant species which can be found on whole Caucasus. Peat moss is not found in this community. The significant component of peat swamps is *Molinia litoralis*. Its distribution is limited to the Kolkheti lowland. *Molinietum litoralis purum* is found in peaty massifs of Maltakva, to the west of river Gurinka. Composition is of species - *Angelica adzharica, Calystegia silvatica, Carex acutiformis, Galium palustre, Holcus lanatus, Iris pseudacorus, Lycopus europaeus, Molinia litoralis, Phragmites australis,*

Scrophularia nodosa, Stachys palustris, and *Typha angustifolia.* Community of *Rhynchospora caucasica and Rhynchospora alba* is typical to the Kolkheti swamp.

Sub-types (70GE04-01): *Molinieta litoralis* is in Imereti sedge. *Molinietum litoralis purum* is described to the west of river Gurinka, in the peaty massive of Maltakva. The species are - *Angelica adzharica, Calystegia silvatica, Carex acutiformis, Galium palustre, Holcus lanatus, Iris pseudacorus, Lycopus europaeus, Molinia litoralis, Phragmites australis, Scrophularia nodosa, Stachys palustris,* and *Typha angustifolia.*

Sub-types (70GE04-02): *Rhynchosporeta caucasici* and *Rhynchosporeta albae* communities are found in the peaty massive of Imnati above the Bokveradze garden. Composition of species - *Alnus barbata* (scrubbed), *Athyrium filixfemina, Bidens tripartita, Carex lasiocarpa, Erechtites valerianifolia, Eupatorium cannabinum, Frangula alnus, Hypericum mutilum, Menyanthes trifoliata, Molinia litoralis, Osmunda regalis, Rhododendron luteum, Rhynchospora alba, Rh. caucasica, Sphagnum palustre.*

Plants species: *Alnus barbata* (shrubbed), *Angelica adzharica, Athyrium filix-femina, Bidens tripartita, Blysmus compressus, Calystegia silvatica, Carex acutiformis, C. lasiocarpa, Erechtites valerianifolia, Eupatorium cannabinum, Frangula alnus, Galium palustre, Holcus lanatus, Hypericum mutilum, Iris pseudacorus, Lycopus europaeus, Menyanthes trifoliata, Molinia litoralis, Osmunda regalis, Phragmites australis, Rhynchospora alba, Rh. caucasica, Rhododendron luteum, Rhynchospora caucasica, Scrophularia nodosa, Scrophularia nodosa, Sphagnum palustre, Stachys palustris, Typha angustifolia.*

7.5.1. Edificatory plant species yellow azalea - *Rhododendron luteum* (L.) Sweet., Ericaceae

Edificatory species - *Rhododendron luteum* have a special role to contribute in ecosystem structure **(Figure 35).** Habitats: Although no specific mention of toxicity has been seen for this species, it belongs to a genus where many members have poisonous leaves.

The pollen of many if not all species of rhododendrons is also probably toxic, being said to cause intoxication when eaten in large

quantities. Mountain meadows are sometimes on limestone, beech and open coniferous forests, to 2200 metres. Grows is from sea-level to the subalpine zone. Europe is Austria and Poland to Caucasus and Turkey. Occasionally are naturalized in Britain **(Nakhutsrishvili, 2013).**

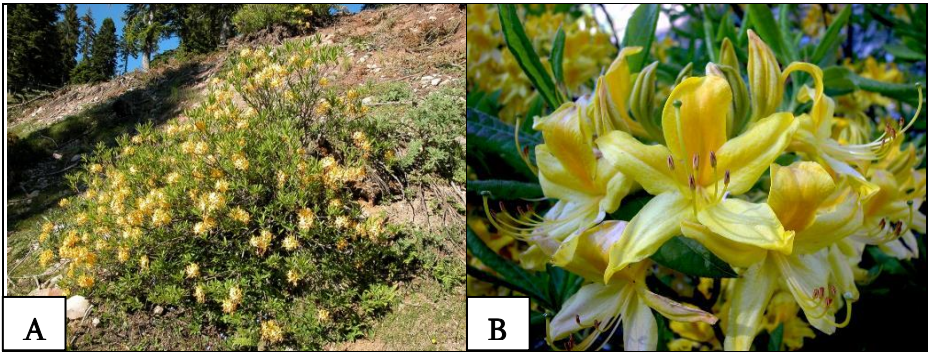


Figure 35. A. B. *Rhododendron luteum* is in eutrophic swamps from areas of Black sea and goas to the subalpine zone. **Photo: Maia Akhalkatsi.**

Rhododendron luteum is a deciduous Shrub growing to 2.5 m by 2.5 m. It is in flower in May. The flowers are hermaphrodite and are pollinated by Insects.Suitable for: light and medium soils and prefers well-drained soil. Suitable pH: acid soils and can grow in very acid soils. It can grow in semi-shade.

It prefers moist soil and can tolerate drought. Succeeds is in a most humus-rich lime-free soils except those of a dry arid nature or those that are heavy or clayey. Prefers is a peaty or well-drained sandy loam. Succeeds in sun or shade, the warmer the climate the more shade a plant requires. A pH between 4.5 and 5.5 is idea. Hardy is to about -30°C. A very ornamental plant, the flowers are sweetly scented with a honey-like fragrance. Plants self-sow freely when in a suitable position. Succeeds is in woodland though, because of its surface-rooting habit, it does not compete well with surface-rooting trees.

Plants need to be kept well weeded, they dislike other plants growing over or into their root system in particular they grow badly with ground cover plants, herbaceous plants and heathers. Plants form a

root ball and are very tolerant of being transplanted, even when quite large, so long as the root ball is kept intact.

Plants are tolerant of drought when they are grown under trees. Plants in this genus are notably susceptible to honey fungus. Seed of *Rhododendron luteum* is best sown in a greenhouse as soon as it is ripe in the autumn and given artificial light.

Alternatively sow the seed in a lightly shaded part of the warm greenhouse in late winter or in a cold greenhouse in April. Surface-sow the seed and do not allow the compost to become dry.

Pot up the seedlings when they are large enough to handle and grow on in a greenhouse for at least the first winter. Layering is in late July. Takes are 15 - 24 months. Cuttings are of half-ripe wood, August in a frame.

7.6. Code of Georgia: Long-rhizome sedge marshes (70GE05*)

Eumesotrophic swamp vegetation, which includes herbal and long rhizome plants. It is also found in the subalpine zone. It plays a great role in the accumulation process.

The typical representative of this community is *Carex cinerea* (=*C. canescens*). From mosses *Calliergon stramineum* and *C. giganteum* are typical. *C. richardsonii* and *C. cordifolium* are rare. The following types of sedge are common – *Carex rostrata* (=*C. inflata*) and holoarctic species - *C. lasiocarpa.*

A typical species *Carex chordorrhiza* is widely distributed in Northern Eurasia and is rare, but still found, in Georgia. It is an obligatory hellophite. *Carex songorica* is extremely rare in Georgia. It is found in limestone places.

Sub-types (70GE05-01): *Cariceta lasiocarpae* is sedge. *Caricetum lasiocarpae purum* is found in Imnati swamps. The following species are the consisting parts - *Alnus barbata, Arthraxon ciliaris* var. *langsdorffii, Carex acutiformis, C. lasiocarpa, Centaurium erythraea, Cladium mariscus, Frangula alnus, Holcus lanatus, Hypericum tetrapterum, Lycopus europaeus, Lysimachia vulgaris, Molinia litoralis, Potentilla erecta, Pycreus flavescens, Stachys palustris*. Community *Sphagnum-palustrae-caricoso-lasiocarpae-moliniosum* is found on the territory of the Imnati swamp.

Sub-types (70GE05-02): Composition of species - *Alnus barbata* (shrubbed), *Athyrium filixfemina, Bidens tripartita, Carex lasiocarpa, Erechtites valerianifolia, Eupatorium cannabinum, Frangula alnus, Hypericum mutilum, Menyanthes trifoliata, Molinia litoralis, Osmunda regalis, Rhododendron luteum, Rhynchospora alba, Rh. caucasica, Sphagnum palustre*.

Sub-types (70GE05-03): The swamp is developed on the Javakheti upland, near the side of the river Kikhr-Bulagi, Taparavani basin. From the northern side this river joins Paravani River 2280 m. The dried-up lake is fully covered with the sedge swampy complex - *Caricetum lasiocarpae purum.* Species - *Carex lasiocarpa, C. acuta, C. cinerea, C. rostrata (=C. inflata), C. vesicaria, Comarum palustre, Deschampsia caespitosa, Poa palustris, Festuca rubra.*

Sub-types (70GE05-04): *Meniantheta trifoliatae* is water clover. *Menyanthes trifoliata* in mountain swamps is found at up to 2250 meters of height. It is also typical at the sea side. It is described in the large peaty swamps located at the eastern side of Paliastomi River. Species are - *Alnus barbata, Calamagrostis epigeios, Carex acutiformis, Carex lasiocarpa, Drosera rotundifolia, Holcus lanatus, Juncus effusus, Menyanthes trifoliata, Molinia litoralis, Potentilla erecta, Sphagnum palustre,* and *Thelypteris palustris.*

Plants species: *Alnus barbata* (shrubbed), *Arthraxon ciliaris* var. *langsdorffii, Athyrium filix-femina, Bidens tripartita, Calamagrostis epigeios, Calliergon stramineum, C. giganteum. C. richardsonii, C. cordifolium, Carex acuta, C. acutiformis, C. cinarea, Carex chordorrhiza, C. lasiocarpa, C. rostrata (C. inflata), C. songorica, C. vesicaria, Centaurium erythraea, Cladium mariscus, Comarum palustre, Deschampsia caespitosa, Drosera rotundifolia, Erechtites valerianifolia, Eupatorium cannabinum, Festuca rubra, Frangula alnus, Holcus lanatus, Hypericum mutilum, Hypericum tetrapterum, Juncus effusus, Lycopus europaeus, Lysimachia vulgaris, Menyanthes trifoliata, Molinia litoralis, Osmunda regalis, Poa palustris, Potentilla erecta, Pycreus flavescens, Rhododendron luteum, Rhynchospora alba, Rh. caucasica, Sphagnum palustre, Stachys palustris, Thelypteris palustris*.

7.6.1. The economically potential species and medicinal plants common rush – *Juncus effusus* L., Juncaceae

The economically potential species - *Juncus effusus* is recreational, ornamental and medicinal plants and other. Habitats**:** Wet pastures, bogs, damp woods etc, usually on acid soils.

Throughout has the northern temperate zone, including Britain, Caucasus, east and South Africa, Australasia. This is oriented to waters **(Figure 36).** *Juncus effusus* is a PERENNIAL growing to 1.5 m by 0.5 m. It is in flower from Jun to August. The flowers are hermaphrodite and are pollinated by Wind. Suitable for: light, medium and heavy soils and can grow in heavy clay soil. Suitable pH: acid and neutral soils. It can grow in semi-shade or no shade.

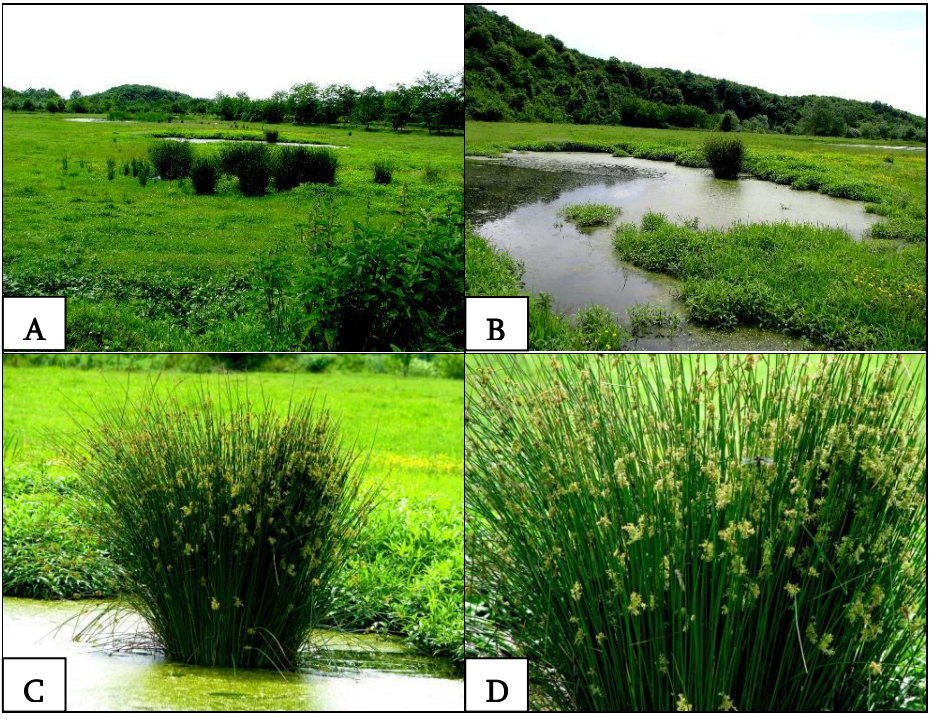


Figure 36. A. B. C. D. - *Juncus effusus* is oriented to water in eastern Caucasus Mountains below in Village Shilda, Kakheti. **Photo: Maia Akhalkatsi.**

It prefers moist or wet soil and can grow in water. The plant can tolerate strong winds but not maritime exposure. Other uses are basketry, lighting, paper, strewing, and string, thatching and weaving. It is used in the treatment of sore throats, jaundice, oedema, acute urinary tract infection and morbid crying of babies (**Boughton et al., 2011**).

Other uses are basketry, lighting, paper, strewing, and string, thatching and weaving. Stems are used in basket making, thatching, weaving mats etc. The stems can also be dried then twisted or braided into ropes for tying or binding. Stems can be peeled and soaked in oil then used as a candle.

A fibre obtained from the stems is used for making paper. The stems are harvested in late summer or autumn, they are split and cut into usable pieces and then soaked for 24 hours in clear water. They are then cooked for 2 hours with lye and beaten in a blender.

The fibres make an off-white paper. When mixed with mulberry fibres they can be used for making stencil paper. The whole plant was formerly used as a strewing herb. Easily is grown in a moist soil, bog garden or shallow water.

Prefers is a heavy soil in sun or light shade. Seed of *Juncus effusus* is surface sow in pots in a cold frame in early spring and keep the compost moist.

When they are large enough to handle, prick the seedlings out into individual pots and plant them out in the summer if they have grown sufficiently, otherwise in late spring of the following year.

Division is in spring. Very easy, larger clumps can be replanted direct into their permanent positions, though it is best to pot up smaller clumps and grow them on in a cold frame until they are rooting well. Plant them out in the spring.

8. ROCKY HABITATS AND CAVES

8.1. Screes

8.1.1. Siliceous scree of the montane to snow levels (8110; PAL. CLASS.: 61.1)

Vegetation is rare in alpine zone on the crushed rock ridge and creates an open cover. Characteristic features are: *Astragalus incertus, Oxytropis lazica, Gypsophila silenoide, Coronilla balansae.*

The system of deep roots is characteristic to plants developed on the landslide, with which the total crushed rock system is criss-crossed. Such a root system is characteristic to the following - *Dentaria bipinnata, Saxifraga laevis, Valeriana saxicola, Viola minuta, Lamium tomentosum, Trisetum distichophyllum.*

Other forms also appear on landslides and cliffs - *Astragalus incertus, Draba polytricha,* and *Campanula aucheri.* The following developed on landslides belong to another ecological type chasmophytes - *Saxifraga sibirica, S. flagellaris, Senecio renifollius, Viola biflora, V. caucasica, Omphalodes rupestris, Saxifraga cartilaginea, S. kolenatiana. Campanula hypopolia* and *Primula nivalis* are endemic species.

The following vegetation is developed on landslides and crushed rock - *Alopecurus sericeus, Thalictrum foetidum, Sedum opositifollium, Sempervivum tectorum, Saxifraga kolenatiana, Genista svanetica, Hypericum orientale, Digitalis ciliata, Thymus nummularius,* and *Anthemis rudolphiana.*

Only several species are common on the non-stable landslide in the subnival zone - *Cerastium kazbek, Delphinium caucasicum;* on the slightly moving remains *Veronica minuta, V. telephiifolia, Scrophularia minima,* and *Lamium tomentosum* can be found whereas *Aetheopappus caucasicus, Symphyoloma graveolens, Jurinella subacaulis, Minuartia inamoena* are common on the hard remains. *Primula bayernii, Draba bryoides, Saxifraga moschata, S. exarata* grow on cliffs.

Plants species: *Aetheopappus caucasicus, Alopecurus sericeus, Anthemis rudolphiana, Astragalus incertus, Campanula aucheri, Campanula hypopolia, Cerastium kazbek, Coronilla balansae,*

Delphinium caucasicum, Dentaria bipinnata, Digitalis ciliata, Draba bryoides, D. polytricha, Genista svanetica, Gypsophila silenoide, Hypericum orientale, Jurinella subacaulis, Lamium tomentosum, Minuartia inamoena, Omphalodes rupestris, Oxytropis lazica, Primula bayernii, P. nivalis, Saxifraga cartilaginea, S. kolenatiana, S. laevis, S. moschata, S. exarata, S. sibirica, S. flagellaris, Scrophularia minima, Sedum opositifollium, Sempervivum tectorum, Senecio renifollius, Symphyoloma graveolens, Thalictrum foetidum, Thymus nummularius, Trisetum distichophyllum, Valeriana saxicola, Veronica minuta, V. telephiifolia, Viola biflora, V. caucasica, V. minuta.

8.1.1.1. Endemic and medicinal plant species Rusty Foxglove - *Digitalis ferruginea* L., Scrophulariaceae

Endemic species is *Digitalis ciliata* Trautv. and as both Georgian and the Caucasian endemic (Scrophulariaceae). *Digitalis ferruginea* L. is medicinal plant. *Digitalis ferruginea* subsp. schischkinii (K.V. Ivanova) K. Werner and *Digitalis nervosa* Steud. & Hochst. ex Benth.are not endemic species. Only several species are common on the non-stable landslide in the subnival zone and only one species of Foxglove is distributed in Meskheti and Javakheti (**Figure 37**).

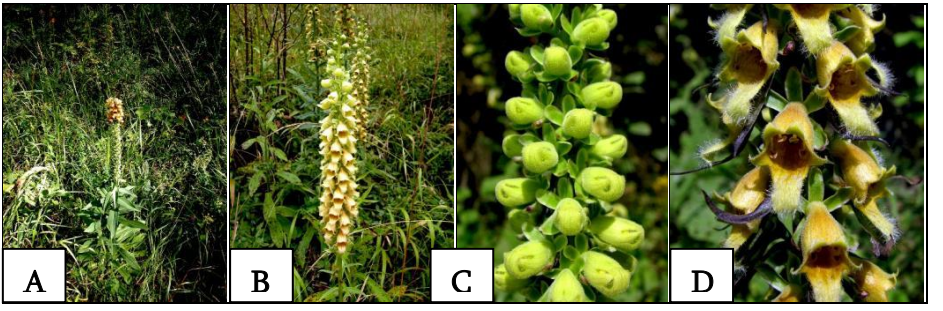


Figure 37. A. B. C. D. *Digitalis ferruginea* (LC), Tetrobi Plateau in Javakheti. **Photo: Maia Akhalkatsi.**

It is grown in forest openings, under trees in forest edges. Biennial/Perennial is growing to 1.2 m by 0.3 m. It is in flower in July, and the seeds ripen in September. The plant prefers light, medium and

heavy soils. The plant prefers acid, neutral and basic soils. It can grow in semi-shade or no shade. It requires dry or moist soil and can tolerate drought.

Medicinal uses are cardiac, stimulant and tonic. The leaves are cardiac, stimulant and tonic **(Uphof, 1959).**

They are often used in the treatment of certain heart complaints. Edible uses are none known. Other uses are it contains digitoxin or digoxin, which is source of cardiac stimulant medicine produced industrially.

Threat is as Grazing, habitat degradation, collected in the wild for medicinal purpose. Easily is grown plant, succeeding in ordinary garden soil, especially if it is rich in organic matter. It also succeeds in dry soils and, once established, is drought tolerant. It prefers semi-shade but succeeds in full sun if the soil is moist. Plants are hardy to about -15°C. This species is a short-lived perennial and is best grown as a biennial. Members of this genus are rarely if ever troubled by browsing deer and rabbits. Seed of *Digitalis ciliata* is surface sow early spring in a cold frame. The seed usually germinates in 2-4 weeks at 20°C. When they are large enough to handle, prick the seedlings out into individual pots and plant them out in the summer. Another report says that the seed is best sown in the autumn. Protection measure is cultivation, insertion in the RDB Georgia.

8.1.2. Calcareous and calcshist screes of the montane to alpine levels (8120; PAL. CLASS.61.2)

Vegetation of limestone rock and remains is found in the Great Caucasus Mountains, mainly in its western part. It holds the biggest territory in Abkhazia, Svaneti, Samegrelo and Racha-Lechkhumi. However, it can be found in the form of small fragments in other regions of the Caucasus as well. Abkhazian limestones are mainly settled with endemic species. *Daphne sericea* is noteworthy from scrub, olives - *Olea europaea* are grown in wilderness in the outskirts of Gagra and Psirtskha. The following perennial herbs can be observed *Psephellus barbeiye, Campanula mirabilis, C. longestyla, Gentiana paradoxa, Melilotus hirsutus.*The given endemic species can be observed in Semegrelo limestone - *Geum speciosum, Carex pontica,*

Astrantia colchica, Alboviodoxa elegans, Kelumariella colchica, Achillea griseo-virens, Campanula dzaaku, and *Scutellaria pontica.*

Plants species: *Achillea griseo-virens, Alboviodoxa elegans, Astrantia colchica, Campanula dzaaku, C. mirabilis, C. longestyla, Carex pontica, Daphne sericea, Gentiana paradoxa, Geum speciosum, Kelumariella colchica, Melilotus hirsutus, Olea europaea, Psephellus barbeiye, Scutellaria pontica.*

8.1.2.1. Endemic plant species Scabious-*Scabiosa* L., Caprifoliaceae

Endemic 10 species of *Scabiosa* are Georgian and the Caucasian endemic - *Scabiosa adzharica* Schchian; *Scabiosa amoena* J. Jacq., *Scabiosa caucasica* M. Bieb.; *Scabiosa colchica* Steven, *Scabiosa correvoniana* Sommier & Levier, *Scabiosa georgica* Sulak., *Scabiosa imeretica* Sulak., *Scabiosa olgae* Albov, *Scabiosa owerinii* Boiss., *Scabiosa sosnowskyi* Sulak. Other species are in this habitats - *S. bipinnata* K. Koch.; *S. columbaria* L.; *S. meskhetika* Schchian; *S. micrantha* Desf., *S. rotata* M. Bieb. and *S. velenovskiana* Bobr. Target species is *Scabiosa caucasica* M. Bieb. **(Figure 38).**

Perennial is growing to 1 m by 0.4 m. It is in flower from July to September. The plant prefers light, medium and heavy soils and requires well-drained soil. The plant prefers acid, neutral and basic soils and can grow in very alkaline soil.

It can grow in semi-shade or no shade. It requires dry or moist soil. Medicinal uses are - Astringent; Diuretic; Homeopathy.

The whole plant is astringent and mildly diuretic **(Launert, 1981).** An infusion is used internally as a blood purifier and externally for treating cuts, burns and bruises.

The fresh or dried flowering plant can be used, with or without the roots. A homeopathic remedy is made from the plant. It is used as a blood purifier and as a treatment for eczema and other skin disorders.

Edible uses are none known. Succeeds is in any well-drained garden soil. Prefers is a neutral or alkaline dry soil. Grows is well on chalky soils. Grows well in a dry sunny meadow A very cold-hardy plant, tolerating temperatures down to at least -25°C **(Phillips, Rix, 1991).** Grows is well in the summer meadow. The plant is an important source of nectar and pollen for bees and lepidoptera.

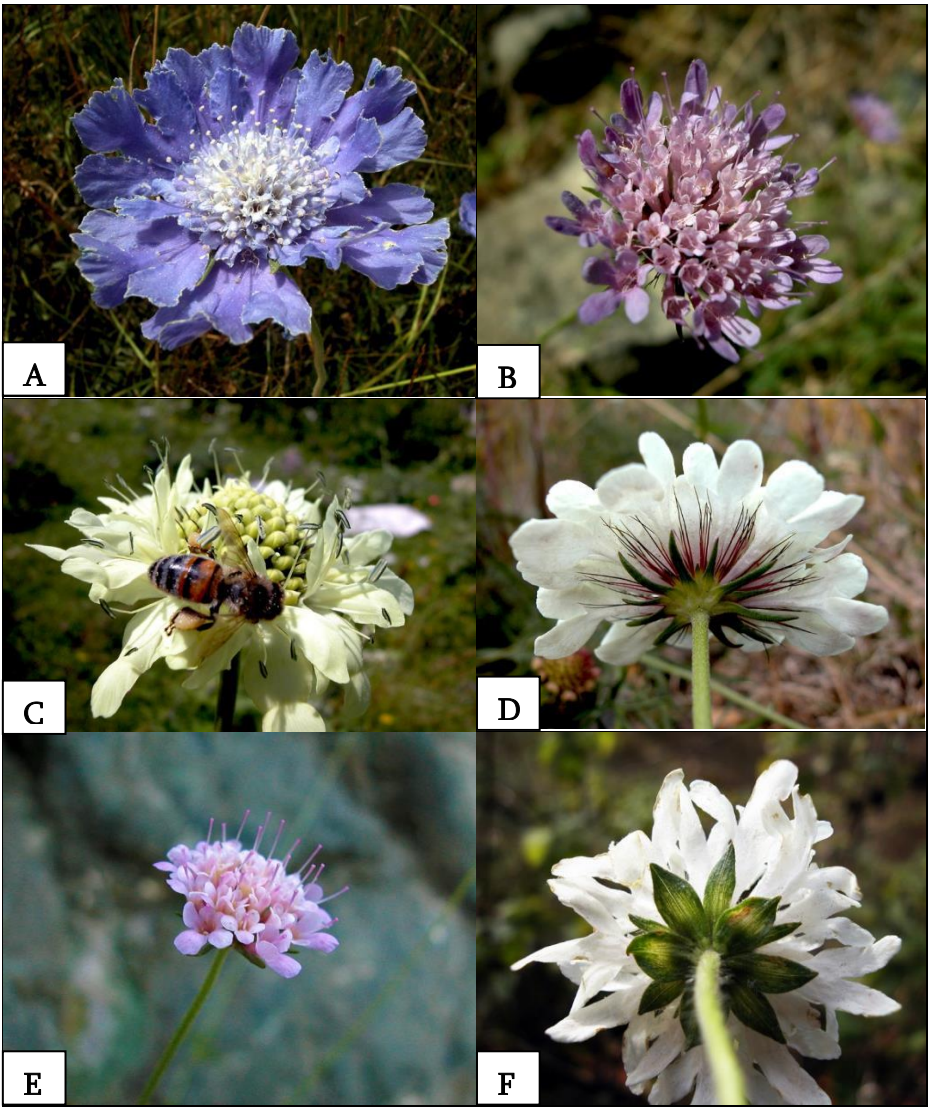


Figure 38. A. *Scabiosa caucasica* (LC), Mt. Abuli, eastern slope, Akhalkalaki distr.; **B.** *S. columbaria*, roadside near v. Rustavi, Aspindza distr.; **C.-D.** *Scabiosa georgiaca* is in mountains of Akhalkalaki distr.; **E.** *S. meskhetika*, road to Vardzia, near v. Nakalakevi, Aspindza distr.; **F.** *Scabiosa bipinnata* is in Tskhratskaro Pass. **Photo: Maia Akhalkatsi.**

The plants are sometimes dioecious; if this is the case then male and female plants will need to be grown if seed is required. Seed of the *Scabiosa* is sow spring or autumn in a cold frame.

When they are large enough to handle, prick the seedlings out into individual pots and plant them out in the summer. If you have enough seed it would be worthwhile trying a sowing in situ outdoors in the spring. The seed germinates in the spring in the wild. Division is in the spring.

Basal cuttings are in late spring. Harvest the shoots when they are about 10–15 cm long with plenty of underground stem. Pot them up into individual pots and keep them in light shade in a cold frame or greenhouse until they are rooting well. Plant them out in the summer.

8.2. Rocky vegetation

8.2.1. Calcareous rocky slopes with chasmophytic vegetation (8210; PAL. CLASS.: 62.1)

Vegetation of limestone rock is compatible with the vegetation of limestone remains and can be found mainly in western Caucasus from Abkhazia including Racha. Significant rock massifs can be found in the gorge of River Tskhenistskali on mountain massifs of Askhi and Khvamli. Communities of the vegetation of limestone rock are very well manifested in the gorge of river Jonoula at Askhi.

They include the following species: *Symphyandra pendula* var. *transcaucasica, Scabiosa imeretina, Umbilicus oppositifolius, Asplenium ruta-muraria,* etc. On mountains of Askhi, Jvari and Migaria there are communities of endemic plants - *Geum speciosum, Scutellaria pontica, Carex pontica, Cyclamen colchica.* The same community is found on limestones of Abkhazia - *Geum speciosum, Carex pontica, Astrantia colchica, Alboviodoxa elegans, Kelumariella colchica, Achillea griseo-virens, Campanula dzaaku, Scutellaria pontica.*

The following need to be highlighted from non-endemic species that are found on limestone - *Cyclamen europaeus, Arctostaphylos uva-ursi* subsp. *caucasica.* In the Alpine zone and below *Daphne sericea* and *Umbilicus oppositifolius* are observed. *Allium globosum* grows on the limestone rock in Racha-Lechkhumi.

A very interesting community of limestone rock massif is in Javakheti, on the Chobareti mountain range, plateau of Tetrobi, which is recognized as a protected territory. According to the composition the Tetrobi pine forest is considered as a peculiar refugium, where pine trees are mixed with mountain steppes. In this community only 48 species of vascular plants are represented.

The following species of herbal plants are associated with *Pinus kochiana* in this community: Steven arenaria - *Arenaria steveniana,* Sosnowski chickweed - *Cerastium sosnowskyi,* Voronov minuartsia - *Minuartia woronowii,* campion – *Silene dianthoides,* Sosnowski houseleek - *Sempervivum sosnowskyi,* astragalus - *Astragalus arguricus, A. campylosema*, Javakheti alfalfa *Medicago dzhawakhetica,* sun-rose - *Helianthemum nummularium, H. orientale,* Transcaucasian *Daphne* - *Daphne transcaucasica,* prickly thrift - *Acantholimon glumaceum,* hog weed - *Heracleum antasiaticum,* bedstraw - *Galium grusinum,* cornflower - *Centaurea bella,* hawksbeard - *Crepis pinnatifida,* grapevine hyacinth - *Muscari sosnowskyi,* etc.

This phytocoenosis is quite rich with endemic species that are mainly found on the limestones of the Tetrobi plateau. The following are especially noticeable: red heliotrope - *Diphelypaea coccinea (*blooming parasite) and asphodel - *Asphodeline taurica.*

Plants species: *Acantholimon glumaceum, Achillea griseo-virens, Allium globosum, Alboviodoxa elegans, Arctostaphylos uva-ursi* subsp. *caucasica, Arenaria steveniana, Asphodeline taurica, Asplenium ruta-muraria, Astragalus arguricus, A. campylosema, Astrantia colchica, Campanula dzaaku, Carex pontica, Centaurea bella, Cerastium sosnowskyi, Crepis pinnatifida, Cyclamen colchica, Cyclamen europaeus, Daphne sericea, Daphne transcaucasica, Diphelypaea coccinea, Galium grusinum, Geum speciosum, Helianthemum nummularium, H. orientale, Heracleum antasiaticum, Kelumariella colchica, Medicago dzhawakhetica, Minuartia woronowii, Muscari sosnowskyi, Pinus kochiana, Scabiosa imeretina, Scorzonera dzhawakhetica, S. ketzkhowelii, Scutellaria abchasica, Scutellaria pontica, Sempervivum sosnowskyi, Silene dianthoides, Symphyandra pendula* var. *transcaucasica, Umbilicus oppositifolius, Umbilicus oppositifolius.*

8.2.1.1. Endemic plant species Daphne - *Daphne* L., Thymelaeaceae

Endemic species of Daphne are in both Georgian and the Caucasian endemic; Endemic species of Georgia: *Daphne albowiana* Woronow ex Pobed. (=*Daphne pontica* subsp. *haematocarpa* Woronow), *Daphne axilliflora* (Keissl.) Pobed., *Daphne caucasica* Pall., *Daphne glomerata* Lam. and *Daphne pseudosericea* Pobed. (=*Daphne serícea* subsp. *pseudosericea* (Pobed.) Halda). Georgian IUCN species are *Daphne transcaucasica* Pobed. (=*Daphne oleoides* subsp. *transcaucasica* (Pobed.) Halda). *Daphne transcaucasica* Pobed. is found in Meskheti and Tetrobi Plateau in Javakheti, where we have seen it in fruiting stage. *Daphne pontica* L. is found on the boundary of Meskheti and Adjara. It is considered as synonym of such rare species of *Daphne* as *D. pseudosericea* and *D. albowiana* attaned EN category of IUCN according to recent survey.

Another Caucasian endemic is *D. axilliflora* found in Meskheti. Two more species *D. glomerata* and *D. mezereum* L. are more widespread, but these species have medicinal use in folk's medicine. Especially valualable features have *D. mezereum*. We studied 3 populations of *D. glomerata*, which is outstanding of high decorative properties **(Figure 39).**

Grows is in treeline ecotone among *Rhododendron caucasicum* bushes. An evergreen shrub is growing to 0.3 m by 0.15 m at a medium rate. It is in flower from May to June, and the seeds ripen from July to August. The plant prefers medium and heavy soils and can grow in heavy clay soil. It prefers acid, neutral and basic soils. It can grow in semi-shade. It requires moist soil. Medicinal use is investigated for *D. mezereum*, but there is no information on use in folk medicine of *D. glomerata*. *D. mezereum* is very effective against Cancer; Cathartic; Diuretic; Emetic; Homeopathy; Rubefacient; Stimulant; Vesicant. Mezereum has been used in the past for treating rheumatism and indolent ulcers, but because of its toxic nature it is no longer considered to be safe **(Bown, 1995).**

The plant contains various toxic compounds, including daphnetoxin and mezerein, and these are currently being investigated for their anti-leukaemia effects **(Bown, 1995).** The bark is cathartic, diuretic, emetic, rubefacient, stimulant and vesicant. The root bark is the most active medically, but the stem bark is also used **(Grieve, 1984).**

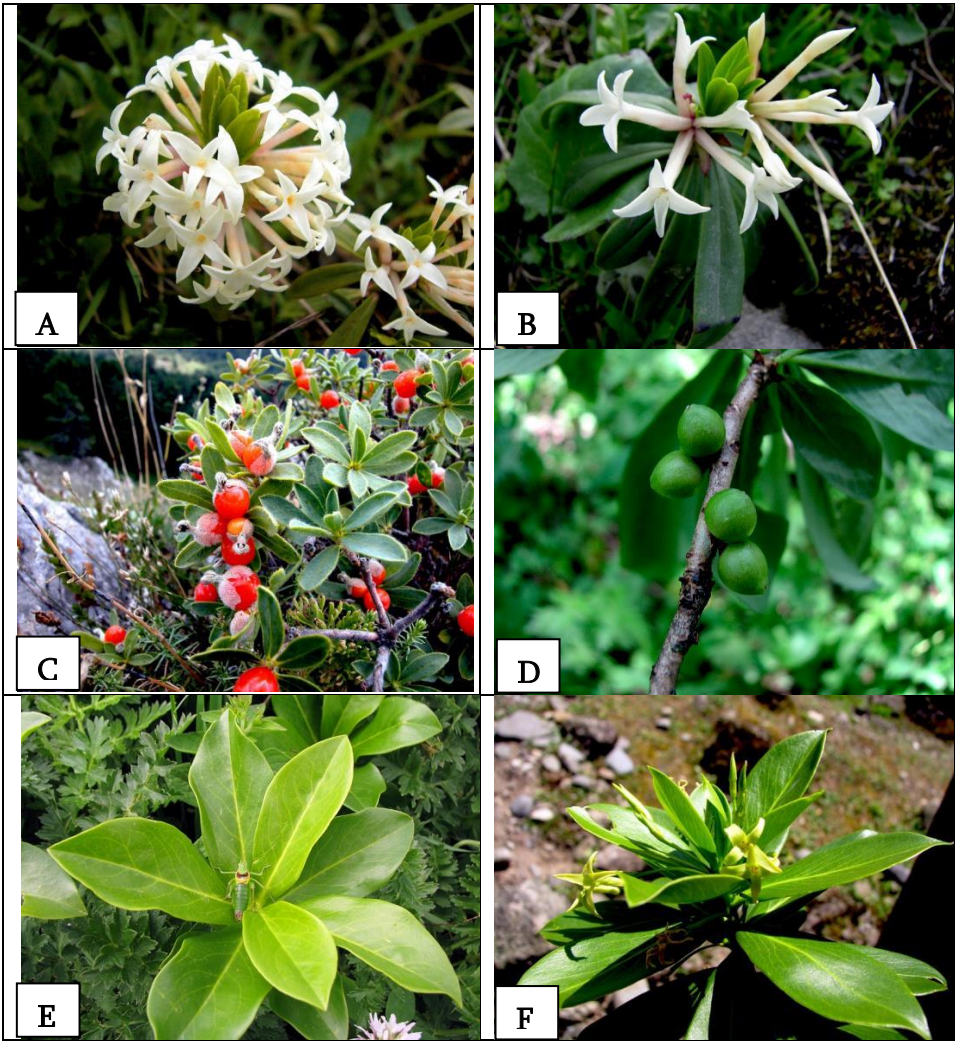


Figure 39. A. *Daphne glomerata* is in Kazbegi distr. and in Tetrobi Plateau, Akhalkalaki distr.; **B.** *D. caucasica* in Jvari Pass; **C.** *D. transcaucasica* in Tetrobi Plateau of Akhalkalaki distr.; **D.** *D. mezereum* in Kazbegi distr.; **E.** *D. pontica* has in high mountain of Mt. Khvamli in Lechkhumi; **F.** *D. pontica* is in River Chorokhi near Black Sea in Adjara**; Photo: Maia Akhalkatsi.**

It has been used in an ointment to induce discharge in indolent ulcers and also has a beneficial effect upon rheumatic joints. The bark is not usually taken internally and even when used externally this should be done with extreme caution and not applied if the skin is broken.

The bark is harvested in the autumn and dried for later use. The fruits have sometimes been used as a purgative. A homeopathic remedy is made from the plant. It is used in the treatment of various skin complaints and inflammations. Edible uses are none known. Other uses are Dye and Oil. A yellow to greenish-brown dye is obtained from the leaves, fruit and bark of different species of *Daphne*.

The seed contains up to 31% of fatty oil. Threat is habitat degradation, climate change. A good sandy loam suits most members of this genus. Prefers is a good heavy soil and some shade. Prefers is a calcareous soil and cool moist conditions.

There is no evidence to suggest it requires a calcareous soil, but all members of this genus do well on acid soils. A very ornamental plant, it is hardy to about -30°C. Plants tend to be short-lived in cultivation, probably due to excessive seed bearing. Plants are resentful of root disturbance and should be planted into their permanent positions as soon as possible.

They also resent being cut and so should not be pruned unless it is essential. A good is bee plant, providing a source of nectar very early in the year. The flowers have a delicious sweet perfume. Seed of the *Daphne* is best sown in a greenhouse as soon as it is ripe with the pot sealed in a polythene bag to hold in the moisture. Remove this bag as soon as germination takes place **(Matthews, 1994).**

The seed usually germinates better if it is harvested 'green' and sown immediately. Germination should normally take place by spring, though it sometimes takes a further year. Stored seed is more problematic.

It should be warm stratified for 8 - 12 weeks at 20°C followed by 12-14 weeks at 3°C. Germination may still take another 12 months or more at 15°C. Prick out the seedlings into individual pots as soon as they are large enough to handle. Grow the plants on in the greenhouse for their first winter and then plant out in spring after the last expected frosts.

8.2.2. Siliceous rocky slopes with chasmophytic vegetation (8220; PAL. CLASS.: 62.2)

Rocky areas can be found in all mountainous regions. Rocks of volcanic origin are more common. However, there are a lor of slate rocks as well. Rock vegetation, as a rule, is adapted to the dry environment. However, there exist moistened cliffs where ground water seeps. Grasses - *Festuca sulcata, Helictotrichon adzharicum,* and tall herb elements - *Heracleum* spp., *Cirsium* spp., *Petasites* spp., and *Hesperis matronalis* grow here. *Anthemis macroglossa, Dianthus* spp is characteristic to the subalpine zone. On cliffs in the alpine and sub-nival zone grow pillow-type plants - *Draba bryoides, Saxifraga cartilagiena, Sempervivum pumilum, Sedum* spp. Samtskhe-Javakheti rock remains vegetation has the xerophytic features. It is widespread in the boundaries of Akhaltsikhe depression (900-1500 m) and Tetrobi plateau. 80 species overall are represented in this biome, including: Erisimum - *Erysimum szowitsianum,* creeping bellflower - *Campanula crispa,* Lebanese Buxbaum's speedwell - *Veronica livanensis,* cornfklower - *Centaurea bella,* minuartia - *Minuartia micrantha,* Iurinea - *Jurinea carthaliniana,*wild chamomile - *Matricaria rupestris,* etc.

Plants species: *Anthemis macroglossa, Campanula crispa, Centaurea bella, Cirsium* spp., *Dianthus* spp., *Draba bryoides, Erysimum szowitsianum, Festuca sulcata, Helictotrichon adzharicum, Heracleum* spp., *Hesperis matronalis, Jurinea cartaliniana, Matricaria rupestris, Minuartia micrantha, Petasites* spp., *Saxifraga cartilagiena, Sedum* spp., *Sempervivum pumilum, Veronica livanensis.*

8.2.2.1. Endemic plant species *Scorzonera* L., Asteraceae

Endemic species of *Scorzonera* has 8 species for both Georgian and the Caucasian endemic - *Scorzonera biebersteinii* Lipsch., *Scorzonera charadzeae* Papava, *Scorzonera czerepanovii* Kuth., *Scorzonera ketzkhowelii* Sosn. ex Grossh., *Scorzonera kozlowskyi* Sosn. ex Grossh., *Scorzonera lanata* M. Bieb., *Scorzonera seidlitzii* Boiss., *Scorzonera sosnowskyi* Lipsch. *(=Scorzonera dzhawakhetica* Sosn. ex Grossh.). Endemic 8 species of genus *Scorzonera* are in Georgia and only 3 endemic species are in Meskheti and Javakheti. One -

Scorzonera dzhawakhetica Sosn. ex Grossh. is endemic of both Meskheti and Javakheti, two others - *S. ketzkhowelii* Sosn. ex Grossh. and *S. kozlowskyi* Sosn. ex Grossh. are distributed only on Tetrobi Pateau in Javakheti **(Figure 40).**

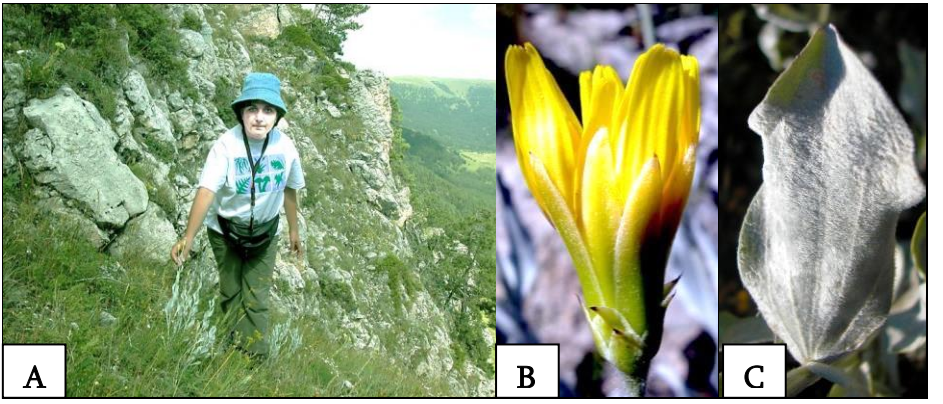


Figure 40. A. Maia Akhalkatsi found *Scorzonera dzhawakhetica* in Tetrobi Plateau, Akhalkalaki distr.; **B.** Flowers are medicinal; **C.** Leaf is differentid and this species is Georgian endemic EN, B2, ab(iii), D, RDB of Georgia, only two population are known for the species. We described both, one in Meskheti, near v. Ota and main population on Tetrobi Plateau in Javakheti. **Photo: Maia Akhalkatsi.**

It is in flower from August to September, and the seeds ripen in September-October. The plant prefers light, medium and heavy soils and requires well-drained soil. The plant prefers calcareous soils. It cannot grow in the shade. It requires dry or moist soil. Edible plant is as rich in vitamins and nitrogenous substances, rubber-bearing plant. Coffee like beverage is prepared from the roots.

The root is rich in inulin. This is a starch that is not easily digested by humans and so generally passes straight through the digestive system and is excreted. Flower buds might be eaten raw. The root contains a high concentration of good quality latex that can be used for making rubber. The latex is extracted by maceration of the root. Succeeds is in any soil in sun or light shade. Plants are required calcareous soils. Plants usually regenerate from the root after they have been cut **(Nakhutsrishvili, 2013).**

Seed of the *Scorzonera* is sow spring in the greenhouse. Prick out the seedlings as soon as they are large enough to handle into relatively deep pots to accommodate the tap root. If growth is good, plant out in early summer, otherwise grow them on in the greenhouse for their first winter and plant them out in late spring of the following year **(Akhalkatsi et al., 2012).** Division in autumn or as growth commences in the spring. Larger divisions can be planted out direct into their permanent positions. We have found it best to pot up the smaller divisions and grow them on in a lightly shaded position in a cold frame, planting them out once they are well established in the summer. Root cuttings in the autumn.

8.3. Other rocky habitats
8.3.1. Caves (8310*; PAL. CLASS.: 65)

Many karst caves are in the calcareous massif of the western Caucasus. Most deep cave (2191 m depth) Krubera is located in Gagra range with highest peak Mt. Arabika (2656 m). Most large cave (1.5 mill. m^3) is Akhali Atoni in Bzifi range with highest peak Napra (2684 m). Caves contain many endemic amphibians. There are bat populations. Flora in karst caves is representing by mossess, - *Campylophyllum halleri*, Lichens and algaes.

Plants species: The cave flora is rather poor, represented by mosses - *Campylophyllum halleri, Dicranum bonjeanii, Neckera besseri, Trichostomum crispulum, Schistostega pennata,* Lichens and algaes, only in relatively illuminated parts of the caves.

8.3.1.1. The economically potential species and medicinal plants *Helichrysum* Mill., Asteraceae

The economically potential species of *Helichrysum* are recreational, ornamental and medicinal plants and other. All 5 species occurring in Georgia - *Helichrysum plicatum* DC.; Georgian endemic - *H. polyphyllum* Ledeb.; *H. graveolens* (M. Bieb.) Sweet; *H. armenium* DC. Caucasian endemic - *H. plintocalyx* (K. Koch) Sosn. Target species are - *H. plicatum* DC.; Caucasian endemic-*H. plintocalyx* (K. Koch) Sosn.; Georgian endemic - *H. polyphyllum* Ledeb. **(Figure 41).**

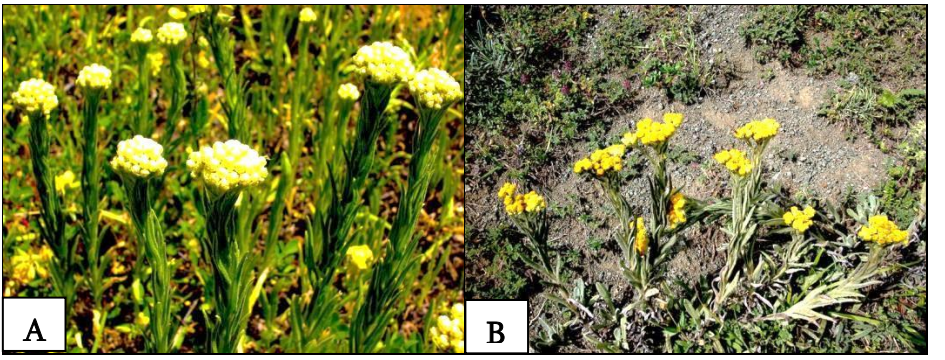


Figure 41. A. *Helichrysum polyphyllum* (NT), Zekari Pass, v. Abastumani, Adigeni distr. **B.** *Helichrysum plicatum* (LC), Zekari Pass, v. Abastumani, Adigeni distr. **Photo: Maia Akhalkatsi.**

The all three species are in leaf all year, in flower from July to August. Perennial is growing to 0.3–0.5 m. The plant prefers light and medium soils and requires well-drained soil. The plant prefers acid, neutral and basic soils. It cannot grow in the shade. It requires dry or moist soil and can tolerate drought. The plant can tolerate strong winds.

