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Diversity, Threats, Conservation and Wise Use of Flora Endemics of Imereti Region

(Nominated for the degree of Doctor of Biology)

Specialty: **Plant Biodiversity**

Annotation

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The dissertation is performed in the Department of Systematics of the Georgian Institute of Botany and in the Department of Biology of Batumi Shota Rustaveli State University.

General description of the paper

Topicality, novelty and significance of the scientific topic. The study of endemic flora is of great importance for the identification of regional florogenesses, which facilitates the cognition of the formation and further development of flora and vegetation. The diversity and originality of the flora of Imereti is promoted by floristic complexes containing relict and endemic species. The abundance of endemic species always reflects that this or that region or country is floristically original. Imereti region is also distinguished in this respect. The study of these processes, as well as the peculiarities of the geography, systematic structure and hypsometric distribution of endemic species, is important for the identification and study of general patterns of species formation.

The issue becomes more relevant when it comes to endemic medicinal species. It is very important for the region to study, establish a base and distinguish from the endemic flora of these species. Based on the knowledge of the chemical composition and medicinal properties of plant, it is possible to use plant raw materials to obtain new medicinal and prophylactic drugs / it is also important to collect medical knowledge scattered among the people and document ethnobotanical materials. Especially since for the last few decades little attention has been paid to the study of this issue.

Research goal. Creating a database of endemic flora species in Imereti, determining the geographical and systematic structure of the species, studying and analyzing the peculiarities of ecotopological and hypsometric distribution. Recommendations for conservation and wise use of limestone habitat and limestone endemics of Imereti floristic region.

Objectives. The following objectives were set in connection with all this:
- Determining the species composition and systematic, geographical and ecotopological structure of the endemic flora of Imereti;
- Imereti Botanical-Geographical zoning;
- Determining the distribution regulations of endemic species in the botanical-geographical areas of Imereti;
- Determining the regularity of hypsometric distribution of endemic species;
- Study of anthropogenic impacts (deforestation, cattle grazing, fires, invasive species);
- Recommendations on the need to grant conservation status to habitats with exceptional biodiversity outside the protected area;

- Inventorization of endemic medicinal species common in Imereti, determination of their geographical and systematic structure and study of ecotopological features. Literary search of chemical composition and medicinal properties of plants and creation of a base of endemic medicinal plants in Imereti. Also, description of folk medical traditions in the Imereti region and documentation of traditional medical knowledge in different parts of Imereti, conducting small excursions in different parts of Imereti and collecting ethnobotanical material based on them, describing and documenting medical traditions.
- Determining the species composition and systematic, geographical and ecotopological structure of the endemic medicinal flora of Imereti. Distribution of medicinal endemic species in the botanical-geographical regions of Imereti. Search the literature for processing to determine the existence of medicinal properties of plants.

Research object. The object of research was to determine the specific composition of the endemic flora of Imereti and the areas of individual endemic species in the whole territory of Imereti. Field data were collected mainly in Kutaisi area, Mukhnari forest, Sataplia reserve, Ajameti reserve, Tskaltsitela gorge, Gelati forest, Dokhora mountain, Tkibuli area, Nakerala southern slope, Tskhrajvari mountain, Kvirila gorge near Kharagauli, in Sairme area of Baghdati district, on the northern slope of the Meskheti ridge (2850 m), in Chiatura district and others. In all types of plant formations, in groups of associations and in the zone within 15 m. to 2850 m. above sea level.

Research method. Habitat and plant cover frequency studies are performed using the DAFOR method; D-dominant species, A-frequent, F-massive, O-few, and R-rare. The name of a given habitat also derives from the dominant species;
- The quadrat method is used in phytocenotic research in this habitat. The dimensions of the quadrats vary as follows: 0.01-0.25 cm^2 for bryophytes, 0.25-10 m^2 for cereals and grasses, and 10-50 m^2 for woody vegetation.
- Braun-Blanquet method is used in field research in the paper.
- During the studies, special attention is paid to: the type of habitat, its ecological condition, vegetation cover (in%), species composition, and their abundance, individual species vitality (viability). The main guide for field research is terrestrial plant ecology.

The quadrat method. The quadrat method is used in phytocenotic research in this habitat.

A special field form was prepared for the fieldwork. The form indicates: surface and individual species coverage (%), rating on Braun-Blanquetia scale, height, tier, phenophases, anthropogenic impact, time, weather. The data of each form is entered into an excel file, which is necessary for the subsequent PC ord program that establishes plant communities. The following is the conservation status of a given, rare species.

Collected herbarium material. Herbarium material was collected in Imereti river valleys and mountain systems of Northern and Southern Imereti in 1996-2019. Several dozen herbarium plants have been collected, which are preserved in the herbarium of Kutaisi University. The taxonomy and nomenclature of the species were established according to the

first (1941-1952: 52) and second (1971-2016) editions of "Flora of Georgia", "Georgian Plant Survey", S. Cherepanov's Nomenclature Reference, web pages: *plantlist* and *Ipni* as well as R. Gagnidze's "Concept of Georgian Flora - Nomenclature List" and compared to the "Red List of Endemic Flora of the Caucasus".

In addition to our own materials, we used the herbarium preserved at Kutaisi Tsereteli University and Tbilisi N. Ketskhoveli Institute of Botany (TBI),floristic and ethnobotanical records, phenological observations and collected herbarium materials collected in the field. The latter was processed at Kutaisi Tsereteli University.

Field data were collected mainly in Kutaisi area - "Mukhnari forest", Sataplia forest, Ajameti forest, Tskaltsitela gorge, Okriba, Gelati forest - Dokhora mountain, Tkibuli area, Nakerala southern slope – on the Tskhrajvari mountain (1650 m. above sea level), in Baghdati district - Sairme area, in Chiatura district, in Jruchula river gorge, on the northern slope of Meskheti ridge - Mepistskaro mountain (2850 m. above sea level). Data were collected in all types of plant formations and zones, in the range of 15 m to 2850 m above sea level. The research was conducted using modern ethnobotanical research methods and interviews of floristic research.

Basic results of labor and scientific novelty

- 5 botanical-geographical regions and sub-regions were allocated for Imereti on the basis of the vertical belt of vegetation, systematic structure of flora, peculiarities of florocomplexes, quantitatively and cenotypically leading taxa and endemic species;

- Specific composition, systematic and geographical structure of Imereti endemic flora have been specified;

- The regularities of the distribution of endemic species in the botanical-geographical regions of Imereti have been studied; in biotopes;

- The regularities of hypsometric distribution of endemic species of different geographical origins have been studied;

- A concept of endemic species of Imereti has been compiled, which shows the distribution of the given species in the vertical zone of vegetation, biotope and botanical-geographical area of Imereti, as well as their exact location;

- The systematic and geographical structure of the endemic flora endemic to southern Imereti, which has not been studied from a botanical point of view, has been specified.