Medicinal uses are cholagogue, diuretic, homeopathy, skin and stomachic. The fresh or dried flowers, or the entire flowering herb, are cholagogue, diuretic, skin and stomachic **(Thomas, 1990).** An infusion is used in the treatment of gall bladder disorders and as a diuretic in treating rheumatism, cystitis etc. A homeopathic remedy is made from the flowering plant. It is used in the treatment of gall bladder disorders and lumbago. Collected is in the wild for medicinal purpose.

Plants tolerate temperatures down to about -7°C. Requires a well-drained, sunny sheltered position. Often cultivated is for its flowers which are extensively used as a decoration and in wreaths etc.

Seed of the *Helichrysum* is sow February/March in a greenhouse. The seed usually germinates in 2-3 weeks at 20°C. When they are large enough to handle, prick the seedlings out into individual pots and grow them on in the greenhouse for at least their first winter. Plant them out into their permanent positions in late spring or early summer, after the last expected frosts. Cuttings are of half-ripe wood, 5 cm with a heel, June/July in a frame. Roots are in 4 weeks.

8.3.2. Rock and true glaciers (8340*; PAL. CLASS.: 63.2 and 63.3)

Habitats adjacent to glaciers are subnival (2900-3750 m) and nival (3700-4000 m) vegetation zones. The heighest level of vascular plant distribution is 4000 m a.s.l. in the Central Greater Caucasus where endemic species *Cerastium kazbek* is found on the Mt. Kazbegi. In the altitudinal zone 3800-4000 m is discribed only 9 vascular plant species from the 300 total species found in the subnival zone.

The heighest distributional level have the following species: *Saxifraga moschata, S. exarata, S. flagellaris, Tripleurospermum subnivale, Colpodium versicolor, Alopecurus dasyanthus, Draba supranivalis, Veronica minuta, V. telephiifoliaa, Senecio karjagini, Cerastium pseudokasbek, Pseudovesicaria digitata.*

Plants species: *Aetheopappus caucasicus, Alopecurus dasyanthus, Cerastium kazbek, C. pseudokasbek, Colpodium versicolor, Delphinium caucasicum, Draba bryoides, D. supranivalis, Jurinella subacaulis, Lamium tomentosum, Minuartia inamoena, M. oreina, M. trautvetteriana, Primula bayernii, Pseudovesicaria digitata, Saxifraga exarata, S. flagellaris, S. moschata, Scrophularia minima, Scrophularia minima, Silene marcowiczii, Senecio karjagini, Symphyoloma graveolens, Tripleurospermum subnivale, Vavilovia formosa, Veronica minuta, V. telephiifolia,* **Mosses:** *Dicranum elongatum, Dicranoweisia crispula, Pohlia elongata, Pogonatum nanum, Tortella tortuosa, Tortula muralis*. **Lichens:** *Cetraria islandica, C.nivalis, Caloplaca elegans, Thamnolia vermicularis, Hypogimnia encausta, Lecidea atrobrunea, Parmelia vagans, Placolecanora melanophthalma, P. rubina, P. murilis, Rhizocarpon geographicum, Stereocaulon alpinum, Umbilicaria cylindrica.*

8.3.2.1. Endemic plant species Whitlow- *Draba* L., Brassicaceae

Endemic species of the *Draba* is both Georgian and the Caucasian endemic; 12 endemic species in the genus *Draba* - *Draba bryoides* DC., *Draba hispida* Willd., *Draba imeretica* (Rupr.) Rupr., *Draba meskhetica* Chinth., *Draba mingrelica* Schischk. ex Grossh., *Draba ossetica* (Rupr.) Sommier & Levier, *Draba rigida* Willd. (=*Draba rigida* var. *bryoides* (DC.) Boiss.), *Draba scabra* C. A. Mey., *Draba*

siliquosa M.Bieb., *Draba subsecunda* Sommier & Levier, *Draba supranivalis* Rupr., *Draba terekemensis* Yıld. (=*Draba imeretica* (Rupr.) Rupr.). Brassicaceae. *Draba nemorosa* L. is not endemic and it has much pollen **(Figure 42).**

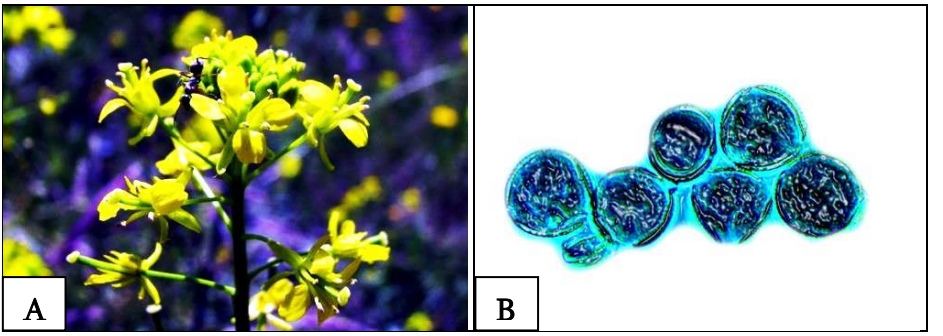


Figure 42. A. *Draba nemorosa* is in Kazbegi distr.; **B.** Pollen of *Draba nemorosa* has length of the horizontal height as 21-24 μm. **Photo: Maia Akhalkatsi.**

Perennial is 3-18 cm tall herb. Flowering stem weak erect or slightly curved, with 1-3 small leaves, rarely leafless. Rosette leaves narrow, oblong lanceolate, entire or with 1-3 teeth, 7-15 mm long, 1.5-2,5 mm wide, pubescent with fine, simple and branched hairs, margins with simple cilia **(Erschbamer et al., 2010).**

Raceme is many-flowered, tight during flowering, longer and looser at fruiting. Pedicle is thin, glabrous, slanting ascending. Sepals are oval, glabrous. Petals white, oblong obovate, with small incision at the tip.

Silique glabrous is oblong lanceolate or elliptical, 5-10 mm long, and 1.5-2.5 mm wide. It has flowering and seeds from July and August. Grows is on rocks, screes, in alpine and subnival zones, 2000-3500 m. Native to Caucasus, Asia Minor, Iran.

9. FORESTS

The forest is natural or semi-natural woody vegetation, which consists of local species and creates a forest that involves the understories and meets the following criteria: have rare, residual species and/or those interesting for the community.

9.1. Forests of temperate Europe (91F-GE: Beech forests PALL. CLASS.: 41.1)

Oriental beech (*Fagus orientalis*) is wide-spread throughout Georgia. Beech forests occupy 1.035.800 hectares throughout the country. They present in the lesser and the Greater Caucasus, Crimea, NE Turkey, and northern part of Iran. In western Georgia, the beech grows up to 2200-2380 meters a.s.l.

In Eastern Georgia it is found from 300-400 to 2250 meters a.s.l. (Alasani valley). It absents from the northern slopes of the Greater Caucasus and is relatively rare in Meskheti historical province.

***Fagus orientalis* Lipsky, Beech, Fagaceae:** It represents one of the main components of deciduous forests. Grows is up to between 1900 and 2200 m. It forms krumholz at treeline in 2200-2380 m a.s.l., 20-56 m tall tree, with smooth light gray bark. Snow cover is <1 m **(Figure 43).**

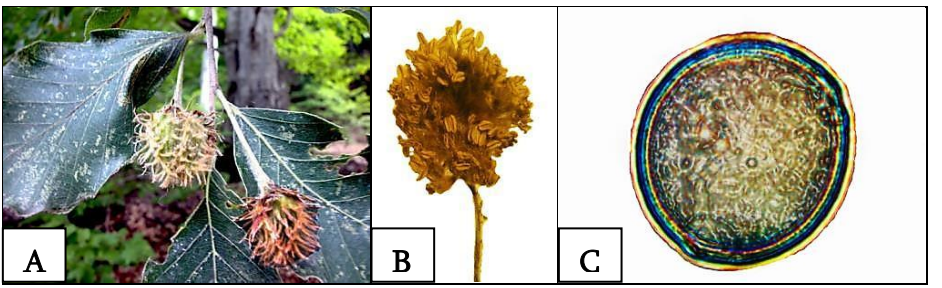


Figure 43. A. *Fagus orientalis* flowering from March; **B.** Flower has many stamen and anthers. **G.** Pollen of *Fagus orientalis* has length of the horizontal height as 133-135 μm and distanth height as 143-145 μm. **Photo: Maia Akhalkatsi.**

The exposition is for all directions and inclination till 40°C. Sunny edge is normal; dappled shade is in North Wall, East Wall, and West Wall. Sunny edge is normal; dappled shade is in North Wall, East Wall, and West Wall. Suitable for: light and medium soils and prefers well-drained soil. Suitable pH: acid, neutral and basic soils. It can grow in full shade semi-shade or no shade. It prefers dry or moist soil.

Trees with smooth gray bark; leaves alternate, coriaceous, lustrous, entire or sometimes sparingly toothed, pubescent on the margin and along the veins beneath. Bark smooth, grey. Leaves are alternate in two rows, 5-12 cm long, elliptic, sometimes ovate, narrows towards the base, acuminate. Upper surface glabrous and dark green, lower more pale, petiole and veins covered with long soft hairs. Leaves in 2 ranks, elliptic or ovate -elliptic, acuminate, rounded or more or less cuneate at base, (1.7) 5-15 (20) cm long, (1.3) 2.4 - 8 (11.6) cm broad, apprised pubescent beneath especially along the veins; Perianth of staminate flowers broadly campanulate, its lobes broad-ovate or almost round (very rarely elongate lanceolate), (0.6) 0.8 - 3 (3.6) mm long, about as long as or shorter than the perianth tube, this (l) 1.4-4 (4.4) mm long, often with a black spot at apex, the margin beset with black or white hairs; stamens to 12, (0.3) -1 -6.8 - (7.6) mm, anthers (0.8) - 1 -2 mm long; appendages of involucre of two kinds, the lower ones leaflike, green, many-nerved, (2.6) -4.2 - 15 -(17) mm long and 0.4-2-(4) mm broad, the upper ones subulate, (1.2) -2 -6.8 -(8.2) mm long; stalk of involucre (0.9) 1.4-4.5 - (9- 7) cm long, appressed-pubescent; nut triquetrous, (1.2) 1.3 - 1.9 (2.2) cm long, (0.5) 0.6-1 (l . 15) broad, not exceeding the involucres. Perianth is of the staminate flowers broadly bell-shaped. Pistillate flowers give rise to 2-3 edging nut, enclosed within hard bur covered with bristle-like outgrowths. It opens along 4 sutures when mature. Flowers unisexual, monoecious, with a simple inconspicuous perianth; staminate flowers in many -flowered heads, the perianth 5-lobed; stamens 8-12, at anthesis greatly exceeding the perianth; anthers elongated, obtuse or pointed at base; pistillate flowers 2-4, surrounded by an involucre; perianth adnate to ovary, with a short 4- or 5-lobed limb; ovary inferior, 3 -locular; styles 3, elongated, hairy; ovules anatropous, 2 in each locule; involucre (cupule) becoming woody in fruit, covered outside with leaflike or subulate appendages; nuts 2-4 in each involucre, sharp-edged; seeds 1 or rarely 2 in each nut;

cotyledons reniform. Flowering in April-May (with appearing of the leaves), fruit are in September-October.

The value of beech consists chiefly in its wood. This takes one of the first places as regards caloric value. On dry distillation it yields alcohol and creosote. It is widely used for a variety of woodwork, such as bent cabinet work, oars, shoe lasts, small articles for domestic use, spoons, trays, etc. It is also employed in boat construction and carriage construction. Beech staves are made into containers for oil. For this purpose only so-called "white" beech is used, since "red" beech imparts to the oil a bitter taste and a dark color. These differences in the wood are due to the formation of so-called false heartwood as a result of fungal infection. Such modified wood becomes permeated with tannic substances that bring about the darkening. In recent times beech wood has been used for the production of railroad ties, which are impregnated with creosote or other chemical compounds. Wood with strongly developed false heartwood impedes the penetration of chemicals, as cellular pores become blocked by tyloses. Beech nuts contain a considerable amount of valuable oil which is extracted by pressing. Apart from its applications for food and burning, this oil is used as adulterant for walnut, poppy, or olive oil. Large yields of seed are not obtainable annually but rather in 5-10 - year cycles. The foliage provides feed for goats and cattle. It is also used to replace straw as bedding for livestock. The genus attained extensive development in Tertiary formations of both hemispheres, especially in regions of temperate forest flora.

Young leaves - raw. A very nice mild flavour, but the leaves quickly become tough so only the youngest should be used. New growth is usually produced for 2 periods of 3 weeks each year, one in spring and one in mid-summer. Seed is raw or cooked. Richis is in oil. The seed should not be eaten raw in large quantities. It can be dried and ground into a powder and then used with cereal flours when making bread, cakes etc. Edible semi-drying oil is obtained from the seed.

Thrives on a light or medium soil, doing well on chalk, but ill-adapted for heavy wet soil. Fairly tolerant of most conditions, this is the most successful native species of *Fagus orientalis* in Caucasus. Young trees are very shade tolerant, but are subject to frost damage so are best grown in a woodland position which will protect them. Trees have surface-feeding roots and also cast a dense shade. This greatly inhibits

the growth of other plants and, especially where a number of the trees are growing together, the ground beneath them is often almost devoid of vegetation.

The seed has a short viability and is best sown as soon as it is ripe in the autumn in a cold frame. Protect the seed from mice. Germination takes place in the spring. When they are large enough to handle, prick the seedlings out into individual pots and grow them on in the greenhouse for at least their first winter.

Plant them out into their permanent positions in late spring or early summer, after the last expected frosts. The seedlings are slow growing for the first few years and are very susceptible to damage by late frosts.

The seed can also be sown in an outdoor seedbed in the autumn. The seedlings can be left in the open ground for three years before transplanting, but do best if put into their final positions as soon as possible and given some protection from spring frosts. These species is in Native to Balkan, Crimea, Caucasus, Asia Minor, and Iran.

9.1.1. Code of Georgia: Luzulo-Fagetum beech forests *Luzula sylvatica* (Huds.) Gaudin, Juncaceae (9110GE; 9110; PAL. CLASS.: 41.11)

In Georgia, as well as in the central Europe, *Luzulo-Fagetum* (*Fageta luzulosa*) is found at elevations 1700-2150 meters. The habitat is found in Upper and Lower Svaneti, on Egrisi and Svaneti ranges, at the upper part of rivers Enguri and Tskhenistkali.

On the slopes with the inclination of 20-45°C of all kinds of exposition, communities are created by the following dominant species: *Luzula sylvatica, Vaccinium arctostaphylos, Laurocerasus officinalis, Rhododendron luteum, Viburnum orientale. Daphne pontica* is a rare species **(Figure 44).**

Plants species: *Fagus orientalis, Abies nordmanniana, Acer trautveterii, Asperula odorata, Betula litwinowii, Gymnocarpium dryopteris, Laurocerasus officinalis, Ligusticum physospermifolium, Luzula sylvatica, Milium schmidtianum, Oxalis acetosella, Paeonia wittmanniana, Paris incompleta, Prenanthes purpurea, Ranunculus cappadocicus, Rhododendron luteum, Sorbus caucasigena, Vaccinium arctostaphylos, V. myrtillus, Viburnum orientale,* etc.

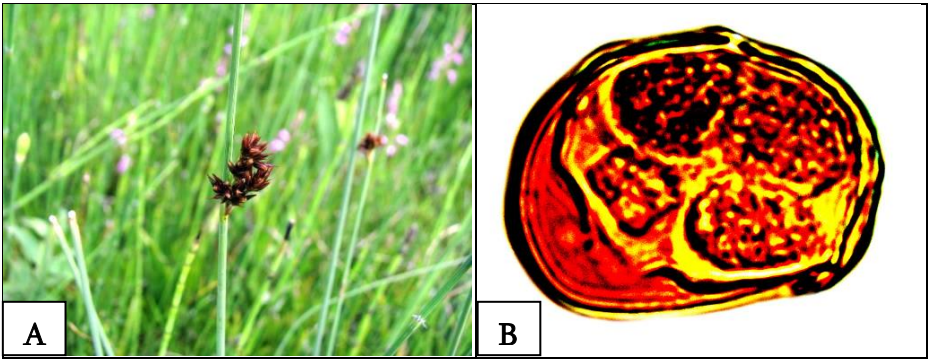


Figure 44. A. *Luzula sylvatica* is in water page of River Aragvi; **B**. Pollen has length of the horizontal height as 91-93 μm and distanth height as 125-127 μm. **Photo: Maia Akhalkatsi.**

9.1.1.1. Flagship plsnt species mountain-ash - *Sorbus aucuparia* L., Rosaceae

Flagship species of *Sorbus aucuparia* (*Sorbus caucasigene* Kom. ex Gatsch.) is as the concept of flagship species is a concept with its genesis in the field of conservation biology. Trees or shrubs have mostly with deciduous stipulate leaves. Grows is in subalpine krumholz forests at 1600-2400 m a.s.l., sometimes lower. 4-20 m is tall tree or shrub with gray, smooth bark and pubescent young branches. Snow cover is >1 m. The exposition is for all directions and inclination till 30°C **(Figure 45).**

Sunny edge not in North Slope for this species; dappled shade is in North Wall, East Wall, and West Wall. Widespread is in the Temperate Zone of the northern hemisphere. Forest edges, glades, undergrowth, less often meadows, also rocky or stony sites, riverbanks bluffs, etc.; often planted near houses and in orchards. Suitable for: light, medium and heavy soils, prefers well-drained soil and can grow in heavy clay soil. Suitable pH: acid, neutral and basic soils and can grow in very acid and very alkaline soils. It can grow in semi-shade or no shade. It prefers moist soil. The plant can tolerate maritime exposure. It can tolerate atmospheric pollution.

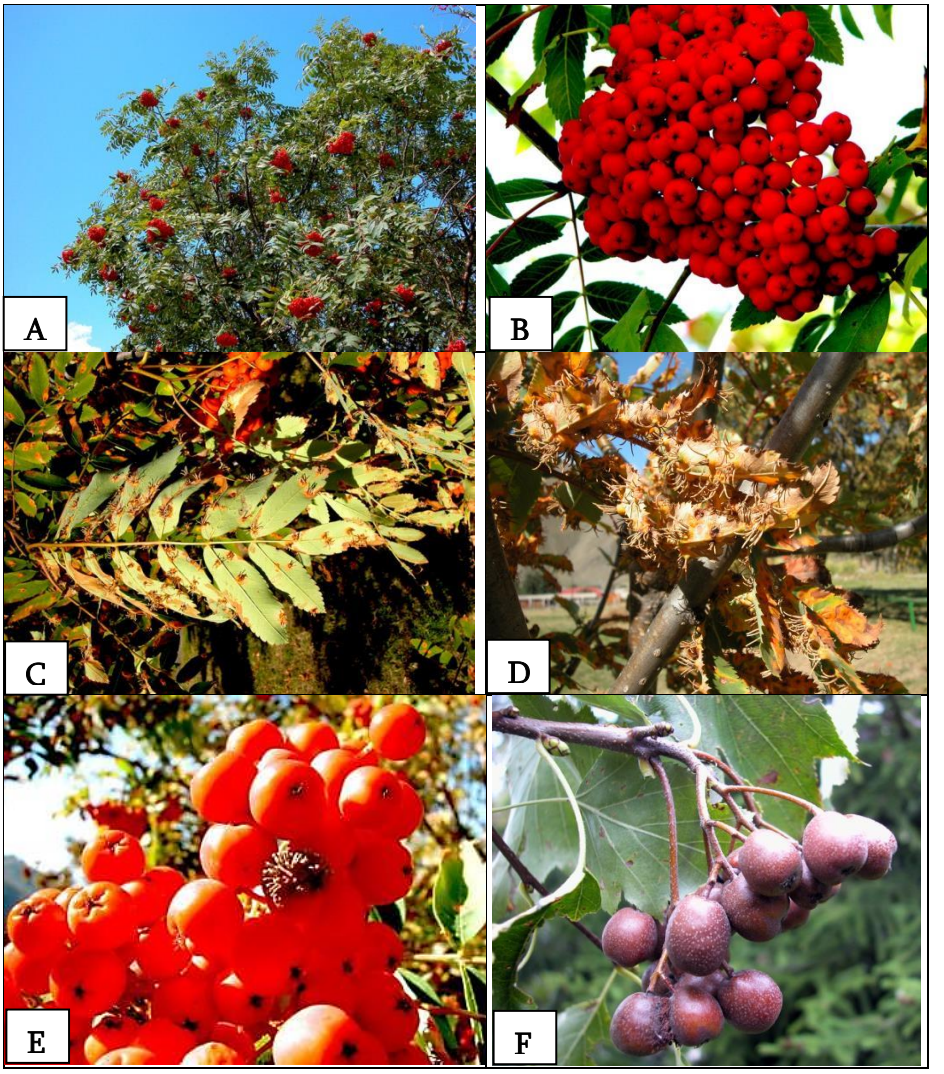


Figure 45. A. B. *Sorbus aucuparia* in Kazbegi distr., **C. D. E.** *Sorbus aucuparia* has infected from mushrooms; **F.** *Sorbus torminalis* is in high mountain of Goderdzi in Adjara. **Photo: Maia Akhalkatsi.**

Crown broad. Bark of the trunk dark brown. buds tomentose; Leaves odd pinnate with 4-7-paired, the leaflets oblong or oblong-lanceolate, entire in lower part, serrate higher, mat-green above, glaucous or grayish below, more or less hairy. Upper surface of the

leaflet glabrous, dark green, lower surface glaucescent. Apical leaflet is elliptical - lanceolate, middle - lanceolate or oval - lanceolate, asymmetrical, lower leaflets narrow-lanceolate. All leaflets sharply serrate either from base or above the middle of the blade. Inflorescences pubescent have less often inflorescence branches glabrous, 5-10 cm in diameter; Flowers in more or less many-flowered, corymbiform inflorescences. Flowers are white or whitish-rose, in corymb. Flowers 0.8-1.5 cm in diameter, with a rather sharp odor of trimethylamine; Hypanthium urn-shaped; calyx more or less lanate, later glabrescent, its teeth with glandular cilia on the margin; sepals 5, triangular; petals orbicular or ovate, with or without short claw, white, less often pink.

Orbicular is 4-5 mm long, the upper surface lanate, pubescent from base; Stamens 20 is as long as petals; styles 3 (less often 2, 4, or 5), free, hairy in lower part; Carpels 2-5, adnate by the back to the urn-shaped hypanthium, each carpel with 2 ovules, one of which usually does not reach maturity. Stigma flat, not broader than style. Fruit bright red, subglobose, bright red at maturity, 9-10 mm in diameter narrowly oblong, acute, reddish; seeds usually 3, globose, ovate or pear-shaped. Seeds are oblong, triangular, and acute at both ends. Flowering is in Mai-July, fruits are in September-October.

Wood fine-grained, reddish, lustrous, hard, polishes well, furnishes good material for turning and furniture, etc., mainly for machine parts such as blocks, rollers, and cogs, requiring great strength. The bark contains 7.26% tannin compounds, the fruits malic and citric acids, 4 - 8% dextrose, also traces of hydrocyanic acids, (harmless); used for infusions, vinegar, vodka, marmalade, jam, pastilles, etc. The seeds contain 21.9% fatty oils and the glucoside amygdalin; the young branches furnish a black dye. Reproduces is in cultivation by roots suckers. The Caucasian *Sorbus* with smooth, rather firm leaves forms "islands" among *S. aucuparia*, and will be separated as an independent species if distinguishing characters can be ascertained. Fruit is raw or cooked.

The fruit is very acid and large quantities of the raw fruit can caused stomach upsets. It can be used to make delicious, if slightly acidulous, jams and preserves; the fruit can also be dried and used as flour mixed with cereals. The fruit is about 7.5 mm in diameter and is produced in quite large bunches making harvest easy. The leaves and

flowers are used as a tea substitute. Young leaves are said to be a famine food but they contain a cyanogenic glycoside so you should be very hungry before even thinking of eating them. A coffee is substitute. The report was referring to the fruit; it probably means the roasted seed. The bark is astringent; it is used in the treatment of diarrhoea and as a vaginal injection for leucorrhoea etc.

The fruit is antiscorbutic and astringent. It is normally used as a jam or an infusion to treat diarrhoea and haemorrhoids. An infusion can also be used as a gargle for sore throats and as a wash to treat haemorrhoids and excessive vaginal discharge. The seeds contain cyanogenic glycosides which, in reaction with water, produce the extremely toxic prussic acid. In small quantities this acts as a stimulant to the respiratory system but in larger doses can cause respiratory failure and death. It is therefore best to remove the seeds when using the fruit medicinally or as a food. Both the flowers and the fruit are aperient, mildly diuretic, laxative and emmenagogue. An infusion is used in the treatment of painful menstruation, constipation and kidney disorders. Oil is obtained from the seed. A cosmetic face-mask is made from the fruits and is used to combat wrinkled skin. A black dye is obtained from the young branches. All parts of the plant contain tannin and can be used as a black dye. Trees are very wind resistant and can be used in shelterbelt plantings. Wood - hard, fine grained, compact and elastic. It is highly recommended by wood turners and is also used to make hoops for barrels, cogs and furniture.

Succeeds is in most reasonably good soils in an open sunny position. Grows is well in heavy clay soils. Tolerates some shade, though it fruits better in a sunny position. Prefers is a cool moist position and a lighter neutral to slightly acid soil. Dislikes shallow soils or drought. Succeeds is on chalk or acid peats. A very wind firm tree tolerating very exposed and maritime positions. Tolerates is atmospheric pollution. Some named varieties have been developed for their improved fruits which are larger and sweeter than the type. Plants, and especially young seedlings, are quite fast growing. The fruit is very attractive to birds. 28 species of insects are associated with this tree. Responds is well to coppicing. Plants are susceptible to fireblight.

Seed of the *Sorbus aucuparia* is as best sown as soon as it is ripe in a cold frame. If you have sufficient seed it can be sown in an outdoor seedbed. Stored seed germinates better if given 2 weeks warm then 14-

16 weeks cold stratification, so sow it as early in the year as possible. Prick out the seedlings into individual pots when they are large enough to handle. Seedlings are very slow to put on top-growth for their first year or two, but they are busy building up a good root system. It is best to keep them in pots in a cold frame for their first winter and then plant them out into their permanent positions in late spring. This species is in Native to Caucasus, and Europe.

9.1.2. Code of Georgia: Beech forests with *Ilex* and sometimes also *Taxus* in the shrublayer (*Fageta taxceto-ilicitosa*) (9120GE; PAL. CLASS.: 41.12)

9120 Atlantic acidophilic beech forest with the sub forest (*Ilici-Fagenion*) of holly (*Ilex*) and sometimes is as Yew (*Taxus*). Beech with holly (*Ilex cochica*) cover, *Ilici-Fagenion* (=*Fageta ilicitosa*) is mainly found in west Georgia, on carbonated soils in the circumstances of high humidity. However, it is characteristic to eastern Georgia's several Kolketi type refugiums. Borders of its distribution are 500-2180 meters, it is typical at the height of 1000-1800 meters a.s.l.. This type of biotope corresponds to Colchic type forests, namely, beech with the understories of laurel and Pontic Rhododendron. There are 4 sub-types:

Sub-types (9120GE-01): Typical beech forest with the holly understory (*Fageta ilicitosa typica*) is found in west Georgian middle mountain zone (1000-1500 meters). It is associated with laurel (*Laurocerasus officinalis*) and Caucasian blueberry (*Vaccinium arctostaphylos*).

Sub-types (9120GE-02): Beech forest is of the upper zone and of the mountain with the holly understory (*Fageta ilicitosa superior*) is characteristic to only west Georgia. Holly here is of the prostrate form and associated with other understory species of Colchic forest: *Laurocerasus officinalis, Ruscus colchicus, Vaccinium arctostaphylos,* and *Viburnum orientale.*

Sub-types (9120GE-03): Beech forest with the holly understory and in mountain fescue *(Festuca drymeja*) cover (*Fageta festucoso-ilicitosa*) and it is found in fragments in west and east Georgia (on water dividing ranges of Saguramo, Gombori and Iori-Alazani). Associated types are: *Ruscus cochicus, Vaccinium arctostaphylos, Rhododendron luteum.*

Sub-types (9120GE-04): Beech forest with Yew *(Taxus baccata*), holly and ivy (*Hedera pastuchovii*) understory (*Fageta taxceto-ilicitosa-hederosa*) is widespread on Kakhetian Caucasus (Batsara and Pankisi gorges), Trialeti (Nichbisi), and Aragvi gorge of Pshavi (near Kanatia). Assocated species: *Taxus baccata, Fraxinus excelsior, Quercus iberica, Carpinus caucasica,* etc.

Plants species: *Fagus orientalis, Taxus baccata, Fraxinus excelsior, Quercus iberica, Carpinus caucasica, Ruscus colchicus, Vaccinium arctostaphylos, Paris incompleta, Dentaria bulbifera, Trachystemon orientalis, Rubus* spp., *Festuca drymeja, Dryopteris filix-mas, Athyrium filixfemina,* etc.

9.1.2.1. The economically potential species and medicinal plants

Briar Common - *Rosa canina* L., Rosaceae

Grows is on roadsides, in open slopes, disturbed forests, at edges of the forests and in fields, from lowland up to upper montane belt. 1.5-3 m tall shrub, sometimes scrambling. Forest edges and thinned-out forests, shrubs, open slopes, banks of mountain streams and brooks, felled areas, pastures, roadsides, fences. *Rosa canina* is a deciduous shrub growing to 3 m by 3 m at a fast rate. The flowers are hermaphrodite (have both male and female organs) and are pollinated by Bees, flies, beetles, lepidoptera, self, apomictic. The plant is self-fertile. It is noted for attracting wildlife. Snow cover is <0.3 m. The exposition is for all directions and inclination till 30°C. Sunny edge is normal; dappled shade is in North Wall, East Wall, and West Wall. Suitable for: light, medium and heavy soils, prefers well-drained soil and can grow in heavy clay soil. Suitable pH: acid, neutral and basic soils. It can grow in semi-shade or no shade. It prefers moist or wet soil. The plant can tolerate strong winds but not maritime exposure **(Figure 46).**

Twigs often arching, covered with hooked prickles. High, sparse, branching shrub with arcuate branches; bark green or red -brown, usually without glaucous bloomj prickles often sparse or remote, on main shoots, in pairs or whorled, with very broad base, compressed, falcately curved, smaller on fertile shoots and usually rather abundant; Leaves usually with 7- elliptic or ovate leaflets, simple or doube serrate, 1.5-4 cm long and 1-2 cm wide, stipules narrow, with infrastipular acute prickles. leaves glabrous or with few hairs on rachis

above, green or glaucescent; stipules narrow, only in terminal leaves slightly broadened, with distally divergent auricles, glandular -ciliate; leaflets of different shapes, often elliptic, 1.5-6 cm long, acuminate, acutely serrate, with thin –acuminate teeth curving upward, simple or with 1-2 secondary teeth terminating in a gland, smooth or at times sparsely glandular along veins beneath.

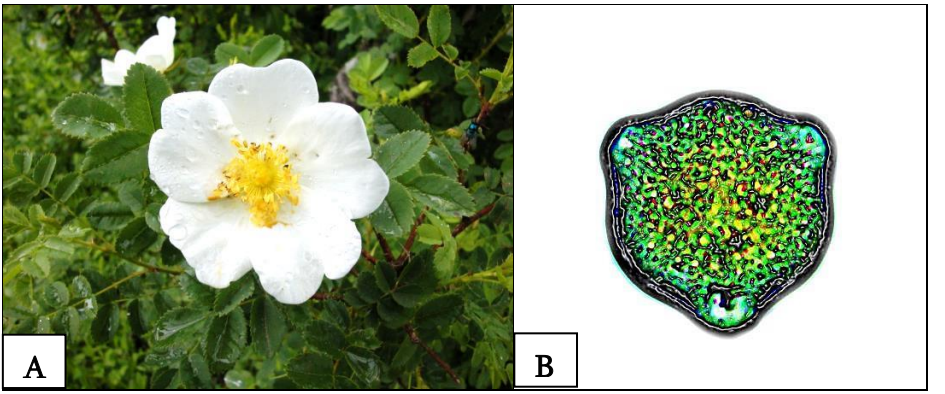


Figure 46. A. *Rosa canina* is a medicinal plant in woods and degraded areas; **B.** Pollen of *Rosa canina* has length of the horizontal height as 38-40 μm. **Photo: Maia Akhalkatsi.**

Flowers solitary or clustered into many-flowered inflorescence, rose, sometimes red or white. Hip elliptic, rarely nearly globose, mostly red, sometimes dark grey or yellow. Flowers solitary, 3, 4 or 5(20) in corymbiform inflorescence, on more or less long, glabrous or sparingly pubescent pedicels, as long to twice as long as hypanthium, often as long as fruit, 0.5-2.5 cm long, smooth; sepals medium-sized, with lateral pinnules and terminal appendage, recurved after flowering and usually caducous long before ripening of fruit, well separated from disk; corolla 2-8 cm in diameter; petals usually pale pink or white, sometimes rather bright pink; disk flat or concave, sometimes distinctly conical; hypanthium mouth not exceeding one -fourth the diameter of the disk; style long, sparsely hairy or glabrous, folded in a raceme; style heads often conical; fruit globose, or elongate -ovoid, smooth, bright or pale red. Flowering is in May-July. Fruits are in October-December.

This species is a widely used stock for cultivated roses. Various parts of the plant contain tannins. Officinal plant is with astringent properties. The ripe fruit is used in the treatment of diarrhea. In Caucasus the fruit pulp of *R. canina* has been found to contain in percent of dry weight: sugars 8.09, pectin 2.74, pentosans 2.18, nitrogenous substances 3.58, tannins and dye stuffs 3.58, acids 1.31, etc. Its vitamin content is low, 0.24—0.85% ascorbic acid per dry weight of pulp.

Fruit is in raw or cooked. It can be used in making delicious jams, syrups etc. The syrup is used as a nutritional supplement, especially for babies. The fruit can also be dried and used as a tea. Frost softens and sweetens the flesh. The fruit is up to 30 mm in diameter, but there is only a thin layer of flesh surrounding the many seeds. Some care has to be taken when eating this fruit, see the notes above on known hazards. The seed is a good source of vitamin E, it can be ground and mixed with flour or added to other foods as a supplement. Be sure to remove the seed hairs. The dried leaves are used as a tea substitute. Coffee substitute is according to another report. Petals are as raw or cooked. The base of the petal may be bitter so is best removed. The petals are also used to make an unusual scented jam.

The petals, hips and galls are astringent, carminative, diuretic, laxative, ophthalmic and tonic. The hips are taken internally in the treatment of colds, influenza, minor infectious diseases, scurvy, diarrhoea and gastritis. Syrup made from the hips is used as a pleasant flavouring in medicines and is added to cough mixtures. Distilled water made from the plant is slightly astringent and is used as a lotion for delicate skins. The seeds have been used as a vermifuge. The plant is used in Bach flower remedies - the keywords for prescribing it are 'Resignation' and 'Apathy'. The fruit of many members of this genus is a very rich source of vitamins and minerals, especially in vitamins A, C and E, flavanoids and other bio-active compounds. It is also a fairly good source of essential fatty acids, which is fairly unusual for a fruit. It is being investigated as a food that is capable of reducing the incidence of cancer and also as a means of halting or reversing the growth of cancers. Ascorbic acid in Dog Rose shells (vitamin C, 0.2 to 2.4%). Plants make a dense and stock-proof hedge, especially when trimmed.

Succeeds is in most soils. Grows is well in heavy clay soils. Prefers is a circumneutral soil and a sunny position with its roots in the shade. When grown in deep shade it usually fails to flower and fruit. Succeeds in wet soils but dislikes water-logged soils or very dry sites. Tolerates has maritime exposure. The fruit attracts many species of birds, several gall wasps and other insects use the plant as a host-**A** very polymorphic species, it is divided into a great number of closely related species by some botanists. The leaves, when bruised, have a delicious fragrance. The flowers are also fragrant. Grows is well with alliums, parsley, mignonette and lupins. Garlic planted nearby can help protect the plant from disease and insect predation. Grows is badly with boxwood. Hybridizes freely has with other members of this genus. Plants in this genus are notably susceptible to honey fungus.

Rose seed often takes two years to germinate. This is because it may need a warm spell of weather after a cold spell in order to mature the embryo and reduce the seed coat. One possible way to reduce this time is to scarify the seed and then place it for 2-3 weeks in damp peat at a temperature of 27°C - 32°C. It is then kept at 3°C for the next 4 months by which time it should be starting to germinate. Alternatively, it is possible that seed harvested 'green' and sown immediately will germinate in the late winter. This method has not as yet been fully tested. Seed sown as soon as it is ripe in a cold frame sometimes germinates in spring though it may take 18 months. Stored seed can be sown as early in the year as possible and stratified for 6 weeks at 5°C. It may take 2 years to germinate. Prick out the seedlings into individual pots when they are large enough to handle. Plant out in the summer if the plants are more than 25 cm tall, otherwise grow on in a cold frame for the winter and plant out in late spring. Cuttings are of half-ripe wood with a heel, July in a shaded frame. Overwinter the plants in the frame and plant out in late spring. High is percentage. Cuttings are of mature wood of the current season’s growth. Select pencil thick shoots in early autumn that are about 20–25 cm long and plant them in a sheltered position outdoors or in a cold frame. The cuttings can take 12 months to establish but a high percentage of them normally succeed. Division is of suckers in the dormant season. Plant them out direct into their permanent positions. Geographic is distribution are in Native to Europe, Northern Africa, Caucasus, Asia.

9.1.3. Code of Georgia: Beech forests with the woodruff covers (9130GE; PAL. CLASS.: 41.13)

Beech is distributed on the slopes of northern exposition having small or average inclination. The altitude a.s.l. varies between 1100 and 1550 meters. It is found in moist environment, on brown soils of well drainaged forests. It mainly consists of the beech and does not have an understory.

The forest woodruff *Asperula odorata* (=*Galium odoratum*) comprises 30-90% of grass cover in such types of forests. It differs from Corresponding European communities by the floristic composition, which is mainly expressed rarely in the existence of separate bushes of the holly (*Ilex colchica*). Such cases are rarely reported in Kolkheti and eastern Georgia, at a water division of Iori-Alazani upper streams. That's why; **A. Dolukhanov et al. (1946)** differentiated it from European communities and called it *Fageta asperulosa caucasica*.

Together with the beech the following species of trees are found - *Pyrus caucasica, Carpinus caucasica, Acer platanoides,* and *Tilia begoniifolia.*

Two sub-types are distinguished in the beech forest with woodruff cover. One is common on the carbonated soils of Gombori range whereas the second type is disseminated in local places of small Caucasus. It is intended to include beech communities in this type of habitat where the understory is weakly represented and grass cover is well developed:

Sub-types (9130GE-01): Gombori beech forest with woodruff cover. *Asperula odorata* holds 30-95% of grass cover in this association. Besides, the following species dominate: *Dryopteris filix-mas, Epipactis helleborine, Geranium robertianum, Viola reichenbachiana* etc.

Sub-types (9130GE-02): South Caucasus beech forest with woodruff cover contains many species that are identical to the first sub-type. However, *Epipactis helleborine, Mycelis muralis, Viola alba, Primula woronowii, Geranium robertianum,* etc. cannot be found here. Although, there are no species that can't be found in the Gombori association - *Solidago virgaurea, Pachyphragma macrophyllum,*

Neottia nidus-avis, Daphne pontica, Symphytum grandiflorum, Paris quadrifolia, Brachypodium sylvaticum.

Plants species: *Fagus orientalis, Acer platanoides, Brachypodium sylvaticum, Carex sylvatica, Carpinus caucasica, Cephalanthera damasonium, C. helleborine, C. longifolia, C. rubra, Daphne pontica, Dryopteris filix-mas, Epilobium montanum, Epipactis helleborine, Geranium robertianum, Hordelymus europaeus, Lamium album, Mycelis muralis, Neottia nidus-avis, Poa nemoralis, Pachyphragma macrophyllum, Paris quadrifolia, Primula woronowii, Salvia glutinosa, Solidago virgaurea, Symphytum grandiflorum, Tamus communis, Tilia begoniifolia, Vicia crocea, Viola alba, V. odorata, V. reichenbachiana,* etc.

9.1.3.1. Relict plant species Caucasian wild pear - *Pyrus caucasica* Fed., Rosaceae

Relict species of *Pyrus caucasica* are as a relict plant or animal is a taxon that persists as a remnant of what was once a diverse and widespread population **(Figure 47).**

Figuse 47. A. The tree of *Pyrus caucasica* is planted and used for food; **B**. The fruit is used for medicinal and consists of beer. **Photo: Maia Akhalkatsi.**

Grows is in lower and middle montane belts, sometimes higher, mainly in broad-leaved forest. Tree to 20-30 m high, sometimes a shrub; Deciduous, sometimes coniferous forests and shrub thickets, in deep

soils; sometimes forming pure stands; in the Caucasus from 100 m to 2000 m. Snow cover is <1 m. The exposition is for all directions and inclination till 30°C. Sunny edge is normal; dappled shade is in North Wall, East Wall, and West Wall. Suitable for: light, medium and heavy soils, prefers well-drained soil and can grow in heavy clay soil. Suitable pH: acid, neutral and basic soils. It can grow in semi-shade or no shade. It prefers moist soil and can tolerate drought. It can tolerate atmospheric pollution.

Crown is of pyramidal form. Branches are with or without spines; Young branches glabrous, bark grey, thorny. Buds and shoots glabrous, less often pubescent; Leaves glabrous or densely pubescent at the lower surface, somewhat leathery, upper surface glossy, round or broadly ovate, sometimes oblong, rarely rhomboid, with a long petiole, entire, margins covered with ciliate hairs. petioles about as long as the leaf blade, 2-5-7 cm long, initially Moj E or less pubescent, later glabrous; leaves 2-5-7 cm long, 1.5-2.5 cm broad, suborbicular or oval, rounded or obscurely cuneate at base, short -tapering, acuminate apex, entire or serrulate or crenate on whole or part of margin, initially white-arachnoid-pubescent, especially below, later quite glabrous or subglabrous, with a stronger pubescence - masking the teeth - only along the veins and the leaf margin, lustrous green, lighter below, drying black; pedicels 3.5 cm long, pubescent or glabrous; Flowers white, clustered into corymbs.

Flowers 2.5-3 cm in diameter; sepals triangular -lanceolate, densely pubescent like the ovary, erect; petals short -clawed, ca. 1.5 cm long, 1 cm broad; Fruit mostly globose pome, flattened at both poles, glabrous, on long stalk. Fruits have pyriform or subglobose, very variable in size and shape, to 3-4 cm long, 1.5-2 cm broad, green, sometimes reddening, less often yellow. Flowering is in April- May, fruits are from September-October.

The Caucasian pear is the ancestor of up to 15 cultivated forms. The most ancient of these, which have changed little, are derived directly from this species; most varieties, however, are the result of hybridization with other species. Pear trees were first cultivated in ancient Georgia, then penetrated into Greece and Italy, and later became widespread in Europe. Wild pear fruits are usually tart, becoming sweeter if stored. They are used in various ways depending on their gustatory qualities: they are eaten raw or dried, stewed, or used

for making of drinks (kvass, cider) or as fodder for cattle. The utilization of wild pear fruits is of great importance in Ciscaucasia, where in the Krasnodar Territory alone, according to Trusevich, pear forests with an admixture of apple 261 trees occupy 30,347 hectares, and the possible yield (together with the apples) is estimated at 139 thousand tons. Wild pear fruits contain 70-85% water, 6-13% sugar, 0.1-0.2% acids (mainly citric and malic), 0.29% ash, tannins, etc. The seeds contain 12-21% fatty oils. The wood is heavy, specific gravity 0.72, fine-grained, solid, reddish brown, an excellent imitation of ebony when covered with black varnish; used for lathework, cabinet -making, and musical instruments. A light brown dye is obtained from the bark. Fruit is raw or cooked. The flavour ranges from rather harsh and astringent through to soft, sweet and very juicy. The best dessert fruits have an exquisite sweet flavour, usually with a very soft flesh, whilst cooking varieties have harder less sweet flesh. A yellow-tan dye is obtained from the leaves. Wood - heavy, tough, durable, fine grained, hard. Used by cabinet and instrument makers. When covered with black varnish it is an excellent ebony substitute.

Prefers are a good well-drained loam in full sun. Grows is well in heavy clay soils. Tolerates light shade but does not fruit so well in such a position. Tolerates atmospheric pollution, excessive moisture and a range of soil types, if they are moderately fertile, avoiding only the most acid soils. Dislikes very exposed positions. Established plants are drought tolerant. A very hardy plant, tolerating temperatures down to below -15°C. Plants often sucker and can form dense thickets. A parent is of the cultivated pear, possibly by crossing with *P. nivalis* and *P. cordata*. There are many hundreds of varieties of cultivated pears and they are widely cultivated in the temperate zone for their edible fruits. By selection of varieties fresh fruits can be obtained from late July to April or May of the following year. Special Features: Edible, Naturalizing, Attractive flowers or blooms.

Seed of the *Pyrus caucasica* is as best sown in a cold frame as soon as it is ripe in the autumn, it will then usually germinate in mid to late winter. Stored seed requires 8-10 weeks cold stratification at 1°C and should be sown as early in the year as possible. Temperatures over 15 - 20°C induce a secondary dormancy in the seed. Prick out the seedlings into individual pots when they are large enough to handle and grow them on in light shade in a cold frame or greenhouse for their first year.

Plant them out in late spring or early summer of the following year. Geographic distribution is in Caucasian endemic - Caucasus, Anatolia and Iran.

9.1.4. Code of Georgia: Subalpine beech forest with *Acer trautvetteri* Medw. and *Rumex arifolius* All., Aceraceae (9140GE* PAL. CLASS.: 41.15)

Oriental beech - *Fagus orientalis,* creates dwarf trees in the subalpine zone. It is associated with the following species - *Acer trautveterii, Quercus macranthera, Betula litwinowii, Sorbus caucasigena,* etc. The Colchic understory is represented by sprawling bushes - V*accinium arctostaphylos, Ilex colchica, Laurocerasus officinalis, Ruscus colchica* and rarely by *Rhododendron ponticum.*

In eastern Georgia in the circumstances of a drier climate the beech forest in the subalpine zone is associated with the cover of the mountain fescue (*Fageta festucosa*). In the grass cover the following species dominate: *Festuca drymeja, Calamagrostis arundinacea, Milium schmidtianum, Calamintha grandiflora, Geranium sylvaticum,* etc.

The upper border of the subalpine krummholz beech forest is 2300 meters from the sea level. However, in the humid mountain places of south Kolkheti this community is found at the altitude of 2350 - 2570 meters a.s.l.. *Rumex* spp. is not typical to this habitat compared to the middle European subalpine beech forest.

Plants species: *Fagus orientalis, Acer trautveterii, Betula litwinowii, Calamagrostis arundinacea, Calamintha grandiflora, Corylus colchica, Gentiana schistocalyx, Ilex colchica, Laurocerasus officinalis, Monotropa uniflora, Neottia nidus-avis, Oxalis acetosella, Quercus macranthera, Rhamnus imeretina, Rhododendron luteum, Ruscus colchica, Salix* spp., *Solidago virgaurea, Sorbus subfusca, Trachystemon orientalis, Vaccinium arctostaphylos.*

9.1.4.1. Edificatory plant species Trautvetter's Maple - *Acer trautvetteri* Medw., Aceraceae

Edificatory species have a special role to contribute in ecosystem structure of *Acer trautvetteri* **(Figure 48).**

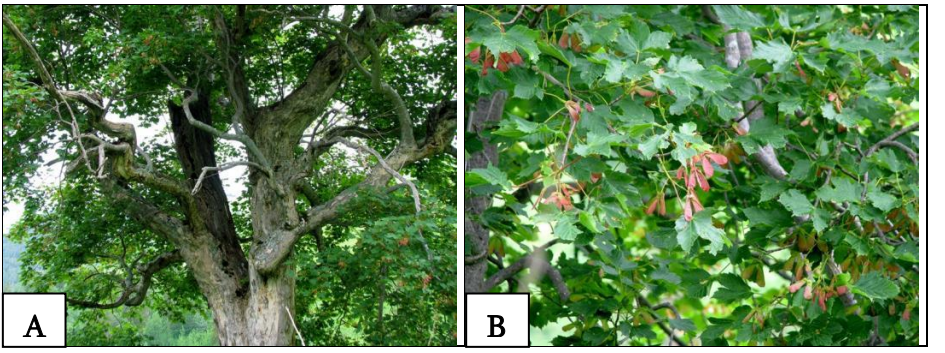


Figure 48. A. *Acer trautvetteri* is in subalpine forest on mountain south plateau; **B.** Flower is red and other inclined. **Photo: Maia Akhalkatsi.**

Trees of average size with broad crown and straight trunk covered with smooth gray bark, but often growing as a knotty sapling or even shrub; Subalpine zone up to 1800-2500 m, more often in community with birch, *Sorbus* and high mountain shrubs; sometimes in the upper belt of spruce-fir forests, near forest edges, extending beyond the area of forest vegetation; occurs individually or colonial. Snow cover is <0.5 m in subalpine forest areas and Snow cover is >2 m in treeline of 2500 m. The exposition is for all directions and inclination till 30° C. Sunny edge is normal; dappled shade is in North Wall, East Wall, and West Wall.Suitable for: light, medium and heavy soils and can grow in heavy clay soil. Suitable pH: acid, neutral and basic soils and can grow in very alkaline soils. Juvenile shoots glabrous, brown or reddish-brown; outer bud-scales glabrous, brown, the inner large, carmine-red; leaves 9-14 cm long, 11-16 cm wide, dark green above, glabrous, pale, yellowish beneath, the juvenile hairy, later with tufts of rufous or rust-colored hairs only at angles of nerves at base of leaves, cordate at base, sometimes base of leaves on short shoots rounded; dissected for into 5 lobes; lobes acuminate, the lateral nearly as long as the terminal,

usually declinate outwardly above, the lower small, horizontal or recurved below, irregularly acutely dentate at margin, median lobe nearly always with 2 pairs of large teeth above, lower teeth much larger than the upper, lobes widest at level of teeth, cuneately tapering to base.

Inflorescence a long- pedunculate small corymbiform panicle; rhachis and pedicels glabrous except for base beset with bundles of rufous hairs; bracts up to 1.8 cm long, not deciduous; Flowers usually bisexual, the staminate with or without rudimentary ovary, stamens of pistillate flowers absent or with sterile anthers, plants monoecious or dioecious or polygamous; samaras with elongated wing developing from the outer side of cell; inflorescences racemiform or corymbiform at ends of short branches; flowers ca. 1 cm in diameter, whitish-green; sepals broadly oval; petals nearly as long as sepals, narrower, both hairy at base inside, slightly ciliate at margin; stamens with glabrous filaments; samaras large, 3.5-7 cm long, with vertical wings often partly overlapping each other or slightly diverging, reddish when young, rarely bright carminered , ripe nuts brown, broadly ovoid, inflated, hairy when young, usually glabrous when ripe with internal walls lined with hairs. Flowering is in June. Fruits are in September.

A cold-resistant and ornamental plant has grown very often in parks. All the species of maple are ornamental trees or shrubs notable for the shapes of the leaves and crowns, especially in the fall when the leaves turn yellow, orange, bronze and red. Good nectar plants. Maple wood possesses all the qualities of good timber: density, uniform structure, durability, well-polished, splitting evenly, finegrained and beautiful color. For these reasons it is widely used in carpentry and woodwork and some species are even used in the building industry. *A. velutinum* and *A. pseudoplatanus* are especially valued for the fine resonant qualities of the timber which is used as sounding boards for musical instruments. They also yield firewood and high-quality charcoal. The sap of the trunk of all species contains sugar, some in such abundant quantity (especially the American species *A. saccharum* Marsh and *A. saccharinum* L. it is made into the popular favorite maple syrup. The species rich in sugar are *A. platanoides* L., *A. pseudoplatanus* L., *A. trautveterii* and *A. tataricum* L. Maple leaves contain properties that yield black, brown and yellow dyes. The leaves are also used to feed cattle. The leaves are packed around apples, root crops etc. to help preserve them. A fast growing plant and bearing

clipping well, it makes an excellent clipped hedge and can also be used as part of a native wildlife hedge where it is only trimmed every 3-4 years. It has also been used in topiary. Wood - fine-grained, tough, elastic, hard to split, takes a high polish and is seldom attacked by insects. Trees are seldom large enough to supply much usable timber, but when available it is much valued by cabinet makers. It is also used for cups bowls etc. The wood of the roots is often knotted and is valued for small objects of cabinet work. The wood is an excellent fuel. A charcoal made from the wood is a good fuel. Landscape is in Firewood, Pollard, Screen, Standard, Superior hedge, Specimen, Street tree. Of easy cultivation, it prefers a good moist well-drained soil in a sunny position but tolerates some shade. Does it well on chalky soils, tolerating a pH as high as 8, but becoming a shrub in such conditions? Does it not thrive in soils with a pH much below 6? Grows is well in heavy clay soils. Tolerates is atmospheric pollution. Growth is fast once the trees are established, but this later slows down and trees take about 50 years to reach maturity. Frequently found as a shrub in light woodland, especially under oak. It is one of the first trees to colonize chalk grassland. The field maple is a bad companion plant, inhibiting the growth of nearby plants. Good is bee plant. This species has often been coppiced in the past for its wood. Trees produce seed in about 10 years from sowing. Seed of the *Acer trautvetteri* is as best sown as soon as it is ripe in a cold as frame; it usually germinates in the following spring. Pre-soak stored seed for 24 hours and then stratify for 2-4 months at 1-8°C. It can be slow to germinate. The seed can be harvested 'green' and when it has fully developed but before it has dried and produced any germination inhibitors and sown immediately. It should germinate in late winter. If the seed is harvested too soon it will produce very weak plants or no plants at all. When large enough to handle, prick the seedlings out into individual pots and grow them on until they are 20 cm or more tall before planting them out in their permanent positions. Layering, which takes about 12 months, is successful with most species in this genus. Cuttings are of young shoots in June or July. The cuttings should have 2-3 pairs of leaves, plus one pair of buds at the base. Remove a very thin slice of bark at the base of the cutting; rooting is improved if a rooting hormone is used. The rooted cuttings must show new growth during the summer before being

potted up otherwise they are unlikely to survive the winter. Geographic distribution is in Caucasus Mountains, Transcaucasus, and Daghestan.

9.1.5. Code of Georgia: Limestone beech forests (*Cephalanthero-Fagion*) (9150GE*; PAL. CLASS.: 41.16)

Middle European limestone beech forest (*Cephalanthero-Fagenion*): Xero-thermophyllic beech forest is widespread on calcium-rich soils and can be found in the whole area of the forest at the altitude from 600 to 1600 meters. Characteristic species are calcareous orchids - *Cephalanthera* spp., *Epipactis* spp. and *Neottia nidus-avis.* The following are characteristic from arboreal plants: an oak (*Quercus iberica*), hornbeam (*Carpinus caucasica*), ash (*Fraxinus excelsior;* **Figure 49).**

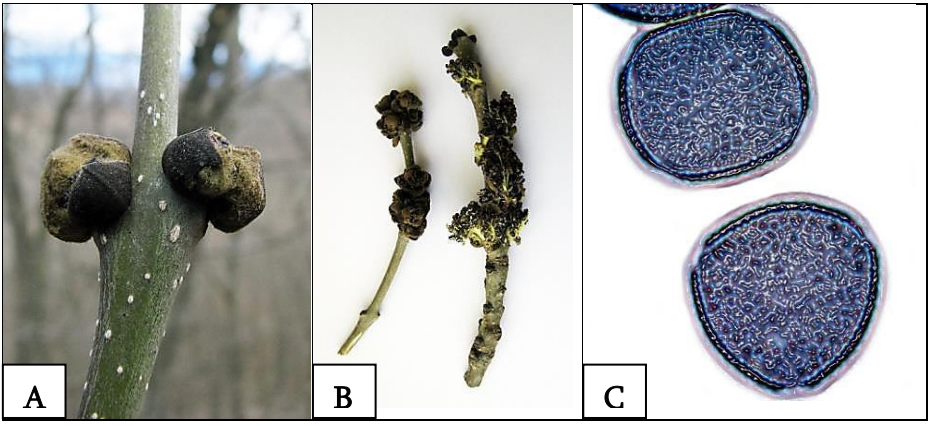


Figure 49. A. Flowers of *Fraxinus excelsior* begin in March; **B.** Flower pollen grains have many pollens; **C.** Pollen of *Vicia purpurea* has length of the horizontal height as 28-34 μm. **Photo: Maia Akhalkatsi.**

It is more characteristic to Kakhetian Caucasus. It is situated at the slopes of the inclination of 10-25°C, on moderately moistened soils, where grass cover and scrub understory are quite well represented. The following are distinguished from the grass cover: sedge (*Carex sylvatica*), mountain fescue (*Festuca drymeja*), meadow grass (*Poa nemoralis*), etc. Existence of Colchic boxwood (*Buxus colchica*) bushes is possible in the understory.

Sub-types (9150GE-01): Hemixerophillic forest of *Fagus orientalis* (*Fageta hemixerophylla*) can be found in the middle mountain zone of east Georgia on calcium-rich soils, normally, on significantly stretched downhill slopes. In west Georgia it is rare and is associated with azalea groups. The following types of arboreal plants are mixed with the beech in small amounts: Georgain oak - *Quercus iberica,* ash - *Fraxinus excelsior,* maple - *Acer laetum,* mountain ash - *Sorbus torminalis.* The following form the understory: medlar- *Mespilus germanica,* dog rose - *Rosa* spp., hawthorn - *Crataegus* spp., etc. sedge - *Carex sylvatica* represents the grassy sward. *Festuca drymeja, Poa nemoralis, Brachypodium sylvaticum* – grasses; - *Cephalanthera damasonium, C. longifolia, C. helleborine, C. rubra, Epipactis leptochila* subsp. *leptochila, E. leptochila* subsp. *neglecta, E. microphylla, E. persica, E. viridiflora* subsp. *kunkeleana, Neottia nidus-avis,* etc. *Epipogium aphyllum* is very rare.

Sub-types (9150GE-02): The beech forest without understory (*Fageta nuda*) can be found on the southern slopes of the Great Caucasus, in the lower zone of the mountain, 500-1200 meters a.s.l.. Annual precipitation does not exceed 850 mm. The understory is scarce, contains the species of *Rhododendron luteum, Ilex colchica, Vaccinium arctostaphylos*. Grassy sward is rare. The following can be found: ivy - *Hedera pastuchowii* in east Georgia and *H. colchica* in west Georgia.

Sub-types (9150GE-03): The beech forest with forest bastard cabbage cover - *Fageta dentariosa iberica*, Common in the Alazani river basin. Together with the beech the following can be found: lime, sometimes chestnut and maple (*Acer laetum*). The understory is represented by blackberry, ivy and ferns. Orchids - *Cephalanthera* spp., *Neottia nidus-avis,* and *Pachyphragma macrophyllum* can also be found.

Plants species: *Fagus orientalis, Acer laetum, Castanea sativa, Tilia begoniifolia, Achillea biserrata, Bromopsis benekenii, Campanula rapunculoides, Carex digitata, C. sylvatica, Festuca drymeja, Cephalanthera damasonium, C. longifolia, C. rubra, Epipactis helleborine, E. leptochila* subsp. *leptochila, E. leptochila* subsp. *neglecta, E. microphylla, E. persica, E. viridiflora* subsp. *kuenkeleana, Neottia nidus-avis, Orobus hirsutus, Rubus* spp., *Serratula quinquefolia, Solidago virgaurea.*

9.1.5.1. Relict plant species wild apple - *Malus orientalis* Uglitzk., Rosaceae

Relict species of *Malus* are as a relict plant and it is a taxon that persists as a remnant of what was once a diverse and widespread population **(Figure 50).**

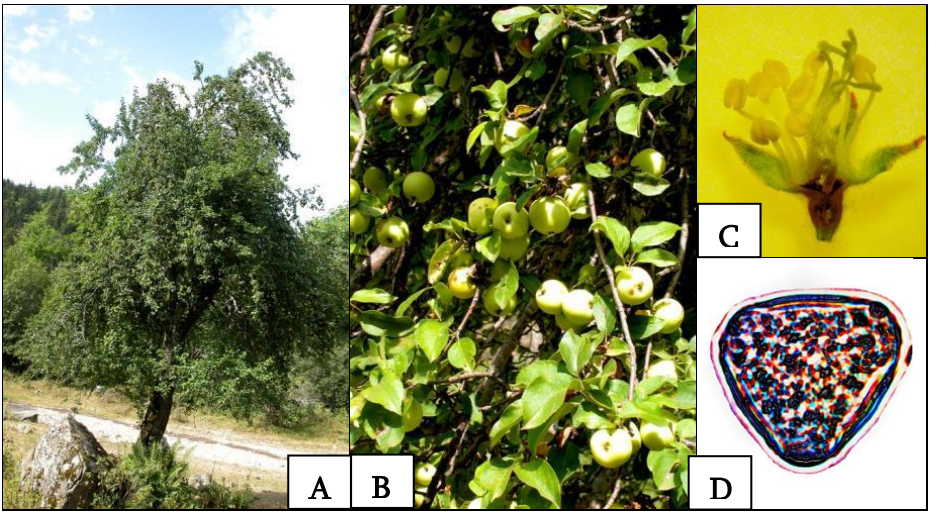


Figure 50. A. *Malus orientalis* is in forest in Meskheti; **B.** *M. orientalis* has many fruits; **C.** Flowers have pollen in April**; D.** Pollen of *M. orientalis* has length of the horizontal height as 36-39 μm. In down has 14-16 μm and distanth height as 38-41 μm. **Photo: Maia Akhalkatsi.**

Grows in forests, scrubs, forest margins, in lower and middle montane belts, sometimes reaches higher elevations 0-2000 m. Medium - sized or more or less tall tree, to 10-11 m high; Deciduous (especially broadleaf) mountain forests, forest edges, among shrubs, on riverbanks. Snow cover is <1 m. The exposition is for all directions and inclination till 30°C. Sunny edge is normal; dappled shade is in North Wall, East Wall, and West Wall. Suitable for: light, medium and heavy soils, prefers well-drained soil and can grow in heavy clay soil. Suitable pH: acid, neutral and basic soils. It can grow in semi-shade or no shade. It prefers moist soil.

Young branches brown, densely pubescent and twigs dark grey. Branches usually unarmed; young shoots dark brown, somewhat tomentose, when adult dark gray with sparse lenticels; Leaves 3-8 cm long, 1,5-3,5 cm wide of variable shape, ovate-lanceolate, oblong elliptical or almost round, entire at the base, the other parts of the margin serrate. Usually cuneately tapering at base, obtuse, less often acuminate with inconspicuous or rather short mucro, entire at base, otherwise serratedentate, less often crenate-serrate, usually with very large acute or subobtuse teeth in upper part, thickish; Upper surface of young leaves scarcely pubescent, lower surface densely puberulence, later upper surface becomes glabrous. Young leaves scattered-hairy above, densely white-tomentose below, the adult hairy above only along the veins, otherwise quite glabrous, with strongly impressed lateral veins, rather densely, sometimes rather sparsely grayish tomentose below, usually very prominently veined.

Flowers of 4-6 per inflorescence ca. 4 cm in diameter, with densely tomentose -villous pedicels 8-12 mm long; Pedicles densely tomentose, petioles 0.5-3 cm long, thickish or rather slender, more or less tomentose; hypanthium obconical, very densely tomentose; sepals rather short, narrowly triangular, acute, spreading, densely tomentose outside, subglabrous or slightly tomentose inside; petals obovate, narrowing to a conspicuous claw; styles about as long as stamens, tomentose at base, otherwise glabrous; stigmas clavate, narrow; Fruit rounded pome, flattened at both poles, globose, 2-3 cm in diameter with short, densely tomentose pedicels 1-2.5 cm long. Flowering in April- May, fruits from September.

The fruits of the species belonging to this group are edible, but those of the wild-growing varieties are seldom eaten raw owing to their high acidity; they are usually dried and for stewed fruit, etc. or for the preparation of drinks. Nectariferous is here. The wood of some forms finds applications in carpentry and turnery, but is less valuable than pearwood, because it warps and splits. See also economic importance data cited for the individual species. Fruit is raw, cooked or dried for later use. Apples are one of the most common and widely grown fruits of the temperate zone. There are a great many named varieties with differing flavours ranging from sour to sweet and textures from dry and mealy to crisp and juicy. There is also a wide range in the seasons of ripening with the first fruits being ready in late July whilst other

cultivars are not picked until late autumn and will store for 12 months or sometimes more. See individual records for more details.

The fruit of some cultivars is rich in pectin and can be used in helping other fruits to set when making jam etc. Pectin is also said to protect the body against radiation. Edible oil can be obtained from the seed. It would only really be viable to use these seeds as an oil source if the fruit was being used for some purpose such as making cider and then the seeds could be extracted from the remaining pulp. The fruit is astringent and laxative. The bark, and especially the root bark, is anthelmintic, refrigerant and soporific. An infusion is used in the treatment of intermittent, remittent and bilious fevers. The leaves contain up to 2.4% of an antibacterial substance called 'phloretin'. This inhibits the growth of a number of gram-positive and gram-negative bacteria in as low a concentration as 30 ppm. A ripe raw apple is one of the easiest foods for the stomach to deal with, the whole process of digestion taking about 85 minutes.

The apple juice will reduce the acidity of the stomach; it becomes changed into alkaline carbonates and thus corrects sour fermentation. The apple is also an excellent dentifrice, the mechanical action of eating a fruit serving to clean both the teeth and the gums. The fruit is a source of pectin. Pectin is used as a thickener in jams etc. and as a culture medium in laboratories. The apple is also an excellent dentifrice, the mechanical action of eating a fruit serving to clean both the teeth and the gums. The oil from the seed has been used as an illuminant. Wood has hard, compact, fine-grained. Used for turnery, tool handles canes etc. It makes an excellent fuel.

An easily grown plant, it succeeds in most fertile soils, preferring a moisture retentive well-drained loamy soil. Grows is well in heavy clay soils, though if these are poorly drained there could be problems with diseases such as canker. Prefers a sunny position but succeeds in partial shade though it fruits less well in such a situation. Tolerates is a pH range from 6 to 7, preferring a range of 6.5 to 6.8. The apple is one of the most commonly cultivated fruit crops in the temperate zone. The primary climatic requirements for the production of good quality fruit are warm summer temperatures, relative freedom from spring frosts, reasonable protection from the wind (especially cold north and east winds) and an evenly distributed rainfall of about 600 – 800 mm per annum. Good apple production has been achieved as far north as 65°C,

whilst about 1000 hours of winter temperatures below 7°C are necessary to initiate flower production. However good is quality apples can still be produced in other areas with careful management and choice of cultivars? Even in tropical latitudes, the plant has succeeded at high elevations, producing fruit at elevations over 3000 metres in Ecuador for example. Where space is at a premium or at the limits of their climatic range, apples can be grown against a wall. Most cultivars will grow well against a sunny south or west facing wall, an east facing wall will suit many of the tougher cultivars and even a north facing wall can be used for early culinary cultivars. A hybrid of mixed origins, including *Malus dasyphylla, M. praecox, M. pumila, M. sieversii* and *M. sylvestris*, this species is very commonly cultivated in temperate areas for its edible fruit. There are very many named varieties and with careful choice of these varieties it is possible to provide freshly harvested fruit from July to December and stored fruit for the rest of the year. When chives (*Allium schoenoprasum*) or other alliums are grown under apple trees it can prevent or cure scab. A spray of the infused leaves of Equisetum spp can also be used against scab. If climbing nasturtiums (*Tropaeolum majus*) are grown into the tree they can repel woolly aphis. Apples lose their flavour if they are stored with potatoes. They will also impart a bitter flavour to carrots or potatoes if they are stored in the same area. Growing apples near potatoes makes the potatoes more susceptible to blight. Wrapping maple leaves (*Acer* spp.) around apples in store helps to preserve the apples. Apples store better if they are grown in a sward that contains a high percentage of clover. Apple trees grow better and produce better quality fruit when foxgloves (*Digitalis* spp.) and wallflowers (*Erysimum cheiri*) are growing in the orchard. Dandelions (*Taraxacum* spp.) produce ethylene gas and this can cause earlier ripening of fruit if plants are growing in an orchard. The fruit is a good wildlife food source, especially for birds. Hybridizes freely with other members is of this genus. Plants in this genus are notably susceptible to honey fungus.

Seed of *Malus* is as this species is a hybrid and will not breed true from seed, though some interesting new fruiting cultivars can be produced. It is best sown as soon as it is ripe in the autumn in a cold frame. It usually germinates in late winter. Stored seed requires stratification for 3 months at 1°C and should be sown in a cold frame as soon as it is received. It might not germinate for 12 months or more.

Prick out the seedlings into individual pots as soon as they are large enough to handle. If given rich compost they usually grow away quickly and can be large enough to plant out in late summer, though consider giving them some protection from the cold in their first winter. Otherwise, keep them in pots in a cold frame and plant them out in late spring of the following year. Cuttings are of mature wood, November in a frame. Geographic distribution is in Native to Caucasus, Asia Minor, Iran.

9.1.6. Code of Georgia: Beech forests with Colchic understory (*Fageta fruticosa colchica*) (91FC-GE*)

The existence of the dense understory differentiates the beech forest of Georgia from the one in the rest of Europe. The beech forest with the Colchic understory is the composing part of the eco-region of Colchic mixed broad leaved forest. It is widespread in west Georgia on Northern-western slopes of Great Caucasus and the Ajara-Imereti Ridge. The climate is moist with about 2500 mm of annual precipitation. In South Colchic forests of this type start from the sea coast. In the Northern part it does so at the 200 meters a.s.l. and reaches about 2250 meters. As a result, the type of vegetation significantly differs. There are several sub-types. Sometimes sub-types are mixed with each other, which makes their classification difficult.

Colchic forests are extremely rich in terms of flora. They contain relict species of the tertiary period – fern, *Hymenophyllum tunbrigense,* and arboreal plants - *Fagus orientalis, Castanea sativa, Zelkova carpinifolia, Pterocarya fraxinifolia, Diospyros lotus, Taxus baccata.* Species mixed with the beech tree are: *Abies nordmanniana, Picea orientalis, Pinus kochiana, Quercus imeretina, Q. hartwissiana, Acer laetum, Carpinus caucasica, Tilia begoniifolia, Ficus carica, Pyrus caucasica, Malus orientalis, Staphylea colchica, S. pinnata* etc. The following bushes create the understory in the beech forest - *Laurocerasus officinalis, Rhododendron panticum, R. ungernii, Ruscus panticus, R. colchicus, Ilex colchica, Daphne pontica, Epigaea gaultherioides, Vaccinium arctostaphylos, Viburnum orientale* da *Buxus colchica.* The following lianas can be found - *Hedera colchica, Dioscorea caucasica, Tamus communis, Periploca graeca*. Ferns - *Matteuccia struthiopteris, Athyrium filix-femina, Polypodium vulgare,*

Phyllitis scolopendrium, Pteris cretica, etc. The following are worth-mentioning from the grass cover - *Asperula odorata, Calamintha grandiflora, Festuca drymeja, Salvia glutinosa, Viola alba.*

Sub-types (91FC-GE01): Beech forest with the Pontic rhododendron understory - *Fageta rhododendrosa (Rhododendron ponticum, R. ungernii)* for the typical Colchic forest. The understory with *Rhododendron ponticum* can be found in almost all forest massifs of west Georgian forests. It is rare in east Georgia and can be found in Baniskhevi, Kvabliani and Nedzvistskali gorges. The average annual precipitation amount in the scope of its distribution amounts to 1400 mm. The scope of its distribution starts from the sea coast and ends at 1950 meters a.s.l.. In the mountains of high level of moisture in Guria and Ajara it can reach the height of 2100-2200 meters. It grows both in flat open places and heavily inclined slopes. It gives preference to Northern exposition slopes but in the circumstances of high level of moisture grows in the place of southern exposition. It does not like depressed relief with high level of moisture and badly drained soil.

Two types of communities are given:

1) Typical beech with Pontic rhododendron understory (*Fageta rhododendrosa typical*), which is widespread at the altitude of 400-1700 meters a.s.l.. The annual amount of precipitation is 1700-2500 mm. Pontic rhododendron cover is extremely dense. Other common plants are *Trachystemon orientalis, Buxus colchica,* and *Rubus* spp.
2) Beech forest with the understory (*Fageta rhododendrosa ungernii*) of Ungern rhododendron (*Rhododendron ungernii*), which is a relict and local endemic. It can be found in the conditions of high moisture. Annual average precipitation in these places reaches 3000 mm. Small populations can be found in the Seaside Mountains of Ajara in the upper part of the gorge – Bartskhana, Chakvistskali, Koronistskali and Kintrishi. They are also common at the upper stream of other rivers of Kolkheti – Bzhuzha, Natanebi, Bakhvistskali and Supsa.

Sub-types (91FC-GE02): Beech forest with the laurel *(Laurocerasus officinalis)* understory *Fageta laurocerasosa* similar to Pontic rhododendron is common in the conditions of high level of moisture, where the amount of average annual precipitation amounts to 2000 mm. The amplitude of vertical spreading varies between 700 and 2000 meters. Different from Pontic rhododendron, laurel grows well on

limestone and well-illuminated slopes of the south. Besides Kolkheti, it is common in the form of small populations far from the areal. For example, in east Georgia it is widespread in the Alazani basin and river Ilto gorge. Existence is of such a widely disseminated areal of distribution is related to ornithochoria, since birds feed on its fruit and disseminate seeds on large distances. Different from Pontic rhododendron, in the laurel understory the grassy cover - *Sanicula europaea, Asperula odorata, Viola alba, V. reichenbachiana, Dentaria bulbifera, Calamintha grandiflora, Salvia glutinosa, Geranium gracile,* etc. ferns - *Dryopteris filix-mas, D. carthusiana, D. assimilis, Polystichum braunii.* are better developed.

Three types of communities are observed:

1) Typical beech forest with laurel *(Laurocerasus officinalis)* subforest (*Fageta laurocerasosa typica)* is widespread in the places where annual amount of precipitation does not exceed 1700 mm.
2) Beech forest with the understory (*Fageta ilicitoso-laurocerasosa*) of holly (*Ilex colchica*) and laurel *(Laurocerasus officinalis)* can be found on Limestone Mountains in Abkhasia and Samegrelo – on mountain massives of Kvira, Migaria and Askhi.
3) Beech forest with the mountain fescue (*Festuca drymeja*) cover and laurel understory (*Fageta festucoso-laurocerasosa*) are described only in two places. The first is in the tract of mountain Kvira, in the upper part of the karstic limestone macro-slope with the inclination of 28°C at the altitude of 1780 meters. The second one is on the same mountain at the 1700 meters on the southern slope of 30°C inclination. In the first place the forest is represented only by the beech whereas in the second one, *Acer trautveterii* is also mixed.

Sub-types (91FC-GE03): Beech forest with the butcher's broom *(Ruscus colchicus)* understory *Fageta ruscosa* is quite rare. However, the butcher's broom itself is characteristic to quite many various communities. But it is a small type of a plant and, therefore, is less visible. It is common in large quantities when other species of Colchic understory are excluded from communities due to certain circumsrances. That's why; the existence of the understory of only butcher's broom is the indicator of the reduction of those conditions that are essential for the existence of the Colchic type understory. Firstly, this community was described by **V.A. Povarnitsin (1931)** on

the northern-eastern border of Kolkheti, in the Basin of Kvirila River, Jalabeti forest massif.

Sub-types (91FC-GE04): Beech forest with the typical understory (*Fageta magnovacciniosa*) of Caucasian blueberry (*Vaccinium arctostaphylos*). It is most widely distributed in Kolkheti. In east Georgia it is common in the Lagodekhi region. Two types of communities are differentiated:

1) Beech forest with the typical understory of Caucasian blackberry (*Fageta magnovacciniosa Typical*. It is common in west Georgia, distributed in the middle and upper zones of the forest at the altitude of 900-2150 meters. In east Georgia it is common in the Lagodekhi reserve and extends to the Zakatala reserve on the territory of Azerbaijan. Besides *Vaccinium arctostaphylos,* the understory is created by ivy - *Hedera colchica* (west Georgia), or *H. pastuchowii (*east Georgia*),* Blackberry - *Rubus* spp., mountain blueberry – *Vaccinium myrtillus,* fern - *Gymnocarpium dryopteris,* grass cover – *Festuca drymeja, Paris incompleta, Oxalis acetosella,* these species are rare species - *Trachystemon orientalis, Neottia nidus-avis, Monotropa uniflora.*
2) Beech forest with the cover of mountain fescue (*Festuca drymeja*) and Caucasian blueberry understory (*Fagetum festucoso-magnovacciniosa*) are common on the slopes of the Southern exposition, in the upper zone of the forest (900-1500 m). The understory is sparse. Besides Caucasian blueberry, azalea (*Rhododendron luteum*) is represented.The following dominate in the grass cover - Solidago *virgaurea, Gentiana schistocalyx, Calamintha grandiflora, Oxalis acetosella, alamagrostis arundinacea.*

Sub-types (91FC-GE05): Beech forest with azalea *(Rhododendron luteum)* understory (*Fageta azaleoza*) is less dependent on moisture conditions and frequently found on dry southern slopes as well. As usual, besides the beech forest it grows in oak-hornbeam forests.

Three communities are differentiated:

1) Beech forest with the azalea (*Fageta azaleosa media*) understory of the middle zone of the forest is common in mountain massifs of west Georgia with the average annual precipitation of 800-1500 mm. Characteristic landscape is the southern slope with the embossed relief of average inclination. Hornbeam, Georgian oak

and Caucasian maples (Acer velutinum) are mixed with the beech. Species of the lower layer are: *Festuca drymeja, Rubus* spp., *Vicia crocea, Trachystemon orientalis.*

2) The beech forest with azalea (*Fageta azaleosa superior*) is maily common at the height of 1700-1900 meters. The spruse (*Picea orientalis*) is also mixed with the beech.
3) East Georgia beech forest with the azalea understory (*Fageta azaleosa iberica*) is widespread in Aragvi gorge, the upper current areal of Iori and Alazani and mountains of the left side of the valley. It grows on slopes of different exposition having the embossed relief, at the height from 1000-1700 meters, or even higher in some places.

Sub-types (91FC-GE06): Beech forest with viburnum *(Viburnum orientale)* understory - *Fageta viburnosa* is characterized by a small synecological areal of distribution. The viburnum creates the understory mainly in the beech forest. It rarely does so in the fir-forest or other types of forests. From different forms of the Colchic type understory it holds the most moistened location. It can be common outside Kolkheti in the upper streams of rivers Aragvi and Alazani. The area of its distributed varies between 900 and 1900 meters. It mostly grows on the slopes of northern exposition of little hillside or flat open space. It can not be found on the slope of more than 25°C of inclination. Viburnum is the Colchic relict. Its close relative species *Viburnum acerifolium* grows in the eastern part of the USA.

Three communities are differentiated:

1) Beech forest with the typical understory of viburnum (*Fageta viburnosa typica*) grows in the middle zone of the forest of west Georgia, 1100-1600 meters a.s.l.. It is more common on slopes of small and middle inclination of Great Caucasus. Besides it, Caucasian blueberry and laurel grow in the understory. From other plants blackberry, box, *Trachystemon orientalis, Dentaria bulbifera, Paris incomplete,* etc. dominate.
2) The beech forest with blackberry-viburnum understory (*Fageta ruboso-viburnosa*) is common in Kokheti forests and extreme east of the area of its distributed, Aragvi gorge. Together with the beech, the maples (*Acer platanoides, A. pseudoplatanus, A. trautvetteri*) can be found, from bushes - blackberry, Caucasian

blueberry, holly, nut (*Corylus avellana*), elder (*Sambucus nigra*) and ferns - *Dryopteris filix-mas, Athirium filix-femina*.

3) Beech forest of the upper forest zone with the viburnum understory (*Fageta viburnosa superior*) can be found only in west Georgia at the height above 1700 meters and is rare. There are the following species that are characteristic to the upper zone of the forest and drier biotopes: *Calamagrostis arundinacea, Gentiana schistocalyx, Oxalis acetosella, Gymnocarpium dryopteris, Festuca drymeja, Asperula odorata, Cardamine pectinata, Neottia nidus-avis, Epilobium montanum*, etc.

Plants species: *Fagus orientalis, Abies nordmanniana, Acer laetum, A. platanoides, A. pseudoplatanus, A. trautvetteri, Asperula odorata, Buxus colchica, Calamintha grandiflora, Carpinus caucasica, Castanea sativa, Daphne pontica, Dentaria bulbifera, Dioscorea caucasica, Diospyros lotus, Epigaea gaultherioides, Epilobium montanum, Festuca drymeja, Ficus carica, Gentiana schistocalyx, Geranium gracile, Hedera colchica, Ilex colchica, Laurocerasus officinalis, Malus orientalis, Neottia nidus-avis, Oxalis acetosella, Paris incompleta, Periploca graeca, Picea orientalis, Pinus kochiana, Pterocarya fraxinifolia, Pyrus caucasica, Quercus imeretina, Q. hartwissiana, Rhododendron panticum, R. ungernii, Ruscus colchicus, R. panticus, Salvia glutinosa, Sanicula europaea, Staphylea colchica, S. pinnata, Tamus communis, Taxus baccata, Tilia begoniifolia, Trachystemon orientalis, Vaccinium arctostaphylos, Viburnum orientale, Viola alba, V. reichenbachiana, Zelkova carpinifolia*, etc. ferns - *Athyrium filix-femina, Gymnocarpium dryopteris, Matteuccia struthiopteris, Phyllitis scolopendrium, Polypodium vulgare, Pteris cretica*, etc.

9.1.6.1. **The economically potential species and medicinal plants Gentiana – *Galanthus alpinus* Sosn., Amaryllidaceae**

The economically potential species of *Galanthus* are recreational, ornamental and medicinal plants. We have found 3 small populations of *Galanthus alpinus* Sosn. Near Atskuri adjoining is to Borjomi district, where it is abundant **(Figure 51).**

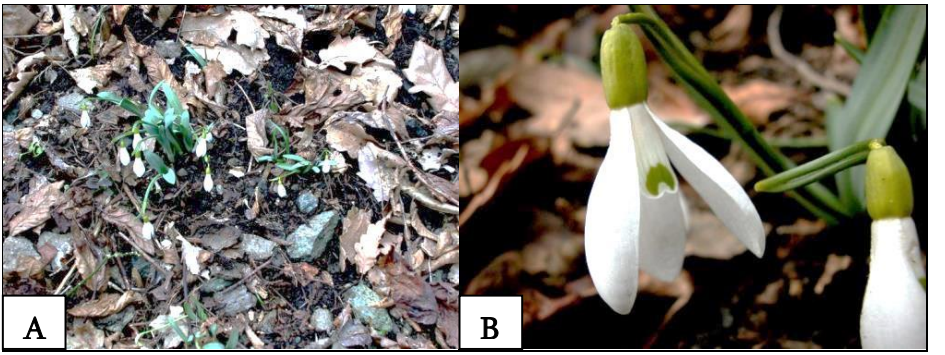


Figure 51. A. *Galanthus alpinus* (VU), Tsriokhistskali gorge, v. Tsriokhi, Akhaltsikhe distr**.; B.** Flowers of species are others and this is *Galanthus alpinus*. **Photo: Maia Akhalkatsi.**

The bulbs should be planted about 5 – 7 cm deep as early in the spring as possible. A good is bee plant, providing an early source of pollen and nectar. More abundant population of this species were found on Zekari Pass in Adjara-Imereti Range, However, it was located in Imereti, outside of Samtskhe-Javakheti region. According to local population it is to found in Shavsheti range, Mt. Erbo, Persati range and Mt. Chechla. However, we did not find these populations. Target species is *Galanthus alpinus* Sosn. Georgian endemic, RDB USSR, CITES, IUCN, ornamental. Bulb growing is to 0.2 m by 0.08 m. It is in flower in February-March. Seeds mature in June. After this aboveground part dries and bulb overwinters underground, where in September-November is formed flower primordium. Leaves and flowers appear in January almost simultaneously. The seeds ripen from May to June. Galanthamin is used in pharmaceutical industry for treatment of poliomyelitis and disease of the central nervous system. Lycorin is used for bronchitis and other lung disease. Edible uses are none known. Illegal collection in the wild and export instead of cultivated *Galanthus woronowii.* Establishment is of managed reserves, insertion in the RDB Georgia. Prefers is a moist heavy loam, growing well in grass or amongst shrubs. Prefers is a shady position. The dormant bulbs are fairly hardy and will withstand soil temperatures down to at least -5°C **(Matthews, 1994**). A very ornamental plant, it grows well on the woodland edge.

Seed of the *Galanthus* is as best sown as soon as it is ripe in a cold frame. Sow the seed thinly so that there is no need to thin them. The seed usually germinates in the spring. Grow them on in the same pot in a cold frame for the first two years, giving an occasional liquid feed to ensure the plants do not become nutrient deficient. Pot up the small bulbs whilst they are still in leaf in early summer of their second year's growth, putting about 3 bulbs in each pot. Grow them on in the cold frame for a further year before planting them out into their permanent positions in late spring whilst they are still in growth. The plants take about 4 years to flower from seed. Division of offsets is best done immediately after the plants have finished flowering (and still have green leaves) though it can also be done in late summer and early autumn when the plants are dormant. Establishment is of managed reserves, insertion in the RDB Georgia.

9.1.7. Code of Georgia: Beech forests without understory (*Fageta sine fruticosa*) (91SF-GE)

In this type of habitat those communities of the beech are associated where there is no understory represented by bushes and developed significantly, which is characteristic to the beech forest with the Colchic type understory. In this case, vegetation of the lower tier is represented by grasss - *Festuca drymeja*, herbal species - *Trachystemon orientalis, Pachyphragma macrophyllum,* and blackberry runner/undergrowth - *Rubus* spp., ferns, etc.

Sub-types (91SF-GE 01): Beech forest with the mountain fescue (*Festuca drymeja*) cover (*Fageta festucosa*) is the most widely distributed community in the beech forests in east Georgia, at the altitude of 1000-1750 meters. In east Georgia this association is more rare and is expelled by the forests of spruce and fir or the beech forest having the Colchic understory where *Vaccinium arctostaphylos, Rhododendron luteum* and *Ilex colchica* dominate.The following are common from arboreal plants: *Carpinus caucasica, Acer laetum, A. platanoides, Tilia begoniifolia, Castanea sativa, Fraxinus excelsior, Quercus iberica, Prunus avium,* etc. The grass cover in the beech forest of the subalpine zone is associated with the mountain fescue cover (*Fageta festucosa*). *Festuca drymeja, Calamagrostis arundinacea,*

Milium schmidtianum, Calamintha grandiflora, Geranium sylvaticum, etc. dominate here.

Sub-types (91SF-GE 02): Beech forest with the phachyphragma *(Pachyphragma macrophyllum)* cover *Fageta pachyphragmosa* is common in more moist areas than the sub-types of the beech described above not having the understory. In Kakheti the beech in this sub-type of the habitat is mixed with the maple (*Acer velutinum*), in west Georgia - with the mountain maple (*Acer pseudoplatanus*), Norway maple - (*Acer platanoides*), lime, ash, hornbean, sometimes fir. The understory is represented by the elderberry and the nut. Pachyphragma, which is the relict plant of the monotype species, and Colchic local endemic, mainly create the herbal cover. However, it is common as well in east Georgia. Namely, in the Lagodekhi reserve. Pachyphragma is the indicator species, its existence is related to the humus rich soil. It is distributed in the areas that are moderately moist at the 500-1000 meters a.s.l.. It reaches the margin of maximum distribution, 1820 meters in Upper Svaneti. Blackberry, ivy, woodruff, as well as the species blooming in spring - *Galanthus lagodechianus, Scilla sibirica, Anemone caucasica, Corydalis caucasica, C. marschalliana, Viola alba, V.odorata, Dentaria bulbifera,* etc. participate in forming the lower layer.

Sub-types (91SF-GE 03): Beech forest with blackberry *(Rubus hirtus)* cover (*Fageta rubosa*) is widely distributed in the middle zone of the forest, on the moderately moist slopes of the southern exposition of the Great Caucasus, at the altitude of 1100-1600 meters. It is quite rare in small Caucasus. *Rubus hirtus* is characterized by great polymorphism. Other species of blackberry include *R. serpens, R. platyphyllus, R. caucasicus, R. ponticus, R. candicans, R. cartalinicus, R. georgicus, R. tomentosus, R. piceetorum, R. dolichocarpus,* etc. The grass cover is quite arid and is observed in small quantities *Cephalanthera longifolia, C. rubra, C. damasonium, Epipactis helleborine, E. microphylla, Neottia nidus-avis, Dentaria bulbifera, Arum albispathum.*

Sub-types (91SF-GE04): Beech forest with borage *(Trachystemon orientalis)* cover *Fageta trachystemosa* is characteristic to the beech forests of west Georgia. Borage is the relict species of Kolkheti. The amplitude of its distribution varies according to the height up to almost the subalpine zone from the sea level. However, it is more typical in the

middle zone of the forest (700-1200 meters). At the low height it is under strong anthropogenic impact, which causes decrease of its number. At higher altitude it is expelled by the communities of coniferous forests. In the circumstances of wet climate borage is associated with blackberry. The understory is not developed but in certain cases there are separate species of the nut and elder. Herb cover is represented by the following species - *Polygonatum orientale, Paris incompleta, Dentaria bulbifera, Tamus communis, Actaea spicata, Euphorbia macroceras, Circaea lutetiana, Vicia crocea.* From ferns dominate - *Dryopteris filix-mas, Athyrium filix-femina, Matteuccia struthiopteris,* and *Polystichum braunii.*

Sub-types (91SF-GE 05): Beech forest with fern *(Dryopteris filix-mas, D. pseudomas,* etc.) cover (*Fageta filicosa*) is the indicator of the humid biotope, provides creation and maintenance of environment conditions of the specific micro-habitat. Dominant species of the fern that create a massive cover are - *Dryopteris filix-mas, D. pseudomas, Athyrium filix-femina* and *Matteuccia struthiopteris.* In the upperborder of the forest the following species are also observed - *Dryopteris oreades, Oreopteris limbosperma* and *Athyrium distentifolium.* The rest are large size ferns - *Dryopteris assimilis, D. expansa, D. alexeenkoana, D. liliana, Polystichum* spp., that are common in the form of separate species but do not create a massive cover.

There are 4 types of communities:

1) The beech forest with the black-berry-male-fern cover (*Fageta ruboso-dryopteridosa)* in east Georgia is distributed at the altitude of 1300-1700 meters. In the eastern part of Trialeti range in the circumstances of drier climate it reaches the altitude of 1800 meters. Together with the beech Caucasian lime, mountain maple and Norway maple are common. Caucasian elm (*Ulmus elliptica*) and the hazelnut (*Corylus iberica*) are rare. In the understory elder, nut, Caucasian jasmine (*Phyladelphus* caucasicus) and Caucasian honeysuckle (*Lonicera caucasica*) are rare. Among other plants the following are worth noting - *Symphytum grandiflorum, Valeriana alliariifolia, Geranium robertianum, Paeonia wittmanniana, Ranunculus ampelophyllus.*
2) The beech forest with large-fern cover (*Fageta athyriosa*) is characterized by the domination of the mountain holly-fern (*Athyrium filix-femina*) and intensive development of the fern

cover. 2 separate communities are differentiated. The first is in the middle zone of the forest at the height of 1300-1500 meters and the second one at the height of more than 1750 meters. There are transition forms among them. From the fern species the following can be found in the middle zone of the forest: *Athyrium filix-femina, Dryopteris filix-mas, D. pseudomas, D. assimilis* and *Matteuccia struthiopteris.* From other species the following need to be mentioned: *Euphorbia macroceras, Paris incompleta, Pachyphragma macrophyllum, Actaea spicata, Petasites alba.* The community of the mountain holly-fern is found in the upper zone of the forest together with the subalpine forest species - *Acer trautveterii, Sorbus caucasigena*, the beech in this case does not create the bending forest. The following can be found in the understory: *Ribes biebersteinii, Rubus idaeus* and *Daphne mezereum.*

3) The beech forest with the black fern (*Matteuccia struthiopteris*) covers (*Fageta struthiopteridosa*. The black fern is the biggest size fern distributed in Georgia, which is the strong edifier and expels other ferns and herbal plants from the habitat. Single species of the following may co-exist with it: *Symphytum grandiflorum, Paris incompleta, Rubus* spp., *Dryopteris filix-mas, Athyrium filix-femina, Impatiens noli-tangere, Polygonatum orientale, Pachyphragma macrophyllum, Asperula odorata, Hedera colchica, Euphorbia macroceras, Tamus communis, Urtica dioica, Dentaria bulbifera,* etc.

Plants species: *Fagus orientalis, Acer laetum, A. platanoides, A. pseudoplatanus, A. velutinum, Actaea spicata, Anemone caucasica, Arum albispathum, Asperula odorata, Athyrium distentifolium, Athyrium filix-femina, Calamagrostis arundinacea, Calamintha grandiflora, Carpinus caucasica, Castanea sativa, Prunus avium, Circaea lutetiana, Corydalis caucasica, C. marschalliana, Dentaria bulbifera, Dryopteris assimilis, D. alexeenkoana, D. expansa, Dryopteris filix-mas, D. liliana, Dryopteris oreades, D. pseudomas, Euphorbia macroceras, Festuca drymeja, Fraxinus excelsior, Galanthus lagodechianus, Geranium robertianum, Geranium sylvaticum, Hedera colchica, Ilex colchica, Impatiens noli-tangere, Lonicera caucasica, Matteuccia struthiopteris Milium schmidtianum, Neottia nidus-avis, Oreopteris limbosperma, Pachyphragma*

macrophyllum, Paeonia wittmanniana, Paris incompleta, Petasites alba, Phyladelphus caucasicus, Polygonatum orientale, Polystichum braunii, Quercus iberica, Ranunculus ampelophyllus, Rhododendron luteum, Rubus hirtus, R. serpens, R. platyphyllus, R. caucasicus, R. ponticus, R. candicans, R. cartalinicus, R. georgicus, R. tomentosus, R. piceetorum, R. dolichocarpus, Scilla sibirica, Symphytum grandiflorum, Tamus communis, Tilia begoniifolia, Ulmus elliptica, Urtica dioica, Vaccinium arctostaphylos, Valeriana alliariifolia, Vicia crocea, Viola alba, V. odorata.

9.1.7.1. Endemic plant species Stone gooseberry - *Ribes* L., Grossulariaceae

Endemic species of *Ribes* is as both Georgian and the Caucasian endemic. Endemic species are *Ribes biebersteinii* Berland. ex DC., *R. caucasicum* M. Bieb. **(Figure 52).**

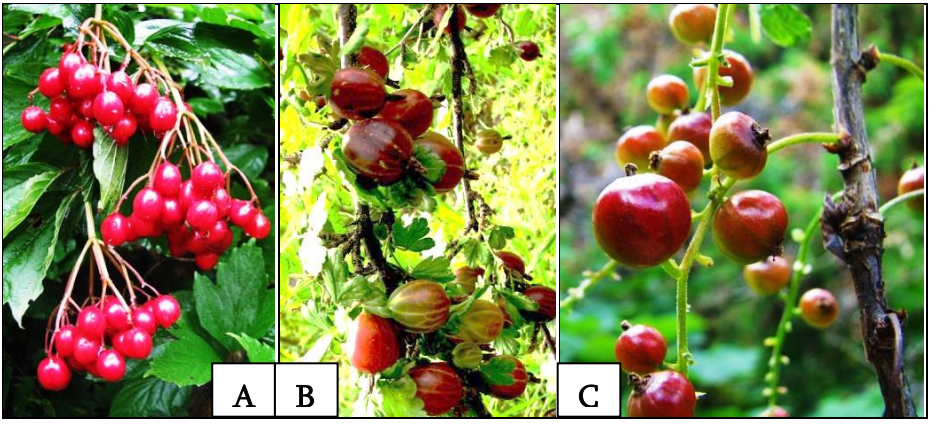


Figure 52. A. *Ribes rubrum*, **B.** *Ribes uva-crispa*, **C.** *Ribes biebersteinii*. **Photo: Maia Akhalkatsi.**

Grows is in forests of middle and upper montane belts, sometimes reaches subaline zone from 900 to 2100 m a.s.l.. *Ribes biebersteinii* is a deciduous shrub growing to 1.5-2 m high with light, glabrous shoots; it is hardy to subalpine zone and is not frost tender. Snow cover is <1 m. The exposition is for all directions and inclination till 30°C. Sunny

edge is normal; dappled shade is in North Wall, East Wall, and West Wall. Suitable for: light, medium and heavy soils, prefers well-drained soil and can grow in nutritionally poor soil. Suitable pH: acid, neutral and basic soils. It can grow in semi-shade or no shade. It prefers moist soil. Shoots densely covered with acicular spines and, in addition, with larger spines at the nodes, 7-15 in each verticillaster; Young branches greenish-dark grey, glossy, older twigs with dark greyish-dark brown bark shredding into stripes.