- A list of endemic medicinal plants of Imereti has been compiled through inventorization and the traditional knowledge of the population of some districts of Imereti has been documented on the basis of ethnobotanical materials.

Approval of research results:

The materials of the dissertation were presented to the Academic Board of the Department of Biology of the Faculty of Natural Sciences and Health Care of Batumi Shota Rustaveli State University in the form of seminar and colloquium papers and presentations (2018-2019). The paper successfully passed the approbation on the Faculty Board.

The results of the research have been published in high-ranking scientific journals, as well as in the papers of several international conferences.

Dissertation volume and structure:

The text of the dissertation includes 158 computer-printed pages and consists of an introduction, literature review, experimental part, conclusions and a list of literature. The text includes: 25 tables, 19 pictures, 8 diagrams, 6 maps.

Literary Review:

The first part of the dissertation gives the results of the literary analysis. The natural-climatic description of Imereti region, the history of the study of Imereti flora, the history of the study of the herbarium of Kutaisi University are given.

Chapter 1. Natural-climatic characterization of Imereti region

Imereti is a floristically rich and diverse region in western Georgia, in the eastern part of the Kolkheti Plain. Imereti is part of the ancient Mediterranean world in the sub-Mediterranean region of Kolkheti or Eastern Evxin province. Its territory includes parts of Racha-Lechkhumi and Imereti limestones, Kolkheti lowlands and foothills, Guria-southern Imereti districts. Imereti is divided into Lower and Upper Imereti, the total area is 6.6 thousand km^2, which is 9.2% of the total area of Georgia.

Rivers. All rivers flowing into the Imereti zone belong to the Black Sea basin and are divided into upper and lower inland water regions (Lortkipanidze, 1997: 37). The main transit rivers of Imereti are Rioni and Tskhenistskali (the length of Rioni within Imereti is 95 km, and the length of Tskhenistskali is 60 km).

Map 1. Floristical regions of Georgia

Soils. According to the classification scheme developed by I. Sabashvili, alluvial carbonate and non-carbonate soils of the Imereti region are spread in the Imereti region. - yellow-earth heavy loamy soils, yellow-earth loamy soils, red-earth soils, humus-carbonate (typical and alkaline) medium-depth loam soils, humus-carbonate, shallow, bare core rock,

forest sandy soils (acidic and weakly fed soil), brown loosely loamy, heavy loamy soils, loamy, medium to shallow and heavily washed soils, mountain-meadow, peaty and primitive soils.

Climate. Imereti is located in a humid climate zone of the sea and is characterized by high altitude zonation to match the relief. Imereti plain - the plain has an extremely humid subtropical climate.

Due to the seasonality of atmospheric precipitation distribution in Imereti, the climate of most parts of the region belongs to the type of Mediterranean climate.

Chapter 2. History of Imereti Flora and History of Kutaisi University Herbarium

Kutaisi Akaki Tsereteli State University was founded in 1933, the first head of the Department of Botany was Academician Niko Ketskhoveli. Imereti flora was studied by A. Kuthatheladze, L. Kemularia-Natadze, E. Sokhadze, M. Sokhadze, R. Gagnidze and the staff of the department. The total number of the collection includes 25,600 sheets. Specimens of 126 families, 492 genera and 1267 species are preserved here. The herbarium has no index. There are also types of endemics in the herbarium: *Campanula irinae* A. Kuthatheladze; *Genista sachokiana* A.Kuthatheladze; *Potentilla kemulariae* Kapell. et A.Kuthatheladze.

Chapter 3. Vertical zoning of Imereti vegetation, main core of vegetation distributed in zones and endemic species

The relief of Imereti is flat-hilly, low and medium-mountainous, therefore the various climatic and soil conditions determine the vertical zoning of vegetation, which is of the Colchian type. The region is characterized by mixed-leaved, broad-leaved and dark coniferous forests, subalpine and alpine zones. Imereti lacks a subnival zone due to relatively low absolute heights; The distribution of the alpine zone is also limited and it is expressed in a narrow strip up to 2500-2800 m. above sea level on the Adjara-Imereti ridge.

According to O. Chkheidze Imereti vegetation can be presented with several zones:

I. Forest area - with 6 zones:

1. Wetland vegetation zone of Kolkheti plain (15-150 m above sea level).

2. Oak and oak-hornbeam forests zone of Kolkheti plain and adjacent hilly foothills (160-600 m above sea level).

3. Mixed broad-leaved forest zone of lowland Kolkheti (600-1200 m above sea level).

4. Medium-sized chestnut-hornbeam forest zone.

5. Beech forest zone of the upper mountain area.

6. Mixed (beech-dark coniferous) and coniferous forest zone of the upper mountain area.

II. Subalpine forest-meadow zone.

III. Alpine meadow zone.

Experimental part

Chapter 4. Botanical-geographical zoning of Imereti

A. Kolakovsky distinguishes the sub-provinces ofnon-limestone and limestone soils in the Kolkheti forest and alpine provinces. The non-limestone sub-province is

characterized by relict mesophilic forests with their evergreen undergrowth. As for the limestone soils of Imereti, it is completely located on the foothills of the limestone sub-province of Kolkheti forest province and in the mountainous areas.

During the botanical-geographical zoning of Imereti, as a region of diverse orographic conditions, vertical zonation, systematic structure of flora and peculiarities of florocomplexes were taken into account, as well as geomorphological zone of Imereti given by O. Chkheidze. (Chkheidze ... 2004: 78) In order to facilitate the study of the flora of the region, at this stage we have identified 5 botanical-geographical areas for Imereti:

I. Kolkheti lowland region (eastern part of Kolkheti lowland);

II. Khvaml-Racha ridge and Askhi massif district (southern slope of Khvaml-Racha ridge and south-eastern part of Askhi massif);

III. Okriba district (foothills of northern Imereti);

IV. Upper Imereti Plateau and Likhi Ridge District (Western Slopes of Upper Imereti Plateau and Likhi Ridge);

V. Meskheti ridge district (sections of Guria-Imereti, Adjara-Imereti, Akhaltsikhe-Imereti ridges).

Chapter 5. Systematic, geographical and ecotopological review of endemic species of Imereti flora

1.1. Systematic structure of endemic flora of Imereti

According to the results of the study, the diversity of endemic flora of Imereti is defined by 142 species, which belong to 35 families and 81 genera, which is 15.7% of the total floristic composition of Imereti (900 species). Particularly noteworthy is the genus richness of the endemic flora. E.g. the numerical ratio of endemic genera to the total number of species is 1:1.75.

Analysis of distribution of endemic species of Imereti flora in systematic, ecotopological and botanical-geographical areas.