Leaves rigid-hispid; flowers flat; berries black, glandular-hispid berry dark red or cherry-red 12. Leaf glabrous above, pubescent beneath, lobes acuminate, margins toothed. Leaves thin, deeply cordate, large 10 cm long and 13 cm wide, usually 5-lobed with cordate base, either glabrous on both sides, or densely hairy below, rarely with scattered glandular bristles above and with hairs along the veins below and on the petioles; racemes 4-12 cm long, horizontal, nodding in fruit, loose, 15-50 -flowered; Flowers reddish or purple in drooping racemes of 15-20 per inflorescence.

Hypanthium with fleshy excrescences below the petals; flowers purple; pedicels 2-3 mm long; flowers 5-6 mm long, dark purple; sepals recurved; hypanthium with conspicuous excrescences below petals; styles broadly conical; berry small, 6-7 (8) mm in diameter, dark red or black -purple. Fruit deep purple.

Fruit a succulent berry with dried perianth at the apex, at maturity disarticulating from pedicel; seeds with interior hard endopleura and gelatinous testa. Flowering is in June. Fruits are in July-August. Because all *Ribes* species are alternative hosts of the destructive blister rust fungus, which also attacks white pines, there are local prohibitions to growing *Ribes* near any white pine plantations. The flowers are hermaphrodite and are pollinated by Insects. Suitable for: light, medium and heavy soils and prefers well-drained soil. Suitable pH: acid, neutral and basic soils. It can grow in semi-shade (light woodland) or no shade.

It prefers moist soil. Fruit is raw or cooked. A good-sized red currant, (though it is almost black in colour), but plants only had a small crop. The flavour is rather tart, but acceptable raw. It is probably best as a cooked fruit, making a good jam or preserve. Its main drawback is the large number of seeds in each fruit.

Plants for **A** future cannot take any responsibility for any adverse effects from the use of plants. Always seek advice from a professional before using a plant medicinally. Easily grown is in a moisture retentive but well-drained loamy soil of at least moderate quality. Plants are quite tolerant of shade though do not fruit so well in such a position. Hardy to about -20°C. Plants can harbour a stage of 'white pine blister rust', so they should not be grown in the vicinity of pine trees. Plants in this genus are notably susceptible to honey fungus.

Seed - best sown as soon as it is ripe in the autumn in a cold frame. Stored seed requires 3 months cold stratification at between 0 and 5°C and should be sown as early in the year as possible. Under normal storage conditions the seed can remain viable for 17 years or more. Prick out the seedlings into individual pots when they are large enough to handle and grow them on in a cold frame for their first winter, planting them out in late spring of the following year. Cuttings are of half-ripe wood, 10-15 cm with a heel, July/August in a frame.

Cuttings are of mature wood of the current year's growth, preferably with a heel of the previous year's growth, November to February in a cold frame or sheltered bed outdoors. Landscape is Erosion control, Foundation, Ground cover, Massing, Rock garden, Seashore. Easily grown is in a moisture retentive but well-drained loamy soil of at least moderate quality. This species succeeds on poor soils. Does is well in shade though it does not fruit so well in such a position.

A very hardy plant has tolerating temperatures down to about -25°C. A number of named varieties have been developed for their ornamental value. The flowers are sweetly fragrant. Plants are dioecious. At least one male plant must be grown in the vicinity of up to 5 females if fruit is required. Plants can harbour a stage of white pine blister rust, so should not be grown in the vicinity of pine trees. Plants in this genus are notably susceptible to honey fungus.

Seed of the *Ribes biebersteinii* is as best sown as soon as it is ripe in the autumn in a cold frame. Stored seed requires 3 months cold stratification at 0-9°C and should be sown as early in the year as possible. Under normal storage conditions the seed can remain viable for 17 years or more. Prick out the seedlings into individual pots when they are large enough to handle and grow them on in a cold frame for their first winter, planting them out in late spring of the following year.

Cuttings are of half-ripe wood, July/August in a frame. Cuttings are of mature wood of the current year's growth, preferably with a heel of the previous year's growth, November to February in a cold frame or sheltered bed outdoors. Geographic distribution is in Native to Caucasus, Northern Anatolia, and North-Western Iran.

9.2. Galio-Carpinetum oak-hornbeam forests

9.2.1. Code of Georgia: Oak or oak-hornbeam forests (*Quercitum - Carpinion betuli*) (9160GE; PAL. CLASS.: 41.24)

Oak forests in Georgia are mainly created by two species – the Georgian oak (*Quercus iberica*) and high mountain oak (*Q. macranthera*). Other oak species - *Q. pedunculiflora, Q. hartwissiana, Q. imeretina, Q. pontica, Q. dshorochensis,* are mixed with other species in the forests of a different type, such as, Colchic mixed forest (*Q. hartwissiana, Q. pontica, Q. dshorochensis*), or the Riparian forest (*Q. pedunculiflora, Q. imeretina*) **(Figure 53).**

The Georgian oak forest is widespread in almost all forest regions of Georgia. It is not found in Tusheti, northern Khevsureti and Khevi. It holds about 200 thousand hectares of the area. In eastern Georgia it is found from 350-500 to 1000-1550 meters. In west Georgia it's distributed at the height of 1500-1800 m a.s.l. (Svaneti). The following species can be found together with the oak: *Carpinus caucasica, C. orientalis, Acer laetum, Sorbus torminalis, Zelkova carpinifolia, Ostrya carpinifolia.*

High mountain oak (*Quercus macranthera*) is common in the eastern part of the Great Caucasus on both southern and northern micro slopes, small Caucasus and west Georgia, Svaneti. It holds the middle, upper and subalpine zones of the mountain, within the limits of 1450-2400 meters. In some places the upper margin of its distribution reaches 2600-2700 meters. The optimal height of distribution varies between 1450 -1600 meters. 4 types of oak forests are differentiated:

Sub-types (9160GE-01): Georgian has oak monodominant forest (*Iberica-Quercetum*) is characterized by the well-developed understory. It is situated at the altitude of 1000-1550 meters a.s.l.. The following oak forests are differentiated: hemi-xerophytic, growing in the arid regions of eastern Georgia and xero-mesophytic, characteristic to the rest of the places.

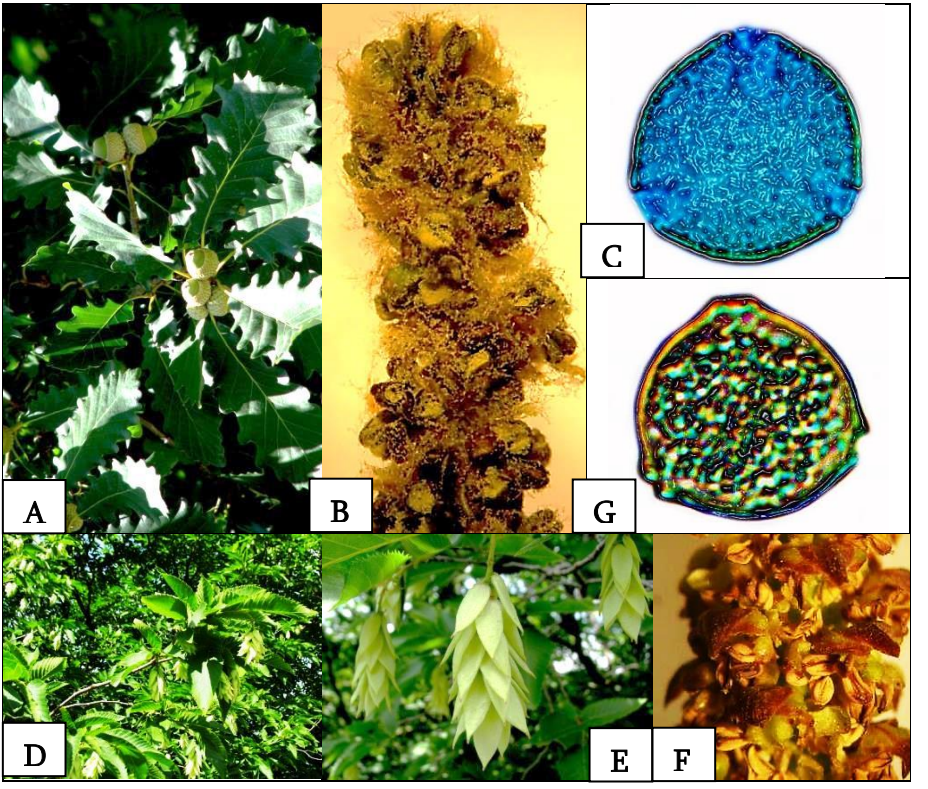


Figure 53. A. *Quercus iberica* is in Tbilisi in Nuthubidze area**; B.** *Q. iberica* flowers has many pollen; **C.** Pollen *Q. iberica* has length of the horizontal height as 35-37 μm; **D.** *Ostrya carpinifolia* is in Quercus forest in Meskheti and Adjara; **E.** *O. carpinifolia* has other flowers as Carpinus in famaly Corylaceae; **F**. Flowers has many pollen**; G.** Pollen *O. carpinifolia* has length of the horizontal height as 27-31 μm. **Photo: Maia Akhalkatsi.**

6 communities are differentiated:

1. Georgian oak forest with varied dry understory (*Quercetum iberici multifruticosum siccum*), where *Spiraea hypericifolia, Pyracantha coccinea, Juniperus oblonga* create the understory. In Abkhasia the oak forest with *Sesleria anatolica* and *Psoralea bituminous* can be found;
2. Georgian oak forest with understory (*Quercetum iberici cotinosa*) of *Cotynus coggygria*;

3. Georgian oak forest with herbal cover (*Quercetum iberici herbosa*), where the following are observed from herbal species: *Campanula rapunculoides, Carex bushiorum, Clinopodium vulgare, Dactylis glomerata, Polygonatum glaberrimum, Veronica peduncularis*, etc.;
4. Georgian oak forest with barren-worth (*Epimedium colchicum*) cover (*Quercetum hypericoso-epimediosa*), which can be found in Abkhasia, where the following dominate: *Epimedium colchicum, Hypericum xylosteifolium* and *Dioscorea caucasica.*Widely distributed species are: *Sesleria anatolica, Trachystemon orientalis, Ruscus ponticus, Carex transsilvanica, Dorycnium graecum,* etc. Rare species are: *Iris colchica, Dianthus imereticus, Hypochaeris radiata, Psoralea bituminosa, Aristolochia steupii, A. iberica, Primula sibthorpii, Veronica peduncularis, Helleborus abchasicus,* etc. Among the bushes, the following are found: *Rhododendron luteum, R. ponticum, Vaccinium arctostaphylos, Erica arborea, Lonicera caprifolium, Smilax excels* grow on the rocky cape of Bichvinta. *Arbutus andrachne* is at the sea side;
5. The species characteristic to the community of *Iberica-Quercetum-genistosum* to the east is *Genista transcaucasica,* to the west - *G. kolakowskyi* and *G. abchasica*;
6. Oak forest with Colchic understory: 1. Oak forest with azalea - *Quercita azaleoza (Rhododendron luteum),* oak forest with Pontic rhododendron, *Quercita rhododendrosa (R. ponticum),* oak forest with bladder-nut, *Querceta staphyleosa (Staphylea colchica, S. pinnata).*

Sub-types (9160GE-02): Oak-oriental hornbeam *(Carpinus orientalis)* forest (*Iberica-Quercetum-Carpinion orientale*) in east Georgia is distributed at the height of 600- 1000 meters a.s.l.. In the west is from 350 to 700-800 meters. It can be found in the limestone region of Abkhasia and Samegrelo and eastern Georgia on rocky slopes.

3 types of oak forests are differentiated:

1. With the oak-oriental hornbeam-sedge (*Carex buschiorum*) xerophytic cover (*Carpineto-Quercetum-xerocaricosum*);
2. With the oak-oriental hornbeam-meadow grass (*Poa nemoralis*) cover (*Carpineto-Quercetum- poosum*);

3. With the oak-oriental hornbeam-false brome (*Brachypodium sylvaticum*) cover (*Carpineto-Quercetum -brachypodiosum*).

Sub-types (9160GE-03): Oak-hornbeam forest (*Quercetum-Carpinion betulii*) is distributed at the altitude of 600-1100 meters a.s.l.. Tree species found: *Quercus iberica, Carpinus caucasica, C. orientalis, Sorbus torminalis, Acer laetum, Picea orientalis, Abies nordmaniana.* Bushes - *Cornus mas, Corylus avellana, Swida australis, Chamaecytisus caucasica, Lonicera caucasica, Mespilus germanica.* Herbaceous plants - *Festuca drymeja, Clinopodium vulgare, Veronica peduncularis, Polygonatum glaberrimum, Campanula rapunculoides, Dactylis glomerata.* Oak-hornbeam forest with the sedge understory is characteristic to Georgia.

Sub-types (9160GE-04): Oak- and hop-hornbeam (*Ostrya carpinifolia*) forest (*Quercetum-ostryosa*) is in Samtskheti and the distinguished quality in that is in the upper border of this type of this forest (1200-1600 m) hornbeam is substituted by the hop hornbeam forest - *Ostrya carpinifolia*. These forests occupy significant territory in the gorges of Uraveli and Kvabliani. As a result of the degradation of natural oak forests, vegetation of shibliak mixed with the oak is represented in the lower border of their distribution with the participation of Jerusalem thorn - *Paliurus spina-christi,* black buckthorn - *Rhamnus pallasii, Spiraea hypericifolia,* etc. Honey suckles - *Lonicera iberica* is rare in these forests.

Sub-types (9160GE-05): The oak-pine-oriental hornbeam forest (*Pineto-Quercetum-Carpinion orientale*) is for widespread in eastern Georgia (Borjomi gorge, Gombori range) at the altitude of 1000-1200 meters a.s.l. It can be found on the slopes of various inclination of the southern-western exposition.

Sub-types (9160GE-06): High Mountain oak forest (*Quercus macranthera*) creates mixed and monodominant forests. The mixed forest is represented by the association of the following species: 1. *Q. macranthera* da *Betula litwinowii,* 2. *Q. macranthera, B. litwinowii* da *Sorbus caucasigena;* 3. *Q. macranthera* da *Acer trautvetteri.* Dominant species are - *Acer platanoides, A. hyrcanum, Sorbus caucasigena, Lonicera caucasica, Ribes biebersteinii,* etc.

Plants species: *Quercus iberica, Q. macranthera, Abies nordmanniana, Acer laetum, A. platanoides, A. hyrcanum, Arbutus*

andrachne, Aristolochia steupii, A. iberica, Betula litwinowii, Campanula rapunculoides, Carex transsilvanica, Carpinus caucasica, C. orientalis, Chamaecytisus caucasica, Clinopodium vulgare, Cornus mas, Corylus avellana, Cotinus coggygria, Cytisus caucasicus, Dactylis glomerata, Dianthus imereticus, Dioscorea caucasica, Dorycnium graecum, Epimedium colchicum, Erica arborea, Festuca drymeja, Helleborus abchasicus, Hypericum xylosteifolium, Hypochaeris radiata, Iris colchica, Laser trilobum, Lathyrus roseus, Ligustrum vulgare, Lonicera caucasica, L. caprifolium, Mespilus germanica, Orobus laxiflorus, Ostrya carpinifolia, Peucedanum caucasicum, Physospermum cornubiense, Picea orientalis, Poa nemoralis, Polygonatum glaberrimum, Primula sibthorpii, Psoralea bituminosa, Rhododendron luteum, R. ponticum, Ribes biebersteinii, Rosa canina, Ruscus ponticus, Sesleria anatolica, Smilax excelsa, Sorbus caucasigena, Sorbus torminalis, Swida australis, Trachystemon orientalis, Vaccinium arctostaphylos,Veronica peduncularis.

9.2.1.1. Flagship plant species Caucasian oak - *Quercus macranthera* Fisch. & C.A. Mey. ex Hohen., Fagaceae

Flagship species of *Quercus macranthera* is as the concept of flagship species is a concept with its genesis in the field of conservation biology **(Figure 54).**

Figure 54. A. *Quercus macranthera* is in subalpine forest in village Mitarbi; **B.** Leaf from above side; **C.** Leaf from back side; **Photo: Maia Akhalkatsi.**

A hardy has above all, drought -resistant oak that constitutes the only high-mountain forest-forming species in arid areas of East and South Caucasus. Forming forests are in the mountains, on dry, mostly southern slopes, at altitudes between 800 and 2400 m above sea level.

A tree to 20 m, but usually lower, the short stout trunk covered with thick fissured bark. Snow cover is >2 m. The exposition is for all directions and inclination till 60°C.

Sunny edge is normal; dappled shade is in North Wall, East Wall, and West Wall. The wood is used like that of other oaks. The leaves often display very large spherical long-villous galls that need study as to their tannin content. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and can grow in heavy clay soil. Suitable pH: acid, neutral and basic (alkaline) soils and can grow in very alkaline soils.

Shoots densely shaggy with long yellowish -gray hairs, the 1- and 2 -year old branchlets gradually glabrescent; buds 5-6 mm long, obtuse, ovaloid, with few heavily gray -pubescent scales; stipules to 1.5 cm long, densely villous; leaf petioles 1-2 cm long, subcoriaceous, 6-18 cm, on the average ca. 10 cm, long and 3-12 cm broad, dark green and at first sparingly puberulous above, becoming glabrate with pubescence confined to the veins, yellowish -gray beneath with dense sometimes partly disappearing pubescence, oboval or elongate, commonly cuneate or rarelytruncate or subcordate at base, with a short obtuse terminal lobe and 8 -12 pairs of short, obtuse entire or coarsely toothed lateral lobes, the sinuses one-fifth to one-sixth the breadth of the blade; the lobes sometimes longer, the sinuses thus attaining one -third to one -fourth the breadth of the blade, and then they are commonly narrowed and rather pointed; lateral veins as many as and directed only toward the lobes, straight or arched, parallel, intermediate veins none or 1 or 2 faint ones in the lower part of the blade; Staminate flowers in long pendulous slender – stalked aments; perianth 4-7 -parted (mostly 6-parted) to the middle or almost down to base; stamens 4-12, mostly 6; Staminate inflorescence to 10-15 cm long, with a densely pubescent peduncle; anthers large, to 1.5 mm long; ovary 3- or sometimes 4-locular, with 2 ovules in each locule, surrounded by a cup-shaped cupule covered outside with numerous scales; styles 3; stigma large, completely covering the upper face of the style; pistillate flowers and fruits 1-5, sessile or borne on a stalk to 2 cm long; Cupule hemispherical, to 1.5 cm long and 1.5-2 cm in diameter, enclosing the

acorn to between one-half and one-third; lower scales and those of young fruits somewhat spreading, the middle and upper ones appressed, narrowly lanceolate, gray -pubescent, with a brown glabrous tip; acorns 2-2.5 cm long, initially appressed-pubescent, finally glabrous. Fruit a 1-celled 1-seeded acorn, with rudiments of abortive seeds in upper or lower part; shell of the acorn thin, glabrous within, or else thick 3-layered May. Flowering in May, fruit are in September-October.

Most oaks are important and widely distributed species, yielding durable hard lumber used for a variety of purposes. The bark contains tannin and is extensively used for leather tanning; of similar use are the cups of certain species and galls formed by the puncture of insects. The bark of the cork oak and of some other species is the principal source of cork. The acorns are used as a coffee substitute and as feed for swine; in some species they are sweet and edible in raw condition. Many oak species are eminently suited for pleasure-ground, street and avenue planting, etc. and are recommended for extensive ornamental use. The drought resistance of some of the species and their modest soil requirements enable their use for afforestation of arid regions. Fossils of *Quercus* occur in the earliest Cretaceous layers which contain remnants of dicotyledonous plants. Oaks were widely distributed through the Upper Cretaceous and all the Tertiary floras, although the geographical distribution of the sections was quite different than it is at the present time. Oak fossils have also been found in Tertiary formations. Gradual transition to European forms took place in the course of the Tertiary period. Unidentified, reported for many distribution areas in Tertiary and Postpliocene formations, e. g., in the Paleocene. Deserves are attention as a valuable tree for afforestation and ornamental planting in the dry parts of Transcaucasia.

Prefers is a good deep fertile loam which can be on the stiff side. Dislikes has heavy clay. Young plants tolerate reasonable levels of side shade. Found mainly on acid soils in the wild. Thrives in well drained soils but is also tolerant of periodic flooding. Tolerates has exposure and strong winds if these are not salt-laden. A very important timber tree in Britain, it is also a food plant for the caterpillars of many species of butterfly, and there are 284 insect species associated with this tree. Trees were often coppiced or pollarded in the past for their wood, though this is best done on a long rotation of perhaps 50 years. The tree

flowers on new growth produced in spring, the seed ripening in its first year.

Older trees have a thick corky bark and this can protect them from forest fires, young trees will often regenerate from the base if cut down or killed back by a fire. Trees transplant badly unless moved regularly. Hybridizes has freely with other members of the genus. Immune is to attacks by the Tortix moth. This species is notably resistant to honey fungus.

Seed of *Quercus macranthera* is as it quickly loses viability if it is allowed to dry out. It can be stored moist and cool overwinter but is best sown as soon as it is ripe in an outdoor seed bed, though it must be protected from mice, squirrels etc. Small quantities of seed can be sown in deep pots in a cold frame. Plants produce a deep taproot and need to be planted out into their permanent positions as soon as possible, in fact seed sown in situ will produce the best trees. Trees should not be left in a nursery bed for more than 2 growing seasons without being moved or they will transplant very badly. Geographic distribution is in the Caucasus South and Eest, Armenia, Talysh, Dagestan, Iran.

9.2.2. Code of Georgia: Hornbeam forest *Carpinus* L., Betulaceae (91CBGE)

Carpinus caucasica is widely distributed in Georgia. It grows on fertile, well-drained soil. From mixed species dominate beech or the oak in other locations. The hornbeam is the component of the polidominant forest and is common together with other species.

Sub-types (91CB-GE01): Hornbeam forest with Colchic type understory: Four communities are characteristic: 1. Hornbeam forest with the understory of azalea, *C. caucasica - Rhododendron luteum*, is found in both west and east Georgia. Namely are in Kakheti and Aragvi gorges. 2. Hornbeam forest with the understory of blueberry, *C. caucasica - Vaccinium arctostaphylos*, is found only in west Georgia (Abkhazia, Upper Svaneti, Guria), at the altitude of 900-1750 meters. 3. Hornbeam forest with the understory of Pontic rhododendron, *C. caucasica - Rhododendron ponticum,* is found on the slope of the northern exposition, in the lower zone of the forest (100-800 meters a.s.l.) where there is no limestone layer. 4. Hornbeam forest with laurel understory, *C. caucasica - Laurocerasus officinalis.* It occupies rocky,

stretching downhill slopes of northern exposition both on limestone and non-limestone places 300-800 meters a.s.l..

Sub-types (91CB-GE01): Hornbeam forest without the understory: 1. Hornbeam forest with meadow grass covers, *C. caucasica - Poa angustifalia*; 2. Hornbeam forest with fescue covers, *C. caucasica - Festuca drymeja*; 3. Hornbeam forest with herbal cover, *C. caucasica* – multi herbosa transcaucasica group; 4. Hornbeam forest with borage cover, *C. caucasica - Trachystemon orientalis.*

Plants species: *Carpinus caucasica, Fagus orientalis, Festuca drymeja, Laurocerasus officinalis, Poa angustifalia, Quercus iberica, Rhododendron luteum, R. ponticum, Trachystemon orientalis, Vaccinium arctostaphylos.*

9.2.2.1. Relict plant species *Carpinus* L., Betulaceae

1. *Carpinus caucasica* L., Hornbeam, Heinbuche, Betulaceae: Plant characteristics are for tree up to 30 m tall. Trunk mostly crooked and slightly angled, sometimes bent. Bark grey and smooth or partially ridged. Multiplication is for monoecious. Staminate flowers in drooping catkins, pistillate flowers form straight terminal catkins. Leaves glabrous, on short petiole, leaf blade oblong-ovate, acuminate, margins double serrate, base rounded or slightly cordate, 5-12 cm long **(Figure 55).**

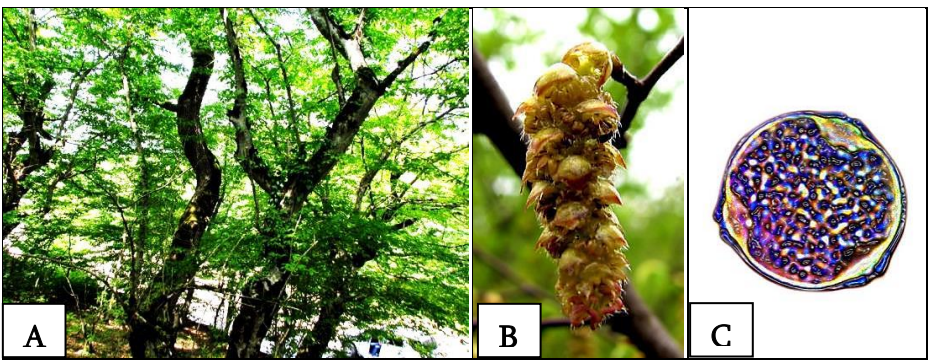


Figure 55. A. *Carpinus caucasica* is in Quercus forest; **B.** Flowers has much pollen; **C.** Pollen ***C. caucasica*** has length of the horizontal height as 32-35 μm. **Photo: Maia Akhalkatsi.**

Fruit one seeded nutlet, edging along, surrounded by 3-lobed leafy bract on one side. Middle lobe is longer than the others. Flowers are in March and April. Fruits are in June and July. Protective measures are grows in lower and middle montane belts, mixed with beech and oaks. Native are to Caucasus, Asia Minor, Northern Iran.

2. *Carpinus orientalis* Mill. Oriental hornbeam, Orientalische Heinbuche. Betulaceae: Plant characteristics: 4-5 m tall shrub or tree. Stem crooked stronger than by hornbeam, angled and branched from the base. Bark dark grey, stems densely foliated. Leaf up to 5 cm long, on short petiole, ovate or oblong ovate, acuminate, base rounded or slightly asymmetric, margins double serrate **(Figure 56).**

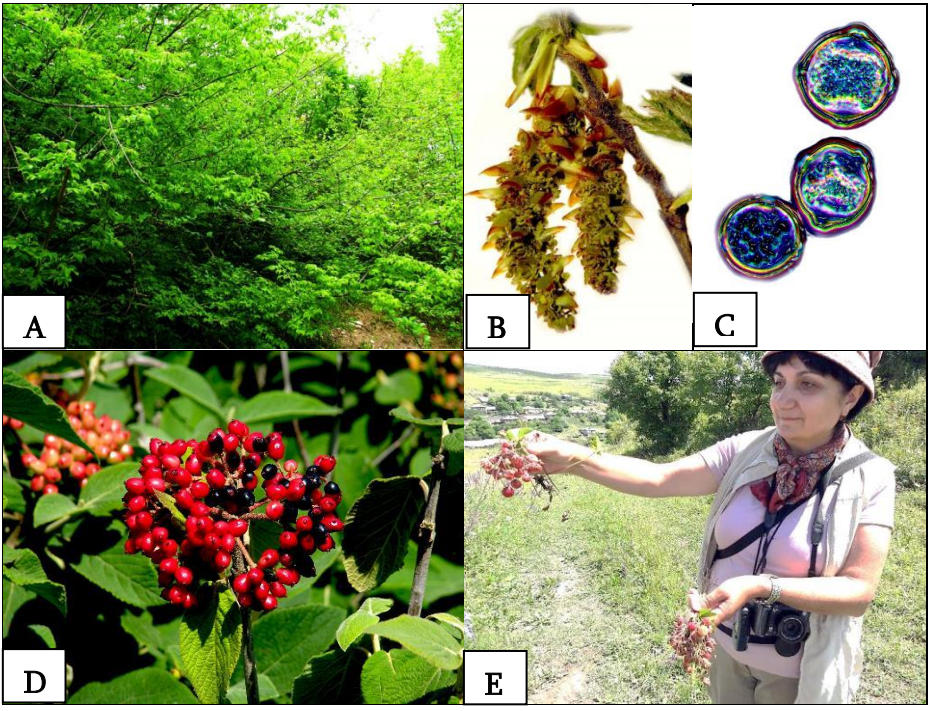


Figure 56. A. *Carpinus orientalis* is in degraded areas; **B.** Flowers has many pollen; **C.** Pollen ***C.*** *caucasica* has length of the horizontal height as 32-35 µm. **D.** *Viburnum lantana* L. (Caprifoliaceae) is feedback **to** *C. orientalis*; **E.** Fruits of *Viburnum lantana* found by Maia Akhalkatsi in Meskheti and this is as medicinal plant. **Photo: Maia Akhalkatsi.**

Plant characteristics are for monoecious plant. Staminate and pistillate flowers clustered in oblong tight catkins. Fruit one seeded nutlet edging along; leafy bract surrounding the fruit is entire, asymmetric and irregularly toothed. Flowers are in April. Fruits are in June and July. Protective measures is grows from lower to upper montane belts in understory of oak or oak-hornbeam forests, more rarely forms pure stands. Native is to Eastern Mediterranean, Caucasus.

9.3. Forests of the slope, remains and the cleft

9.3.1. Code of Georgia: *Tilio-Acerion* forests of slopes, screes and ravines (9180 GE* PAL. CLASS.: 41.4)

Mixed forests (*Tilio-Acerion*) are created by secondary species (*Acer* spp., *Fraxinus excelsior, Ulmus glabra, Tilia begoniifolia, T. cordata,* etc.) and are located on steep rocky slopes, mainly on limestone, sometimes on siliceous ground material at various elevations **(Figure 57).**

One group is differentiated. It grows in more moist areas (hygroscopic and shadow resistant forest, sub-alliance - *Lunario-Acerenion*), where species of a maple dominate. In the outskirts of Manglisi, Bedeni plateau and Aghbulaghi, among oak- and sedge forests, mixed forests occupy large areas, where the following can be found in a mixed form: maples (*Acer laetum, A. campestre, A. platanoides, A. hyrcanum*), Caucasian elm (*Ulmus elliptica*), lime (*Tilia begoniifolia*) and aspen (*Populus* spp.).

On southern slopes of the central Caucasus original mixed forests belonged to holly places, so-called "Khati's Forests" are preserved. Such a forest is described in Kaishauri gorge, where the following can be found - *Acer trautveterii, A. platanoides, Fagus orientalis, Ulmus elliptica, Fraxinus excelsior, Padus avium, Betula litwinowii, B. raddeana, Sorbus caucasigena, Rubus idaeus, Euonymus verrucosa, Viburnum opulus,Corylus avellana, Rhododendron luteum, Poa nemoralis, Circaea alpina, Aruncus vulgaris, Scutelalria altissima, Veronica peduncularis, Valeriana officinalis, V. alliariifolia, V. tiliifolia, Doronicum macrophyllum, Campanulla collina, Polemonium caucasicum, Athyrium filix-femina, Polystichum braunii, Geranium robertianum,* etc.

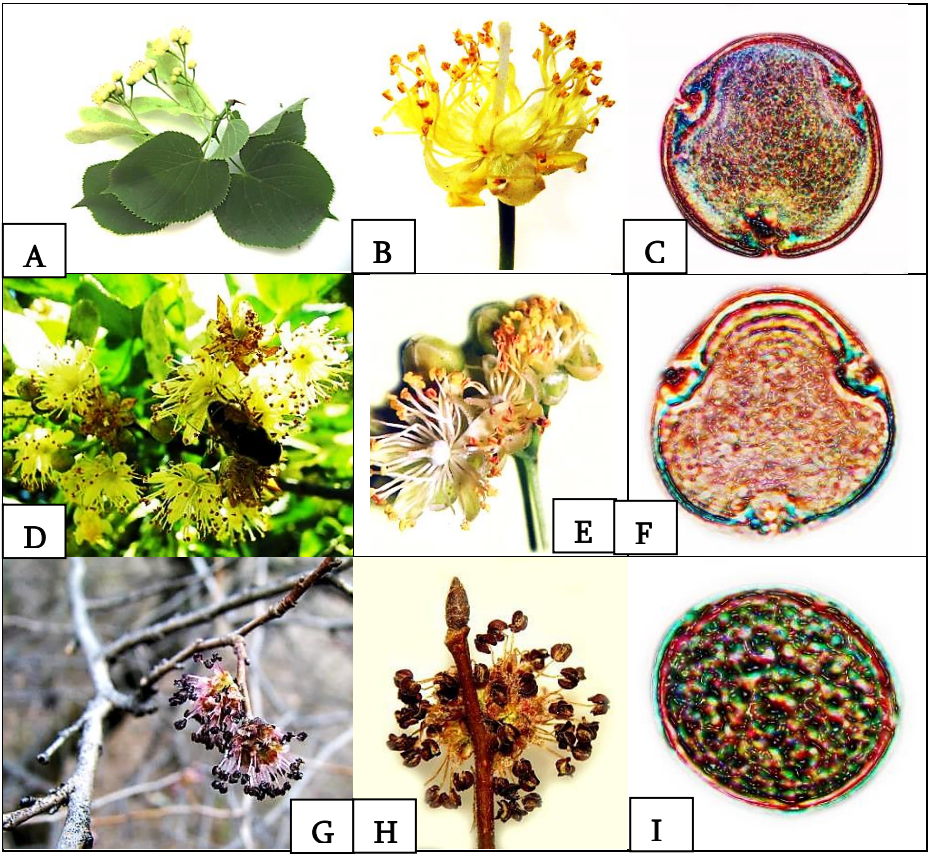


Figure 57. A. *Tilia begoniifolia (= T. caucasica)* is endemic and relict species in Georgia; **B.** Flowers has many pollen**; C.** Pollen of *Tilia begoniifolia* has length of the horizontal height as 43-48 μm; **D.** *Tilia platyphyllus* is invasive species and planted on the road in Tbilisi; **E.** Flowers has many pollen; **F.** Pollen of *Tilia platyphyllus* has length of the horizontal height as 43-47 μm; **G.** *Ulmus minor* is in forests of *Quearcus*; **H.** Flowers has much pollen; **I.** Pollen of *Ulmus minor* has length of the horizontal height as 23-25 μm. **Photo: Maia Akhalkatsi.**

Forests with maple trees are found in Kolkheti at higher altitudes, where the beech is the prevailing species mixed with the lime, Caucasian elm, oak and maple (*Acer velutinum*). The following can also be found here: Cherry - *Prunus avium,* maple - *Acer laetum, A. platanoides,* a rarer species is Yew - *Taxus baccata.* From lianas there

is Colchis ivy - *Hedera colchica,* the understory is created by meddler, sour plum, cornelian cherry, elder dog weed, guilder rose, Caucasian jasmine, azalea and blueberry. Herbal species that are common are: *Salvia glutinosa, Stachys sylvatica, Sanicula europaea, Asperula odorata, Pyrethrum parthenifolium, Geranium robertianum, Aristolochia iberica, Impatiens noli-tangere, Neottia nidus-avis,* etc. The following are reported from relict species: *Pachyphragma macrophyllum, Brunnera macrophylla.*

A second variety of the mixed forest is the one which is typical to dry and warm slopes and sptread out places (xero-thermophyllic forest, sub-alliance *Tilio-Acerenion*), where species of lime dominate. There is also hornbeam, with which grow oriental hornbeam (*Carpinus orientalis*), hazelnut (*Corylus avellana*), elm (*Ulmus glabra*, beech (*Fagus orientalis*), lime (*Tilia begoniifolia*), simple Adler (*Alnus barbata*), clematis (*Clematis vitalba*), wild grapevine (*Vitis vinifera* subsp. *sylvestris*; **Akhalkatsi, 2014),** herbaceous plants blooming early - *Scilla sibirica, Primula woronowii, Helleborus caucasicus, Viola alba, V. odorata* etc. In summer the following replace them - *Poa nemoralis, Piptatherum virescens, Polygonatum glaberrimum, Tamus communis, Laser trilobum,* from fern-like plants there is *Dryopteris filix-mas,* in rocky places there are - *Asplenium trichomanes, Polypodium vulgare.*Beech and High Mountain oak significantly decrease in Ajara, middle zone of the mountain and hornbeam, elm (*Ulmus glabra*), lime (*Tilia begoniifolia*), and ash (*Fraxinus excelsior* dominate. From the herbaceous cover these are common - *Circaea lutetiana, Poa nemoralis, Stachys silvatica, Salvia glutinosa* and ferns.

Plants species: *Lunario-Acerenion - Acer campestre, A. laetum, A. hyrcanum, A. platanoides, A. pseudoplatanus, Acer velutinum, Actaea spicata, Aristolochia iberica, Aruncus vulgaris, Asperula odorata, Athyrium filix-femina, Betula litwinowii, B. raddeana, Brunnera macrophylla, Campanulla collina, Circaea alpina, Corylus avellana, Doronicum macrophyllum, Euonymus verrucosa, Fraxinus excelsior, Geranium robertianum, Impatiens noli-tangere, Lunaria annua, Neottia nidus-avis, Pachyphragma macrophyllum, Padus avium, Poa nemoralis, Polemonium caucasicum, Polystichum braunii, Prunus*

avium, Pyrethrum parthenifolium, Rhododendron luteum, Rubus idaeus, Salvia glutinosa, Sanicula europaea, Scutellaria altissima, Sorbus caucasigena, Stachys sylvatica, Taxus baccata, Ulmus elliptica, U. glabra, Valeriana officinalis, V. alliariifolia, V. tiliifolia, Veronica peduncularis, Viburnum opulus.

Tilio-Acerenion *- Alnus barbata, Asplenium trichomanes, Carpinus caucasica, Circaea lutetiana, Clematis vitalba, Corylus avellana, Fagus orientalis, Helleborus caucasicus, Laser trilobum, Piptatherum virescens, Poa nemoralis, Polygonatum glaberrimum, Primula woronowii, Quercus iberica, Salvia glutinosa, Scilla sibirica, Stachys sylvatica, Tamus communis, Tilia begoniifolia, T. cordata, Ulmus elliptica, U. glabra, Viola alba, V. odorata, Vitis vinifera* subsp. *sylvestris*.

9.3.1.1. Endemic plant species Corylus - *Corylus* L., Betulaceae

Corylus (Betulaceae**)** are 6 endemic species as both Georgian and the Caucasian: 1) *Corylus abchasica* Kem.-Nath. (= *Corylus colurna* L.), 2) *Corylus colchica* Albov, 3) Corylus *egrissiensis* Kern.-Nath., 4) Corylus *iberica* Wittm. ex Kem.-Nath. (= *Corylus colchica* Albov,); 5) *Corylus imeretica* Kem.-Nath. (=*Corylus avellana* var. *pontica* (K. Koch) H.J.P. Winkl.); 6) *Corylus kachetuca* Kem.-Nath. (=*Corylus colurna* L.). *Corylus avellana* is nor endemic of Georgia and Caucasus **(Figure 58).**

Common hazel is typically a shrub reaching 3-8 m tall, but can reach 15 m. The leaves are deciduous, rounded, 6-12 cm long and across, softly hairy on both surfaces, and with a double-serrate margin. The flowers are produced very early in spring, before the leaves, and are monoecious with single-sex wind-pollinated catkins. Male catkins are pale yellow and 5-12 cm long, while female catkins are very small and largely concealed in the buds with only the bright red 1-3 mm long styles visible. The fruit is a nut, produced in clusters of one to five together, each nut held in a short leafy involucre ('husk') which encloses about three quarters of the nut. The nut is roughly spherical to oval, 15-20 mm long and 12-20 mm broad (larger, up to 25 mm long, in some cultivated selections), yellow-brown with a pale scar at the base.

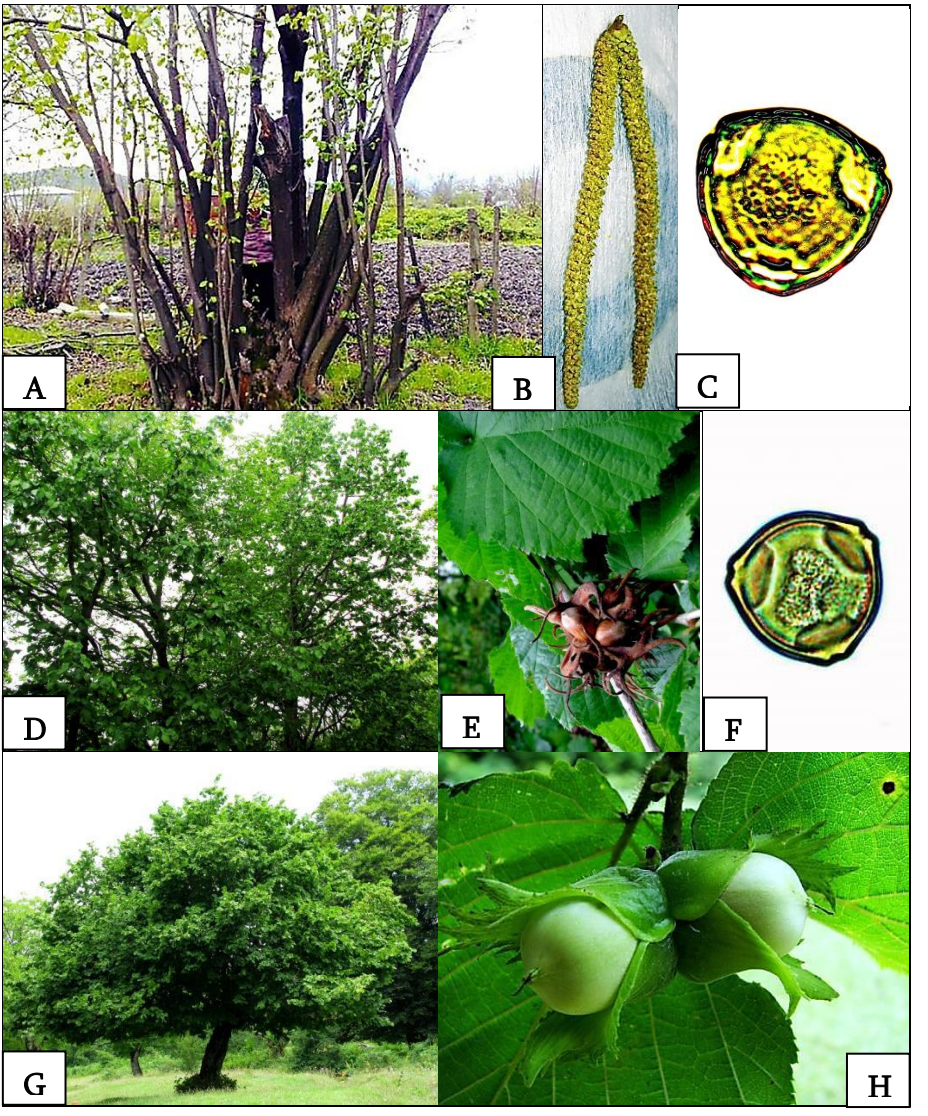


Figure 58. A.*Corylus avellana* is in villagis of Georgia. This tree is with Zira Sidamon in V. Shilda; **B.** Flowers has pollen in February**; C.** Pollen has length of the horizontal height as 34-37 μm; **D.***C. iberica* is relict species; **E**. Fruits are many; **F.**Pollen has length of the horizontal height as 34-37 μm; **G.-H.** *C. kachetuca* is relict species in v. Shilda, Kakheti. **Photo: Maia Akhalkatsi.**

The nut falls out of the involucre when ripe, about 7–8 months after pollination. The overall distribution is in Scandinavia which is as except the northern part Central Europe, Atlantic Europe, the Mediterranean, the Balkans, and Asia Minor. Within the former USSR, species occurs in the European region is in the Ladoga-Ilmen region, far southwestern areas of the Dvina- Pechora region, Upper- and Middle-Dnieper, Upper-Volga, Volga-Kama, Trans-Volga, Volga-Don, Near-Black-Sea and Crimean regions, and the Caucasus has Ante-Caucasus, Daghestan, Western, Southern and Eastern Transcaucasia, and the Talysh region. Distribution in Samtskhe-Javakheti region is occurs in all forests of Meskheti and Javakheti from middle montane belt up to 1500 m. Threat assessment is in wood cutting and habitat disturbances might threat this species.

Ex situ status - The seeds of this species have been collected in Meskheti and delivered to the fruit tree collection at the TBG&BI. *In situ* status - It grows in protected areas such as Borjomi-Kharagauli National Park. Common Hazel is cultivated for its nuts in commercial orchards in Europe, Turkey, Iran and Caucasus. The seed has a thin, dark brown skin which has a bitter flavour and is sometimes removed before cooking. The top producer of hazelnuts, by a large margin, is Turkey, specifically the Ordu Province. Turkish hazelnut production of 625,000 tonnes accounts for approximately 75% of worldwide production.

Hazelnuts are rich in protein and unsaturated fat. Moreover, they contain significant amounts of thiamine and vitamin B6, as well as smaller amounts of other B vitamins. Additionally, 1 cup (237 ml) of hazelnut flour has 20 g of carbohydrates, 12 g of which are fibre. Oil from its fruit is one of the highest in quality among vegetable oils. Branches are used to manufacture wicker furniture, pipe shanks, walking sticks and hoops. Medicinal uses - the bark, leaves, catkins and fruits are sometimes used medicinally. They are astringent, diaphoretic, febrifuge, nutritive and odontalgic. The seed is stomachic and tonic. The oil has a very gentle but constant and effective action in cases of infection with threadworm or pinworm in babies and young children. Wood cutting and habitat degradation can cause serious problems to survival of the species. The introduction of cultivars from different countries might lead to genetic pollution of local populations.

Proposed action plan objectives and targets: 1. Maintain the current populations of *C. avellana* in Meskheti and Javakheti. 2. Reduce the decline of this species through appropriate habitat management. *C. avellana* should be declared as species of high economic value as wild relative of edible plants. Sites are not protected, only in case when the individuals are growing on the territory of protected areas such as Borjomi-Kharagauli National Park. *Ex situ* conservation of this species will be effective to collect seeds and keep in seed banks. The local population and governmental bodies responsible for the nature protection should be informed about high conservation value of this species. Monitoring of the number of individuals in populations should be undertaken.

9.3.2. Code of Georgia: Marsh forest and Bog woodland (91D0*; PAL. CLASS.: from 44.A1 to 44.A4)

The marshy forest is mainly distributed on the lowland. It holds an especially large area in Kolkheti. It is distributed from the sea coast to the Rioni lowland and reaches Samtredia, Gubistskali river gorge where it is not preserved in its original form. Also, it is found in the form of small planted forests on the Alazani valley and great and small Caucasus in various places of the forest zone of the mountain. On the lowland the dominant species of the marshy forest is a common alder *Alnus barbata* – whereas in higher mountainous areas there is white Adler - *A. incana.*

The common alder is not evenly distributed in the forest. It creates planted forests among which the forest sections covered with water are developed. The level of water there goes down in summer sometimes even drying up completely. The Colchic marsh forest, together with the Adler trees contains 160 species of vascular plants.

However, other species of trees are rare. In Samegrelo at the sea coast and along the lowland of river Rioni wing-nut (*Pterocarya fraxinifolia*) is quite rare. In Guria, between Supsa and Natanebi as well as the sea shore there are: *Salix caprea, Frangula alnus,* in high mountaineous places *Ruscus colchicus* is rare. In Kakheti Adler forest grows skirret - *Sium sisaroideum,* in Abkhazeti - *S. latifolium.* The following large size herbs are to be noted: darewort (*Sambucus ebulus*), water iris (*Iris pseudacorus*), *Telekia speciosa*, Ponto hogweed

(*Heracleum ponticum*). Herbal plants are - *Leucojum aestivum, Oenanthe abchasica,* etc. In Guria, places covered with water there are the following marsh plants - *Sparganium microcarpum, Polygonum hydropiper, Mentha aquatica, Scirpus tabernaemontani.*

In high places sedge dominates - *Carex contigua, C. remota.* From grasses there is *Oplismenus undulatifolius.* In marshy forests there are characteristic lianas every where - *Smilax excelsa, Humulus lupulus, Periploca graeca,* and blackberry - *Rubus* spp.

White alder communities are of another composition and frequently develop on peaty marshes. The forest of this type is found in the western part of Upper Imeteri, in the gorge of river Kvirila, near village Sakara.