Table 1

№	Family	Species	endemizm	Habitat tipe	Botanical-geographical region
1	2	3	4	5	6
	Apiaceae	*Anthriscus schmalhausenii* (LC)	K	Subalpine vegetation	I,II,III,IV
1)		*Astrantia colchica* (EN)	G (Colch)	Crushed on limestone. Subalpine	V

2)		*A.trifida* (NE)	K	Subalpine meadows	V
3)		*Chaerophyllum roseum* (NE)	K	Subalpine meadows	IV
4)		*Cnidium grossheimii* (DD)	G	On subalpine belt models, forest fields.	I
5)		*Heracleum chorodanum* (NE)	K	In the middle of the mountain belt. Grassy slope, bush. In Raqqa, on forest edges.	I,III
6)		*H. grossheimii* (DD)	G (Colch)	High grasslands, sloping stony slopes	II
7)		*H.leskovii* (LC)	K	Demolished stony slope, Subalpine	II,IV
8)		*H.mandenovae* (DD)	K	Subalpine meadows	II
9)		*Peucedanum adae* (LC)	K	On dry open slopes, in clear oak forests	III
10)		*Polylophium panjutinii* (EN)	G (Colch)	Subalpine limestone habitat	II
11)	*Asteraceae*	*Achillea griseo-virens* (DD)	K	Subalpine meadows	II
12)		*Anthemis macroglossa* (DD)	K (Colch)	Subalpine meadows 1800-2600 m a.s.l.	II,IV
13)		*A.schischkiniana* (DD)	G (Colch)	Subalpine meadows	V
14)		*A.sosnovskyana* (NE)	K	Alpine medows, stony habitat 1800-2200 m a.s.l.	V
15)		*A.woronowii* (DD)	K (Colch)	Forested rocky habitats	I,II,III,IV,
16)		*Cicerbita deltoidea* (NE)	K	Fagetum-Abietum habitat 800-2000 m a.s.l.	II
17)		*C.prenanthoides* (NE)	K	Subalpine high grassland 2500 m a.s.l.	III,IV
18)		*Cirsium imereticum* (LC)	G (Colch)	Forested rocky habitat, subalpine meadows	V
19)		*C. kemulariae* (DD)	G	Subalpine meadows	IV
20)		*C.oblongifolium* (VU)	G (Colch)	Fagetum-Abietum habitat	II
21)		*C.sosnowskyi*	G	Subalpine limestone habitat	II,III,IV

		(LC)	(Colch)		
22)		*Hieracium x abacurae* (DD)	G	Subalpne meadows 1200-2100 m a.s.l.	II
23)		*H.elisabethae* (DD)	K	To the middle belt of the mountain, up to the subalpine, on an open slope	I,III
24)		*H. x pseudosvaneticum* (LC)	K	Rare in subalpime and alpine meadows	II
25)		*H. x raddeanum* (LC)	K	From the middle belt of the mountain to the upper belt in mukhnar and other deciduous forests.	I,III
26)		*Inula magnifica* (LC)	K (Colch)	Forest-meadow subalp. On high grass.forests	I,III
27)		*Lapsana pinnatisecta* (DD)	K	On the upper reaches of the forest, sometimes as a weed.	II
28)		*Petasites georgicus* (DD)	G	In the middle and upper part of the mountain. River valleys	III
29)		*Psephellus colchicus* (LC)	K (Colch)	Subalpine limestone habitat	II,III
30)		*Pyrethrum chamaemelifolium* (LC)	K (Colch)	Lime stone habitat	II
31)		*P.peucedanifolium* (DD)	K	Forested rocky habitat	IV
32)		*Senecio massagetovii* (DD)	K	Subalpine limestone habitat	II
33)		*S.platyphylloides* (LC)	K (Colch)	Subalpine high grassland	II
34)		*S.rhombifolius* (NE)	K	Subalpne high grassland	III
35)		*Taraxacum confusum* (NE)	K	Subalpine meadows	I
36)		*T.grossheimii* (NE)	K	Nixed brial leaves forest in ruderal habitat	I,III
37)		*Tephroseris cladobotrys* (LC)	K	Subalpine high grassland	II
38)		*Tripleurospermum colchicum*	K	Rocky forst and subalpine stone habitat	I,IV

		(DD)			
39)	*Betulaceae*	*Corylus imeretica* (DD)	G (Colch)	Lime stone habitat	III,IV
40)	*Boraginaceae*	*Nonea decurrens* (DE)	K	Subalpine meadows	III
41)		*N.setosa* (NE)	K	Subalpine meadows	III
42)		*Paracynoglossum imeretinum*(VU)	G	Forested Rocky habitats	I,II,III,V
43)		*Symphytum grandiflorum* (LC)	K	Moist, shaded area of lower and middle belt of forest. Following the fences.	I,III
44)	*Brassicaceae*	*Arabis nordmanniana* (LC)	K	Humid rocky forest	I
45)		*Draba bryoides* (NE)	K	Rocky habitat, subalpine habitat	II
46)		*D.imeretica* (EN)	K (Colch)	Limestone, the middle belt of the mountain	I,III
47)		*D.mingrelica* (NT)	G (Colch)	Limestone, the middle belt of the mountain	II
48)		*Erysimum ibericum* (NE)	K	A rock falls habitat 1500-2800 m a.s.l.	IV
49)	*Campanulaceae*	*Asyneuma campanuloides* (NE)	K	Subalpine meadows	II,III
50)		*Campanula albovii* (DD)	G	The upper belt of the forest cracks in the rocks	V
51)		*C.collina* (DD)	K	The upper belt of the forest cracks in the rocks	V
52)		*C.imeretina* (NT)	G (Colch)	The upper belt of the forest cracks in the rocks	I,III
53)		*C.irinae* (VU)	G (Imer)	Rocky stone habitat	II
54)		*C. kemulariae* (VU)	G (Imer)	Lime stone habitat	III,IV
55)		*C.letschchumensis* (VU)	G (Colch)	Limestone habitat	I,II,III
56)		*C.longistyla* (LC)	G (Colch)	Dry slope s of forest	I,III

57)		*C. makaschvilii* (VU)	G	Dry slope s of forest	I
58)		*C. radchensis* (VU)	G (Colch)	Limestone habitat 2000 m a.s.l.	I I
59)		*C.sphaerocarpa* (LC)	K (Colch)	Rocky habitats	V
60)	*Caprifoliaceae*	*Cephalaria gigantea* (NE)	K	Subalpine meadows	II,V
61)		*Scabiosa caucasica* (DD)	K	Subalpine meadows subalpine high grassland	V
62)		*S. colchica* (NT)	G (Colch)	Ricky habitats	III
63)		*S.georgica* (LC)	K	Dry slope s of forest	I,IV
64)		*S.imeretica* (NT)	G (Colch)	Lime stone forest	II,III
65)		*Valeriana colchica* (LC)	K (Colch)	Subalpine meadows subalpine high grassland	II,IV
66)		*V.jelenevskyi* (LC)	K (Colch)	Granite rock and ricky habitats subalpne	III,IV
67)		*V.tiliiflora* (DD)	K	Subalpine meadows subalpine high grassland	II,III,IV
68)	*Caryophyllacea e*	*Dianthus caucasicus* (LC)	K	meadows	IV
69)		*D. imereticus* (NT)	K (Colch)	Lime stone habitat	I,II,III,IV
70)	*Celastraceae*	*Euonymus leiphloea* (NE)	K (Colch)	Wet places, cracks in the rocks 1500 m a.s.l.	I,II,III,IV
71)	*Euphorbiaceae*	*Euphorbia macroceras* (NE)	K	Subalpine meadows subalpine high grassland	I,III,IV
72)		*E.scripta* (LC)	K (Colch)	Subalpine meadows	I,III,IV
73)		*Leptopus colchicus* (VU)	K (Colch)	Limestone ricky habitat	I,III
74)	*Fabaceae*	*Anthyllis irenae* (DD)	K	Meadows the upper and middle belts of the hills	II,III,IV
75)		*Astragalus kemulariae* (LC)	G (Colch)	Stone habitat	I,II,III
76)		*Galega orientalis* (NE)	K	Subalpine meadows subalpine	I,IV