Plants species: *Alnus barbata, A. incana, Frangula alnus, Heracleum ponticum, Humulus lupulus, Iris pseudocorus, Leucojum aestivum, Mentha aquatica, Oenanthe abchasica, Oplismenus undulatifolius, Periploca graeca, Polygonum hydropiper, Pterocarya fraxinifolia, Ruscus colchicus, Salix caprea, Sambucus ebulus, Scirpus tabernaemontani, Sium sisaroideum, S. latifolium, Smilax excelsa, Sparganium microcarpum, Telekia speciosa.*

9.3.2.1. Edificatory plant species Willow - *Salix* L., Salicaceae

Edificatory species have a special role to contribute in ecosystem structure - 1) *Salix caprea* L.; 2) *S. kazbekensis* A.K. Skvortsov 3) *S. kusnetzowii* Laksch. ex Goerz., Willow, Salicaceae. These species are in the alpine zone and mainly on north, east and western slopes and not in southern exposition. Wood margins, coppices, and mixed woods. A fast-growing tree of *S. caprea* is to 6-10 m tall and to 0.75 m in diameter, or a fairly low arboraceous shrub. It is distributed from 900 to 2,000 m. Snow cover is >0.5-1 m. Grows at edges of the forests and along streams, up to 2,400 m a.s.l., reaches subalpine krumholz. Snow cover is >2-3 m. The exposition is for all directions and inclination till 70°C **(Figure 59).**

S. kazbekensis is more shrubs till 3 m and growing in alpine zone from 1900 to 3300 m. It is growing on rocks, high inclined slopes, near river and lake banks as well in birch forest coasts.Snow cover in subnival zone 2900-3300 m is >5-6 m. The exposition is for all directions and inclination till 70°C.

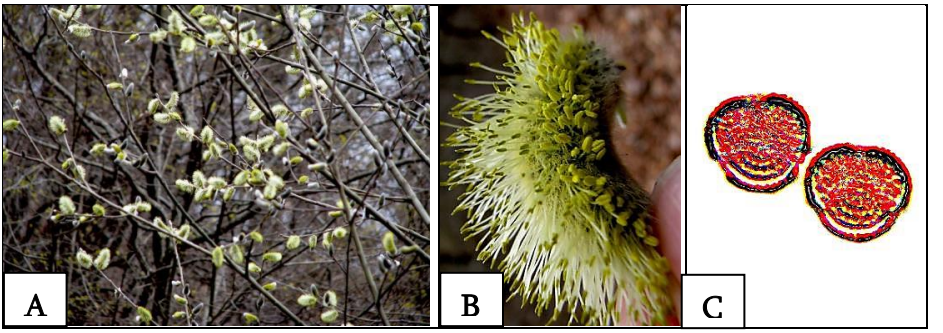


Figure 59. A. *Salix caprea* is in Quercus forest; **B.** Flower has much pollen; **C.** Pollen of *Salix caprea* has length of the horizontal height as 41-42 μm. **Photo: Maia Akhalkatsi.**

S. kusnetzowii is endemic species, 3-5 m high in of the Caucasus and distributed in subalpine coppices, birch and beech woods, at 1800-2400 m. The exposition is for all directions and inclination till 30°C.

Sunny edge is normal; dappled shade is in North Wall, East Wall, and West Wall. Suitable for: light), medium and heavy soils and can grow in heavy clay soil. Suitable pH: acid, neutral and basic soils. It can grow in semi-shade or no shade. It prefers dry moist or wet soil. The plant can tolerate maritime exposure. It can tolerate atmospheric pollution.

Salix caprea has bark smooth, greenish-gray, often splitting near the base of the trunk; exposed wood smooth, without striations, reddening; branches stout, spreading, gray -pubescent when young, at length dark, brown or gray, knotty, brittle; buds very large (especially the flower buds), glabrous, brown, ca. 5 mm long and 3 mm broad; stipules reniform, 4-7 mm long, serrate and lobed, soon caducous; petioles to 2 cm long, sturdy, dilated toward base; leaves varying in size and shape: ovate, suborbicular, subcordate, elliptic, oblonglanceolate, obovate -oblong, or rarely lanceolate, to 11-18 cm long and 5-8 cm broad, the margin hairy, irregularly dentate, the upper surface glabrous, rugose, dark green, the lower gray-tomentose, rarely diffusely puberulent or glabrate, with a lurid network of veins; lateral veins 6-9, forming wide round loops at the margin; network of veins prominent, with large alveoles; midrib and lateral veins mostly densely hairy; expanding leaves flat; hairs on the lower surface recurved; young

leaves silky-pubescent; catkins precocious, dense, large, the staminate sessile, subtended by few small bracts, 5-6 cm long and 1.6-2 cm broad; pistillate short-stalked, numerous, littering the soil when shedding, in fruit to 10 cm long, the rachis pubescent; scales lanceolate, blackish or dark brown at apex, covered with long white hairs; stamens 2, glabrous (in Electronic f. borealis England hairy), 2-3 times as long as the scale; anthers yellow; ovary ovoid -conical, villous -tomentose, the stipe one -half to two -thirds the length of ovary; style short or very short, yellow as the stigma lobes; gland 1, posterior, one-third as long as the stipe. Flowering in April; fruits in May.

S. kazbekensis is depressed or prostrate, with a short, often half-subterranean stem; branches glabrous, lustrous, castaneous, yellowish-brown or greenish-yellow; buds glabrous, small, acute, reddish-yellow; wood under the bark not ridged; stipules semiovate or ovate -lanceolate, small, glandular -dentate, soon caducous; petioles short, glabrous; leaf blades 2-5 cm long and to 2 cm broad, ovate to broadly ovate or oblong to lanceolate, obtusish at apex and at base, remotely dentate to subentire, not blackening, dark green and glossy above, glaucescent or green with a yellow midrib beneath; lateral veins slender and rather inconspicuous; vesture none or young leaves with long hairs, mainly beneath; catkins with or after the leaves, the staminate subsessile, to 2.5 cm long, the pistillate on lateral branchlets, borne on a fairly long leafy -bracted stalk, at first 2-3 cm long, elongating to 5-7 cm, upright or spreading, dense; scales elliptic or obovate, obtuse and dark brown at apex, light at base, covered with crisped white hairs, in pistillate flowers covering the ovary up to the middle; stamens 2, distinct, glabrous; anthers golden-reddish; ovary thickish, ovoid-conical, silky, rarely glabrate, brownish or reddish, subsessile; style one -third the length of ovary, commonly deeply 2-parted; stigma with linear-lobes; gland 1, posterior, filiform or clavate, about as long as the stipe. Flowering is in June. Fruits are in June-July.

S. kusnetzowii is a shrub, apparently fairly tall; exposed wood without striations; branches stout, in age ranging from rich brown to dark brown, glabrous, when young tomentose-pilose with white hairs; buds yellowish-brown or fulvous, glabrous or more or less pubescent, to 5 mm long and 4 mm broad, subacute; stipules only at the ends of vigorous shoots, very small, semicordate, densely hairy, sometimes tomentose as the midrib beneath; leaf blades oblong, obovate, or rarely

narrowly elliptic, 7-13 cm long and 3-4.2 cm broad, 3-3.5 times as long as broad, the margins entire or irregularly dentate or undulate, somewhat revolute; expanding leaves strongly involute, densely white -tomentose; grown leaves dark green whitish -veined above, more or less glaucescent and grayish-tomentose beneath with recurved hairs; veins very prominent beneath, rather insignificant above; lateral veins 10-12 pairs; catkins after the leaves, borne on a leafy -bracted hairy stalk to 2 cm long; staminate ovoid, to 3 cm long; pistillate cylindric, 4-6.5 cm long and 1.5 cm broad, in fruit to 12-14 cm long and 2.5 cm broad, flexuous, loose, interrupted below; rachis densely hairy; scales to 2 -3 mm long, liguliform, light brown, sometimes fulvous at apex, more or less hairy, the staminate more heavily; stamens 2, distinct, hairy at base; anthers oblong, yellow; ovary ca. 5 mm long, white -tomentose, ovoid -conical, the stipe 3- 4 mm long; style ca. 0.5 mm long, reddish-brown; stigma with 4 spreading lobes, ca. 0.5 mm long, reddish-brown like the style; gland interior, oblong, ca. 0.6 mm long; capsule valves helically twisted after dehiscence. Flowering in June; fruits in June-July.

Family of great economic importance as a source of timber, carpentry wood, fuel, fodder, and best is tanning agents, and medicinal products. Many of the arboraceous species make very rapid growth and are easily propagated by cuttings. Not fastidious as regards soil but mostly dependent on good supply of moisture. Willows are of outstanding importance to man, furnishing timber, fuel, and wood for carpentry, material for basket making, tanning agents, and medicaments. They are also of importance as ornamental plants and as a source of fodder for domestic animals. The presence of willow thickets is biologically associated with certain lignivorous ruminants, such as reindeer, red deer, elk, etc., which feed upon the bark, branches, and leaves. The bark is also eaten by hares, squirrels, beavers, and water voles. Certain species of Lagomyidae collect and dry willow leaves. Birds, such as rock ptarmigan, willow grouse, hazel hen, blackcock, etc., feed in winter and spring upon willow buds and catkins. Willow thickets provide stations for various animals and birds of economic importance that find in them refuge and food. The kinds yielding material for basketry are of outstanding value; they are collected and cultivated both for home use and for export. An outstanding is early nectariferous plant. Bark is used as tanning agent

(tannin content 5.24 -13.1%) and for production of a black dye. Employed is in popular medicine as an astringent remedy for scurvy and fever. The foliage is used as feed for sheep and goats and as an adulterant for tea. Leaves eaten by deer and domestic stock, and buds by arctic partridge and rock ptarmigan. The bark contains up to 8-9% tannins. The twigs are used for charcoal making and for fuel; they are not suitable for wickerwork. The wood is reddish or yellowish -brown, shiny, rather firm and tough; harder, heavier, and more tensile than that of many other European species of willow; it splinters easily. It can be used as firewood, as a source of charcoal, as a component of gunpowder, and as construction timber.

The willow is propagated only by seed. Cuttings are difficult to root. The plant is frost-resistant. It consolidates the soil and is used for planting on slopes. Its hybrids are distinguished by strong growth and are used as rootstocks for weeping varieties. Most species are in subarctic region; alpine and subalpine zone; moss-and-lichen tundra and banks of mountain streams.

The stems are very flexible and are used in basket making. The plant is usually coppiced annually when grown for basket making, though it is possible to coppice it every two years if thick poles are required as uprights. The bark is tough and flexible; it is used as a substitute for leather. The bark contains around 10% tannin. The plant is fast growing and tolerant of maritime exposure, it can be used as a windbreak hedge and shelterbelt though it is of untidy habit. The seeds are very light and so can travel some distance in the wind.

The plant is therefore able to find its way to areas such as cleared woodland where the soil has been disturbed. Seedlings will grow away quickly, even in exposed conditions and the plant will provide good shelter for the establishment of woodland plants. Thus it makes a good pioneer species and, except in wetter and moorland-type soils, will eventually be largely out-competed by the other woodland trees. Its main disadvantage as a pioneer plant is that it has an extensive root system and is quite a greedy plant, thus it will not help as much in enriching the soil for the other woodland plants as other pioneer species such as the alders, *Alnus* species. Some cultivars can be grown as ground cover. Wood is soft, elastic easily split. Used for baskets, rugs etc. A good quality charcoal is made from the wood.

Succeeds in most soils, including wet, ill-drained or intermittently flooded soils, but prefers a damp, heavy soil in a sunny position. Grows is in drier soils than any other British species of *Salix*. Rarely thrives on chalk. Plants are found most frequently on basic soils in the wild. Tolerates atmospheric pollution and exposed positions, including maritime exposure. A fast growing tree, it establishes well.

The tree has an untidy habit. A light demanding tree, it becomes tall and drawn when grown in woodland, though it grows well along the sunnier edges. Hybridizes freely is with other members of this genus. Although the flowers are produced in catkins early in the year, they are pollinated by bees and other insects rather than by the wind. Trees are very tolerant of cutting, they coppice well. Plants in this genus are notably susceptible to honey fungus. Dioecious is here. Male and female plants must be grown if seed is required.

Seed is must be surface sown as soon as it is ripe in late spring. It has a very short viability, perhaps as little as a few days. Cuttings are of mature wood of the current year's growth, November to February in a sheltered outdoor bed or planted straight into their permanent position and given good weed-suppressing mulch. Cuttings of this species do not root well. Plant has into their permanent positions in the autumn. Cuttings are of half-ripe wood, June to August in a frame. Cuttings of this species do not root well.

Geographic distribution of *S. caprea* is in Europe, Caucasus and Central Asia on arctic and mountain areas. *S. kazbekensis* and *S. kusnetzowii* are mainly in Great Caucasus birch forest of high mountain areas.

9.3.3. Alluvial forest tree with Adler - *Alnus* Mill., Betulaceae; (91E0*; PAL. CLASS.: 44.3, 44.2 and 44.13)

Riverside forests are developed both in the forest zone and places without the forest, where it grows as a narrow line along the river-bed. In the forest zone the riparian forest is less distinguished from the structure of the bordering forest.

However, it always has a characteristic composition of species. The wing-nut (*Pterocarya fraxinifolia*) always grows in the riparian forest in Abkhazia, Kolkheti and Kakheti. Common alder forest is frequently grown in the riparian forest but it is not as typical as in the marshy

forest. *Holcus lanatus, Paspalum paspaloides, Briza minor, Pycreus colchicus, Poa trivialis, Polygonum persicaria,* etc. are characteristic from herbaceous species.

In Ajara, the riparian forest is deeply intruded into the mountains. Besides wing-put and alder trees there is an ash (*Fraxinus oxycarpa*), aspen (*Populus tremula*); from lianas there are: smilax (*Smilax excelsa*) and ivy (*Hedera colchica*). In the outskits of Natanebi and Vakejvari moist sides of the narrow gorges are covered with the invasive plant - *Perilla nankinensis.* In Rioni gorge near Kutaisi there are alders and persimmons. Along the Kakheti Rivers wing-nut and bladder-nut (*Staphylea pinnata*) are common.

Sub-types (91E0-01): Floodplain forest in Abkhazia and the wide bed of rivers is periodically covered with water, which causes washing away of the vegetation existing there. However, after a certain period they will again return to the initial conditions. Mainly, such places are covered by annual plants, such as, *Aira capillaris. Epilobium palustre* is found on high places which rarely get covered by water. In Svaneti and Lechkhumi the vegetation of riverside rock on the banks of river Enguri and its tributary also gets covered with water during the summer flood. Common (*Alnus barbata*) and white (*A. incana*) Adler and species of the willow (*Salix* spp.) grow here **(Figure 60).**

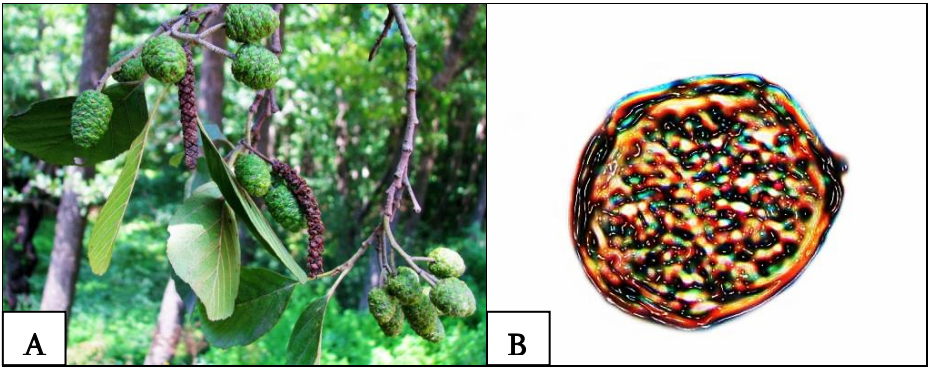


Figure 60. A. *Alnus barbata* near the river bank; **B.** Pollen of *Alnus barbata* has length of the horizontal height as 75 μm. **Photo: Maia Akhalkatsi.**

Among the bushes there area lot of amounts of nut and azalea. From ferns we can see *Matteuccia struthiopteris.* White Adler in these gorges reaches the subalpine zone. In Meskheti, on the sandy-rocky banks of rivers Mtkvari and Potskhovi scrub composed of various species of buckthorn and willow is widely distributed. In Middle Kartli the vegetation of the Mtkvari riverside rock is often washed away during the flood. Here vegetation is well developed in the second part of summer when the level of water in Mtkvari significantly decreases. Mainly grasses and sedges participate in forming this vegetation cover. The following are worthnoting: grasses - *Calamagrostis glauca,* sedges - *Cyperus fuscus, Pycreus flavescens, Eleocharis palustris, Fimbrystilis bisumbellata,* and rushes- *Juncus articulatus, J. tenageia.* Dicotyledons - *Pulicaria dysenterica, Mentha aquatica, Eupatorium cannabinum.*

Sub-types (91E0-02): River silt vegetation: Rioni silt banks are covered with bushes which consist of species of buckthorn and willow. In Upper Imereti there are hawthorn and oriental hornbeam. Buckthorn and Jerusalem thorn are rare. Willow, tamarisk, blackberry and many herbal plants - *Galium articulatum, Senecio grandidentatus* grow in Kartli, oon islands covered with silt, which is rarely covered by water. *Clematis vitalba*, asparagus (*Asparagus verticillatus*) and madder (*Rubia tinctorum*) are to be mentioned from bindweed plants.

Plants species: *Aira capillaris, Alnus barbata, Asparagus verticillatus, Calamagrostis glauca, Carpinus orientalis, Clematis vitalba, Cyperus fuscus, Eleocharis palustris, Epilobium palustre, Eupatorium cannabinum, Fimbrystilis bisumbellata, Fraxinus oxycarpa, Galium articulatum, Hedera colchica, Hyppophaë rhamnoides, Juncus articulatus, J. tenageia. Matteuccia struthiopteris, Mentha aquatica, Paliurus spina-christi, Perilla nankinensis Populus hybrida, P. tremula, Pterocarya fraxinifolia, Pulicaria dysenterica, Pycreus flavescens, Rubia tinctorum, Salix abla, S. excelsa, Senecio grandidentatus, Smilax excelsa, Staphylea pinnata, Tamarix ramosissima.*

9.3.3.1. Edificator species and medicinal plants *Sambucus* L., Caprifoliaceae

So far two species of *Sambucus* were described for Georgia - *Sambucus ebulus* L. and *S. nigra* L., in 1980-s was discovered in Georgia popula-

tion of *S. tigranii* Troitzk., which was before considered as endemic plant of Armenia. Target species is *Sambucus tigranii* Troitzk. **(Figure 61).**

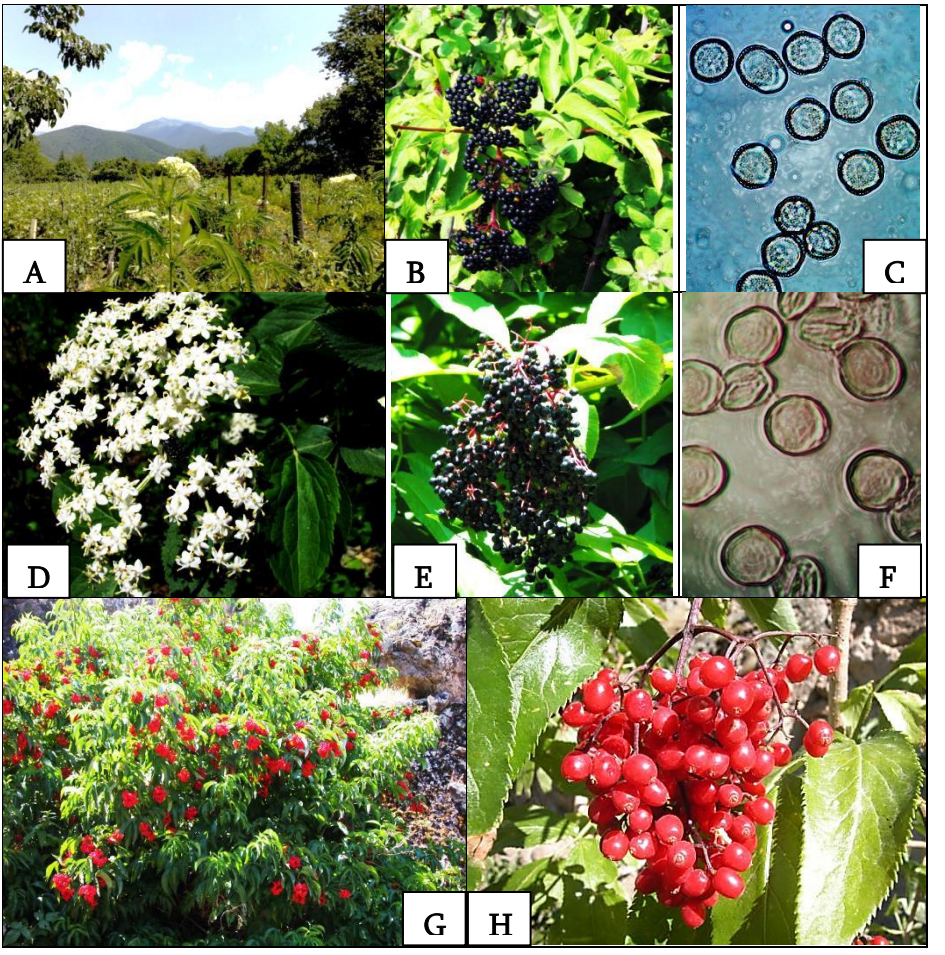


Figure 61. A. *Sambucus ebulus* in agrarian areas, v. Shilda for Zira Sidamon; **B**. Fruits are medicinal**; C.** Pollen of *S. ebulus* has length of the horizontal height as 18-20 µm; **D.** *Sambucus nigra* is in forests; **E.** Fruits are medicinal; **F.** Pollen of *S. nigra* has length of the horizontal height as 18.5-21 µm; **G.** *Sambucus tigranii* is endemic for Caucasus and it is in Meskheti; **H.** Fruits are not used as medicinal. **Photo: Maia Akhalkatsi.**

Although, medicinal property of this species is not yet investigated, it is known that the other two species have high value as medicinal plants. Therefore we decided to study the rare species - *S. tigranii*, which is included in the IUCN Red Data List as vulnarable.

Deciduous shrub is growing to 4 m by 3 m at a fast rate. It is in leaf from March to November, in flower from June to July, and the seeds ripen from August to September. The plant prefers light, medium and heavy soils and can grow in heavy clay soil. The plant prefers acid, neutral and basic soils and can grow in very alkaline soil. It can grow in semi-shade or no shade. It requires moist soil. The plant can tolerate maritime exposure. It can tolerate atmospheric pollution.

Medicinal use has two other species of this genus *S. ebulus* and *S. nigra*. The first is herb and the other shrub up to 6 m height. They are antiinflammatory; Aperient; Diaphoretic; Diuretic; Emetic; Emollient; Expectorant; Galactogogue; Haemostatic; Laxative; Ophthalmic; Purgative; Salve; Stimulant. Elder has a very long history of household use as a medicinal herb and is also much used by herbalists **(Grieve, 1984).** The flowers are the main part used in modern herbalism, though all parts of the plant have been used at times. Stimulant is here. The inner bark is collected from young trees in the autumn and is best sun-dried. It is diuretic, a strong purgative and in large doses emetic. It is used in the treatment of constipation and arthritic conditions **(Bown, 1995).** The leaves can be used both fresh and dry. For drying, they are harvested in periods of fine weather during June and July. The leaves are purgative, but are more nauseous than the bark. They are also diaphoretic, diuretic, expectorant and haemostatic. The juice is said to be a good treatment for inflamed eyes. An ointment made from the leaves is emollient and is used in the treatment of bruises, sprains, chilblains, wounds etc. A tea made from the dried berries is said to be a good remedy for colic and diarrhea **(Grieve, 1984).**

The pith of young stems is used in treating burns and scalds. The root is no longer used in herbal medicine but it formerly had a high reputation as an emetic and purgative that was very effective against dropsy. A homeopathic remedy is made from the fresh inner bark of young branches. It relieves asthmatic symptoms and spurious croup in children.

The fruit of *S. ebulus* and *S. nigra* is widely used for making wines, preserves etc., and these are said to retain the medicinal properties of

the fruit. *S. tigranii* is too few plants in Georgia to be have importance in human being. *S. ebulus* and *S. nigra* have many uses in himan being as dye, wood, cosmetic etc. The dried flowering shoots are used to repel insects, rodents etc. The flowers are used in skin lotions, oils and ointments. *S. nigra* is an excellent pioneer species to use when re-establishing woodlands. The berries yield various shades of blue and purple dyes. The pith in the stems of young branches pushes out easily and the hollow stems thus made have been used as pipes for blowing air into a fire. The mature wood is white and fine-grained. It is easily cut and polishes well and valued highly by carpenters, it has many used, for making skewers, mathematical instruments, toys etc.

A very easily grown plant, it tolerates most soils and situations, growing well on chalk, but prefers a moist loamy soil **(Huxley, 1992).** Grows is well in the heavy clay soils. Tolerates some shade but fruits better in a sunny position. Tolerates is atmospheric pollution and coastal situations. The elder is very occasionally cultivated for its edible fruit. The leaves often begin to open as early as January and are fully open in April. The leaves fall in October/November in exposed sites, later in sheltered positions. Young stems can be killed by late frosts but they are soon replaced from the ground level. Very tolerant of pruning, plants can be cut back to ground level and will regrow from the base. The flowers are very attractive to insects. The fruit is very attractive to birds and this can draw them away from other cultivated fruits.

Seed is as best sown as soon as it is ripe in the autumn in a cold frame, when it should germinate in early spring. Stored seed can be sown in the spring in a cold frame but will probably germinate better if it is given 2 months warm followed by 2 months cold stratification first. Prick out the seedlings into individual pots when they are large enough to handle. If good growth is made, the young plants can be placed in their permanent positions during the early summer.

Otherwise, either put them in a sheltered nursery bed, or keeps them in their pots in a sheltered position and plants them out in spring of the following year. Cuttings are of half-ripe wood, 7–10 cm with a heel, July/August in a frame. Cuttings are of mature wood of the current season's growth, 15–20 cm with a heel, and late autumn in a frame or a sheltered outdoor bed. Division is of suckers in the dormant season.

9.3.4. Code of Georgia: Riparian mixed forests (91F0 GE; PAL. CLASS.: 44.4)

The riparian forest is common on the banks of large rivers and lowland areas. Dominant species are: Flood plane oak (*Quercus pedunculiflora=Q. longipes*), wing-nut (*Pterocarya fraxinifolia*), white aspen (*Populus alba*), oleaster (*Elaeagnus angustifolia*), tamarisk (*Tamarix ramosissima, T. hohenackeri*), buckthorn (*Hippophaë rhamnoides*. Trees are covered with lianas - *Vitis vinifera* subsp. *sylvestris, Periploca graeca, Cynanchum acutum, Solanum persicum,* etc.

In Colchic riparian forests are dominated by hornbeam and beech. Rhododendron, Ponto and Colchic butcher's broom, blackberry, smilax and silk-vine create an understory in Abkhazia. In Samegrelo oak and wild pear adds to the beech and hornbeam. Planted forests of the small area of such a forest are common in the gorges of rivers Tekhura and Abasha.

In Kartli, on the bank of river Mtkvari the forest dominating with flood-plane oak and white aspen is developed. In the middle of the Kartli elm (*Ulmus minor*) and mulberry (*Morus alba*) add to these species with multiple scrub and lianas. In Tbilisi surroundings the flood plane is developed in the gorges of river Mtkvari (village Kavtiskhevi) and river Aragvi (village Natakhtari). Here the white leaf aspen (*Populus hybrida*) is the dominant species. The rest are those growing in the above-described forests – flood plane oak, mulberry, elm, buckthorn, tamarisk, silk-vine, smilax, honey suckle, hops, clematis. The herbal cover is rich. European dogbane (*Apocynum)* and *Solenanthus biebersteinii* are found only in this place.

At the lower current of Mtkvari, from Gardabani to the border of Azerbaijan a typical aluvial forest is developed. A. Grosshaim calls it the Tugai type forest. Forests of such a type are common in Georgia in the coast line of Iori, Alazani and Mtkvari.

The moist riparian forest at the lower stream of river Mtkvari is composed of large size trees that are covered with lianas. From trees the following can be found: the flood plane oak (*Quercus pedunculiflora*), black aspen (*Populus nigra*), the white leaf aspen (*Populus hybrida*), elm (*Ulmus minor*), white willow (*Salix alba*); From bushes: hawthorn (*Crataegus monogyna*), cornelius (*Cornus*

mas), blackberry (*Rubus* spp.), privet (*Ligustrum vulgare*); lianas – ivy (*Hedera helix*), wild vine (*Vitis vinifera* subsp. *sylvestris*), smilax (*Smilax excelsa*), silk-vine (*Periploca graeca*), valerian (*Clematis vitalba*); Herbaceous plants are: red clover (*Trifolium pratense*), white clover (*T. repens*), cock's foot (*Dactylis glomerata*).

In Kakheti riparian forests are extremely moist and frequently get covered with water. Alazani flood planes occupy the largest area, which is stretched along the central part of Alazani valley and its width gradually increases towards the direction of Kiziki. The forest is extremely dense and almost impassable. Besides the oak tree the species that dominate are: hornbeam (*Carpinus caucasica*), maple (*Acer velutinum*), lime (*Tilia begoniifolia*), ash (*Fraxinus excelsior*), elm (*Ulmus minor*), wild pear (*Pyrus caucasica*), mulberry (*Morus alba*), black mulberry (*M. nigra*). In more moist areas dominate wing-nut (*Pterocarya fraxinifolia*), persimmon (*Diospyros lotus*), black aspen (*Populus nigra*), white leaf aspen (*Populus hybrida*), species of the willow and alder. The understory is created by hawthorn (*Crataegus pentagyna*), medlar (*Mespilus germanica*), nut, elder dogwood. In drier places there are species of hawthorn, cornel, sour plum, quince, apple, wild pear, and common maple. From lianas there are: ivy (*Hedera helix*), wild grapevine (*Vitis vinifera* subsp. *sylvestis*), *Clematis vitalba*, smilax (*Smilax excelsa*). From herbaceous plants - *Oplismenus undulatifolium, Circaea lutetiana, Stachys sylvatica, Asperula odorata, Pachyphragma macrophyllum, Lapsana grandiflora, Sanicula europaea, Geranium robertianum, Salvia glutinosa.* Fern and danewort are widely distributed. Here as well *Althaea cannabina, A. officinalis, Datisca cannabina, Lysimachia dubia, L. verticillaris* are mixed. The Iori flood plane is preserved in its original form in Koruhi, Sagarejo region and is strentxhed at the length of about 1 km. The types common in this forest are: flood plane oak, wtite aspen and elm. Ash, mulberry and oleaster are rare. In the understory tamarisk, hawthorn, pomegranate and berberis are common. As for liana type plants, those widespread here are clematis, from herbaceous plants - *Cynanchum acutum, Plantago lanceolata, Sisymbrium loeselii* and sedges.

Plants species: *Acer campestre, A. velutinum, Alnus barbata, Althaea cannabina, A. officinalis, Apocynum venetum, Asperula odorata, Berberis iberica, Carpinus caucasica, Circaea lutetiana, Clematis vitalba, Crataegus pentagyna, Cydonia oblonga, Cynanchum*

acutum, Dactylis glomerata, Datisca cannabina, Elaeagnus angustifolia, Fraxinus excelsior, Geranium robertianum, Hedera helix, Lapsana grandiflora, Lysimachia dubia, L. verticillaris, Malus orientalis, Mespilus germanica, Morus alba, M. nigra, Oplismenus undulatifolius, Pachyphragma macrophyllum, Periploca graeca, Plantago lanceolata, Populus alba, P. hybrida, P. nigra, Prunus divaricata, Punica granatum, Pyrus caucasica, Quercus pedunculiflora, Salvia glutinosa, Sambucus ebulus, Sanicula europaea, Sisymbrium loeselii, Smilax excelsa, Solenanthus biebersteinii, Stachys sylvatica, Tamarix ramosissima, T. hohenackeri, Tilia begoniifolia, Trifolium pratense T. repens, Ulmus minor, Vitis sylvestris.

9.3.4.1. The economically potential species and medicinal plants *Althaea* L., Malvaceae

There are 3 of total 4 species of *Althaea* occurring in Georgia –*Althaea armeniaca* Ten., *A. cannabina* L., *A. hirsuta* L., *A. officinalis* L., *A. rosea* (L.) Cav., *A. rugosa* (Alef.) Litv. (=*Alcea rugosa* Alef.) **(Figure 62).**

A. armeniaca is rare ornamental plant growing in wetlands and moist meadows. It is perennial growing to 2 m by 1.70 m. It is in flower from July to August, seeds ripen from August to September. 3 populations have been found in Meskheti.

A. officinalis grows in cultivated beds in house gardens, rarely naturalized. It is in flower from July to September, seeds ripen from August to October. We have found one population naturalized. Both species prefer light, medium and heavy soils.

The plant prefers acid, neutral and basic soils and can grow in saline soil. It cannot grow in the shade. It requires dry or moist soil. Only one naturalized population has been found in Meskheti, near Safara. We describe only populations of *A. armeniaca*, however in the database is information on *A. officinalis*.

The characteristics of the population were determined. The number of individuals was determined in three plots of each population, which is indicated in the data base and was used for determination of total number of individuals in the entire area of the distribution of the population.

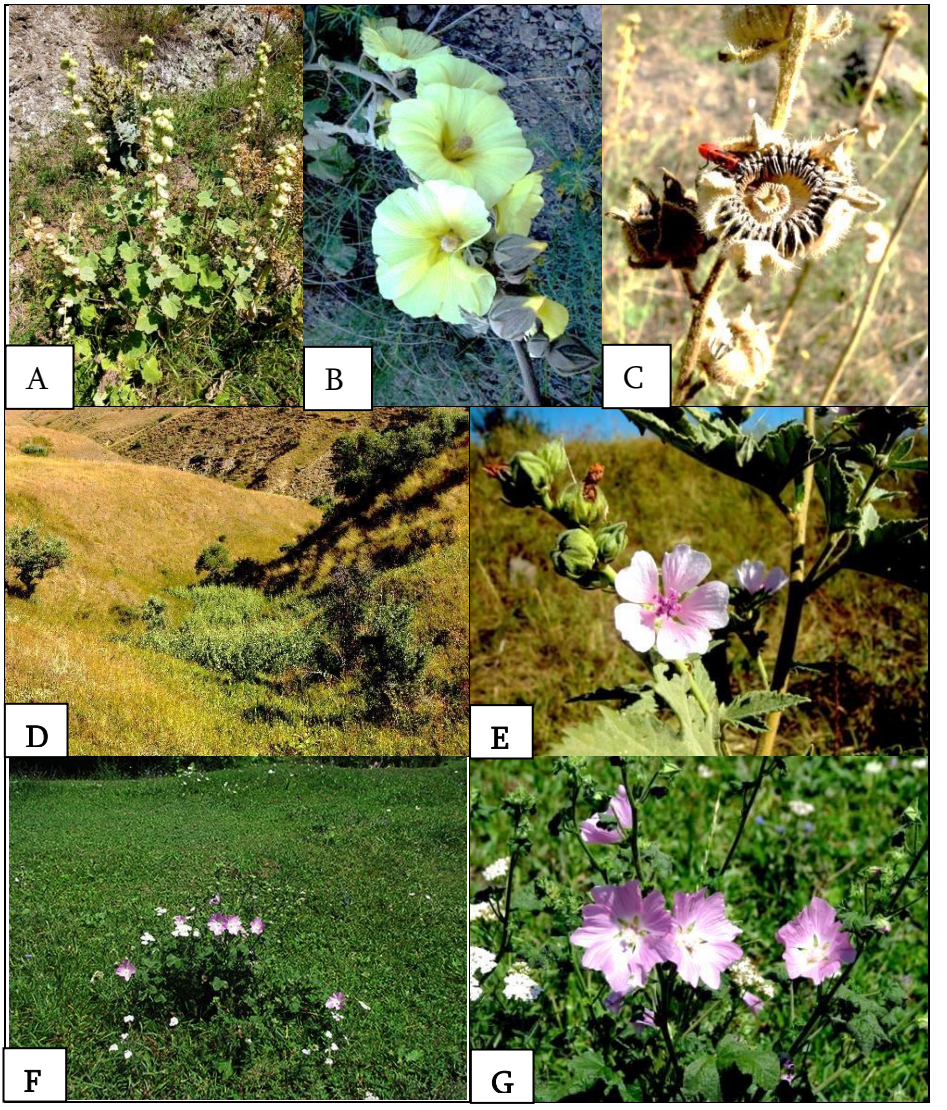


Figure 62. The species of *Althaea* grows in arid meadows. Flowering and used for medicinal. **A. B. C.** *Althaea rugosa* (*=Alcea rugosa*) is growing near shore road*;* **D. E.** *Althaea armeniaca* is in near water in meadows; **F. G.** *Althaea cannabina* is in meadows and near agrarian areas. **Photo: Maia Akhalkatsi.**

Medicinal uses are - Antitussive; Demulcent; Diuretic; Emollient; Laxative. Both species, but especially *A. officinalis* are a very useful household medicinal herb. It's soothing demulcent properties make it very effective in treating inflammations and irritations of the mucous membranes such as the alimentary canal, the urinary and the respiratory organs **(Chevallier, 1996).**

The root counters excess stomach acid, peptic ulceration and gastritis **(Chevallier, 1996).** It is also applied externally to bruises, sprains, aching muscles, insect bites, skin inflammations, splinters etc. **(Bown, 1995).** An infusion of the leaves is used to treat cystitis and frequent urination **(Chevallier, 1996).**

The leaves are harvested in August when the plant is just coming into flower and can be dried for later use **(Grieve, 1984).** The root can be used in an ointment for treating boils and abscesses (**Chevallier, 1996**). The root is best harvested in the autumn, preferably from 2 year old plants, and is dried for later use (**Bown, 1995**).

Leaves and roots are used as tea. The root is used as a vegetable (**Grieve, 1984**). It contains about 37% starch, 11% mucilage, 11% pectin (**Chevallier, 1996**). Other uses are Adhesive; Fiber; Oil; Teeth. The dried root is used as a toothbrush or is chewed by teething children. It has a mechanical affect on the gums whilst also helping to ease the pain. The root is also used as a cosmetic, helping to soften the skin.

A fiber from the stem and roots is used in paper-making. The dried and powdered root has been used to bind the active ingredients when making pills for medicinal use (**Stuart, 1979**). Threats are habitat degradation, climate change.

Marshmallow is often cultivated in the house garden, as a culinary and medicinal herb as well as for ornament. Succeeds in almost any soil and conditions (**Grieve, 1984**), though it prefers a rich moist soil in a sunny position. It also tolerates fairly dry soil conditions. Plants are hardy to about -25°C.

Seed of *Althaea* is as sow spring or autum n in individual pots. The seed is best sown as soon as it is ripe in October. The germination is often erratic (**Bown, 1995**). Stratification can improve germination rates and time.

Prick out the seedlings when they are large enough to handle and plant them out in the summer. It is best to put them in lightly shaded position until plant them out into their permanent positions.

9.3.5. Code of Georgia: Xero-thermophyte oak forest (91I0*; PAL. CLASS.:41.7A)

Xero-thermophyte oak forest can be found in the lower zone of east and west Georgia, southern slopes, where Georgian oak (*Quercus iberica*) is mixed with the oriental hornbeam (*Carpinus orientalis*). It is distributed 500-1100 meters a.s.l., grows in dry and sometimes limestone soil. The understory usually is weakly developed and is mainly represented by the cornel and cotynus. Hawthorn *(Crataegus monogyna,*), spindle (*Euonymus europaea, E. verrucosa*), *Swida australis*, medlar (*Mespilus germanica*) and oriental fleabane (*Lonicera orientalis*) are rare. Herbal cover and sedge are very well developed.

Plants species: *Quercus iberica, Carpinus orientalis, Acer campestre, Buglossoides purpuro-caerulea (=Aegonichon purpuro-caeruleum*), *Carex michelii, Cornus mas, Cotinus coggygria, Crataegus monogyna, Dactylis glomerata, Geum urbanum, Euonymus europaea, E. verrucosa, Lathryrus aphaca, Lonicera orientalis, Mespilus germanica, Polygonatum multiflorum, Prunus spinosa, Pulmonaria dacica, Pyrus salicifolia, Rhamnus cathartica, Sorbus torminalis, Tanacetum vulgare, Ulmus minor, Vincetoxicum hirundinaria.*

9.3.5.1. Crop wild relatives (CWR) plant species *Lathyrus* L., Fabaceae

Crop wild relatives (CWR) are determined by the exchange of gene crops and germaplazma used agricultural crop domestication ancestor species. Cultivated grass pea - *Lathyrus sativus* L. was domesticated in West Asia with a center of diversity in the Mediterranean region. In Georgia, there are 14 species of *Lathyrus*. Among them 5 are distributed in Samtskhe-Javakheti - *L. aphaca* L., *L. miniatus* M. Bieb. ex Steven, *L. pratensis* L., *L. roseus* Steven, *L. tuberosus* L. *Lathyrus tuberosus* L. - Earthnut Pea **(Figure 63)**.

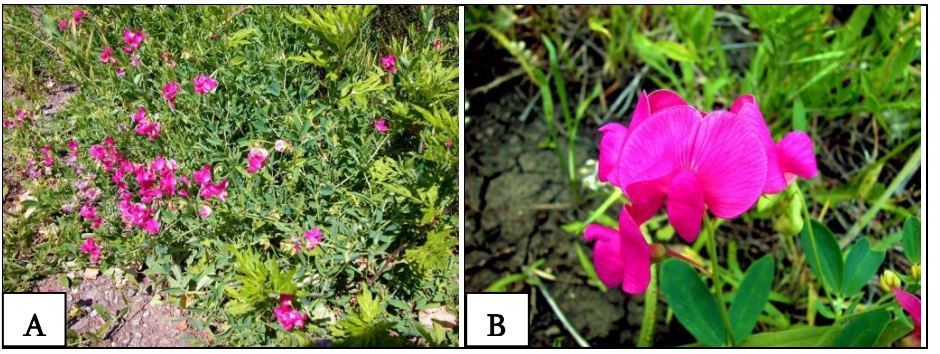


Figure 63. A. *Lathyrus tuberosus* is CWRs of cultivated grass pea - *Lathyrus sativus.* **B.** Flowers will have seeds for food. **Photo: Maia Akhalkatsi.**

Perennial is growing to 1.2 m. It is in flower from June to July, and the seeds ripen in August. The flowers are hermaphrodite (have both male and female organs) and are pollinated by Bees. The overall distribution is in Europe to West Asia. Distribution in Samtskhe-Javakheti region is in occurs almost on all territory of Meskheti and Javakheti, but the populations contain just little number of individuals, sometimes 1-2. The plant prefers light, medium and heavy soils. The plant prefers acid, neutral and basic soils. It can grow in semi-shade or no shade. It requires moist soil. It can fix Nitrogen. It is noted for attracting wildlife. Easily is grown plant, succeeding in any moderately good garden soil. It prefers a limestone soil in a warm position, and likes some shade. A climbing plant is scrambling through other plants and supporting itself by tendrils. It tends to be slightly invasive with new stems emerging at some distance from the bacteria; these bacteria form nodules on the roots and fix atmospheric nitrogen. Some of this nitrogen is utilized by the growing plant but some can also be used by other plants growing nearby. Pre-soak the seed for 24 hours in warm water and then sow in early spring in a cold frame. When they are large enough to handle, prick the seedlings out into individual pots and plant them out in the summer. If you have sufficient seed, then it can also be sown in situ in mid spring. Division is of the tubers when the plant is dormant in spring or autumn. Grazing and habitat are disturbances. *Ex situ status* - Seeds are kept in USDA seed bank.

In situ status is not protected in the natural habitats. Used as fodder plant is grazed by livestock animals.

Proposed action plan objectives and targets: 1. Maintain the current populations of *L. tuberosus* in Samtskhe-Javakheti region. 2. Reduce the decline of this species through appropriate habitat management.

L. tuberosus should be declared as species of high economic value as genetic ancestor for cultivated grass pea. Sites of population distribution need to be protected. *Ex situ* conservation of this species will be effective to collect seeds and keep in seed banks. The local population and governmental bodies responsible for the nature protection should be informed about high conservation value of this species. Monitoring of the number of individual in populations should be undertaken.

9.4. Dark-coniferous forest

9.4.1. Code of Georgia: Dark-coniferous forest (*Picea orientalis - Abies nordmanniana*); (91PA-GE)

After the beech forest the spruce (*Picea orientalis*) and the fir (*Abies nordmanniana*) forest is at the second place **(Figure 64).** It occupies 15.6% of the overall area of the forest. Out of this amount 5.6 % is occupied by the spruce whereas 10% is dedicated to the fir. Beeches and pines are most commonly mixed in these forests. Dark coniferous forests are common in both east and west Georgia.

It does not create the united zone and holds a specific habitat from 1000 to 2000 meters of height. Separate species can be grown at the lower altitude (200-300 meters) or even higher (2300-2350 m). On great Caucasus in east Georgia, the spruce is widely distributed in the gorge of river Didi Liakhvi.

To the east it is common in separate groups and reaches the most extreme border of it's distributed in the Aragvi gorge of river Pshavi. On small Caucasus spruce is common in the gorge of the river Tedzami, on the slopes of the Northern exposition. In the form of separate groups it almost reaches Tbilisi and is found in the upper part of the river Vere. The eastern border of the distribution of the fir on Great Caucasus flows in the Didi Liakhvi gorge whereas the Corresponding border on small Caucasus is in Algeti reserve.

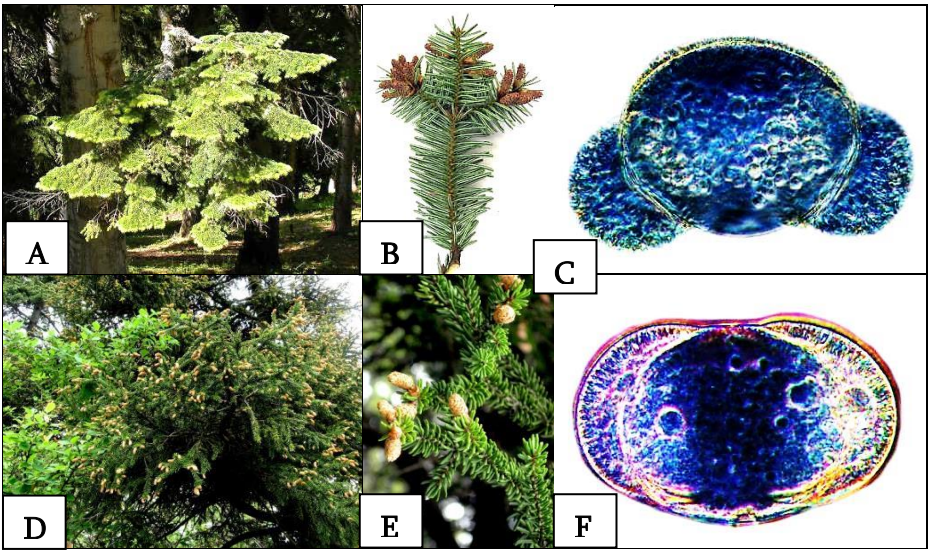


Figure 64. **A.** *Abies nordmanniana* in v. Bakuriani; **B.** Male flowers with pollen in April; **C.** Pollen of *Abies nordmanniana* has length of the horizontal height as 160-163 μm and distanth height as 95-105 μm. **D.** *Picea orientalis* is in v. Bakuriani; **E.** Male flowers with pollen in May; **F.** Pollen of *Picea orientalis* has length of the horizontal height as 105-108 μm and distanth height as 65-80 μm. **Photo: Maia Akhalkatsi.**

Sub-types (91PA-GE-01): Dark coniferous forest without the understory (*Picea-Abies* sine *fruticosa*). The following communities are differentiated

1. The spruce forest with the moss cover (*Picea orientalis maculato-muscosa*) is distributed at the height of 1100-2100 meters. On the soil it is characterized by the thick layer of moss. The understory is not found. However, rarely there can be found species of Caucasian honey-suckle (*Lonicera cauacsica*) and spindle (*Euonymus leiophloea*). From the herbal cover the following are common: *Festuca drymeja, Campanula cordifolia, Oxalis acetosella, Vicia crocea, Orobus hirsutus, Viola alba, Veronica officinalis.* Above 1700 meters the following can be found: *Calamagrostis arundinacea, Valeriana alliariifolia, Calamintha grandiflora, Lapsana grandiflora, Lilium szowitsianum, Gymnocarpium dryopteris, Vaccinium myrtillus.* Indicator species are: *Dryopteris*

carthusiana, Orthilia secunda, Moneses uniflora, Epipogium aphyllum, Listera cordata da *Goodyera repens.* From mosses, the following are observed - *Hylocomium splendens, Pleurozium schreberi, Rhytidisdelphus triquetrus, Dicranum scoparium, Eurhynchium striatum, Ptilium cristacastrensis,* and *Brachithecium velutinum.*

2. Dark coniferous forest with the cover of mountain fescue. Mountain fescue cover is common in relatively less moist places in the fir, beech-fir, spruce-fir and spruce forests of all regions of Georgia at the altitude from 900 to 2100 meters. In Kolkheti fir forest the following understory species are common - *Ilex colchica, Vaccinium arctostaphylos, Rhododendron luteum. Hedera colchica* is rare. From herbal vegetation there are - *Viola reichenbachiana, Sanicula europaea, Oxalis acetosella, Vicia crocea, Dentaria bulbifera, Neottia nidus-avis,* and *Cardamine pectinata.* The herbal cover above 1850 meters changes and we can see *Calamagrostis arundinacea, Milium schmidtianum, Gentiana schistocalyx, Hieracium prenanthoides, Polygonatum verticillatum, Valeriana aliariifolia,* etc.
3. Hemixerophyllic spruce forest. Spruce forest of dry habitat is common on the northern slope of Trialeti range 1000-1500 meters a.s.l.. Herbal cover is represented by the following species – *Poa nemoralis, Brachypodium sylvaticum, Festuca drymeja, Oxalis acetosella, Polypodium vulgare, Carex buschiarum, C. digitata.* Moss is distributed in fragments in the form of spots - *Hylocomium splendens, Pleurozium schreberi, Scleropodium purum,* and *Rhytidiadelphus triquetrus.*
4. Fir forest with sedge (*Luzula sylvatica*) covers. It is distributed on slopes of every exposition, at the altitude of 1600-2150 meters. There is no understory but separate species of the following plants are represented at the border of the forest - *Vaccinium arctostaphylos, Ilex colchica, Lonicera caucasica, Ribes biebersteinii, Rubus buschii, Sorbus caucasigena, Rhododendron caucasicum.* Herbal cover is represented by: *Festuca drymeja, Oxalis acetosella, Valeriana alliariifolia, Calamintha grandiflora, Viola reichenbachiana, Sanicula europaea,* etc. *Milium schmidtianum, Calamagrostis arundinacea, Polygonatum*

verticillatum, Senecio platyphylloides, Aconitum nasutum, etc. are distributed above 1800 meters.