				high grassland	
77)		*Genista patula* (NE)	K	Lowlands and meadows of the lower belt of the forest In deciduous forests	II
78)		*G.sachokiana* (NT)	G (Imer)	Limestone habitat	II,IV
79)		*Lotus caucasicus* (NE)	K	High grassland	I
80)		*Vicia antique* (NE)	K (Colch)	Bushland, meadows	I,III
81)		*V.ciliatula* (NE)	K	Wet places, cracks in the rocks 1500 m a.s.l.	IV
82)		*V.grossheimii* (NE)	K	Forested meadows	III
83)	*Fagaceae*	*Quercus imeretina* (VU)	G	The lower part of the mountain, peatland	I,II,III,IV
84)	*Gentianaceae*	*Gentiana kolakovskyi* (DD)	G (Colch)	Lime stone habitat	II
85)		*Swertia iberica* (NE)	K	Subalpine meadows	II,III,V
86)	*Lamiaceae*	*Thymus caucasicus* (NE)	K	Alpine stone habitat	V
87)		*Th.collinus* (NE)	K	Rocky ecotopes, lower and middle belt of the mountain	III
88)		*Th.ladjanuricus* (VU D2)	G (Colch)	Lime stone habitat	IV
89)		*Th. nummularius* (DD)	K	Alpine stone habitat	V
90)	*Malvaceae*	*Alcea transcaucasica* (DD)	G	Forest-rock hemix. Shrubs, on forest edges	I
91)	*Orobanchaceae*	*Euphrasia caucasica* (NE)	K	Forested Rocky meadows	II,III
92)		*E.kemulariae* (DD)	G (Imer)	Rocky habitat for upper belts from the forest till subalpine meadows	II
93)		*Rhinanthus colchicus* (DD)	K	Limestone habitat	II,III
94)	*Paeoniaceae*	*Paeonia caucasica* (LC)	K	Forest	I,II,III,IV
95)		*P.macrophylla* (VU)	K (Colch)	Carpinetum-Oak habitat	IV
96)		*P.ruprechtiana* (EN)	G (Colch)	Lime stone bushlend	IV

97)	*Plantaginaceae*	*Digitalis ciliata* (LC)	K	Pinetum on shale strips of rocky habitat	III
98)		*Paederotella pontica* (VU)	K	Subalpine ricky habiats 1000-2700 m a.s.l.	I
99)		*Verbascum alpigenum* (NE)	K	Subalpine meadows	IV
100)		*Veronica galathica* (NE)	K	Limestone habitat	IV
101)		*V.imerethica* (DD)	K	Limestone habitat	I,III
102)	*Polygalaceae*	*Polygala caucasica* (NE)	K	Various forests, in the middle belt on alpine meadows.	I,II,III
103)		*P.makaschwilii* (DD)	K	Limestone habitat	I,II,III,IV
104)	*Primulaceae*	*Cyclamen colchicum* (VU)	G (Colch)	Crused stony habitat	III
105)		*Primula woronowii* (NE)	K	forest	I,II,III,IV
106)	*Ranunculaceae*	*Aquilegia caucasica* (NE)	K	Subalpine meadows	I,IV
107)		*A.colchica* (EN)	G (Imer)	Lime stone habitat	IV
108)		*Delphinium flexuosum* (NE)	K	Subalpine high grassland	IV,V
109)		*D.thamarae* (VU)	G	On the upper slopes of the forest, on the forest edges	V
110)		*Helleborus abchasicus* (DD)	K	On the front of the mountain, on the limestone in the middle of the mountain.	II,III
111)		*H.caucasicus* (DD)	K	Mixed broad live forest	I,II,III,IV
112)		*Ranunculus baidarae* (VU)	K	On the upper belts of the forest.	II
113)	*Rhamnaceae*	*Rhamnus cordata* (NT)	G (Colch)	Lime stone habitat	II,III
114)	*Rosaceae*	*Alchemilla kozlowskii* (NE)	K	meadows	II
115)		*A.subcrenatiformis* (DD)	G	Forested meadows	II
116)		*A.undecimloba*	K	Subalpne high grassland	II

		(DD)			
117)		*A.woronowii* (DD)	G	Rocky slopes, subalpine meadows	II
118)		*P.caucasica* (DD)	G	Mountain forest bush	I,II,III
119)		*Potentilla imerethica* (DD)	G (Imer)	Limestone habitats	II,IV
120)		*P.kemulariae* (VU)	G (Imer)	The middle belt of the mountain open places on the mixes.	II
121)		*Rubus moschus* (DD)	G (Colch)	Mixed forest	II,IV
122)		*R.ponticus* (DD)	G	Forest	II,IV
123)	*Rubiaceae*	*Asperula abchasica* (LC)	K	Alpine meadows, lime stone habitat	II
124)		*A.kemulariae* (NE)	K (Colch)	Lime stone habitats	II
125)		*Galium valantoides* (NE)	K	o the middle of the mountain belt to the Alpine belt	I,II,III,IV
126)	*Santalaceae*	*Thesium laxiflorum* (LC)	G	On the lower belt of the mountain. On the grassy slope. On the forest edges.	I,II,III,IV
127)	*Scrophulariaceae*	*Scrophularia imerethica* (NT)	G (Imer)	In the middle of the mountain belt forests, on dry slopes.	II
128)		*S.lateriflora* (NE)	K	Rocky ecotopes, mountain upper subalpine belt.	II,III
129)	*Solanaceae*	*Atropa caucasica* (NE)	K	Forests, forests.mountain in the middle of the mountain.in shaded areas.	II,III
130)		*Solanum woronowii* (NT)	K	In the middle of the mountain belt. In the valleys.	III
131)	*Thymelaceae*	*Daphne axilliflora* (NE)	K	In the lower and upper belt forests of the mountain, on the banks of rivers and waterfalls.	III
132)		*Daphne pseudosericea* (EN)	K (Colch)	In the upper belt of the forest, in the alpine	II,III