5. Dark coniferous forest with low-herbal cover is predominantly found in moist places, at the altitude of 1300-2000 meters in various regions of Georgia. Herbal cover is mainly of two types. In the first case *Oxalis acetosella* dominates whereas in the second one - *Sanicula europaea.* Other species are represented by *Galium rotundifolium, Calamintha grandiflora, Cardamine pectinata, Paris incompleta.* A special association is found on the Ajara-Guria border of the Meskheti Ridge, at the altitude of 1600-2050 meters where together with low-herbal vegetation species of Colchic understory are found - *Vaccinium arctostaphylos, Daphne pontica, Rhododendron luteum, Laurocerasus officinalis, Ruscus ponticum.* In the limestone habitat of Bzipi gorge there are *Oxalis acetosella* and *Galium rotundifolium.* In Abkhazia, the following arboreal plants are found in the forest of the same type - *Acer pseudoplatanus, A. platanoides,* and *Tilia begoniifolia.*
6. The dark coniferous forest with borage cover is found in Northern Kolkheti at the altitude of 900-1900 meters both on limetome and non-limestone rock layers. Mixed species are: *Acer pseudoplatanus, A. platanoides.* Species of the understory are *Vaccinium arctostaphylos, Viburnum orientale, Ilex colchica, Rhododendron ponticum.* The herbal cover is represented by *Oxalis acetosella, Polygonatum orientale, Sanicula europaea, Paris incompleta, Euphorbia macroceras, Actaea spicata, Circaea lutetiana.* At high altitude the following can be found: *Cicerbita petiolata, Prenanthes purpurea, Chaerophyllum aureum, Ligusticum alatum, Senecio platyphylloides.* In Abkhazia, in the surroundings of Lake Ritsa, mountain Atsetuka, mountain fescue and borage dominate simultaneously.
7. Beech and fir forests with fern cover are found in the total massif of west Georgia's fir forest in the form of fragments and they are characterized by the large fern cover - *Athyrium filix-femina, Dryopteris filix-mas, D. oreades, Oreopteris limbosperma,* and *Matteuccia struthiopteris*. From the herbal cover the following are worth mentioning - Euphorbia *macroceras, Actaea spicata, Circaea lutetiana, Impatiens noli-tangere, Pachyphragma macrophyllum,*

Trachystemon orientalis, Paris incompleta, Dentaria bulbifera, Polygonatum orientale, Carex sylvatica, etc.

8. Subalpine fir forest with small-reed covers. The subalpine forest of this type is preserved only in places that are not easily accessible where grazing almost never takes place, at the altitude of 1950-2100 meters and inclination of 25-40°C, on slopes of southern exposition and having convex relief. Beech, spruce, rarely birches (*Betula litwinowii*) and mountain ash (*Sorbus caucasigena*) can be found. In the understory there are: *Vaccinium arctostaphylos,* rarely *Rhododendron luteum.* From the herbaceous plants there are: *Festuca drymeja, F. gigantea, Poa nemoralis, Gadellia lactiflora, Gentiana schistocalyx, Polygonatum verticillatum, Astrantia maxima, Valeriana tiliifolia, Solidago virgaurea, Geranium sylvaticum, Vaccinium myrtillus, Gymnocarpium dryopteris,* etc.
9. Subalpine fir forest with the cover of various herbs is less studied. The reason for this is the fact that the upper border of the mountain in the place of forests of such a type is most cases in lowered/dragged and replaced by the vegetation of the subalpine meadow existing there.
10. Fir forest with thin herbal cover is described in the eastern part of northern Kolkheti. The herbal cover here is either extremely thin or is not found at all. The species are mainly represented by xero-mesophyllic harbaceous vegetation - *Poa nemoralis, Brachypodium sylvaticum, Carex digitata, Orobus hirsutus, Lathyrus roseus, Mycelis muralis.*

Sub-types (91PA-GE-02): Dark coniferous forest with Colchic understory (*Picea-Abies-fruticosa-colchica*) Combination of separate species of the understory of Kolkheti is characteristic to this type of the forest. These species are: Pontic rhododendron (*Rhododendron ponticum*), laurel (*Laurocerasus officinalis*), holly (*Ilex colchica*), and whortleberry (*Vaccinium arctostaphylos*). It is not represented in the amount the beech forest with the understory is and holds much less space. Several types of communities are differentiated:

1. Dark coniferous forest with the understory of pontic rhododendron, mainly found in the beech-fir forest, at the altitude of 1600-1800 meters, rarely in the eastern Georgia. The grassy cover is rare and represented only by vegetation resistant to the shadow: *Trachystemon orientalis, Galium rotundifolium.* From ferns the

following can be found: *Blechnum spicant, Polystichum woronowii.* These species are rare: *Ruscus colchicus, Rubus hirtus,* and *Hedera colchica.*

2. Dark coniferous forest with the understory of laurel is common on Great Caucasus, in the upper forest zone, at the altitude of 2050-2100 meters, mainly in west Georgia. It is rarely found in east Georgia. In the understory of this type, laurel grows up to 2-3 meters. Other represented species are: holly (*Ilex colchica*). The rest of the species are identical to those given in the Pontic rhododendron forest.
3. Dark coniferous forest with the holly understory is common in the dense forest of fir and beech trees at the height of 1200-1700 meters. Different from the European holly (*Ilex aquifolium*), the Kokheti type holly is more resistant to shadow and can only compete with Colchic butcher's broom (*Ruscus colchicus*). Therefore, in this forest we see together both plants and sometimes there is whortleberry (*Vaccinium arctostaphylos*) as well. Characteristic ferns are - *Dryopteris filix-mas, D. assimilis, Athyrium filix-femina, Gymnocarpium dryopteris,* from herbaceaous plants occur - *Oxalis acetosella, Asperula odorata, Neottia nidus-avis, Epipogium aphyllum, Dentaria bulbifera, Galium rotundifolium, Viola reichenbachiana,* etc.
4. Dark coniferous forest with the whortleberry sub-zone is a rare community. It can be found at the altitude of 1200-1900 meters. Herbal cover is extremely poor. The following are found scattered as separate species: *Festuca drymeja, Oxalis acetosella, Dentaria bulbifera,* and *Vaccinium myrtillus.* In the basin of Tskhenistskali river at the altitude of 1900-2050 meters there are rare communities of firs and spruces where the forest of whortleberry co-exists with the moss cover. *Festuca drymeja, Oxalis acetosella, Goodyera repens, Listera cordata, Prenanthes purpurea, Hieracium prenanthoides, Calamagristis arundinacea,* etc. are noteworthy from herbaceous vegetation. As for mosses, they are represented by *Hylocomium splendens, Eurhinchium striatum, Pleurozium schreberi, Dicranum scoparium, Rhytidiadelphus triquetrus,* etc.

Plants Species: *Abies nordmanniana, Picea orientalis, Aconitum nasutum, Asperula odorata, Astrantia maxima, Athyrium filix-femina, Blechnum spicant, Brachypodium sylvaticum, Calamagrostis*

arundinacea, Calamintha grandiflora, Campanula cordifolia, Cardamine pectinata, Carex buschiarum, C. digitata, Daphne pontica, Dentaria bulbifera, Dryopteris assimilis, D. carthusiana, D. filix-mas, Epipogium aphyllum, Euonymus leiophloea, Festuca drymeja, F. gigantea, Gadellia lactiflora, Galium rotundifolium, Gentiana schistocalyx, Geranium sylvaticum, Goodyera repens, Gymnocarpium dryopteris, Hedera colchica, Hieracium prenanthoides, Ilex colchica, Lapsana grandiflora, Laurocerasus officinalis, Lilium szowitsianum, Listera cordata, Lonicera cauacsica, Luzula sylvatica, Milium schmidtianum, Moneses uniflora, Neottia nidus-avis, Orobus hirsutus, Orthilia secunda, Oxalis acetosella, Paris incompleta, Poa nemoralis, Polygonatum verticillatum, Polypodium vulgare, Polystichum woronowii, Prenanthes purpurea, Rhododendron caucasicum, R. luteum, Ribes biebersteinii, Rubus buschii, R. hirtus, Ruscus colchicus, R. ponticum, Sanicula europaea, Senecio platyphylloides, Sorbus caucasigena, Solidago virgaurea, Trachystemon orientalis, Vaccinium arctostaphylos, V. myrtillus, Valeriana alliariifolia, V. tiliifolia, Veronica officinalis, Vicia crocea, Viola alba, V. reichenbachiana. **Mosses** - *Brachithecium velutinum, Dicranum scoparium, Eurhinchium striatum, Hylocomium splendens, Pleurozium schreberi, Ptilium crista-castrensis, Rhytidiadelphus triquetrus, Scleropodium purum.*

9.4.1.1. Endemic plant species lily - *Lilium* L., Liliaceae

Endemic species are in both Georgian and the Caucasian endemic - *Lilium caucasicum* (Miscz.) Grossh., *Lilium kesselringianum* Miscz., *Lilium martagon* subsp. *caucasicum* Miscz., *Lilium georgicum* Mandem.(=*Lilium monadelphum* M.Bieb.), Lilium *szovitsianum Fi*sch. & Avé-Lall. Only one species was known for Meskheti and Javakheti - *Lilium szovitsianum* Fisch. & Ave-Lall. We have found one population of rare - *L. kesselringianum* Miscz. in Meskheti on Shavsheti range Mt. Erbo. Before it was found near Tabatskuri Lake in Borjomi district. Target species is *Lilium kesselringianum* Miscz. **(Figure 65).**

Bulb is growing to 1.5 m. It is in flower in July, and the seeds ripen from August to September. The plant prefers light (sandy) and medium (loamy) soils, requires well-drained soil and can grow in nutritionally poor soil. The plant prefers acid and neutral soils. It can grow in semi-shade (light woodland) or no shade. It requires moist soil.

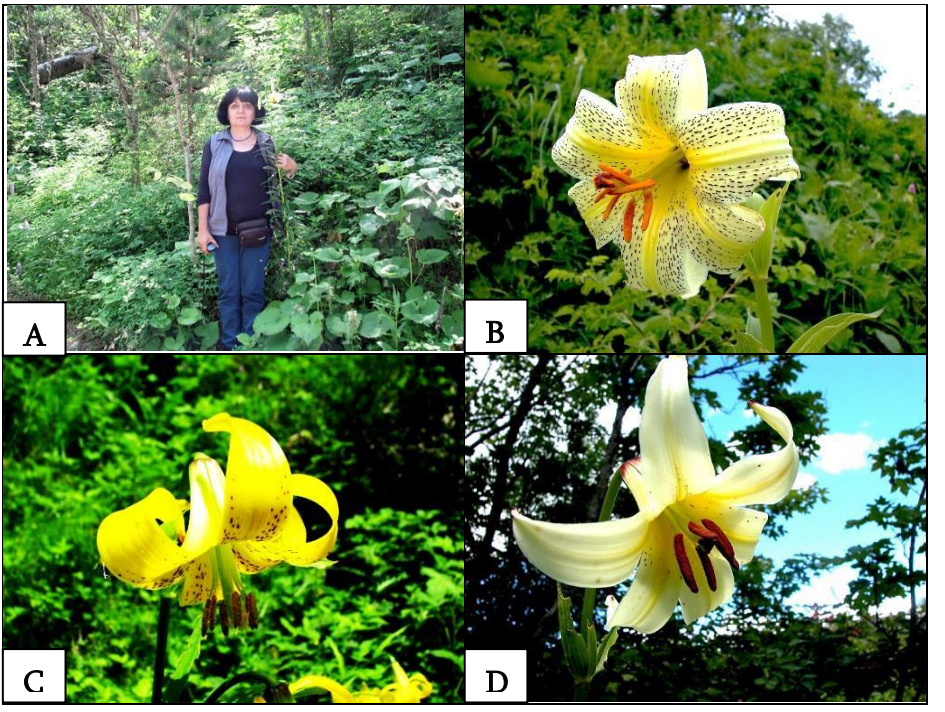


Figure 65. A. *Lilium szovitsianum* is very high in forest in Meskheti and this plant is the height of the Maia Akhalkatsi size 1.67 m; **B.** *Lilium szovitsianum* is in subalpine meadows; **C.** *Lilium georgicum* is in Kazbegi distr.; **D.** *Lilium kesselringianum* Miscz. is Meskheti and in Samegrelo. **Photo: Maia Akhalkatsi.**

Medicinal uses are - Antiasthmatic; Antitussive; Expectorant; Nutritive; Sedative; Tonic. The bulb is antiasthmatic, antitussive, expectorant, sedative and tonic (nutritive). It is used in the treatment of coughs, haemoptysis, insomnia and fidgetiness in the later stage of febrile disease (**Yeung, 1985**).

Bulbils from the leaf axils are used in the treatment of intestinal disorders. Edible uses are Edible Parts and Root. It contains about 18% starch. It can be used as a vegetable in similar ways to potatoes (*Solanum tuberosum*). Other uses are none known. Prefers are an open free-draining humus-rich loamy soil with its roots in the shade and its head in the sun **(Huxley, 1992).**

Grows is well in open woodland. Likes plenty is of moisture and some shade. The bulbs should be planted 15 – 20 cm deep. Early to mid autumn is the best time to plant out the bulbs in cool temperate areas, in warmer areas they can be planted out as late as late autumn. The plant should be protected against rabbits and slugs in early spring. If the shoot tip is eaten out the bulb will not grow in that year and will lose vigour.

Seed best sown as soon as ripe in a cold frame, it should germinate in spring. Stored seed will require a warm/cold/warm cycle of stratification, each period being about 2 months long. Grow on in cool shady conditions. Great care should be taken in pricking out the young seedlings, many people leave them in the seed pot until they die down at the end of their second years growth. This necessitates sowing the seed thinly and using a reasonably fertile sowing medium. The plants will also require regular feeding when in growth.

Divide the young bulbs when they are dormant, putting 2-3 in each pot, and grow them on for at least another year before planting them out into their permanent positions when the plants are dormant. Division with care in the autumn once the leaves have died down. Replant immediately. Bulb scales can be removed from the bulbs in early autumn. If they are kept in a warm dark place in a bag of moist peat, they will produce bulblets. These bulblets can be potted up and grown on in the greenhouse until they are large enough to plant out.

9.4.2. Code of Georgia: Caucasian Pine forest (*Pinus kochiana*); (91PK-GE)

A widely distributed species of the pine in Georgia is - *Pinus kochiana* (=*P. hamata, P. sosnowskyi*). It is the species related to the European pine (*Pinus sylvestris*). The area of its common distribution is Caucasus, Crimea and western part of small Asia, Ponto mountains. In Georgia pine forests are mainly common in the mountains. In east Georgia it follows the Mtkvari gorge, creates a pure stand on the Gombori range, Mariamjvari reserve and Tusheti. In west Georgia it is mixed with coniferous forests, the pure stand is only in rocky locations. Vertical borders on the distribution of the pine forest are from 700 to 2400 meters a.s.l.. Optimum conditions for the distribution are at the altitude of 1000-2200 meters. In certain places pine is found at the

altitude of 2500-2600 meters. The pine grows both on limestone and volcanic layers. The pine rocky forest is especially distinguished in terms of the great variety of species.

Sub-types (91PK-GE 01): Caucasian pine forest of dry ecotope:

1. Pine forest with tragacantha (*Astaracantha microcephala*) vegetation is common in Meskheti, near village Damala. The following are represented in the herbaceous cover: Astragalus - *Astragalus arguricus, A. raddeanus,* sainfoin - *Onobrychis sosnowskyi,* fetch - *Vicia akhmaganica,* sage - *Salvia compare,* skullcap - *Scutellaria sosnowskyi,* psephelus - *Psephellus meskheticus,* etc. On the northern slopes of Trialeti range there is a pine forest with *Chamaecytisus caucasicus* and in Abkhazia the pine forest is developed where the lower plant layer is composed of *C. hirsutissimus*. In Ajara, in the same community another species is found, namely, *C. salvifolius.*
2. The pine forest of limestone on Tetrobi-Chobareti range (1800-2000 meters) is characterized by a slightly different composition. Earlier the pine distribution here was considered as endemic *P. kochiana,* whereas a more widely distributed was called "Sosnowski pine" (*P. sosnowskyi).* At the moment they are considered as one species. However, the Tetrobi pine forest according to the composition is considered as a peculiar refugium where pine is mixed with mountain steppes. In this community overall 48 species of vascular plants are represented. The following species of herbaceous plants are associated with *Pinus kochiana:* Steven arenaria - *Arenaria steveniana,* Sosnowski chickweed - *Cerastium sosnowskyi,* Voronov minuartsia - *Minuartia woronowii,* caryophylaceae campion - *Silene dianthoides,* Sosnowski houseleek - *Sempervivum sosnowskyi,* astragalus - *Astragalus arguricus, A. campylosema,* Javakheti lucerne - *Medicago dzhawakhetica,* sun-rose – *Helianthemum nummularium, H. orientale,* Transcaucasian *Daphne* - *Daphne transcaucasica,*prickly thrift - *Acantholimon glumaceum,* hogweed - *Heracleum antasiaticum,* bedstraw - *Galium grusinum,* cornflower - *Centaurea bella,* hawksbread - *Crepis pinnatifida,* grapevine hyacinth - *Muscari sosnowskyi,* etc. This phytosenosis is quite rich with endemic species that are mainly common on the limestones of the tetrobi plateau. *Diphelypaea coccinea* (the blooming parasite)

and asphodelo - *Asphodeline taurica* need to be mentioned especially.

3. Seaside pine forest with endemic Bichvinta pine (*Pinus pithyusa*) grows on the plain place in the form of the stand (Bichvinta stand) and is distributed on steep lime stone slopes 200 meters a.s.l.. This species of the pine is a big type of a tree, with large cones and needles. It grows in groups and is encountered in the form of separate species as well. Often it is mixed with the oak-oriental hornbeam forest. It can be found in the Gagra surroundings. Where the Bichvinta pine does not create a strong stand, a large size wide open forest windows are created, in which often xerophite and forest vegetation are represented. Ever-green forest elements and a large amount of blackberry are rare. The following are to be noted: *Ruscus ponticus, Rhus coriaria, Mespilus germanica, Hippophaë rhamnoides, Cistus tauricus, Orobus laxiflorus, Galium mullogo, Psoralea bituminosa.*

Sub-types (91PK-GE 02): Caucasian pine tree forest of moderately moist ecotope: It is mixed coniferous-broad leaved type of a forest where spruce, fir, birch, beech, rowan, ash, etc. dominate. The following communities are differentiated:

1) Pine forest with the understory of blueberry (*Vaccinium myrtillus*) - *Pineta myrtillosa*;
2) Pine forest with cover of yellow sorrel (*Oxalis acetosella*) - *Pineta oxalidosa*;
3) Pine forest with the understory of red blueberry (*Vaccinium vitis-idaea*) - *Pineta vacciniosa*;
4) Pine forest with the understory of Pontic rhododendron (*Rhododendron ponticum*) - *Pineta rhododendrosa*;
5) Pine forest with the mixed understory - *Pineta mixtofruticosa*;
6) Pine forest with the understory of azalea (*Rhododendron luteum*) - *Pinetum azaleosum*;
7) Pine and lime (*Tilia begoniifolia*) forest - *Pinetum tiliosum*. First three communities are common in Tusheti, on slopes with northern exposition where the flora-genetic complex is closer to the boreal taiga type. The remaining four communities are characteristic to mountain regions of west Georgia. The following communities are also diffrentiated in Tusheti;
8) Pine forest with dry cover, *Pinetum siccum*;

9) Pine forest with summer sypress (*Cytisus caucasicus*) cover, *Pinetum cytisosum*;
10) Pine forest with small reed (*Calamagrostis arundinacea*) cover, *Pinetum calamagrostidosum*, In Ajara, along the middle current of river Ajaristskali, pine is introduced into the oak forest where varied herbal cover is developed;
11) Pine forest with green cover, *Pinetum prasinosum.*

Sub-types (91PK-GE 03): Cucasian pine marsh forest: Separate species of the pine are scattered in peat marshes, which is situated in Ajara, near Kobuleti - Ispani I and Ispani II. This marsh is very similar to Northern European marsh type. Some authors consider it a refugium, which did not change as a result of the ice age. The proof of this hypothesis is the existence of such palaearctic and boreal relict species as: *Osmunda regalis, Calluna vulgaris, Frangula alnus, Vaccinium arctostaphylos, Drosera rotundifolia,* etc. Population of the orchid (*Spiranthes amoena*) was also found here, which is distributed in far east, Mongolia, Kazakhstan, Russia and the closest population encountered is in Carpathian mountains. Similar marsh is described near village Smekalovka, Ajara, which is created by especially endemic moss (*Sphagnum batumense*). The marshy forest of this type is found in the western part of upper Imereti, river Kvirila gorge, near village Sakara.

Sub-types (91PK-GE 04): Caucasian pine rock-scree forest: Caucasian pine rock-scree forest is distributed on the slopes of rocky southern exposition dry ecotone or limestone layers. Several communities are differentiated:

1. Rock pine forest with scattered herbal cover (*Pineta rariherbosa*) grows on clear rocky slopes with a thin soil layer where herbal cover is rare due to the washing out of the soil.
2. Rock pine forest with xerophyte herbal cover (*Pineta xeroherbosa*) is characteristic to the society which is found on southern slopes of Meskheti, Ajara-Imereti and Trialeti range. However, pine is more common in spruce forests on northern slopes. In these forests, 1500 meters a.s.l. the second zone is created by the Georgain oak (*Quercus iberica*), whereas above 1500 meters there is high mountain oak (*Q. macranthera*). There are also species of maple. The herbal cover is represented by - *Carex buschiorum*, *Poa nemoralis, Brachypodium sylvaticum, Sesleria anatolica,* etc.

Plants species: *Pinus kochiana, P. pithyusa, Acantholimon glumaceum, Arenaria steveniana, Asphodeline taurica, Astaracantha microcephala Astragalus arguricus, A. campylosema, A. raddeanus, Brachypodium sylvaticum, Calamagrostis arundinacea, Calluna vulgaris, Carex buschiorum, Centaurea bella, Cerastium sosnowskyi, Chamaecytisus caucasicus, C. hirsutissimus, Cistus tauricus, Crepis pinnatifida, Cytisus caucasicus, Daphne transcaucasica, Diphelypaea coccinea, Drosera rotundifolia, Frangula alnus, Galium grusinum, G. mullogo, Helianthemum nummularium, H. orientale, Heracleum antasiaticum, Hippophaë rhamnoides, Mespilus germanica, Minuartia woronowii, Medicago dzhawakhetica, Muscari sosnowskyi, Onobrychis sosnowskyi, Orobus laxiflorus, Osmunda regalis, Oxalis acetosella, Poa nemoralis, Psephellus meskheticus, Psoralea bituminosa, Quercus iberica Q. macranthera, Rhododendron ponticum, R. luteum, Rhus coriaria, Ruscus ponticus, Scutellaria sosnowskyi, Sempervivum sosnowskyi, Sesleria anatolica, Silene dianthoides, Sphagnum batumense, Spiranthes amoena, Tilia begoniifolia, Vaccinium arctostaphylos, V. myrtillus, V. vitis-idaea, Vicia akhmaganica.*

9.4.2.1. Flagship plant species Caucasian pine - *Pinus kochiana* Klotzsch ex K. Koch, Pinaceae

Flagship species is as the concept of flagship species is a concept with its genesis in the field of conservation biology. Caucasian pine trees growing in slopes with all exposition and are oriented as well on high inclination till 90^0C. Natural habitat of this species is oriented on rocks and as well on other slopes with different geological rocks. The elevation is from 0 to 2100 m a.s.l. Caucasian pine tree up to 35 m tall and only to 15-20 m high in Kazbegi high mountain areas. Snow cover is <0.3 m. Sunny edge is low on North Slope; dappled shade is more not only on North Slope: North Wall, East Wall, and West Wall. Suitable for: light and medium soils, prefers well-drained soil and can grow in nutritionally poor soil. Suitable pH: acid, neutral and basic soils and can grow in very acid and very alkaline soils. It can grow in semi-shade or no shade. It prefers dry moist or wet soil and can tolerate drought. The plant can tolerate maritime exposure. It can tolerate atmospheric pollution. Other, planted pine species are migrated from Russia in Kazbegi in 1970s and this is mainly *Pinus sylvestris* L. and

some other individuals' *P. nigra* subsp. *pallasiana* (D. Don) Holmboe. These planted species are in all regions, from the subarctic to the forest steppe zone, it forms pure pine forests in the mountains, on sandy soils of the plains and mixed forests on loamy soils and podzols.

Caucasian pine tree with whorled branches and two types of shoots: long shoots appearing in spring and becoming woody, and dwarf shoots growing from the axils of scale-like leaves and also bearing scale-like and true acicular leaves, in clusters of two, three, or five. Caucasian pine has crown wide, twigs spreading and directed upright. Bark dark greyish-dark browns or dark browns **(Figure 66).**

Needles greyish-green, margins fringed, 3.5-5 or 5-8 cm long, to two, rarely to three of tree. Leaves in clusters of two or three; Male cone is round or oblong-cylindrical, clustered into globose or broadly ovoid racemes. Male strobilus develops at the base of young long shoots in the axils of scale leaves.

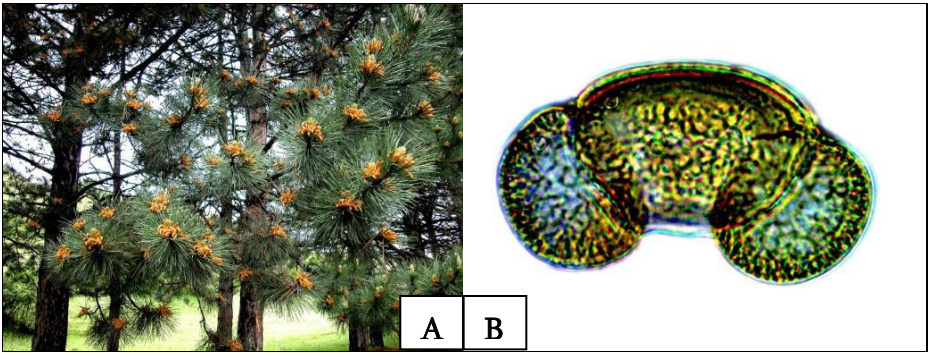


Figure 66. A. *Pinus kochiana* is relict species in Caucasus; **B.** Pollen of *Pinus kochiana* **has** length of the horizontal height as 100-105 μm and distanth height as 50-53 μm. **Photo: Maia Akhalkatsi.**

Female cones woody, maturing in two to three years, bract scales coriaceous, shorter than the broad ovuliferous scales; seeds winged, less often nut-like, wingless. Female cones opening at seed maturity; mature female cones 3-7 cm long, dull, light brown or gray 6 seeds winged 4. Seed cones ovate, solitary, pink-brown or yellowish when mature, glossy, directed horizontally or upright. Seed scales with pyramidal and hooked apophysis. Seed is as obovate, acute, 4.5 mm

long, wing with brown stripes. Needles persisting for four to eight years, yellowing in winter, 3-3.5 cm long; cones 3-3.5 cm long. Flowering period of this species is April-May and seeds are matured in September-October. It forms woods forests or grows as single trees on rocks, reaches tree line.

Pine is an umbrella species for squirrel. Umbrella species determines conservation of other species in the habitat conditions where there are species communities and one umbrella species will have a protection due to their conditions. It is oriented on mycorrhizas and pH is lower 4-5. Non-wood products are seeds used as recourses in Italian food and people can use this as resources. Pine has quite a wide range of medicinal uses, being valued especially for its antiseptic action and beneficial effect upon the respiratory system. It should not be used by people who are prone to allergic skin reactions whilst the essential oil should not be used internally unless under professional supervision. The turpentine obtained from the resin is antirheumatic, antiseptic, balsamic, diuretic, expectorant, rubefacient and vermifuge. It is a valuable remedy in the treatment of kidney, bladder and rheumatic affections, and also in diseases of the mucous membranes and the treatment of respiratory complaints. Externally it is used in the form of liniment plasters and inhalers. The leaves and young shoots are antiseptic, diuretic and expectorant. They are harvested in the spring and dried for later use. They are used internally for their mildly antiseptic effect within the chest and are also used to treat rheumatism and arthritis. They can be added to the bath water for treating fatigue, nervous exhaustion, sleeplessness, and skin irritations. They can also be used as an inhalant in the treatment of various chest complaints. The essential oil from the leaves is used in the treatment of asthma, bronchitis and other respiratory infections, and also for digestive disorders such as wind. An essential oil obtained from the seed has diuretic and respiratory-stimulant properties. The seeds are used in the treatment of bronchitis, tuberculosis and bladder infections. Decoction of the seeds can be applied externally to help suppress excessive vaginal discharge. The plant is used in Bach flower remedies - the keywords for prescribing it are 'Self-reproach', 'Guilt feelings' and 'Despondency'. The essential oil is used in aromatherapy. Its keyword is 'Invigorating'.

A tan or green dye is obtained from the needles. The needles contain a substance called terpene, this is released when rain washes over the needles and it has a negative effect on the germination of some plants, including wheat. A reddish yellow dye is obtained from the cones. This tree yields resin and turpentine. Oleo-resins are present in the tissues of all species of pines, but these are often not present in sufficient quantity to make their extraction economically worthwhile. The resins are obtained by tapping the trunk, or by destructive distillation of the wood. In general, trees from warmer areas of distribution give the higher yields. Turpentine consists of an average of 20% of the oleo-resin and is separated by distillation. Turpentine has a wide range of uses including as a solvent for waxes etc. for making varnish, medicinal etc. Rosin is the substance left after turpentine is removed. This is used by violinists on their bows and also in making sealing wax, varnish etc. Pitch can also be obtained from the resin and is used for waterproofing, as a wood preservative etc. An essential oil obtained from the leaves is used in perfumery and medicinally. A fibre from the inner bark is used to make ropes. The roots are very resinous and burn well. They can be used as a candle substitute. The leaves are used as a packing material. The fibrous material is stripped out of the leaves and is used to fill pillows, cushions and as a packing material. Trees are very wind resistant and quite fast growing. They can be planted as a shelterbelt, succeeding in maritime exposure. Wood - light, soft, not strong, elastic, durable, rich in resin. Used in construction, furniture, paper manufacture etc. A good fuel but it is somewhat smokey.

Thrives is in a light well-drained sandy or gravelly loam. Trees grow well on poor dry sandy soils. Fairly shade tolerant. Prefers a light acid soil, becoming chlorotic at a pH higher than 6.5. Trees can succeed for many years on shallow soils over chalk.

Tolerates chalk for a while, but trees are then short-lived. Tolerates is some water-logging. Dislikes poorly drained moorland soils. Established plants tolerate drought. Very wind is resistant, tolerating maritime exposure. Tolerates is atmospheric pollution. Fairly long-lived, to 200 years or more and quite fast growing, but trees are very slow growing in wet soils. Young trees can make new growth of 1 metre a year though growth slows down rapidly by the time the tree is 18 metres tall. This species is extensively used in cool temperate

forestry as a timber tree. Plants are strongly outbreeding, self-fertilized seed usually grows poorly.

They hybridize freely with other members of this genus. Cones take two seasons to ripen. Plants are easily killed by fire and cannot regenerate from the roots. A good is food plant for the caterpillars of several species of butterflies. This tree has over 50 species of associated insects. Leaf secretions inhibit the germination of seeds, thereby reducing the amount of plants that can grow under the trees. There are several named forms selected for their ornamental value. Plants in this genus are notably susceptible to honey fungus.

It is best to sow the seed in individual pots in a cold frame as soon as it is ripe if this is possible otherwise in late winter. A short stratification of 6 weeks at 4°C can improve the germination of stored seed. Plant seedlings out into their permanent positions as soon as possible and protect them for their first winter or two.

Plants have a very sparse root system and the sooner they are planted into their permanent positions the better they will grow. Trees should be planted into their permanent positions when they are quite small, between 30 and 90 cm. We actually plant them out when they are about - 10 cm tall. So long as they are given very good weed-excluding mulch they establish very well larger trees will check badly and hardly put on any growth for several years. This also badly affects root development and wind resistance.

Cuttings are here. This method only works when taken from very young trees less than 10 years old. Use single leaf fascicles with the base of the short shoot. Disbudding the shoots some weeks before taking the cuttings can help. Cuttings are normally slow to grow away.

Geographic distribution of the *Pinus kochiana* is native to Caucasus, additionally in Chaneti of Asia Minor Turkey territory of Caucasus ecoregion.

9.4.3. Code of Georgia:Bichvinta Pine Forest *Pinus pithyusa* Steven, Pinaceae (91PP-GE*)

Bichvinta pine (*Pinus pithyusa* Fox-Strangw.) is distributed along Black Sea coast on Bichvinta rock cape and on southern slopes of

Calcareous Mountain massive of Gagra, Abkhazia. The square of this forest is ca. 250-300 ha **(Figure 67).**

Figure 67. A. *Pinus pithyusa* is endemic species of Georgia; **B.** Pollen of *Pinus pithyusa* has length of the horizontal height as 90-93 μm and distanth height as 47-50 μm. **Photo: Maia Akhalkatsi.**

The following plant communities are described:

1. Pine forest with understory of *Cistus creticus*. The dominant species are - *Ruscus ponticus, Mespilus germanica* and *Hedera helix.*
2. Pine forest with understory of oriental hornbeam (*Carpinus orientalis*). The dominant species are - *Ruscus ponticus, Ligustrum vulgare, Lonicera caprifolium* and *Hedera helix.*
3. Pine forest with understory of *Ruscus ponticus.* The dominant species are - *Brachypodium sylvaticum, Festuca drymeja.*
4. Pine forest with undersory of grasses. The dominant species are - *Sesleria anatolica, Poa nemoralis, Psoralea bituminosa, Anthemis euxina.*

Plants species: *Pinus pithyusa, Anthemis euxina, Cistus creticus, Hedera helix, Ruscus ponticus, Ligustrum vulgare, Lonicera caprifolium, Brachypodium sylvaticum, Festuca drymeja, Poa nemoralis, Psoralea bituminosa, Sesleria anatolica.*

9.4.3.1. Edificatory plant species Aspen - *Populus tremula* L., Salicaceae

Edificatory species of *Populus tremula* is as that has a special role to contribute in ecosystem structure. Aspen is growing in many different forest habitats and mainly it grows in degraded forest areas. Birch forest as native habitat in Kazbegi contains many individuals of *Populus tremula* in degraded forest successions **(Figure 68).**

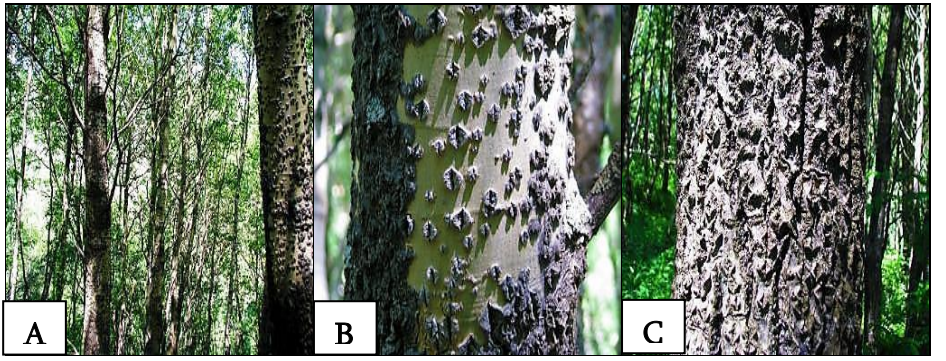


Figure 68. A. *Populus tremula* is in Betula forest; **B.- C.** *P. tremula* is fungus diseases. **Photo: Maia Akhalkatsi.**

It grows from lower to upper mountain belts from 100 to 2300 m a.s.l. along riverbanks, in disturbed forests and on open slopes. Aspen tree to 25-50 m high and to 5 m in circumference. The exposition is for all directions and inclination till 30°C. Snow cover is <0.5 m. Sunny edge is normal; dappled shade is in North Wall, East Wall, and West Wall. Suitable for: light, medium and heavy soils and can grow in heavy clay and nutritionally poor soils. Suitable pH: acid and neutral soils. It can grow in semi-shade or no shade. It prefers moist or wet soil. The plants can tolerate strong winds but not maritime exposure.

A fast growing dioecious tree; terminal and lateral buds protected by numerous scales, often profusely resinous; Bark greenish-dark grey, smooth on young tree, later deeply furrowed; Young branches glabrous; Leaves of short branches orbicular, minutely point-tipped, rather coarsely dentate; Leaves of shoots large, deltoid or deltoid-elliptic, slightly cordate or straight at base, distinctly apiculate, the

margins denticulate; expanding leaves ciliate, covered with scattered hairs. Leaves of short shoots are round or rounded-ovate, apiculate, margins coarsely toothed. Leaf is drooping, on long petiole and trembling. Pale is green above, glaucous beneath. leaves of branches glabrous or obscurely 179 rounded -deltoid or orbicular, minutely apiculate, with clearly dentate margin; occasional specimens have leaves cuneate at base; stipules soon caducous, whitish, linear; petiole about as long as the leaf blade, strongly compressed in upper part; Leaves of long and root shoots are ovate to deltoid and apiculate, blade with cordate base, 7 cm long, 8 cm wide, catkins 4 -14 cm long and 2 cm thick, villous; Flowers clustered into pistillate and staminate catkins. Anthers purplish-red, becoming paler; Ovary pale green, conical, with 2 purple stigmas; Disk pale, glabrous or more or less ciliate on the margin, pedicel very short. Nectariferous glands present at the base of young leaf blades (extranuptial nectaries). Fruit is many-seeded capsule.

The mycorrhizas are only 4 species and this tree might be growing in degraded soil with little number of biota. Woods of this type, most often at wood margins, clearings, and in places where trees have been broken by the wind, often as part of birch forests or in small pure stands, especially on felling sites, etc., as forerunners of natural reforestation; also gullies, shores, and swamp margins. Generally a species requiring light, but the seedlings prefer a certain amount of shade. This species wood is white, without heartwood, soft, easily cleft, in dry condition rather durable; suitable for paper manufacture for match production is in exported in blocks to Japan, for turning roof shingles, hoops, bobbins, rural dishware, etc. The trunks are made in some places into canoes and small boats.

The shavings provide good packing material. The bitter bark is used in tanning and in medicine. The wood contains, in addition to cellulose (ca. 50%) lignin, galactan, and pentosan; yields on distillation 4.17% acetic acid. The bark contains the glucosides salicin and populin, and the enzyme salicase. Easily is propagated by seed and within twenty years reaching mature condition at 12 m height. A tree to 20 m high, with rather thin oval or round head; bark smooth, greenish or pale gray, that of old trees dark gray and fissured in the lower part of the trunk; the leaves differing from those of common aspen in the finer and shallower dentation; they are often orbicular, terminating in a small

point; catkins so far not studied. The bark and the leaves are mildly diuretic, expectorant and stimulant. The plant is seldom used medicinally, but is sometimes included in propriety medicines for chronic prostate and bladder disorders. Although no specific mention has been seen for this species, the bark of most, if not all members of the genus contain salicin, a glycoside that probably decomposes into salicylic acid in the body. The bark is therefore anodyne, anti-inflammatory and febrifuge. It is used especially in treating rheumatism and fevers, and also to relieve the pain of menstrual cramps. The plant is used in Bach flower remedies - the keywords for prescribing it are 'Vague fears of unknown origin', 'Anxiety' and 'Apprehension'.

A very fast growing and wind resistant tree, it can be planted to provide a shelterbelt. Trees can also be planted to improve heavy clay soils in neglected woodlands. Wood - very soft, elastic, easily split, rather woolly in texture, without smell or taste, of low flammability, not durable, very resistant to abrasion. It makes a high quality paper and is also used to make a very good charcoa.

A very easily grown plant, it does well in a heavy cold damp soil, preferring a neutral to acid soil, and avoiding calcareous soils. The species generally prefers a deep rich well-drained circumneutral soil. Growth is much less on wet soils, on poor acid soils and on thin dry soils. This species grows well on poor soils, probably because of its intolerance of competition.

Plants are very tolerant of exposure, doing well in cold exposed sites so long as sufficient moisture is present. Plants dislike shade, and are intolerant of root or branch competition. A fast growing tree but it is short-lived. Trees produce suckers freely and can form dense thickets.

The aspen is a very good wildlife plant; it has over 90 associated insect species and is a food plant for the green hairstreak butterfly. Poplars have very extensive and aggressive root systems that can invade and damage drainage systems.

Especially when grown on clay soils, they should not be planted within 12 metres of buildings since the root system can damage the building's foundations by drying out the soil and it can be planted to improve heavy clay soils in neglected woodlands. Dioecious is here. Male and female plants must be grown if seed is required.

Seed - must be sown as soon as it is ripe in spring. Poplar seed has an extremely short period of viability and needs to be sown within a few days of ripening. Surface sow or just lightly cover the seed in trays in a cold frame. Prick out the seedlings into individual pots when they are large enough to handle and grow them on in the old frame. If sufficient growth is made, it might be possible to plant them out in late summer into their permanent positions, otherwise keep them in the cold frame until the following late spring and then plant them out.

Most poplar species hybridize freely with each other, so the seed may not come true unless it is collected from the wild in areas with no other poplar species growing. Cuttings are of mature wood in November/December in a sheltered outdoor bed. This species is rather difficult from cuttings. Suckers are in early spring. Root cuttings in the winter. Geographic distribution is in the Native to Eurasia.

9.4.4. Code of Georgia: Yew forest (*Taxus baccata*); (91TB-GE*)

Yew - *Taxus baccata*, is preserved in the form of the mono-dominant forest in Batsara reserve, Akhmeta region, Kakheti. It grows on the slopes of northern, northern-western exposition, moist carbonated soil, 900-1350 meters a.s.l.. Its compatible species are beech, hornbeam, maple (*Acer laetum*) and very rarely, lime.

The understory and the herbal cover are not found. Vertical distribution of Yew varies in west and east Georgia. In Kolkheti it is found in the form of the lower floor up to 1500 meters a.s.l. in Colchic type forests.

In eastern Georgia it is distributed above 700 meters and is found in the form of small groups of species in beech and oak-hornbeam forests in almost all gorges of left tributaries of Alazani River. Relatively large stands are in Nichbisi and Pshavi Aragvi gorge, village Kanatia.

Plants species: *Taxus baccata, Acer laetum, Fagus orientalis, Tilia begoniifolia.*

9.4.4.1. Flagship species: European yew - *Taxus baccata* L., Taxaceae

Taxus baccata is growing in Kolkheti, Kakheti and Borjomi area and in Adjara. In Meskheti is known from the herbarium data in Goderdzi

Pass, in Meskheti range near v. Anda and in Zekari Pass. However, we did not find any of these populations **(Figure 69).**

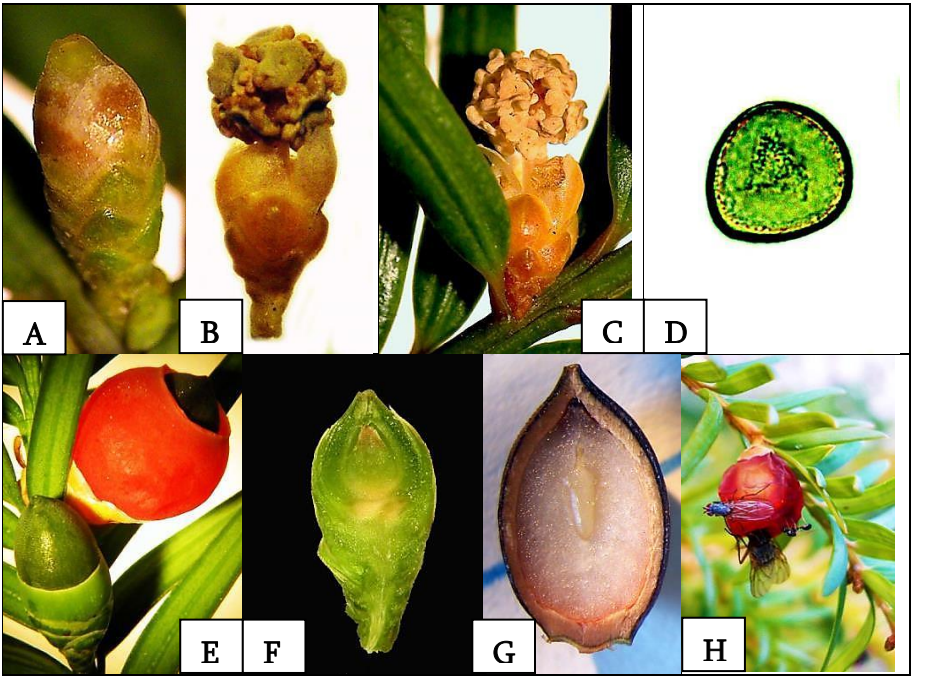


Figure 69. A. B. C. Flowers of *Taxus baccata* has much pollen from December till April**; D.** Pollen of *Taxus baccata* has length of the horizontal height as 30-32 μm **E. F. G. H.** The seed contained are eaten by thrushes. **Photo: Maia Akhalkatsi.**

An evergreen has tree growing to 15m by 10m at a slow rate. It is in leaf all year, in flower from March to April, and the seeds ripen from September to November. The flowers are dioecious is in individual flowers are either male or female, but only one sex is to be found on any one plant so both male and female plants must be grown if seed is required and are pollinated by Wind. The plant prefers light, medium and heavy soils, requires well-drained soil and can grow in heavy clay soil. The plant prefers acid, neutral and basic soils and can grow in very acid and very alkaline soils. It can grow in full shade semi-shade or no shade. It requires dry or moist soil and can tolerate drought.

The plant can tolerate strong winds but not maritime exposure. It can tolerate atmospheric pollution. Medicinal uses are antispasmodic, cancer, cardiotonic, diaphoretic, emmenagogue, expectorant, homeopathy, narcotic and purgative. The yew tree is a highly toxic plant that has occasionally been used medicinally, mainly in the treatment of chest complaints. Modern research has shown that the plants contain the substance 'taxol' in their shoots. Taxol has shown exciting potential as an anti-cancer drug, particularly in the treatment of ovarian cancers (**Bown, 1995**). Unfortunately, the concentrations of taxol in this species are too low to be of much value commercially, though it is being used for research purposes. This remedy should be used with great caution and only under the supervision of a qualified practitioner. See also the notes above on toxicity.