133)	*Urticaceae*	*Parietaria kemulariae* (VU)	G (Colch)	Lime stone habitat	I,III,IV
134)	*Alliaceae*	*Allium gracilescens* (NT)	G (Colch)	Forest-Rock Hemix. The lower belt of the mountain	III
135)	*Amaryllidaceae*	*Galanthus schaoricus* (EN D)	G	Shrubs in the middle belt of the mountain	I,II,III,IV
136)		*Galanthus woronowii* (NE)	K	Mixed broad lives forest	I
137)	*Asparagaceae*	*Muscari alpanicum* (VU)	G	Lime stone habitat	II
138)		*Ornithogalum imereticum* (VU)	G (Imer)	In shady forests, up to the middle belt of the mountain.	I,III
139)	*Iridaceae*	*Iris colchica* (NT)	K	To the middle of the mountain belt, on the forest edges, open bushland	I,II,III
140)	*Liliaceae*	*Erythronium caucasicum* (NE)	K	In the middle and upper belt forests of the mountain.	I,II,III
141)	*Orchidaceae*	*Ophrys caucasica* (NE)	K	To the middle of the mountain belt, on the forest edges, open bushland	I,II,III

CR – Critically endangered, EN – Extent in Nature, VU - vulnerable, NT – Near Threathened ,DD – Date Deficient, LC – Last Cincern, NE – Not Evaluated

K-endemic species for Caucasus, Colch- endemic species for kolkheti, G- endemic species for Georgia, Imer- endemic species for Imereti

Distribution of endemic species in large taxonomic units.

Table 2

Taxons	Family		Genera		Species	
	unite	%	unite	%	unite	%
Total:	**35**	**100**	**81**	**100**	**142**	**100**
Dicotyledoneae	29	82,9	74	91.4	134	94.3
Monocotyledoneae	6	17.1	7	8.6	8	5.7

Note: Percentage is calculated from the total number of endemic taxa (family, genus, species) common in Imereti.

Distribution of endemic species in families

Table 3

№	Family	Number of species	K	Colch	G	Imer
1	*Apiaceae*	11	7	3	4	-
2	*Asteraceae*	28	21	10	7	-
3	*Betulaceae*	1	-	1	1	-
4	*Boraginaceae*	4	3	-	1	-
5	*Brassicaceae*	5	4	2	1	-
6	*Campanulaceae*	11	3	6	8	2
7	*Caprifoliaceae*	8	6	-	2	-
8	*Caryophyllaceae*	2	2	1	-	-
9	*Celastraceae*	1	1	1	-	-
10	*Euphorbiaceae*	3	2	2	2	-
11	*Fabaceae*	9	7	2	2	1
12	*Fagaceae*	1	-	-	1	-
13	*Gentianaceae*	2	1	1	1	-
14	*Lamiaceae*	4	3	1	1	-
15	*Malvaceae*	1	-	-	1	-
16	*Orobanchaceae*	3	2	-	1	-
17	*Paeoniaceae*	3	2	2	1	-
18	*Plantaginaceae*	5	5	1	-	-
19	*Polygalaceae*	2	2	-	-	-
20	*Primulaceae*	2	1	1	1	-

21	*Ranunculaceae*	7	5	-	2	1
22	*Rhamnaceae*	1	-	1	1	-
23	*Rosaceae*	9	3	1	6	2
24	*Rubiaceae*	3	3	1	-	-
25	*Santalaceae*	1	-	-	1	-
26	*Scrophulariaceae*	2	1	-	1	-
27	*Solanaceae*	2	2	-	-	-
28	*Thymelaceae*	2	2	1	-	-
29	*Urticaceae*	1	-	1	1	-
30	*Alliaceae*	1	-	1	1	-
21	*Amaryllidaceae*	2	1	-	1	-
32	*Asparagaceae*	2	-	-	2	1
33	*Iridaceae*	1	1	-	-	-
34	*Liliaceae*	1	1	-	-	-
35	*Orchidaceae*	1	1	-	-	-

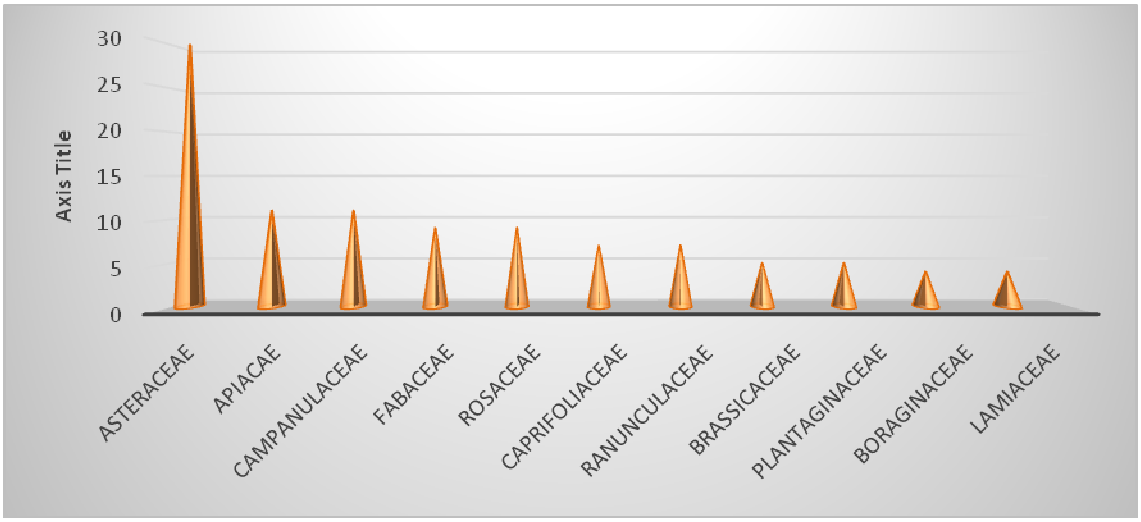


Diagram 1. Families with an abundance of species

Among the genera distinguished by the abundance of species are: *Campanula-10, Hieracium-4, Alchemilla-4, Anthemis-4,Cirsium-4, Heracleum-4.,Thymus-4,Scabiosa-4;*

Diagram 2. Genera distinguished by the abundance of species.

Living forms of endemic flora of Imreti region: tree-2, shrib-7, perennial herbs -111, biennial or perennial herbs -2, biennial herb - 8, annual herb -7, annual or biennial herb -5 species.

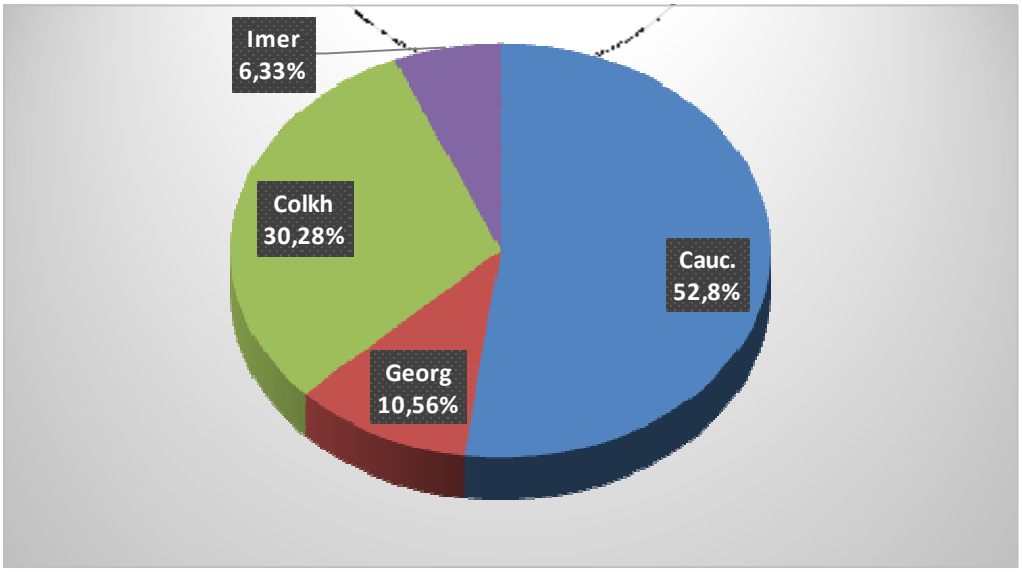


Diagram 3. The geographical structure of endemic flora of Imereti

5.2. Geographical and ecotopic review of endemic species

Endemics of Imereti are distributed in different biotopes, habitats or in the habitat and ecological conditions where these species grow.

Endemics of Imereti flora are spread mainly in: river valleys, forest edges, shrubs, various types of forests in the lower, middle and upper mountain zones, subalpine and alpine meadows, limestone cliffs and rocky outcrops, shaded and sedimentary grasslands.

We significantly single out limestone biotopes because the ecological diversity of limestone biotopes contributes to their floristic richness. Conservation of the species during the change of historical-climatic conditions seems to have taken place more on limestone ecotopes.

5.3. Diversity of endemic taxa of Imereti botanical-geographical areas.

Based on the processing of field materials and their analysis and generalization, based on the Kutaisi A. Tsereteli University herbarium and literary sources, a detailed analysis of the distribution of endemics of various geographical origins is given. The regularities of distribution of endemics in the botanical-geographical areas of Imereti are shown in the corresponding diagram.

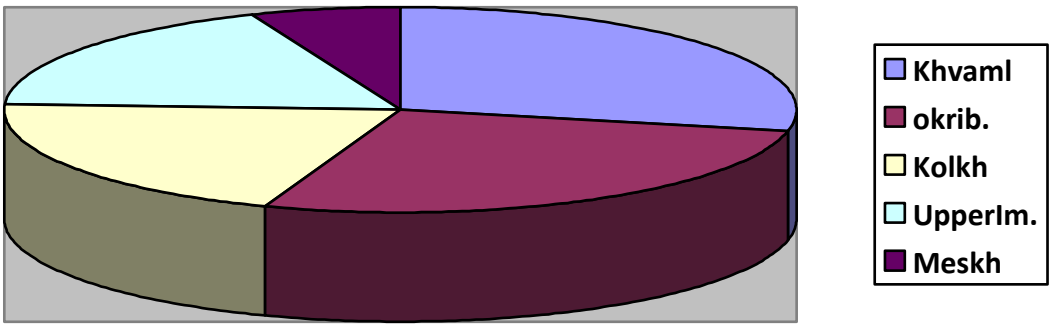


Diagram 4 Distribution of endemic species in botanical-geographical areas of Imereti

As can be seen from the diagram, most of the endemics are concentrated in Khvaml-Racha ridge and Askhi massif area -28%; Then in the Okriba district -27%; In the Kolkheti lowland region -20%; In UpperImereti district -18%; In Meskheti district -6%.

On local endemics of Imereti limestones

A. Kutateladze in his work "Endemic plants of Imereti limestone areas" mentions 14 species and 2 varieties.

Of these species ***Veronica galathica*** **Boiss.** ***and Galium valantioides*** **var.** ***lanceolata*** **Kem.-Nath** are not currently considered endemics of Georgia (and local endemics of Imereti).

Veronica galathica **Boiss**.- is endemic to the Caucasus, because in addition to Georgia it is also described in Armenia.

Galium valantioides **var.** ***lanceolata*** **Kem.-Nath**. - It is endemic to the Caucasus, except for Georgia, it is described in Armenia, Azerbaijan and Russia.

Veronica serpillifolia **var.** ***pumila*** **Kem.-Nath**. And ***Centaurea nathadze*** **D.Sosn**. - are no longer on the list of endemic species.

Polygonum imeretinum **Koch.**, ***Polygala nathadze*** **A. Kuthath.**, ***Veronica kemulariae*** **A. Kuthath** are no longer mentioned in the nomenclature list of Georgian flora.

Potentilla imerethica Gagnidze et Sochadze- Imereti strawberry grass

They were taken independently by R. Gagnidze and M. Sokhadze (1980) on the Upper Imereti plateau, near the village of Nigozeti, on limestone ecotopes. It is a narrow local endemic. Obviously, it could not be included in Kutateladze's articles of earlier years.

Local endemics of flora of Imereti at present includes 9 species:

Fig.1 *Ornithogalum imereticum* D.Sosn.

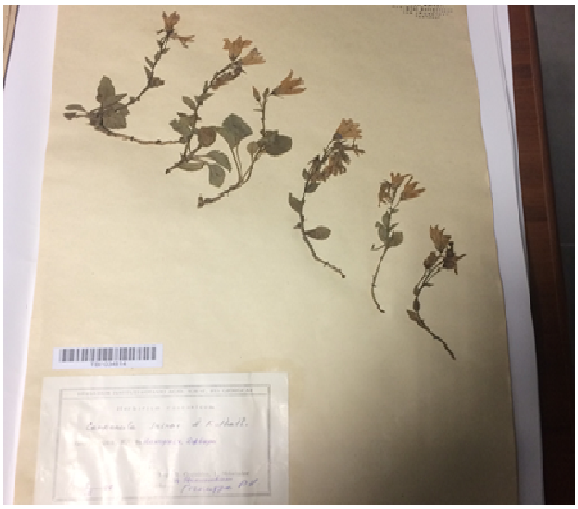


Fig.2, 3 *Campanula irinae* A.Kuthatheladze


Fig.4,5 *Campanula kemulariae* Fomin.


Fig.6.7 *Aquilegia colchica* Kem.-Nath.