All parts of the plant, except the fleshy fruit, are antispasmodic, cardiotonic, diaphoretic, emmenagogue, expectorant, narcotic and purgative. The leaves have been used internally in the treatment of asthma, bronchitis, hiccup, indigestion, rheumatism and epilepsy. Externally, the leaves have been used in a steam bath as a treatment for rheumatism. A homeopathic remedy is made from the young shoots and the berries. It is used in the treatment of many diseases including cystitis, eruptions, headaches, heart and kidney problems, rheumatism etc.

Fruit is raw. Very sweet and gelatinous, most people find it delicious though some find it sickly. A number of people who like the flavour do not like the texture which is often described as being 'snotty'.

All other parts of this plant, including the seed, are highly poisonous. When eating the fruit you should spit out the large seed found in the fruit's centre. Should you swallow the whole seed it will just pass straight through you without harm? If it is bitten into, however, you will notice a very bitter flavour and the seed should immediately be spat out or it could cause some problems. The fruit is a fleshy berry about 10mm in diameter and containing a single seed. Some reports suggest using the bark as a tea substitute; this would probably be very unwise.

Other uses are as fuel, ground cover, hedge, incense, insecticide and wood. Very tolerant of trimming, this plant makes an excellent hedge. The plants are often used in topiary and even when fairly old, the trees can be cut back into old wood and will resprout **(Huxley,**

1992). One report says that trees up to 1000 years old respond well to trimming **(Huxley, 1992).**

A decoction of the leaves is used as an insecticide. Some cultivars can be grown as a ground cover when planted about 1 metre or more apart each way. 'Repandens' has been recommended. Wood - heavy, hard, durable, elastic, takes a good polish but requires long seasoning. Highly esteemed by cabinet makers, it is also used for bows, tool handles etc. It makes good firewood. The wood is burnt as incense.

A very easy plant to grow, it is extremely tolerant of cold and heat, sunny and shady positions, wet and dry soils, exposure and any pH **(Huxley, 1992).** Thrives is in almost any soil, acid or alkaline, as long as it is well-drained. Grows is well in heavy clay soils. Sensitive is to soil compaction by roads etc. Very is shade tolerant. Tolerates is urban pollution. In general they are very tolerant of exposure, though plants are damaged by severe maritime exposure.

A very cold has hardy plant when dormant, tolerating temperatures down to about -25°C. The fresh young shoots in spring, however, can be damaged by frosts. Plants are dioecious, though they sometimes change sex and monoecious trees are sometimes found. Male and female trees must be grown if fruit and seed are required. The fruit is produced mainly on the undersides of one-year old branches. A very long lived tree, one report suggests that a tree in Perthshire is 1500 years old, making it the oldest plant in Britain.

Another report says that trees can be up to 4000 years old. It is, however, slow growing and usually takes about 20 years to reach a height of 4.5 metres. Young plants occasionally grow 30cm in a year but this soon tails off and virtually no height increase is made after 100 years. The bark is very soft and branches or even the whole tree can be killed if the bark is removed by constant friction such as by children climbing the tree. Plants produce very little fibrous root and should be planted in their final positions when still small **(Huxley, 1992).** The fruit is greatly relished by thrushes.

Seed of the *Taxus* is can be very slow to germinate, often taking 2 or more years. It is best sown as soon as it is ripe in the autumn when it should germinate 18 months later. Stored seed may take 2 years or more to germinate. 4 months warm followed by 4 months cold stratification may help reduce the germination time **(Dirr, Heuser, 1987).**

Harvesting the seed 'green' is when fully developed but before it has dried on the plant and then sowing it immediately has not been found to reduce the germination time because the inhibiting factors develop too early. Prick out the seedlings into individual pots once they are large enough to handle and grow them on in pots in a cold frame.

The seedlings are very slow-growing and will probably require at least 2 years of pot cultivation before being large enough to plant out. Any planting out is best done in late spring or early summer, after the last expected frosts.

Cuttings of half-ripe terminal shoots, 5 – 8 cm long, July/August in a shaded frame. Should root by late September but leave them in the frame over winter and plant out in late spring. High percentage is cuttings of ripe terminal shoots, taken in winter after a hard frost, in a shaded frame.

9.5. Mediterranean deciduous forests

9.5.1. Code of Georgia: Chestnut forest - *Castanea sativa* Mill., Fagaceae (9260CS-GE*; PAL. CLASS.: 41.9)

The chestnut forest (*Castanea sativa*) is found both in west and east Georgia. However, in the west is holds a larger territory. Pure stand of the chestnut forest is rare. It is mainly mixed with beech or hornbeam. It is typical on shaded slopes. The border of vertical distribution in west Georgia varies between 100 and 900-1000 meters. It reaches highest altitude at 1450 meters. In east Georgia the lower boundary of its distribution varies between 400-500 meters and the upper boundary is 1350-1380 meters. It grows on brown soils, does not like calcium but can be found in some limestone regions.

Sub-types (9260CS-GE-01): Chestnut forest with borage cover, *C. sativa-Trachystemon orientalis;* It can be found in west Georgia, beech-chestnut forests or hornbeam- beech-chestnut forests.

Sub-types (9260CS-GE-02): Chestnut forest is with fern cover, *C. sativa-Dryopteris filix-mas* occupy rocky slopes. Associated species are - *Alnus barbata, Ulmus carpinifolia, Acer laetum, Fagus orientalis, Carpinus caucasica.*

Sub-types (9260CS-GE-03): Chestnut forest with herbal cover, *C. sativa, Sanicula europaea, Asperula odorata, Festuca drymeja, Paris*

incompleta, Polygonatum orientale. From liana type plants ivy (*Hedera helix*) is typical in this community.

Sub-types (9260CS-GE-04): Chestnut forest with azalea understory, *C. sativa - Rhododendron luteum.* It is mainly distributed in west Georgia but can be found in several place of Kakhetian Caucasus.

Sub-types (9260CS-GE-05): Chestnut forest with Caucasian blueberry understory, *C. sativa - Vaccinium arctostaphylos.* It is characteristic to Abkhasia. Mixed species are: beech and more rarely hornbeam.

Sub-types (9260CS-GE-06): Chestnut forest with the understory of Pontic Rhododendron, C. *sativa - Rhododendron ponticum.* It can be found in mountain regions of west Georgia, in beech and hornbeam forests. Its hight in the forests of such a type reaches 3-4 meters.

Sub-types (9260CS-GE-07): Chestnut forest with laurel understory, *C. sativa - Laurocerasus officinalis.* It is extremely rare. Often laurel is mixed with Pontic Rhododendron.

Plants species: *Castanea sativa, Fagus orientalis, Carpinus caucasica, Acer laetum, Alnus barbata, Asperula odorata, Dryopteris filix-mas, Festuca drymeja, Hedera helix, Laurocerasus officinalis Paris incompleta, Polygonatum orientale, Rhododendron luteum, R. ponticum, Sanicula europaea, Trachystemon orientalis, Ulmus carpinifolia, Vaccinium arctostaphylos.*

9.5.1.1. Relict plant species Sweet chestnut - *Castanea sativa* Mill., Fagaceae

Tree of *Castanea sativa* **is in** up to 30 m tall. Crown open and branched **(Figure 70).** Twigs covered with reddish-dark brown warts. Leaves are petiolate, 15-25 cm long, oblong lanceolate, serrate, and acuminate. Upper surface is dark green, pubescent when young, glabrous at maturity. Lower surface is with dark grey hairs when young, later either only veins are covered with star-shaped hairs or the whole surface becomes glabrous.

Tree is monoecious. Staminate flowers are yellowish, to three or more in clusters forming catkins. Pistillate flowers greenish, clustered to three or more at catkins base. Fruit is nut enclosed into round bur covered with spines. Flowers are in June. Fruits are in September and October.

Grows in forests of lower and middle montane belts, from 500 to 1200-1400 m, sometimes to 1600 m. mostly occurs with beech, hornbeam, linden and other broad-leaved trees. Chestnut sometimes forms pure stands. It grows with fir at 1000-1200 m. Native to Europe, Mediterranean, Balkan, Caucasus, Asia Minor, Eastern Anatolia.

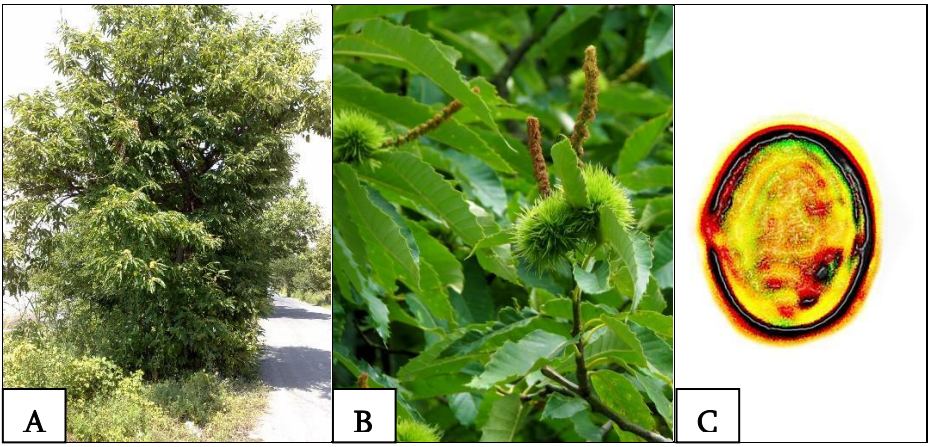


Figure 70. A. *Castanea sativa* **is relict species; B.** Fuits are used for medicinal; **C.** Pollen of *C. sativa* has length of the horizontal height as 29-35 μm. **Photo: Maia Akhalkatsi.**

9.5.2. Code of Georgia: Zelkova forest - *Zelkova carpinifolia* (Pall.) Dippal, Ulmaceae (92ZC-GE*)

Zelkova (*Zelkova carpinifolia*) is the relict of the arctic-tertiary period flora. Its areal of general distribution is Kolkheti and Lenkorani in Azerbaijan. In the form of refugiums on small territories it is found in Kakheti and Karabakh. Monodominant forest of zelkova is extremely rare. Such a forest is preserved in Akhmeta region, Babaneuli reserve. Zelkova stand is found in Akhmeta region in several places – Pichkhovani, Laliskuri and Argokhi. Forests occur on foot-hills of the mountains, slopes of various expositions at the altitude of 430-500 meters.

In west Georgia zelkova forest occupies lower places. The upper margin of its distribution is 750 meters. However, in Karabakh and Lenkoran it can be found at the altitude of up to 1700 meters. In

Kolkheti Zelkova forest is mixed with other deciduous plants - *Q. imeretina, Q. iberica, Q. hartwissiana, Carpinus caucasica, C. orientalis.*

Sub-types (92ZC-GE-01): Zelkova – hornbeam and oak forests - *Zelkova-Carpineto-Quercetum*, are characteristic to west Georgia. The following communities are differentiated:

1. Zelkova forest with Imereti oak, *Zelkoveto-Querceta (Quercus imeretina),*
2. Zelkova forest with oak and Colchic butcher's broom, *Zelkoveto-Querceta ruscosa (Ruscus colchicus),*
3. Zelkova forest with oak and false-brome cover, *Zelkoveto-Querceta brachypodiosa (Brachypodium sylvaticum),*
4. Zelkova forest with oak and azalea, *Zelkoveto-Querceta rhododendrosa (Rhododendron luteum),*
5. Zelkova forest with oak and sedge cover, *Zelkoveto-Querceta juncosa (Juncus effusus),*
6. Zelkova forest with oak and hornbeam, *Zelkoveto-Querceto carpinosa (Carpinus caucasica).*

Sub-types (92ZC-GE-02): Zelkova and oriental hornbeam forest - *Zelkova carpinifolia – Carpinus orientalis* is characteristic to east Georgia. The following communities are observed:

7. Zelkova and Jerusalem thorn forest, *Zelkoveta Paliureto (Paliurus spina-christi),*
8. Zelkova forest with astragal, *Zelkoveta astragalosa (Astragalus brachycarpus),*
9. Zelkova forest with oriental hornbeam, *Zelkoveto-Carpineta (Carpinus orientalis),*
10. Zelkova forest with hawthorn and bog cranesbill, *Zelkoveto-Crataegeta (Crataegus pentagyna) geraniosa (Geranium palustre),*
11. Zelkova forest with nut and wild basil, Juglandeto-*Zelkoveta clinopodiosa (Clinopodium vulgare).*

Plants species: *Zelkova carpinifolia, Astragalus brachycarpus, Brachypodium sylvaticum, Clinopodium vulgare, Carpinus caucasica, C. orientalis, Crataegus pentagyna, Geranium palustre, Juglans regia, Juncus effusus, Paliurus spina-christi, Quercus hartwissiana, Q. iberica, Q. imeretina, Rhododendron luteum, Ruscus colchicus.*

9.5.2.1. Relict plant species Caucasian elm - *Zelkova carpinifolia* (Pall.) Dippal, Ulmaceae

Zelkova carpinifolia is a deciduous tree growing to 25-30 m by 10 m at a fast rate **(Figure 71).**

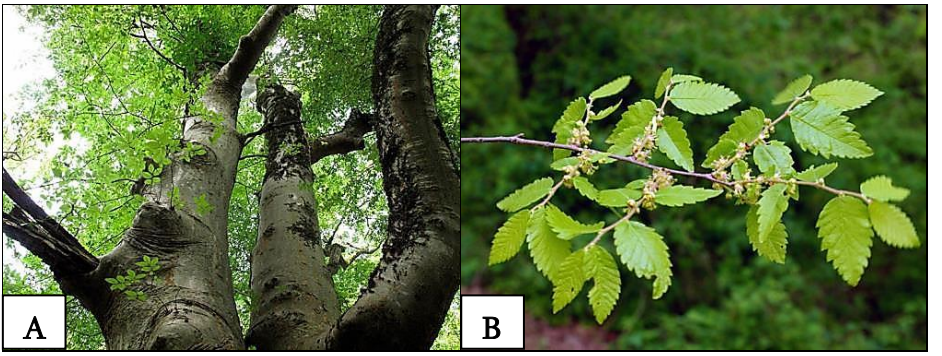


Figure 71. A.- B. *Zelkova carpinifolia* is relict species in the Caucasus. **Photo: Maia Akhalkatsi.**

It is in flower from April to May, and the seeds ripen from September to November. The flowers are monoecious is individual flowers are either male or female, but both sexes can be found on the same plant. Suitable for are light, medium and heavy soils and prefers well-drained soil. Suitable pH: acid, neutral and basic soils. It can grow in semi-shade or no shade. It prefers moist soil. Bark thick, hard, dark greyish-green. Leaves oblong-ovate or elliptic, acute, nearly sessile or on short petiole, base irregularly shaped, margins serrate.

Flowers of two types has staminate and perfect. Perfect flowers solitary, situated in leaf axils of young shoots, staminate flowers form clusters on last year branches. Fruit irregularly shaped one seeded samara. Pest tolerant is for aggressive surface roots possible, Specimen, Street tree. An easily grown plant, it succeeds in almost any good soil, acid or alkaline, preferring a deep well-drained moist loam. Prefers of a moderately is sheltered position. Relatively shade tolerant. A fast is growing tree. Dormant plants are very cold-tolerant, but they are sometimes damaged by late spring frosts when they are young. Plants are susceptible to Dutch elm disease, but the beetle that is the vector of

this disease rarely feeds on *Zelkova* so infestation is rare. Plants in this genus are notably resistant to honey fungus. Special Features: Not North American native is inconspicuous flowers or blooms. Flowers are in March. Fruits are in August till September.

Seed of *Zelkova* is as best sown in a cold frame as soon as it is ripe. Stored seed requires stratification and should be sown as early in the year as possible. Germination rates are variable. When they are large enough to handle, prick the seedlings out into individual pots and grow them on in the greenhouse for their first winter. Plant them out into their permanent positions in late spring or early summer, after the last expected frosts. Grows in humid forests, usually along riverbanks and gorges in lowland and lower montane belt, sometimes reaches 1600-1700 m. Native to Eastern Anatolia, Caucasus, Iran.

9.5.3. Code of Georgia: Forest with Boxwood - *Buxus colchica* Pojark., Buxaceae (92BCGE*)

Colchic boxwood (*Buxus colchica*) is the related species of the boxwood growing in Europe (*B. sempervirens*). It is mainly found in west Georgia, limestone massifs, Abkhazia, Samegrelo and Racha-Lechkhumi. Amplitude of vertical distribution is 1300 meters a.s.l.. It participates in the formation of hornbeam and other broad-leaved forests. In forests of this type the following endemic species characteristic to limestones are represented in large amounts - *Ruscus ponticus, Hedera helix, Asplenium adiantum-nigrum, Carex divulsa, C. transsilvanica,* and *Veronica peduncularis, V. persica.*

In east Georgia boxwood stands are in abundance in Aragvi gorge, Saguramo, Bulachauri, and Navdaraant Kari. In Kakheti boxwood stands are encountered in several places. The boxwood hill is common in Kvareli surroundings, on the Bursa river bank; Devubani, Sviana Khevi, Chontis Khevi, Saborio Khevi and Didgori. Hornbeam, Georgian oak, lime and beech are compatible species of the mentioned boxwood forests in R. Stori gorge. The boxwood here creates the secondary layer. There are different opinions on the primary origin of the boxwood in east Georgia. Some researchers consider that it is the tertiary relict, which is preserved in refugiums **(Grossheim et al., 1928; Matikashvili, 1953; Gurgenishvili, 1967).** Majority though

thinks that the box was planted at the surrounding of churches and it has been naturalized into the natural habitat.

Plants species: *Asplenium adiantum-nigrum, Buxus colchica, Carex divulsa, C. transsilvanica, Carpinus caucasica, Fagus orientalis, Hedera helix, Quercus iberica, Ruscus ponticus, Tilia begoniifolia, Veronica peduncularis, V. persica.*

9.5.3.1. Relict plant species Boxwood - *Buxus colchica* Pojark., Buxaceae

Relict species -A relict plant or animal is a taxon that persists as a remnant of what was once a diverse and widespread population. *Buxus colchica* Pojark. is for Boxwood, Bochsbaum Buxaceae **(Figure 72).**

The shrub or tree is tall 2-12 m and rarely 15 m. Bark greyish-yellow, smooth, stem erect, often branched from the base. Leaves has simple, leathery, glabrous, opposite, oblong-ovate, lanceolate or, lanceolate-ovate, on short petiole, dark and glossy above, light green and pale beneath. Plant is monoecious. Flowers are greenish-yellow, unisexual, in axillary spikes or capitate inflorescence. Fruit is capsule. Flowers are in February till April. Fruits are in June till September.

Forms evergreen understory is in mixed deciduous, broad-leaved and dark coniferous forests. Grows is up to 1600-1800 m. Native to Caucasus, Asia Minor. Landscape uses are - Container, Foundation, Hedge, Superior hedge. Succeeds is in almost any soil that is well-drained, tolerating light shade and chalky soils. Tolerates is a pH range from 5.5 to 7.4. A very ornamental has but slow-growing plant. A polymorphic species, there are some named varieties developed for their ornamental value. The foliage is pungently scented, especially when wet. Special Features: Attractive foliage, Not North American native, all or parts of this plant are poisonous, inconspicuous flowers or blooms.

Seed of *Buxus* is as stratification is not necessary but can lead to more regular germination. The seed is best sown in a cold frame as soon as it is ripe. Sow stored seed as early in the year as possible in a cold frame. It usually germinates in 1-3 months at 15°C but stored seed can take longer. When large enough to handle, prick the seedlings out into individual pots and grow them on in the greenhouse for at least their first winter, planting them out into their permanent positions in

late spring or early summer, after the last expected frosts. Cuttings are of short side shoots with a heel, September in a frame. High is percentage. Rather slow to root Nodal cuttings in spring in a frame. Fairly is easy.

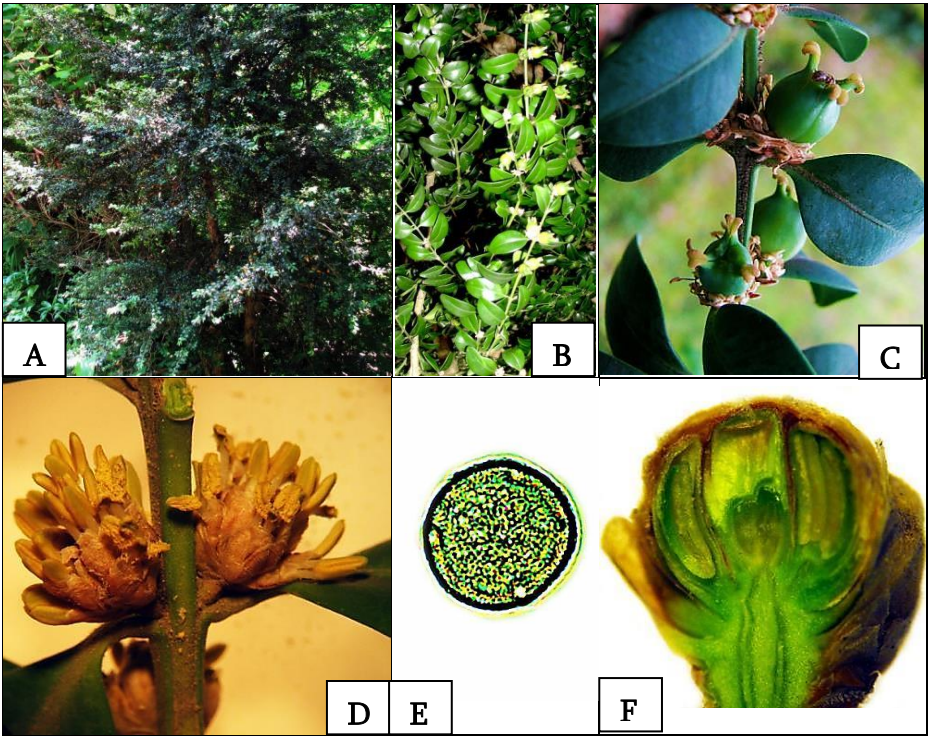


Figure 72. A. *Buxus colchica* is grows in the forest and it is near the river; **B.** Flowering is in March; **C.** The fruit has a seed**; D.** Pollen is in April**; E.** Pollen has length of the horizontal height as 38-40 μm; **F.** Multiplies pollen seeds. **Photo: Maia Akhalkatsi.**

9.5.4. Code of Georgia: Colchic relic broad-leaved mixed forest (9BCGE*)

Colchic broad-leaved mixed forest is mainly distributed in west Georgia, non-marshy lowland places and lower zone of the forest. It holds the eastern slopes of Ajara-Imereti range and northern-western part of Great Caucasus. The boundary of vertical distribution is from

200 to 1000-2000 meters a.s.l.. However, in the southern part of Kolkheti it goes down to almost the sea level. Yellow, brown and red soil of the forest can be found in the area of its distribution. Characteristic climatic feature is high humidity. Annual average precipitation in such types of a forest amounts to 2500 mm. Such a high index of moisture is mainly characteristic to narrow gorges, where the annual precipitation is almost always equal and the temperature is moderate. Colchic forest differs from other broad-leaved forests by the ever-green understory with special composition of species. It contains many relict mesophytic species of the Caucasus **(Kimeridze et al., 2001).**

It is especially represented by tertiary period relicts. Among them the poikilohydric living relict, fern - *Hymenophyllum tunbrigense* is worth noting. It grows in Southern Kolkheti. Overall in such a type of a forest 50 coniferous/evergreen and 80 herbaceous species are described. 6 dominant tree species are distinguished, that create syntaxons of various composition - chestnut (*Castanea sativa*), beech (*Fagus orientalis*), Imereti oak (*Quercus imeretina*), Colchic oak (*Q. hartwissiana*), Alder (*Alnus barbata*) and hornbeam (*Carpinus caucasica*).

From hard-wood plants the following are common: Zelkova (*Zelkova carpintfolia*), Georgian oak (*Q. iberica*), elm (*Ulmus glabra, U. elliptica*), maple (*Acer laetum*), Norway maple (*Acer platanoides*), wire-but (*Pterocarya fraxinifolia*), lime (*Tilia begoniifolia*), maple (*Acer campestre*), willow (*Salix micans, S. pantosericea*), Caucasian wild pear (*Pyrus caucasica*), apple (*Malus orientalis*), *Diospyros lotus*, ash (*Fraxinus excelsior*), pine (*Pinus kochiana*) and Yew (*Taxus baccata*). From ever-green bushes the following are worth noting: *Rhododendron ponticum, Laurus nobilis, Ruscus colchicus, R. ponticus, Daphne pontica, Ilex colchica, Rhododendron ungernii, Epigaea gaultherioides* and *Buxus colchica*.

From deciduous bushes the following can be encountered: relict *Vaccinium arctostaphylos, Staphylea colchica, Viburnum orientale, Philadelphus caucasicus, Euonymus leiophloea, Hypericum xylosteifolium, Swida australis, Corylus avellana, Frangula alnus, Mespilus germanica, Rubus caucasicus; Crataegus microphylla,* etc.

Ferns are represented by *Matteuccia struthioptenis, Athyrium filix-femina, Blechnum spicant, Dryopteris affinis,* etc. The epiphytic ferns

are represented by *Polypodium serratum.* On cliff grow: *Phyllitis scolopendrium, Pteris cretica,* etc. Lianas are widely represented and create an impenetrable plant cover, especially, in forests. Widely distributed species are: Colchic ivy (*Hedera colchica*), Tamus (*Tamus communis*) and silk-vine (*Periploca graeca*), hops (*Humulus lupulus*), prickly ivy (*Smilax excelsa*) and clematis (*Clematis vitalba, C. viticella*). In Abkhazia there are Caucasian Dioscorea (*Dioscorea caucasica*), wild vine (*Vitis vinifera* subsp. *sylvestris, V. labrusca*); characteristic species also are epiphytic lichen old man's beard (*Usnea barbata*) and mosses (from Neckeraceae family).

The following representatives of herbaceous plants are common: *Brachypodium sylvaticum, Oplismenus undulatifolius, Cardamine impatiens, Oxalis corniculata, Fragaria vesca, Lapsana intermedia, Brunnera macrophylla, Clinopodium vulgare, Arthraxon langsdorffii, Salvia glutinosa, Veronica officinalis, Viola alba.*

Invasive species are: Northern-American *Baccharis halimifolia,* Pan-tropical *Paspalum paspaloides, Andropogon virginicus,* etc.

Sub-types:

9BC-GE-01 Beech-chestnut forest (*Fagus orientalis - Castanea sativa*) is a moist forest, widespread on slightly declined slopes, clay soil.

9BC-GE-02 Hornbeam-chestnut forest (*Carpinus caucasica - Castanea sativa*).

9BC-GE-03 Beech-chestnut-hornbeam forest (*Carpinus caucasica - Fagus orientalis-Castanea sativa*).

9BC-GE-04 Beech – alder -chestnut-hornbeam forest (*Alnus barbata - Carpinus caucasica - Fagus orientalis - Castanea sativa*) can be found in moit, slightly incluned locations of the northern slope.

9BC-GE-05 Hornbeam forest with oak (*Carpinus caucasica -Quercus harwissiana*) is found in Abkhazia on the terrace up to 30 meters a.s.l.

9BC-GE-06 Imereti oak and hornbeam riparian forest (*Quercus imeretina-Carpinus caucasica*) grows along moist narrow gorges.

9BC-GE-07 Colchic broad-leaved mixed forest with boxwood (*Buxus colchica*) understory is found in limestone places.

9BC-GE-08 Colchic broad-leaved mixed forest with Pontic Rhododendron (*Rhododendron ponticum*) understory is found in Ajara at the altitude of 960-1060 meters in the Koronistskali river gorge. Characteristic features are: *Epigaea gaulterioides, Ilex colchica,*

Betula medwedewii, Quercus pontica, Vaccinium arctostaphyllos, Viburnum orientale, Rhododendron luteum, R. ponticum, R. ungernii.

Plants species: *Alnus barbata, Castanea sativa, Diospyros lotus, Fagus orientalis, Quercus imeretina, Q. hartwissiana, Q. iberica, Acer campestre, A. laetum, A. platanoides, Andropogon virginicus, Arthraxon langsdorffii, Athyrium filix-femina, Baccharis halimifolia, Blechnum spicant, Brachypodium sylvaticum, Brunnera macrophylla, Buxus colchica, Cardamine impatiens, Carpinus caucasica, Clinopodium vulgare, Corylus avellana, Crataegus microphylla, Daphne pontica, Dryopteris affinis, Epigaea gaultherioides, Euonymus leiophloea, Fragaria vesca, Frangula alnus, Fraxinus excelsior, Hymenophyllum tunbrigense, Hypericum xylosteifolium, Ilex colchica, Lapsana intermedia, Laurus nobilis, Malus orientalis, Matteuccia struthioptenis, Mespilus germanica, Oplismenus undulatifolius, Oxalis corniculata, Paspalum paspaloides, Philadelphus caucasicus, Pinus kochiana, Pterocarya fraxinifolia, Pyrus caucasica, Rhododendron ponticum, R. ungernii, Rubus caucasicus, Ruscus colchicus, R. ponticus, Salix micans, S. pantosericea, Salvia glutinosa, Staphylea colchica, Swida australis, Taxus baccata, Tilia begoniifolia, Ulmus glabra, U. elliptica, Vaccinium arctostaphylos, Veronica officinalis, Viburnum orientale, Viola alba, Zelkova carpintfolia.*

9.5.4.1. Relict plant species Caucasian wingnut - *Pterocarya fraxinifolia* (Poir.) Spach., Juglandaceae

Mixed woods are near rivers in boggy or inundated places. A relict plant is a taxon that persists as a remnant of what was once a diverse and widespread population. 30-35 m is tall tree. Bark whitish on young trees, later, becomes dark grey and ridged. Leaf pinnately compound, consists of 6-12 pair of sessile, ovate, oblong, acute and serrate leaflets **(Figure 73).**

Both surfaces are glabrous or white hairs might occur at vein axils on lower surface. Monoecious are here. Small flowers clustered into long drooping catkins. Staminate flowers on short pedicle, pistillate are sessile. Fruits are samara, with hyaline semiorbicular wings. Flowers are in March and April. Fruits are in June and July.

Prefers is a sunny position in a rich strong loam with abundant moisture at the roots. Grows is well by water. Succeeds in areas that do

not experience prolonged winter temperatures below about -12°C, but young plants and the young shoots of older trees can be cut back by winter frosts. A very ornamental tree, it fruits freely in Britain.

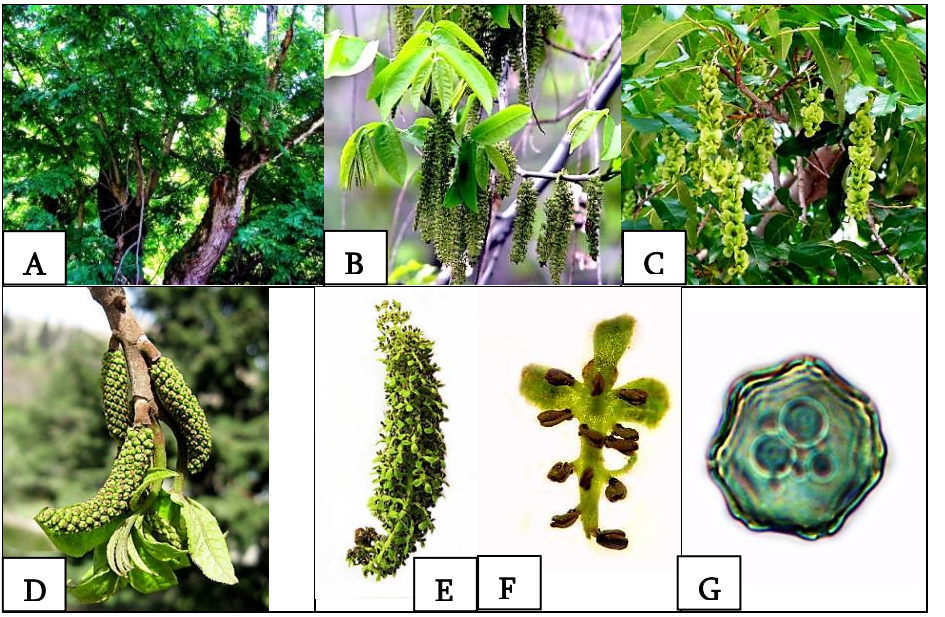


Figure 73. A. *Pterocarya fraxinifolia* is near the river**; B.** Male flowers are in 3 month; **C.** Female flowers are in one year; **D. E. F.** Male flowers has pollen; **G.** Pollen has length of the horizontal height as 32-37 μm. **Photo: Maia Akhalkatsi.**

The leaves are sweetly resinous. The deeply furrowed bark is aromatic. Produces is suckers profusely. Plants in this genus are notably resistant to honey fungus. Grows in forests of lower montane belt, along rivers and streams, forms pure stands, however, it often occurs with alder, white poplar and willow. Native is to Caucasus, Asia Minor, Iran.

Seed has best sown as soon as it is ripe in a cold frame. Pre-soak stored seed for 24 hours in warm water then cold stratify for 2-3 months. Prick out the seedlings into individual pots as soon as they are large enough to handle and grow them on in the greenhouse for their

first winter. Plant them out in late spring or early summer of the following year. Cuttings are of half-ripe wood, July/August in a frame. Cuttings are of mature shoots, November in a frame. Only use vigorous shoots. Layering is here. Division of suckers in the dormant season.

9.5.5. Code of Georgia: Arid open woodlands (9AOWGE*)

Arid open woodlands consist of xerophyte arboreal plants that do not create a closed canopy in upper layer and has xerophytic herbal cover. It is distributed in fragmented forms, between the steppe and semi-desert vegetation in the arid zone of east Georgia. Annual precipitation amounts to 550 mm. It is preserved in its original form in Vashlovani reserve.

Dominant species are: mastic (*Pistacia mutica*), species of juniper (*Juniperus polycarpos, J. foetidisima, J. rufescens*), hackberry (*Celtis caucasica, C. glabrata*), species of willow-leaved pear (*Pyrus salicifolia*), sumach (*Cotynus coggygria*), cattle-herder's cherry (*Prunus incana*), jasmine (*Jasminum fruticans*), black buckthorn (*Rhamnus palasii*), spiraea (*Spiraea crenata*). Thuja (*Biota orientals)* has been planted in v. Alani at the Shiraki forester's summer house and became naturalized.

Invasive weed species in Georgia and causes strong allergy. *Ailanthus altissima* (Mill.), simaroubaceae is increasing in dry rock of arid sone. Swingle is on Ambrosia (*Ambrosia artemisiifolia* L., American wormwood, Asteraceae) has allergic from 1890 years in Georgia. It was planted in maize. It grows in ruderal habitats and flowers from end of August to the end of September. Invasive species are in arid woodlands and it can make allergy (**Figure 74**).

Sub-types (9AOW-GE 01): Dry open woodland with mastic (*Pistacia mutica*). The open woodland formed by the mastic is worth noting. It is associated with the habitat of Iori river flood plane forest. Mastic trees are frequently at a long distance from each other and sometimes grow big size (10.5 meters high, 0.5 diameters). Co-existing

species of the mastic tree are: elm (*Ulmus carpinifolia*), black buckthorn (*Rhamnus pallasii*) and oak (*Quercus iberica*).

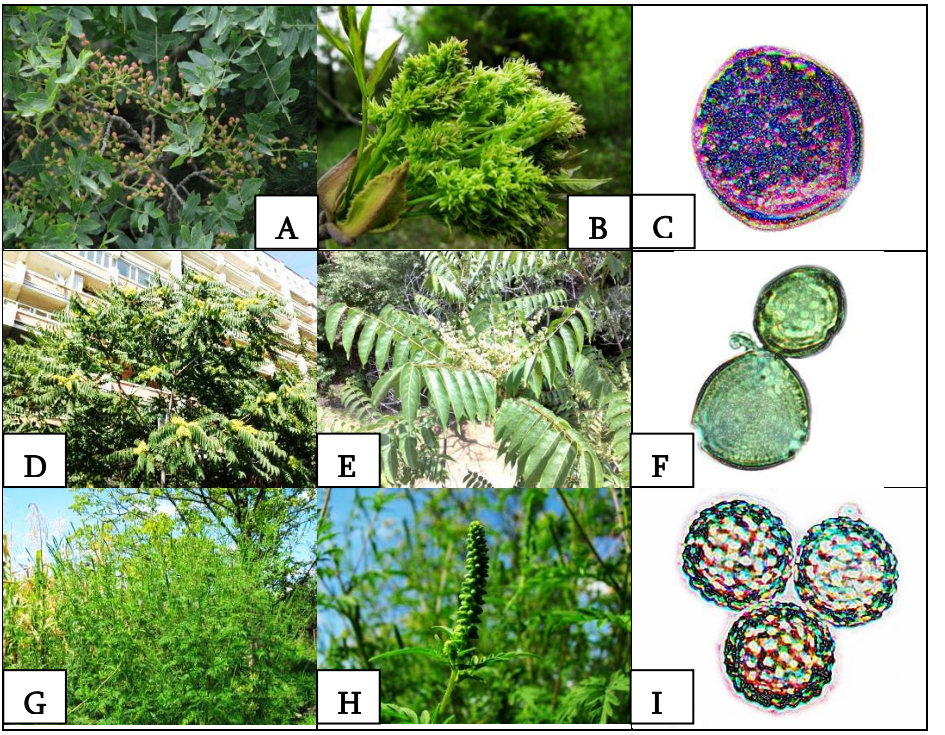


Figure 74. A. *Pistacia mutica* has the fruits and it is not for medicinal; **B.** Flowers has pollen in April; **C.** Pollen has length of the horizontal height as 35-37 μm. **D.** *Ailanthus altissima* is invasive and allergy species in Tbilisi; **E.** Flowers from end of June to the end of August. **F**. Pollen of *Ailanthus altissima* has length of the horizontal height as 32-35 μm; **G.** *Ambrosia artemisiifolia* is invasive and allergy species and it is in agrarian medows to maize; **H.** Flowers from end of August to the end of September; **I.** Pollen of *Ambrosia artemisiifolia* has length of the horizontal height as 33-35 μm. **Photo: Maia Akhalkatsi.**

In the second type of the forest there are mastic, hackberry (*Celtis australis*), berberis (*Berberis vulgaris*), black buckthorn, oleaster (*Elaeagnus angustifolia*), willow-leaved pear (*Pyrus salicifolia*), Jerusalem thorn (*Paliurus spina-christi*) and sumach (*Cotinus*

coggygria). From shrubs there are *Atraphaxis spinosa, Reaumuria alternifolia.* The mastic open woodland is also found in Kvemo Kartli, gorge of the river Khrami, on slopes between Asureti and sadakhlo. Here the following species dominate *Pistacia mutica, Acer ibericum, Celtis caucasica.*

Sub-types (9AOW-GE 02): Dry open woodland with juniper species (*Juniperus* spp.). The juniper is distributed in Southern Kiziki in the form of small stands, on slopes of northern exposition of Vashlovani reserve, on Zilchi Mountain, southern slopes of Palantuki range. It can also be found in Mtskheta surroundings, near Shio-Mgvime, Karsani, etc. Species that form juniper communities are - *Juniperus foetidissima, J. oblonga, J. polycarpos, J. rufescens, Ephedra procera, Rhamnus palasii, Colutea orientalis, Jasminum fruticans, Prunus microcarpa, Atraphaxis spinosa, Cynosurus cristatus, Silene cyri, Teucreum polium, Campanula hohenackeri, Centaurea ovina, Stachys fruticulosa.*

Sub-types (9AOW-GE 03): Dry open woodland with willow-leaved pear species (*Pyrus* spp.). Dominant species are: *Pyrus salicifolia, P. georgica* and *P. demetrii*. From other species *Paliurus spina-christi, Berberis vulgaris, Rosa canina,* etc. are worth noting. Endemic *P. eldarica* is found by A. Grossheim only in Azerbaijan, Samukhi region (Eliar-ougli). *P. fedorovii* is the endeme found in the surroundings of village Gldani and village Mukhrani. *P. oxyprion* can be found in Dedoplistskaro region in the Lekistskali ravine. *Celtis caucasica, Punica granatum, Rosa* spp., *Tamarix ramosissima* also grow in this place. Rare endemic species *P. sakhokiana* is found only in Dedoplistskaro region, on the black mountain. Here are formations a denser stand than *P. salicifolia,* on the northern slope, in the depression. The understory made of Jerusalem-thorn and oriental hirn-beam is developed here. In Ateni village surroundings, on mountain Unagira grow *P. salicifolia* var. *angustifolia.*

Sub-types (9AOW-GE 04): Dry open woodland with willow-leaved pear species (*Pyrus* spp.). Dominant species are: *Pyrus salicifolia, P. georgica* and *P. demetrii*. From other species *Paliurus spina-christi, Berberis vulgaris, Rosa canina,* etc. are worth noting. Endemic *P. eldarica* is found by A. Grossheim only in Azerbaijan, Samukhi region (Eliar-ougli). *P. fedorovii* is the endeme found in the surroundings of village Gldani and village Mukhrani. *P. oxyprion* can

be found in Dedoplistskaro region in the Lekistskali ravine. *Celtis caucasica, Punica granatum, Rosa* spp., *Tamarix ramosissima* also grow in this place. Rare endemic species *P. sakhokiana* is found only in Dedoplistskaro region, on the black mountain. Here are formations a denser stand than *P. salicifolia*, on the northern slope, in the depression. The understory made of Jerusalem-thorn and oriental hirn-beam is developed here. In Ateni village surroundings, on mountain Unagira grow *P. salicifolia* var. *angustifolia.*

Plants species: *Pistacia mutica, Juniperus polycarpos, J. foetidisima, J. rufescens, J. oblonga, Celtis australis, C. caucasica, C. glabrata, Pyrus salicifolia, P. ketzkhovelii, P. demetrii, P. takhtadziani, P. georgica, P. fedorovii, P. oxyprion, P. sakhokiana, P. salicifolia* var. *angustifolia, Acer ibericum, Cynosurus cristatus,, Amygdalus georgica,, Atraphaxis spinosa, Atraphaxis spinosa, Berberis vulgaris, Bothriochloa ischaemum, Campanula hohenackeri, Caragana grandiflora, Prunus incana, Centaurea ovina, Colutea orientalis, Cotinus coggygria, Elaeagnus angustifolia, Ephedra procera, Festuca sulcata, Jasminum fruticans, Lonicera iberica, Paliurus spina-christi, Prunus microcarpa, Punica granatum, Quercus iberica, Reaumuria alternifolia, Rhamnus pallasii, Rhus coriaria, Rosa canina, Silene cyri, Spiraea crenata, Stachys fruticulosa, Tamarix ramosissima, Teucreum polium, Ulmus carpinifolia.*

9.5.5.1. Crop wild relatives (CWR) plant species *Aegilops tauschii* Coss., Poaceae

Crop wild relatives (CWR) are determined by the exchange of gene crops and germaplazma used agricultural crop domestication ancestor species.

Synonyms: *Triticum tauschii* (Coss.) Schmalh., *T. aegilops* P. Beauv. ex Roemer & Schult., *Patropyrum tauschii* (Coss.) A. Love, *Aegilops squarrosa* sensu Tausch non L. The species in Georgia are - *A. tauschii* Coss. subsp. *tauschii*, **C.** *A. tauschii* Coss. subsp. *strangulata* (Eig) Tzvelev; *A. tauschii* Coss. var. *meyerii* (Griseb.) Tzvelev; *A. biuncialis* Vis.; *A. columnaris* Zhuk.; *A. comosa* Sm., *A. cylindrica* Host; *A. geniculata* Roth, *A. neglecta* Req. ex Bertol.; *A. triuncialis* L.; and *A. umbellulata* Zhuk. **(Akhalkatsi, 2015c; Figure 75).**

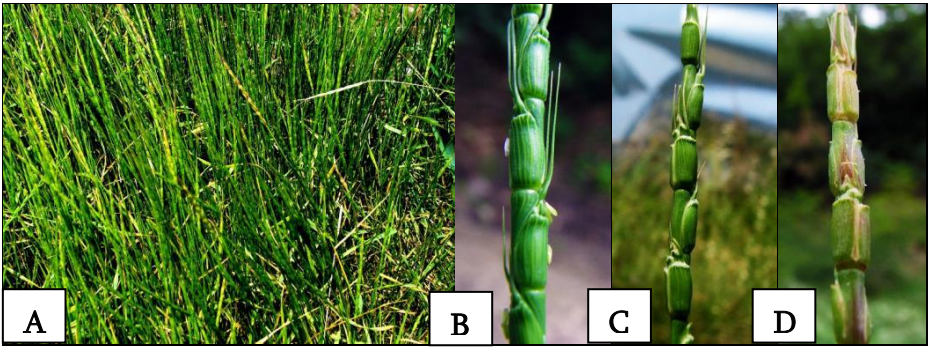


Figure 75. A. *Aegilops tauschii* is distribution in Meskheti and in south Kartli; **B.** *A. tauschii* subsp. *tauschii*; **C.** *A. tauschii* subsp. *strangulata*; **D.** *A. tauschii* var. meyerii. **Photo: Maia Akhalkatsi.**

Annual or biennial plant has 20-40 cm high, with singular or numerous erect or geniculate stems. Leaves are linear. The ear is elongated, cylindrical, and sometimes feebly fusiform; in the mature phase glossy, as if polished, with 5-11 spikelets. At the bottom of the ear there is 1 rudimentary or underdeveloped spikelet. The ear is brittle; when mature easily disintegrates into spikelets, especially in the upper part. Spikelets are cylindrical, circular in cross-section; glumes are rectangular-contoured, nearly square-shaped, 5-6 mm in length and 3-4 mm in width, with 7- 9 thin, weakly denticulated veins, becoming almost smooth when the spikelet is mature. In the upper part the glumes are always awnless, truncated, and obtuse, with an incrassate edge in a bolster-like fashion, which is more expressed in the lower spikelets. The lemma is 1-2 mm longer than spikelet glumes, narrow-rectangular, with an incrassate upper edge; one corner of the lemma's upper edge is extended into a denticle or a short awn. The length of the lemma's awns ranges from 5 to 36 mm, increasing, as a rule, toward the top of the ear. The awns at the base are grooved. Kernels accrete to palea. Wind is and self-pollinated plant. Autochore and propagated are by seed. 2n=14.

The overall distribution - Crimea is Sudak, Caucasus as all, Middle Asia has river valleys of Syr-Darya and Amu-Darya in their upper and middle course, Kyzyl Kum, northern and western Tien Shan, Gissar-Darvaz, Alai, Tarbagatai, Saur, Dzungarian Ala Tau, Kopet Dagh,

Mediterranean region, Asia Minor, Iran, Himalayas. Distribution in Samtskhe-Javakheti region - This species is mixed in populations with *A. cylindrica*, but the number of individuals is much fewer. Not all populations of *A. cylindrical* contained individuals of *A. tauschii*. We have found is only in 5 sites.

Ephemeral is plant. Winter is hardy. Drought is resistant. Salt is resistant. Grows in semi-deserts, over dry loess or rubbly slopes, gravels, on light sandy or, conversely, heavy clay soils of the plains, sometimes even slightly salinized ones, on seaside sands, dry hills and in weedy places.

Threat assessment - This species should be included in RDB Georgia and give a status of NT species. *Ex situ status* - Seeds of *A. tauschii* from different region of Georgia are present in seed banks of USDA, ICARDA, VIR, IPK Gatersleben and Kew RBG. Seeds from Samtskhe-Javakheti are kept at the TBG&BI.

The plant is consumed by animals like *A. cylindrica*. It is used as gene source for disease resistance and pest resistance. Hexaploid bread wheat is originated from hybridization of tetraploid *T. turgidum* L. with diploid *A. tauschii* Coss. **(Kihara 1944; McFadden and Sears 1946).** Good-quality fodder plant, consumed in spring and early summer. In the flowering phase contains 18.9% of albumens (including 10.7% of protein), 2.1% of fats, 23.0% of cellulose; in the fruiting phase there are 17.1% of albumens (including 11.2% of protein), 5.1% of fats, and 32.4% of cellulose.

Tausch's goat grass is spread by seed dispersal only. Therefore, any method that reduces seed spread will reduce the spread of the plant. Population disturbances and habitat fragmentation is expected when road construction works are undertaken.