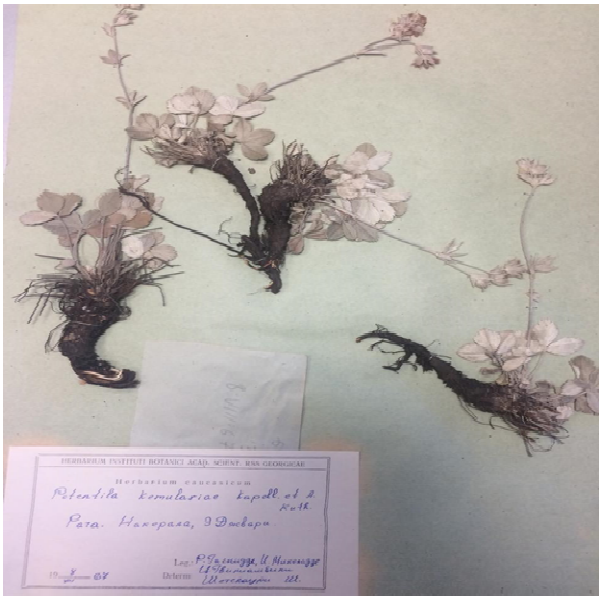


Fig.8. *Potentilla kemulariae* Kapeller

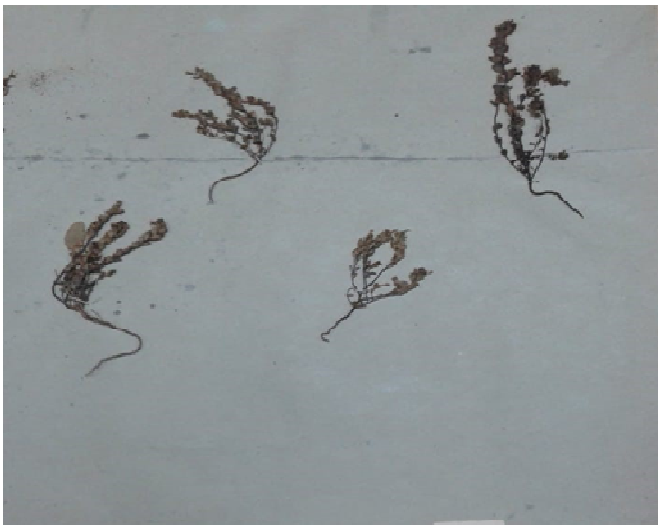


Fig.9 *Euphrasia kemulariae* Juz.

Fig.10. *Scrophularia imerethica* Kem.-Nath.

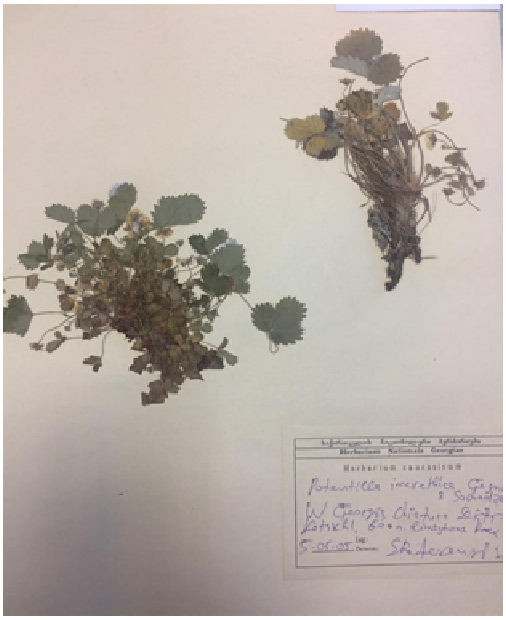
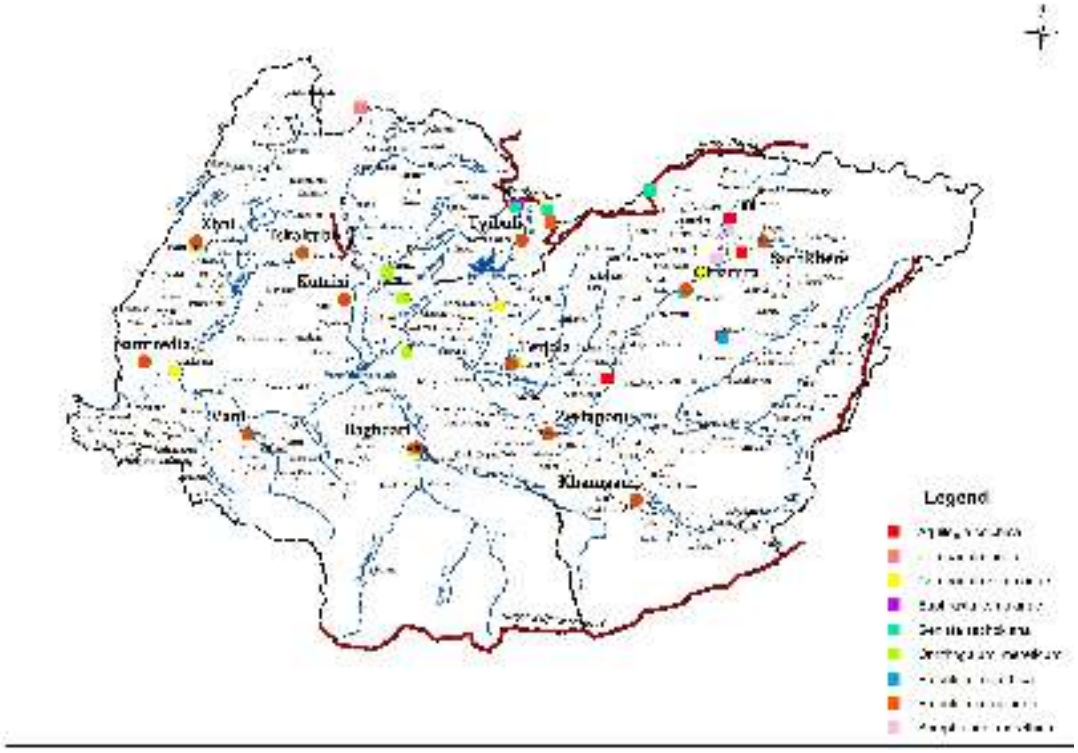


Fig.11. *Potentilla imerethica* Gagnidze et Sochadze

Fig.12, 13. *Genista sachokiana* A.Kuthatheladze

Their location is mainly rocky ecotopes, on Nakerala Pass, on the southern slope of Mount Tskhrajvari and in Upper Imereti, near Chiatura and Sachkhere.