Proposed action plan objectives and targets:

1. Maintain the current populations of *A. tauschii* in Samtskhe-Javakheti region.

2. Reduce the decline of this species through appropriate habitat management.

A. tauschii should be declared as species of high economic value as genetic ancestor for hexaploid bread wheat**.** The territory where *A. tauschii* is distributed in Samtskhe-Javakheti does not needs special conservation measures to be undertaken. However, Road construction works might cause habitat disturbances and fragmentation. The

conservation measures of this species should be directed on establishment of ex situ seed collections and public education on importance of this plant as ancestor of the bread wheat. The local population and governmental bodies responsible for the nature protection should be informed about high conservation value of this species. This species is crossed with winter wheat producing viable hybrids. The genome is used in molecular systematic studies.

9.5.6. Code of Georgia: Sub-alpine birch krummholz *Betula litwinowii* Doluch., Betulaceae (9BFGE*)

The treeline on moist slopes of the northern exposition of the Great and Minor Caucasus is formed by the subalpine forest of birch elfin trees at the altitude of 2400-2500 meters. However, separate trees are common at the altitude of up to 2550 meters. Inclination of slopes does not exceed 10-25°C that determines stable cover of snow during winter. The mountain brown soil is characteristic, mainly on volcanic rock layers with the humus layer of 10-20 cm thick. The forest of this type is found in the Central Caucasus. Namely are in Kazbegi region as well as in the Minor Caucasus. For example, on Tskhratskaro pass above Bakuriani. It is as well common on northern slopes of Shavsheti and Erusheti ranges. In this type of habitat the border of the forest is lowered by 200-400 meters as a result of anthropogenic impact, which is caused by excessive grazing and cutting of trees. However, as a result of recent global warming and decrease of grazing, the slopes where the birch grove had to be present earlier were repeatedly reforested. Those forests on the Great Caucasus that are considered to be the so-called “forests of the church” and where grazing and cutting has not taken place for ages, are well preserved.

Above 1800 meters up to 2300 meters tall birch trees with closed canopy form forest occupied the slopes of northern exposition. The timberline is situated at the altitude of 2400-2500 meters where 2-3 meter tall elfin birch and mountain ashes are found and Caucasian evergreen rhododendron (*Rhododendron caucasicum*) and other evergreen shrubs are introduced as a understory. The treeline reaches 2550 meters where only dwarf trees of the birch grow among Caucasian evergreen rhododendron shrubs. Characteristic species are: *Betula litwinowii, B. radeana, B. pendula, Sorbus caucasigena, Salix*

caprea, S. kazbegensis, Rhododendron caucasicum, Vaccinium myrtillus, V. uliginosum, V. vitis-idaea, Daphne glomerata, D. mezereum, Anemone fasciculata, Polygonatum verticillatum, Swertia iberica, Festuca drymeja, Calamagrostis arundinacea, Dolichorrhiza renifolia, D. caucasica, Cicerbita racemosa.

Plants species: *Betula litwinowii, B. radeana, B. pendula, Salix caprea, S. kazbegensis, Sorbus caucasigena, Rhododendron caucasicum, Vaccinium myrtillus, V. uliginosum, V. vitisidaea, Aconitum nasutum, A. orientale, Anemone fasciculata, Aquilegia caucasica, Calamagrostis arundinacea, Campanula latifolia, Caphalanthera longifolia, Cicerbita racemosa, Daphne glomerata, D. mezereum, Dolichorrhiza caucasica, D. renifolia, Festuca drymeja, Geranium sylvaticum, Heracleum roseum, Lathyrus roseus, Polygonatum verticillatum, Senecio propinquus, Swertia iberica, Vicia balansae, Gymnadenia conopsea, Platanthera montana.*

9.5.6.1. Edificatory species and madicinal plant Birch - *Betula litwinowii* Doluch. - *B. raddeana* Trautv., Betulaceae

These birch species are growing in Upper Mountain and subalpine belts at 1900-2500 m a.s.l. as subalpine birch groves. 15-18 m is tall tree. Snow cover is <0.5 m. The exposition is for all directions and inclination till 40°C. Sunny edge is normal; dappled shade is in North Wall, East Wall, and West Wall.

Sometimes is on rocky or stony slopes. On treeline is forms peculiar subalpine krumholz. Suitable for: light, medium and heavy soils, prefers well-drained soil and can grow in heavy clay and nutritionally poor soils. Suitable pH: acid, neutral and basic soils and can grow in very acid soils. It cannot grow in the shade. It prefers dry or moist soil. The plant can tolerate strong winds but not maritime exposure **(Figure 76).**

B. litwinowii has stemmed mostly crooked, crown loose, bark whitish, often slightly roseate. Leaf thin, ovate or ovate-rhomboid, narrows at the base to a wedge-shaped petiole, acute, margins double serrate. leaves ovate or rarely rhombic -ovate, at base rounded or rarely cordate, acuminate, rather sharply toothed on the margin, firm, lustrous above, paler beneath, 4-6 cm long, 2.5-5 cm broad; young leaves and shoot leaves glutinous, rather heavily pubescent, finally pubescent only

beneath, with warts in the axils of veins; petiole pubescent, one-fourth to one-half the length of the blade; Petiole 3-4-times shorter than the blade, mostly slightly pubescent.

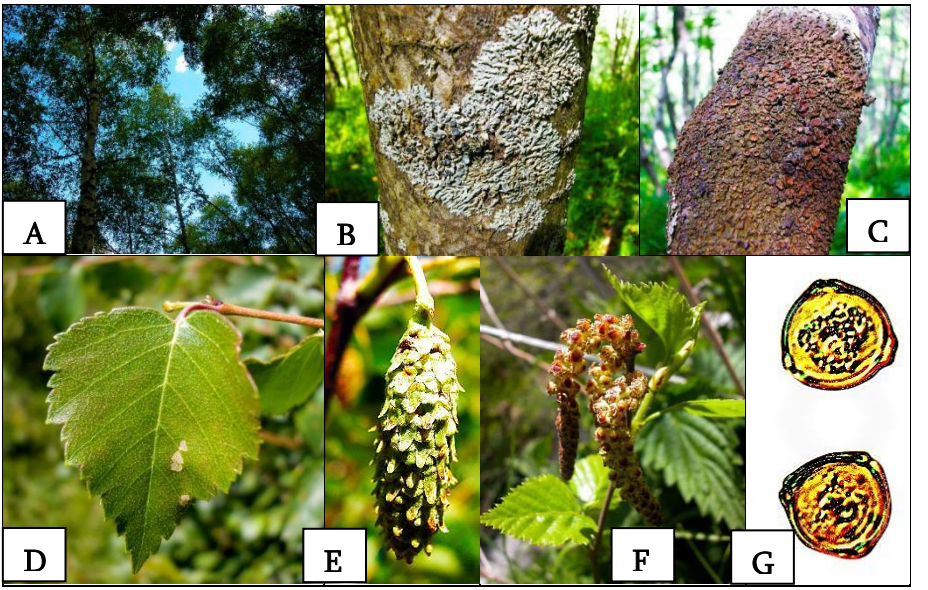


Figure 76. A. *Betula litwinowii* is in subalpine forest and in treeline to 2600 m**. B.** Tree trunk suffering from lichen; **C.** Tree trunk suffering from fungi; **D.** Leaf is of this species; **E.** Female fruits are the one year; **F.** Male fruits have pollen in May**; G.** Pollen has length of the horizontal height as 25-27 µm. **Photo: Maia Akhalkatsi.**

Monoecious is here. Inflorescence catkin, flowers clustered like cylindrical spike. staminate aments 2 or 3 together at the ends of branches, pendulous, 5-6 cm long; fruiting aments solitary on short 2- or 3 -leaved lateral branchlets, 2.5-3 cm long and 9 -10 mm thick, borne on a pubescent peduncle; bracts 3- 5 mm broad, covered in upper part with short hairs, ciliate on the margin; median lobe elongate - oblong; lateral lobes spreading, broad, round-tipped or obtuse to subtruncate; nutlet oblong-ellipsoid, ca. 2 mm long, the wings 1.5 times as broad as the nutlet and reaching tips of stigmas. Pistillate catkins are drooping, on 8-12 mm long peduncle. Fruit is very small, one seeded samara with lateral wings.

B. raddeana is a small tree, with pinkish, white, or brownish bark; Young is catkins **(Figure 77).** No more details are given. A tea is made from the leaves and another tea is made from the essential oil in the inner bark.

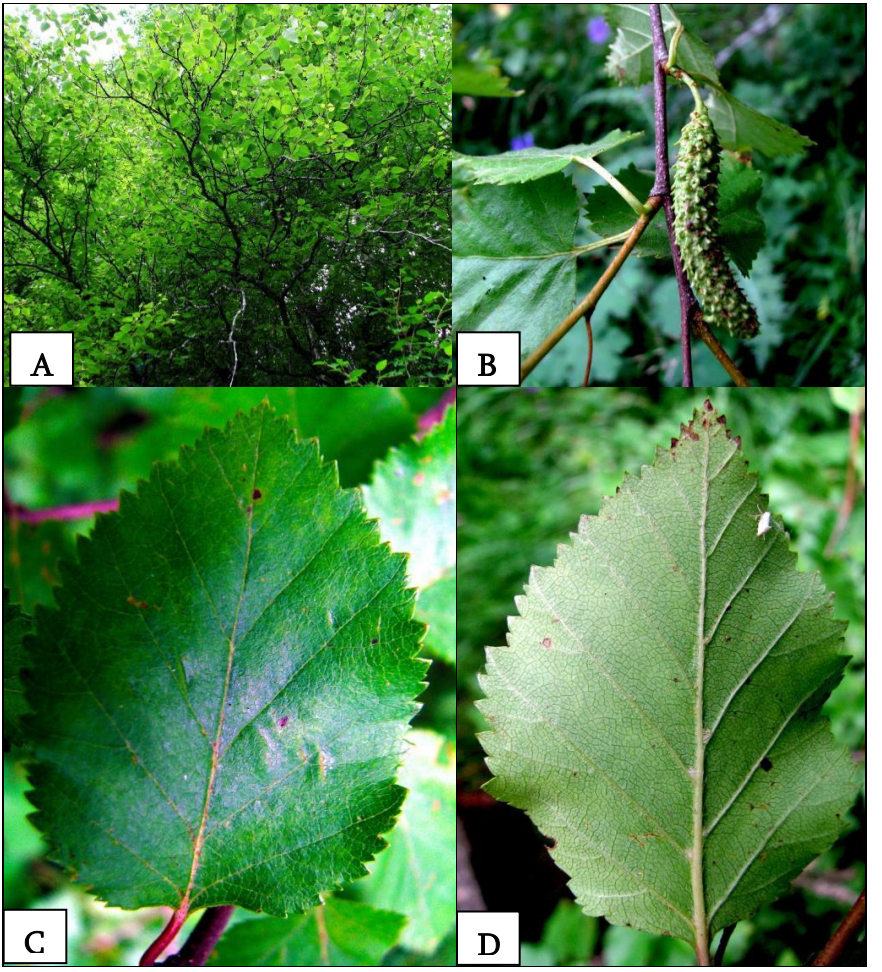


Figure 77. A. *Betula raddeana* is in subalpine forest to 2300 m**. B.** Female fruits are the one year; **C.** Leaf is of this species on the top side; **D.** Leaf is of this species on the bottom side. Photo: Maia Akhalkatsi. **Photo: Maia Akhalkatsi.**

The bark of branches dark brownish, with lenticels; annotinous branchlets yellowish-brown, velutinous, with scattered glands; leaves petiolate, ovate to ovate-oblong, cuneate or rounded at base, acuminate, unequally sharp-toothed on the margin, with 6 or 7 pairs of veins, green and glabrous above, paler and pubescent in the axils of veins beneath, 3-4.5 cm long, 2 -3.5 cm broad, the densely puberulous petiole 10 -15 cm long; staminate aments 2 or 3 together, slender, elongate -cylindric, 2-2.5 cm long and 10 - 14 mm in diameter, the pubescent peduncle 5-6 mm long or rarely longer; bracts caducous, long-cuneate, ca. 8 mm long, puberulous on the margin, the straight oblong or ovate median lobe narrowed toward base, the lateral lobes half to two-thirds as long, oval, acutish to obtusish, slightly divergent; nutlet obovoid, ca. 3 mm long, pubescent at apex, often pointed at base, the wings about as broad as the nutlet. Both species flowering in April-May, fruits are in July-August.

Owing to its quality, the wood provides valuable material for various jobs, especially in carriage construction. The wood of *Betula* differs little in quality from that of *B. litwinowii* and is similarly used in cart construction, etc. Valuable carving material is furnished by the "birch burls," excrescences formed about the root or more rarely on the trunk or on sucker growth. The wood represents a variant of normal birch wood in having irregular twisted annual rings and medullary rays. This wood is highly valued for carpentry and turning jobs and also for veneers. Considerable use is also made of birch bark, especially in the North, sometimes stitching together two or three layers, use it as waterproof cover for their tents, etc.; to increase its flexibility they sometimes scour it with fat. It is also used for canoes and for tar production. Inner bark - cooked or dried and ground into a meal. It can be added as a thickener to soups etc. or can be mixed with flour for making bread, biscuits etc. Inner bark is generally only seen as a famine food, used when other forms of starch are not available or are in short supply. Sap is raw or cooked. A sweet is flavour. It is harvested in early spring, before the leaves unfurl, by tapping the trunk. It makes a pleasant drink. It is often concentrated into syrup by boiling off the water. Between 4 and 7 litres can be drawn off a mature tree in a day and this will not kill the tree as long as the tap hole is filled up afterwards. However, prolonged or heavy tapping will kill the tree. The flow is best on sunny days following a frost. The sap can be fermented

into a beer. Young leaves - raw or cooked. Anti-inflammatory is cholagogue, diaphoretic. The bark is diuretic and laxative. Oil obtained from the inner bark is astringent and is used in the treatment of various skin afflictions, especially eczema and psoriasis. The bark is usually obtained from trees that have been felled for timber and can be distilled at any time of the year. The inner bark is bitter and astringent; it is used in treating intermittent fevers. The vernal sap is diuretic. The buds are balsamic. The young shoots and leaves secrete a resinous substance which has acid properties, when combined with alkalis it is a tonic laxative. The leaves are anticholesterolemic and diuretic. They also contain phytosides, which are effective germicides. An infusion of the leaves is used in the treatment of gout, dropsy and rheumatism, and is recommended as a reliable solvent of kidney stones. The young leaves and leaf buds are harvested in the spring and dried for later use. A decoction of the leaves and bark is used for bathing skin eruptions. Moxa is made from the yellow fungous excrescences of the wood, which sometimes swell out of the fissures. The German Commission E Monographs, a therapeutic guide to herbal medicine, approve *Betula* species for infections of the urinary tract, kidney and bladder stones, rheumatism. The bark is used to make drinking vessels, canoe skins, roofing tiles etc. It is waterproof, durable, tough and resinous. Only the outer bark is removed, this does not kill the tree. It is most easily removed in late spring to early summer. A pioneer species, it readily invades old fields, cleared or burnt-over land and creates conditions suitable for other woodland trees to become established. Since it is relatively short-lived and intolerant of shade, it is eventually out-competed by these trees. A tar-oil is obtained from the white bark in spring. It has fungicidal properties and is also used as an insect repellent. It makes a good shoe polish. Another report says that an essential oil is obtained from the bark and this, called 'Russian Leather' has been used as a perfume. A decoction of the inner bark is used to preserve cordage, it contains up to 16% tannin. Oil similar to Wintergreen oil is obtained from Gaultheria procumbens and it is obtained from the inner bark. It is used medicinally and also makes a refreshing tea. The resin glands has the report does not say where these glands are foundand it are used to make a hair lotion. A brown dye is obtained from the inner bark A glue is made from the sap. Cordage can be made from the fibres of the inner bark. This inner bark can also be

separated into thin layers and used as a substitute for oiled paper. The young branches are very flexible and are used to make whisks, besoms etc. They are also used in thatching and to make wattles. The leaves are a good addition to the compost heap, improving fermentation. Wood - soft, light, durable. It is used for a wide range of purposes including furniture, tool handles, toys and carving. A high quality charcoal is obtained from the bark. It is used by artists, painters etc. The wood is also pulped and used for making paper. A very easily grown plant, it tolerates most soils including poor ones, sandy soils and heavy clays. It prefers a well-drained loamy soil in a sunny position. It is occasionally found on calcareous soils in the wild but it generally prefers a pH below 6.5, doing well on acid soils. Fairly wind tolerant though it becomes wind shaped when exposed to strong winds. The silver birch is a very ornamental tree with many named varieties. It also has a very wide range of economic uses. It is a fast growing tree, increasing by up to 1 metre a year, but is short-lived. It is often one of the first trees to colonize open land and it creates a suitable environment for other woodland trees to follow. These trees eventually out-compete and shade out the birch trees. It makes an excellent nurse tree for seedling trees, though its fine branches can cause damage to nearby trees when blown into them by the wind. Trees take about 15 years from seed to produce their own seed. A superb tree for encouraging wildlife, it has 229 associated insect species. A good plant is to grow near the compost heap, aiding the fermentation process. It is also a good companion plant, its root action working to improve the soil. Trees are notably susceptible to honey fungus. Seed is as best sown as soon as it is ripe in a light position in a cold frame. Only just cover the seed and place the pot in a sunny position. Spring sown seed should be surface sown in a sunny position in a cold frame. If the germination is poor, raising the temperature by covering the seed with glass can help. When they are large enough to handle, prick the seedlings out into individual pots and grow them on in a cold frame for at least their first winter. Plant them out into their permanent positions in late spring or early summer, after the last expected frosts. If you have sufficient seed, it can be sown in an outdoor seedbed, either as soon as it is ripe or in the early spring - do not cover the spring sown seed. Grow the plants on in the seedbed for 2 years before planting them out into their permanent positions in the winter.

10. HABITAT DEFINITION AND CLASSIFICATION

Georgia is located in the Caucasus region, which is among the planet's 25 most diverse and endangered hotspots designated as conservation priorities because the Caucasus is a region of remarkably rich vegetation with a very high level of endemism (**Myers et al., 2000**). Georgia has an extremely varied topography and climate that produce a mosaic of habitat types ranging from see level up to alpine vegetation near the snowline; and, from warm, humid lowlands at the Black See to dry, continental areas in the Eastern Georgia covered by forests of different kinds, steppes, and semi-deserts. 4400 species of vascular plants, including 380 endemic species, occur in Georgia's 69700 kilometres 2 **(Nakhutsrishvili, 2013).**

The Caucasian mountain region is made up of three Separate Mountain systems are the Greater and Lesser Caucasus and Talysh mountains and the lowlands of the Transcaucasian depression located between Black and Caspian Sees **(Neidze, 2003).** Georgian territory covers parts of the Greater Caucasus mountain range, Transcaucasian depression and the Lesser Caucasus Mountains, which run parallel to the greater range, at a distance averaging about 100 kilometres south, between 40°C and 47°C latitude east, and 42°C and 44°C longitude north. Two thirds of the country is mountainous with an average height of 1200 m.a.s.l., with highest peaks of Mount Shkhara (5184 m.a.s.l.) at the Western Greater Caucasus and Mount Didi Abuli (3301 m.a.s.l.) in the Lesser Caucasus.

The core of the Great Caucasus mountain range is composed of Precambrian and Paleozoic crystalline rocks, mostly granites and gneiss. The mountains of the southern macroslope are made of Jurassic and Triassic slates, sandstones, allevrolites, argellites, massive limestone and tuffs **(Romanika, 1977).** The Lesser Caucasus at Javakheti Plateau is composed of Upper Cretaceous and Tertiary igneous rocks including lavas and shallow intrusive rocks such as andesite, basalt and dolerite **(Klopotovski, 1950).** The soils of the southern macroslope of the Great Caucasus mountain range belong to the Western Transcaucasian Mountain Province **(Ivanova et al, 1963).** Within the lower vertical zone (up to 300-500 m above sea level), either mountain zheltozems or gray forest soils predominate. Higher, up

to 1800-2000 m, the soils belong to the brown mountain-forests acid non-podzolized type. Most soils within the forest belt correspond to either Inceptisols or Ultisols. The Lesser Caucasus including Javakheti, Tsalka-Dmanisi and Erusheti uplands is covered with the mountain chernozems which are formed at altitudes from 1200-2200 m and meadow chernozem-like soils. In highlands they are replaced by mountain-meadow soils. Besides, the alluvial soils, redzinas, brown as well as the meadow-brown soils occur here, with the predominance of brown forest type of soil in the mountain forest belt **(Neidze, 2003).** Climate is temperate but fluctuates by elevation, that varies from 0 to 5184 m and air temperature is changed on the average of 0.65°C per 100 m altitude; and by regions from humid western Georgia to arid zones in the Eastern Iori Plateau and annual precipitation varies from 1500-2000 and up to 4500 millimetres in the western, Kolkhic part to 600-1000 mm in drier parts of eastern and southern regions (**Neidze, 2003**). One third of the Georgian territory is covered by forests, 70% of which are mountain forests spread from lower montane belt up to the treeline ecotone. The Caucasus forests have one of the highest levels of endemism in the temperate world **(Nakhutsrishvili, 2013).** 23 percent of vascular plants are endemic to the region. According to **A. Dolukhanov (2010)** the Caucasus forest belt can be subdivided into three major elevation zones: broad-leaved forests (50-900 m), coniferous forests (900-1700 m), and high mountain krummholz forests (1700-2000 m). The overstory is frequently dominated by beech, hornbeam, chestnut, oak, and fir.

Georgian vegetation is well studied by Georgian botanists **(Grossheim et al., 1928; Ketskhoveli, 1959; Dolukhanov, 1989, 2010; Nakhutsrishvili, 2013).** The classification of forest plant communities was done by **A. Dolukhanov (1989).** However, the different methodology used by European and Soviet schools caused differences in nomenclature. Natura 2000 habitat directives based on CORINE biotope classification system developed legislative basis for conservation of natural habitats in EU. To join this system it was necessary to conduct inventory and develop new schema of habitat types according to Natura 2000 standards in Georgia. We have undertaken an attempt to classify Georgian forest area to the habitat types.The aim to develop habitat classification in countries of European

continent based on the standards of the EUR27 version of the Interpretation Manual includes descriptions of new habitats, which are characteristics to concrete countries. These new habitat types should be accepted by the Commission and to be added to Annex I. Georgia is a country with very diverse habitat types. The habitat classification was done recently **(Akhalkatsi, 2009).** Many forest habitat types are identical to the habitats, which are already included in the Annex I of the Interpretation Manual v. EUR27. However, some habitat types are candidates to be included in the Annex I as new habitat types. The new habitats, which to our opinion should be included in Annex I are: 1) Beech forests with Kolkhic understory (*Fageta fruticosa colchica*); 2) Kolhketi broad-leaved mixed forest; 3) Zelkova forest (*Zelkova carpinifolia*); 4) Arid open woodlands; and, 5) Subalpine birch krummholz. There are habitats, which are identical to related European habitats by species composition on generic level, but species are different. The similarity between European and Caucasian plant species is mainly congeneric and not conspecific. Therefore, some habitats, which are similar to the European habitat types, should be considered as sub-types: 1) Beech forests without understory (*Fageta sine fruticosa*); 2) Dark-coniferous forest *(Picea orientalis - Abies nordmanniana)*; 3) Pine forest *(Pinus kochiana)*; 4) Yew forest *(Taxus baccata)*; 5) Hornbeam forest *(Carpinus caucasica)*; 6) Boxwood Forest (*Buxus colchica*). As sensitive habitats might be considered 1) Beech forests with Kolkhic understory (*Fageta fruticosa colchica*); 2) Kolhketi broad-leaved mixed forest; 3) Bog woodland *Tilio-Acerion* forests of slopes, screes and ravines; 4) Alluvial forests; 5) Alluvial forest with Adler trees - *Alnus glutinosa* and ash tree - *Fraxinus excelsior* (*Alno-Pandion, Alnion incanae, Salicion albae*); 6) Riparian mixed forests; 7) Yew forest *(Taxus baccata*); 8) Zelkova forest (*Zelkova carpinifolia*); 9) Boxwood Forest (*Buxus colchica*); 10) Subalpine birch krummholz.

Forests occupy 32-35% of the territory of Georgia **(Nakhutsrishvili, 2013).** The riparian and marsh forests occur in all regions of Georgia. Mountain forests are represented by lower, middle and upper belts. Oak, beech *(Fagus orientalis)* and beech-chestnut forests grow in the lower and middle belts changing higher in the mountains into the Caucasian fir *(Abies nordmanniana)* and Oriental

spruce *(Picea orientalis)* forests. *Pinus kochiana, Acer trautvetteri* or *Quercus macranthera* grow at tree line ecotone in different regions.

There are also well-developed crooked-stem birch forests *(Betula litwinowii)* at the tree line, usually occupying the steepest northern slopes. Dry open woodlands-relict forests are to be found in semi-arid regions of the eastern Georgia and are composed by *Pistacia mutica, Juniperus spp., Pyrus spp.,* etc. Forested land in Georgia occupies 2.773.400 ha. About 2.2 million ha are classified as state forest under the responsibility of the Department of Forest Management (DFM), and the remaining consists of former "Kolkhoz lands" part of which are now in the process of being transferred to the DFM.

Forests in Georgia are mostly heavily damaged due to over cutting, forest fires, tree disease etc. The degradation of qualitative consistence and productivity of the forest fund lead to reduction and sometimes even loss in the functionality of forests. As a result, avalanches and landslides are happening quite often in the mountainous regions. Virgin forests occupy about 500.000 - 600.000 ha **(Ketskhoveli, 1959).** They are mainly located on steep slopes of the Great and Minor Caucasus where access is restricted. The loss of diversity and changes in species composition in forests is mainly a result of anthropogenic influence. The last few years were characterized by the activation of natural disaster processes in certain mountainous areas of the country (Adjara, Svaneti, and Racha) which also affected the state of natural forests. Recent intensive deforestation activities were unprecedented in the history of the country. This is mainly due to the almost complete reduction of timber imports from Russia after declaration of independence.

Besides, uncontrolled illegal forest cutting have been initiated. Especially vulnerable to cutting activities are former kolkhoz owned forests: their structure is destroyed, the modification of species is speeded up, erosion processes are accelerating, the forest forming plant species are substituted by satellite plant species and scrubs. Or even worse the soil on slopes is simply washed away. Therefore in many places oak groves are replaced by oriental hornbeam, hornbeam, or evergreen scrubs, shiblyak. Much of the State Forest also could not escape. The natural forest provides goods and services such as food, fiber, clean air, recreation and wildlife. Sustaining these lands and their ecological functions for future generations requires in-depth knowledge

of vegetation ecology and management systems; the effects of disturbances such as fire, invasive species, insects and diseases; processes and production systems; and how forests interact with global environmental changes and social systems. One of the main issues is forest genetic resources management. Steps to conserve genetic resources are research on an improved genetic base of native tree species (together with increased economic utilization of its wood), evaluation of the gene base relict and endangered species, development of improved silvicultural techniques, and revised costing standards for plantation establishment.

Conservation and sustainable use of forest resources in Georgia needs development of the following priority objectives: implementation of the Forest Code; reform of silviculture and forest management systems, restoration of tree nurseries, establishment of seed banks, inventory and conservation of forest genetic resources, maintenance of forest health and vitality, involvement of the public in forest resources conservation and sustainable use, research activation in the fields of genetic diversity studies and tree breeding. The Caucasus is characterized by high endemism and considered to be one of the 25 hot spots of biodiversity worldwide. The scientific, material and cultural value of biological diversity for present and future generations is an important reason for its conservation today. It is important to preserve natural diversity by way of conservation of native species in every country of the world. While conservation has made great strides in some areas, there are entire regions where still a lot of efforts should be undertaken for fostering the conservation of endangered species. Among these countries is Georgia as well. Endangered species are described as "plant and animal species that are in danger of extinction, the dying off of all individual species" **(IUCN, 2001).** One out of the eight of the worlds' plant species is threatened by extinction. Scientists put more than 34 000 plant species, out of an estimated total of 270 000 species, at a risk.

Maintaining biodiversity is a fundamental environmental planning objective as the loss of species has an immediate impact in terms of depletion of non-renewable resources. It also affects the balance of ecosystems producing secondary impacts in terms of proliferation or reduction of linked species. Strategic criteria for maintaining

biodiversity include: protection of key habitat areas and protection of ecological links that will allow species to migrate as conditions change.

It should be mentioned, that the occurrence of endangered species in the protected territory alone fails to ensure the maintenance of their population stability without applying appropriate management systems. Much more difficult will be the protection of rare species located outside the protected territories. Concrete recommendations should be given to various official bodies and organizations responsible for nature conservation in Georgia to introduce managed regime at sites where the populations of threatened species occur. Especially urgent is the protection of known localities of species classified as Critically Endangered and Endangered. Special attention should be paid to protect the typical habitats of endangered species.

The Georgian legislation regulating tending, protection and use of the Georgian Forest Funds is based on the Constitution of Georgia and on some laws addressing environmental issues ratified by the Georgian Parliament. The main document is the "Forest Code of Georgia". In accordance with the Constitution, Georgia assumed quite serious commitments in the field of environmental protection and started the development of new environmental legislation in order to comply with the constitution, international agreements, laws and regulations Preparation of the first National Environmental Action Plan (NEAP) commenced in 1996 and was completed in 2000. At present, NEAP has the authority of a regulation. As regards the forest sector, NEAP is rather general. It is more a description of the existing situation of the country's forests rather than a program of activities. NEAP calls for reforms with the following priority objectives: preservation of the diversity of the forest ecosystems; stable regeneration of forest resources; improvement of the relevant legal base; training of personnel in sustainable management; improvement of social and economic conditions of the staff; reform of the forestry system by making it independent from entrepreneurial activity; establishment of conditions which attract private investments in the forestry sector.

The main document is the Forest Code of Georgia dealing with the following issues: Management of the State forest fund; Forest protection; Forest use; Forest restoration and tending; State monitoring, supervision of forest protection and enforcement of the forest legislation; Settlement of disputes on tending, protection, restoration,

afforestation and forest use and liability for infringement of the forest legislation. According to this law, forest can be in ownership of the State, the Patriarchy of Georgia, and physical or legal entities.

This article will come into force only after the enactment of the Law on Privatization of Forests owned by the State. Legal and physical persons using forests and forest resources or engaged in forestry activities, as well as the Patriarchy of Georgia are deemed to be subjects of relationships along with the State. Forests are divided into the following categories according their institutional management: a) protected areas of State forests covering territories specified by the Law on the Protected Area System; b) State forestry (managed by the Department of Forest Management) which includes local forests. Protected areas of State Forests are regulated by the Department of Protected Areas, Nature reserves and Hunting Farms; the State forestry, except local forests, by the DFM, and the local forests by local authorities through the relevant services.

Main goals of the "Forest Code of Georgia" are: protecting human rights and law enforcement in the field of forest relations; conducting forest tending, protection and restoration with the purpose of conserving and improving climate-regulating, and recreational, and other useful natural and cultural environment and its specific components - flora and fauna, biodiversity, landscape, cultural and natural monuments located in forests, rare and endangered plant species; regulating of harmonized interrelations between these components; setting rights and obligations of forest users in the field of forest relations, meeting environmental, economic, social, and cultural needs of population through providing access to forest resources as compatible with scientifically defined allowable norms principles of sustainable forest management.

Georgia accepts some international agreements and treaties concerning environmental protection. Among them is the Declaration on Forest Principles of Sustainable Development adopted at the United Nations Environmental Summit in Rio de Janeiro, 1992, which is supported by the Georgian Law on Environmental Protection.

Other International Agreements related to environment are indicated. As stated in “Harmonization of the National Program of Georgian Legislation with EU Legislation” the Georgian legislation in environmental protection needs harmonization with international

conventions and agreements. Georgia is a member of four conventions concerning Biodiversity and is in preparation to join the "Convention on the conservation of European wildlife and natural habitats".

To assure conformity of Georgian environmental legislation with EU legislation this convention will allow an integrated approach on the regional level for biodiversity conservation. The EU directives mentioned in "Harmonization of National Program of Georgian Legislation with EU Legislation" will help us to solve the following problems in particular: fulfillment of conservation of wildlife and natural (floral) habitats, improvement of forest protection and conservation quality, propagation and restoration of endangered species. However, generally speaking, the legislative base for forest management and protection, as well as for biodiversity conservation is not yet sufficient in Georgia and needs further improvement.

The main problem in habitat conservation strategy was absence on any information on habitat classification and prioritization in Georgia up to recent time. The classical definition of a habitat is a sum of all environmental conditions at a particular place to which an organism, species, or community are normally adapted (**Evans, 2010**). However, the habitat as a conservation unit used by European network programs is based on species composition and plant community types besides the abiotic features. The problem in this case is that there is a serious difference in plant species and community type's taxonomic nomenclature in different countries. This is caused by differences between International Code of Phytosociological Nomenclature (**Weber et al., 2000**) based on two Finland and Swiss schools of phytosociology used in Soviet Union and European countries, respectively. The Georgian geobotanists were using Finland classification systems of plant communities called as associations and phytocenoses (**Grossheim et al., 1928; Kimeridze, 1965; Dolukhanov, 2010; Nakhutsrishvili, 2013**).

Therefore, both plant species and community definitions were different in most countries in the past period and some scientific experts did not have a positive opinion about the suitability for phytosociology to be the main geobotanical approach for managing vegetation systems. The solution of the habitat classification problem was introduced by Natura 2000 habitat directive (Council Directive 92/43/EEC) based on CORINE biotope classification **(Devillers et al.,**

1991) and its successor the Palaearctic habitat classification **(Devillers, Devillers, 1996),** using the phytosociological nomenclature of European syntaxa, which are syntaxonomic or heterotypical synonyms of species names based on different nomenclatural types and are considered to belong to the same syntaxon. This is a way to solve the problem in different nomenclatural systems. To support the development of the EU Natura 2000 network for extension to new east European countries as they have joined the EU in 1996 the Emerald network of Areas of Special Conservation Interest (ASCI‘s) under the Berne Convention was adopted. The list of habitat types was taken from the Palaearctic classification in 1996 **(Devilliers, Devilliers 1996).**

However, later was developed new European Nature Information System (EUNIS) habitat classification (T-PVS/PA (2010)10 revE 09), where the habitats are considered as 'a place where plants or animals normally live, characterized primarily by its physical features (topography, plant or animal physiognomy, soil characteristics, climate, water quality etc.) and secondarily by the species composition of plants and animals that live there**‘(Davies et al., 2004)**. EUNIS habitats are based not on plant communities but on a 10 hierarchy levels where terrestrial and freshwater habitats are the highest level. In the marine sector it is based on the JNCC Marine Habitat Classification for Britain and Ireland **(Connor et al, 2004)** and habitat types developed by the Barcelona and HELCOM marine conventions **(Barcelona Convention, 1998; Helsinki Commission, 1998).** Although, EUNIS habitats are re-structured and re-defined to Annex I of the EU Habitats Directive, they are cross-referenced in the internet databases (http://www.biodi-versitya-z.org). The ASCI‘s of the Emerald network contains several habitat types of Natura 2000 and represents not a habitat but their combination, which will not correspond to the priority areas in each country **(Moss, 2008).** Therefore, it is much easier to identify priority areas by habitats based on plant community type and not on combination of many different habitats. Therefore, all EU countries have developed a classification system where EUNIS units coincide to Natura 2000 habitats **(Evans, 2010).** Thus, the habitat classification becomes the core issue for GIZ project on Caucasus Biodiversity in order to define priority habitat types for the country.

11. ANALYSES OF HABITAT CONSERVATION STRATEGY IN GEORGIA

Georgia signed the CBD in 1994. The state program to assess the biodiversity in the country was started in 1996. This document contains species and habitat diversity and conservation strategy. However, there is no description of the habitats identified with the international classification systems. The vegetation description is presented by major biomes of Georgia. However, the biomes do not coincides with general biome types, but is described as vegetation zones of Georgia. Therefore, the habitat types of Georgia are not presented in this document **(NBSAP, 2005).**

The second issue was evaluation of the habitat disturbances. The major impact on habitat degradation is considered anthropogenic impacts such as forest cutting, wetland drainage and transformation of natural habitats into artificial or semi-natural landscapes. No information is done on climate change effect on habitats. The strategic plan to maintain and restore Georgia‘s species, habitats and genetic diversity was based on methodology of *in-situ* and *ex-situ* conservations and through sustainable use of biological resources, which is a right way for maintenance of biodiversity. However, the problem is ignorance of habitat type classification to be necessary for determination of priority and sensitive habitats, which should be protected as pilot areas. The establishment of special areas for conservation (SAC) should be associated with sensitive habitats. National legislation relating to biodiversity conservation is considered as one of the keystone action for further improvement of nature conservation strategy of the country in this document **(NBSAP, 2005).**

The legislation should be ensuring harmonization to international conventions and laws. Currently, most actual amendments of laws and regulations having contact with habitat conservation include Law of Georgia on Red List and Forest Code. The action plan for maintenance of habitat diversity is considered as identification of threatened plant communities (rare, relic, primary and near primary, globally important, and sensitive communities). This action plan do not coincides with international convention guidelines where plant communities are considered as basis for habitat determination and the priority and

sensitivity of habitats should be considered as a major indicator for determination of threats. The hot spots outside legal protected areas and vegetation types are indicated as conservation targets instead of habitats in this document. As threatened areas are considered in **NBSAP (2005**) Important Bird Areas (IBAs) in Georgia (including complete identification of transboundary IBAs), wetland ecosystems, flood plain forests, overgrazed pastures, semiarid ecosystems and biological corridors (Surami and Gombori ranges). Javakheti Wetlands Conservation Management Plan is considered as approved agreement between the neighboring countries (Armenia, Georgia, Turkey) on a large-scale transboundary project achieved.

The main shortcoming of this document concerning evaluation of habitat conservation strategy is a gap with international conventions and networks such as Natura 2000 and Emerald. Therefore, it is necessary to conduct analyses of these network guidelines and implement them in Georgian NBSAP action plan.

12. NATURA 2000 NETWORK ASSESSMENT IN GEORGIA

The classification and creation of the list of Georgian habitats (Habitats of Georgia, **Akhalkatsi, 2010, Akhalkatsi, Tarkhnishvili, 2012)** based on the directives of Natura 2000 (92/43/EEC and 79/409/EEC) and Interpretation manual (**EUR27**) was made in 2010 in the framework of the GIZ project ―Sustainable Management of Biodiversity, South Caucasus and revised in 2012. The description of each habitat types is composed by sections: 1) General description of distribution area and environmental conditions; 2) Species of plants and animals including dominant, rare and endemic species; 3) Corresponding categories in other countries of Europe; 4) Associated habitats, which occupy adjacent territories; 5) Bibliography. The total number of natural, rural and urban habitats of Georgia is 65. Among them only 21 habitat types are identical to listed in Annex I of Directive 92/43/EEC, 44 different habitat types are present in Georgia, and 25 are priority type.

The syntaxonomic list of the vegetation units Georgia (up to alliance level) is 147 with 66 sub-types of forest habitats. The priority

habitats ensure the conservation of vulnerable areas such as marine, terrestrial and freshwater habitats, wetlands, floodplains and forests with relic and endemic umbrella species including arid open woodlands, Colchic mixed and subalpine birch forests, etc., which in turn helps to safeguard the animals and plants needed these places to survive.

A diverse range of priority habitats should be protected, including as well meadows, estuaries and cave systems and this benefits a huge variety of wildlife species throughout the Georgia. It is not only natural habitat types, but also semi-natural ones, which depend on management of humans (e.g. certain types of grasslands, urban and rural habitats). Habitat types recorded in Georgia is essential for the sake of vegetation mapping and nature conservation. The Emerald Network aims to identify and conserve areas of a great ecological value for both the threatened and endemic species listed in the Appendices of the Bern Convention and for the endangered habitat types. The project ―Development of the Emerald Network in Central and Eastern Europe and the South Caucasus was started in 2008 in 7 target countries - Armenia, Azerbaijan, Belarus, Georgia, Moldova, the Russian Federation and Ukraine.

Since 2009 was started the Joint Programme entitled ―Support for the implementation of the Convention on Biological Diversity Program of Work on Protected Areas in the EU Neighbourhood Policy East Area and Russia : Extension of the implementation of the EU‘s Natura 2000 principles through the Emerald Network (DCI-ENV/2008/149-825), which aimed the implementation of an action to identify species and habitats to protect and in selecting the potential sites suitable for ensuring the long-term survival of the species protected by the Bern Convention. Emerald Network Joint Program in Georgia was done by the local NGO NACRES.

Steps undertaken in April-December 2009 are: (1) GIS boundary data for 17 sites were identified; (2) Final list of 20 species of animals and plants identified/agreed; (3) List of habitats identified/agreed (FPR, 2010). List of habitats: 1. Phrygana; 2. Dense perennial grasslands and middle European steppes; 3. Arctoalpine riverine swards; 4. *Salvinia* covers; 5. Near-natural raised bogs. In December 2010 were identified 17 potential Emerald sites, covering an area of 596475,63 ha.

Total number of species or habitats within the annexes and resolutions are 161 species and 15 habitats. The list of habitats was not presented (TPVS/ PA (2010)10 revE 09). These areas are EUNIS habitats, but these units contain several habitats of Natura 2000 and are cross-referenced to Natura 2000 habitat types in the internet databases. They do not correspond to the concrete plant community types, but contain several habitat combinations. The Emerald network (beyond the EU) is still in its initial phase and needs further implementation.

The Georgia‘s strategic plan to protect priority habitats in the coming NBSAP phase have to take into account the following approaches: Natura 2000 is a basic program in EU nature protection policy which includes a network of protected areas important for conservation of priority habitat types and endangered species **(EUR27).** This program contains classification of the European mainland, extending east to the Ural Mountains, including Anatolian Turkey and the Caucasus **(Sundseth, Creed, 2008).**

This program is best to use for conservation of priority habitats in each country. Integration in Natura 2000 network proceeds in three basic phases for each country: making of national lists of habitats, selecting Site of Community Interest (SCI) and designation of SAC. The Georgian Natura 2000 habitat classification and prioritization is already done. However, the next steps should be implemented in the future.

The Emerald Network ASCIs within EU member states are the same as the Natura 2000 habitats **(EIB, 2009).** This network in EU non-member countries seeks to positively influence the conditions for the survival of habitats and species in the fragmented natural areas and human dominated landscapes, through creation of ‘core areas‘, ‘corridors‘ and ‘buffer zones‘. These ASCIs are based on EUNIS habitat classification.

However, the data bases in the internet (http://www.bio-diversitya-z.org) presenting the areas for protection in all EU member countries contains both EEA‘s/EUNIS and Natura 2000 habitats databases. The data from EU non-member countries are included in these data bases in a few amounts. This is the one of the main approach for involving in a strategic plan of NBSAP of Georgia to introduce the data on Georgia‘s habitats and ASCI‘s in these data bases.

The European Landscape Convention **(**Florence Convention) promotes the protection, management and planning of landscapes and organizes European co-operation on landscape issues with non-member states.

The Convention was signed by Georgia in 12.05.2010. The main approach of this program is to identify each landscape forms and structures in the country: types of territories, social perceptions and ever-changing natural, social and economic forces. Once this identification work has been completed and the landscape quality objectives set, the landscape can be protected, managed or developed.

The main aim of this convention is to reveal and sustain the great diversity of the interactions between humans and their environment, to protect living traditional cultures and preserve the traces of those which have disappeared, these sites, called cultural landscapes, have been inscribed on the UNESCO‘s World Heritage List. WWF of Georgia started project on natural heritage area determination in 2012.

Urban environment protection actual when intervention of some functions of habitat takes place in an urban area. The protection of rural areas is not implemented so far. The problem remains for the species, which are growing in rural habitats and on arable lands mixed with field crops have different assessment to threats **(Akhalkatsi et al. 2012).** These species are depending in their existence to the monitoring of arable lands, which crop will be sown, how will be transformed field crop to pasture or hay meadow, or what kind of herbicides and mineral fertilizers will be used in the field. The governmental institutions should control the processes which might bring to the genetic erosion of CWRs having high value of conservation. In this case the legislation bases should be effective to control local farmers not affect CWRs with ecologically unsuitable for this species actions in the field leading to changing in technology of field cultivation methodology and leading to disturbances of wild weed species of high conservation value.

Climate change impacts are forecasted to lose 52%±12.1 of European vertebrates and plants within existing terrestrial protected areas by 2080 (T-PVS/Inf (2009)10 rev). Effective biodiversity conservation requires the identification and management of stationary refugia, or range retention areas (where species are most likely to survive despite climate changes), displaced refugia (where species are able to find suitable conditions after being displaced by climate

change), and areas of high connectivity (allowing species to track climate changes through dispersal; **Araújo 2009**). From the habitat types flatland areas are more reflected by climate change. High altitude habitats may gain species at the expense of the loss of cold-adapted species, some of which are narrow endemics. The safeguarding of new conservation lands freshwater and marine habitats as well as refugia and corridors to upland habitats would allow the establishment of migrating species in the long-term. An integrated policy for mitigation of climate change impacts on biodiversity requires that current approaches for the management of protected areas should be revised.

Transboundary Protected Areas (TBPAs) are recognised by IUCN World Commission on Protected ‘Areas‘(WCPA) as conservation initiatives for National Parks, Conservation and Development Areas, and Transboundary Migratory Corridors. TBPAs are managed cooperatively between two or more countries or the national sub-units. TBPAs are of significant biodiversity importance as large protected areas, which are effective for allowing greater migration of species, especially fauna, maintenance of landscape connections, where animals, plants, and ecological processes, including the human being, can move freely from one habitat to another. TBPAs are also important for adapting to climate change by linking landscapes and allowing ecological processes to take place in fragmented ecosystems. TBPAs allow for greater control of pest species or alien invasive species, poaching and illegal trade across boundaries, reintroduction of large species. The south boundary of Georgia with Turkey was protected long time by military and the territories are actuals for creation of TBPAs in Javakheti, Meskheti and Adjara.

Action Plan:

1. The following actions should be considered as agenda for conservation of habitats in Georgia: (1) to harmonize habitat and species lists through co-ordinate interpretation of the habitat types included in the lists; (2) to create relevant data for areas of special conservation interest and make available to the public, including mapping of designated areas on a Pan-European scale, compatible with geographical information systems and available on the Internet; (3) strengthen the legal status for recognition and protection of the areas by national government; (4) incorporate development of the Natura 2000/Emerald networks into European

Union development assistance programs, namely through European Union accession and neighborhood policies; (5) strengthen existing guidance and mechanisms for reporting and implementation with a view to being able to react to non-compliance with infringement procedures, similar to the European Union procedures.

2. As a next step will be done acceptance of Natura 2000 priority habitats by government and the creation of designating SCI by scientific assessment of threat status and distribution of mentioned habitats at national level. While doing this, it is necessary to take into cons ideration ecological quality of habitats, degree of representatively, size and density of the population of threatened species, degree of isolation, determine umbrella species, etc. After the site has been designates as SCI, member state has six years to declare it as SAC. The most endangered sites have to be protected first. During this six year period member state has to gradually implement different measures for the protection of these areas. Additionally, connectivity between Natura 2000 sites and other areas of conservation need to be further improved, namely thought wider countryside measures;
3. The Emerald Network projects should conduct following activities: (1) Draw up and implement management plans which will identify both short- and long-term objectives; (2) Clearly mark the boundaries of ASCIs on maps; and, as far as possible, on the ground; (3) Conduct training of national multidisciplinary Emerald teams; (4) Provide the evaluation of threats in the chosen 17 ASCIs of the Emerald Network; (5) Do description of selected areas of special conservation interest using the Standard data form of the Emerald/Natura 2000 software which are fully compatible with each other.
4. Each planned possibly threatening activity in the Natura 2000/Emerald sites has to be assessed from the nature protection point of view. Also, the public has to be involved in this assessment. It is necessary to avoid any activity that can negatively influence on the ecologically important area, except in the cases of prevailing public interest. In those cases, activities are approved, but with determination of compensatory measures that are primarily concerning the designation of substitute protected area at the other location.

5. Sometimes certain activities have to be restricted or stopped where they are a significant threat to the species or habitat types for which the site is being designated as a Natura 2000 site. Keeping species and habitats in good condition is not necessarily incompatible with human activities; in fact many areas are dependent upon certain human activities for their management and survival, such as agriculture. The European Commission invites partnership with small and medium sized enterprises (SMEs) at the local level to support Natura 2000 sites in activities such as eco-tourism. The EU member states are responsible for ensuring that all Natura 2000 sites are appropriately managed by conservation authorities in each country. It will be future perspective to provide guidelines to support SAC areas as conservation units for eco-tourism activities in different regions of Georgia.

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