Map 2. Location of endemic species

Chapter 6. Diversity of Endemic Medicinal Plants in Imereti and Some Ethnobotanical Research Materials

List of medicinal plants Imreti

Table 4

Dycotyledoneae	
1.*Apiaceae*	
G - *Heracleum grossheimii* Manden.	**K**- *Astrantia trifida Hoffm.*Albov. **K**- *Chaerophyllum roseum* Bieb. **K**-*Heracleum chorodanum* (Hoffm.)DC. **K**-*H.mandenovae* Satsyperova **K**-*H.leskovii*Gross. **K**-*Peucedanum adae* Woronow
2. Asteraceae	
G -*Anthemis schischkinisna* Fed. **G** -*Petasites georgicus* Manden.	**K**- *Inula magnifica* LIpsky **K** -*Senecio massagetovii* Schischk. **K**- *S.rhombifolius* (Adams) Sch.Bip. **K**- *Taraxacum grossheimii* Schischk.(Kutaisi,Godogani)
3.*Betulaceae*	
G- *Corylus imeretica* Kem.-Nath.	
4.*Boraginacea*	
G - *Paracynoglossum imeretinum* (Kusn.)M.Pop.	
5. *Brassicaceae*	
K –*Erysimum ibericum* (Adams)DC (Kutaisi,Shorapani,vil.Vani)	
6. *Campanulaceae*	
G -*Campanula kemaularieae* Fomin.(Chiatura,Akhalsofeli) **G**-*C.makaschvilii* E.Busch (Tsablariskhevi,near Sairme) **G**-*Campanula letschchumensis*Kem.-Nath. (Sairme pa-ss)	
7.*Caprifoliaceae*	
K-*Cephalaria gigantean* (Ledeb.)Bobr. **K**- *Valeriana colchica* Utkin **K**- *V.Jelenevskyi* P.Smirn.	
8.*Caryophyllaceae*	
K- *Dianthus imereticus* (Rupr.)Schischk. **K** -*Dianthus caucasicus* Smith. (Mountainous districts of Imereti)	
9.*Euphorbiaceae*	
	K -*Euphorbia macroceras* Fisch et C.A. Mey **K** -*E.Scripta* Somm. et Levier **K**-*Leptopus colchicus* (Fisch et C.A. Mey.ex

Boiss)Pojark.(Kutaisi,Motsameta)	
10.*Fabaceae*	
K -*Galega orientalis* Lam.(Imereti,vil.Gordi) **K**-*Genista patula* Bieb. **K**-*Lotus caucasicus* Kuprian.ex Juz. **K**-*Vicia grossheimii* Ekvtim.	
11.*Fagaceae*	
G –*Quercus imeretina* Stev. Ex Woronow (Kutaisi,Gelati,Motsameta)	
12.*Lamiaceae*	
G- *Thymus ladjanuricus* Kem.-Nath.(Chiatura,Mghvimevi Monastery)	**K** -*Thymus collinus* Bieb. **K**- *Thymus caucasicus* Willd ex Ronn.(Zekari pass)
13.*Orobanchaceae*	
K -*Euphrasia caucasica* Juz.	
14.*Paeoniaceae*	
G- *Paeonia ruprechtiana* Kem.-Nath.	**K**- *Paeonia caucasica* (Sch.Per)Sch.Bip. (Between Gelati and Godogani) **K**-*Paeonia macrophylla* (Albov)Lomak. (Kharagauli,vil.Partskhnali)
15. *Plantaginaceae*	
K -*Digitalis ciliata* Trautv. **K**- *Verbascum alpigenum* C.Koch (environs of vil.Partskhnali)	
16. *Polygalaceae*	
K- *Polygala caucasica* Rupr	
17.*Primulaceae*	
G- *Cyclamen colchicum* (Albov)Albov	**K**-*Primula woronowii* Losinsk.
18.*Ranunculaceae*	
G-*Delphinium thamarae* Kem.-Nath.	**K** -*Helleborus abchasicus* A.Br. **K**- *H.caucasicus* A.Br. (Imereti,vil.Godogani,Motsameta) **K**-*Ranunculus baidarae*Rupr. **K**-*Delpinium flexuosum* Bieb.
19.*Rhamnaceae*	
G-*Rhamnus cordata* Medw	
20.*Rosaceae*	
G -*Potentilla imerethica* Gagnidze et M.Sochadze (Nigozeti,Sataplia)	
21.*Scrophulariaceae*	
K-*Scrophularia lateriflora* Trautv	
22.*Solanaceae*	

K -*Atropa caucasica* Kreyer
23.*Tymelaceae*
K-*Daphne pseudosericea* Pobed
Monocotyledoneus
24.*Amaryllidaceae*
G-*Galanthus woronowii* Losinsk.
25.*Asparagaceae*
G-*Muscari alpanicum* Schchian
26.*Liliaceae*
K-*Erythronium caucasicum* Woronow (ewerywhere in Imereti,in the middle belt of mountain forest)

Chapter 7. Influence of anthropogenic factors on the diversity of habitats and flora

Very low environmental awareness, lack of conservation status for habitats, infrastructure projects and other anthropogenic factors have a great impact on habitats and species, changing the landscape in general and habitat modification takes place (Map 6). Deforestation is a particular danger. Deforestation takes place in spruce-coniferous forests. Excessive grazing of cattle is especially noticeable in the summer towards Mount Mepitskari where the Yaylas are present. Fires are frequent. Climate changes. Habitat modification takes place. Multiplied infrastructure projects. The *Cyclamen colchicum*, as a species of the CIITES convention, is collected from the wild. Environmental awareness is very low.

Most of the medicinal plants are collected in nature, which poses a potential threat to their existence. The current economic situation has led to a number of problems (deforestation, overgrazing, habiat degradation etc.).

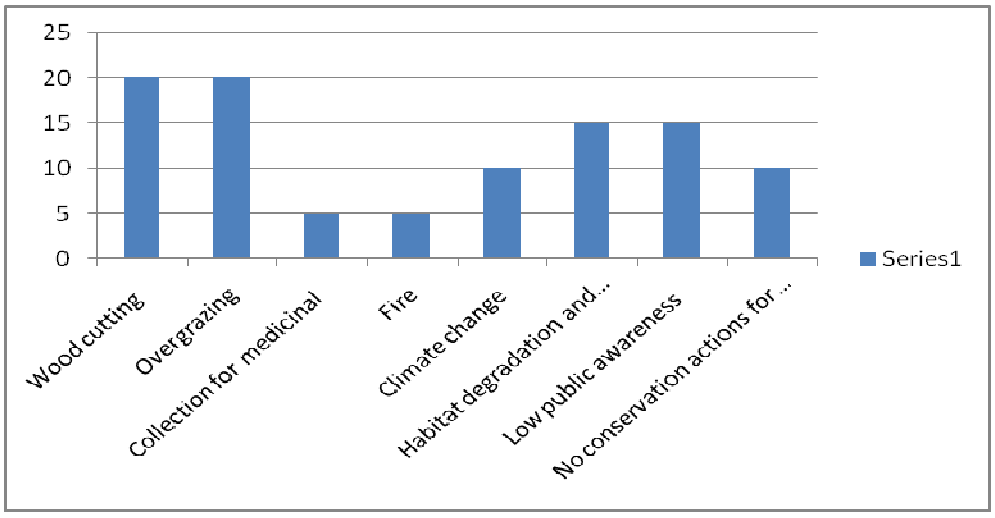
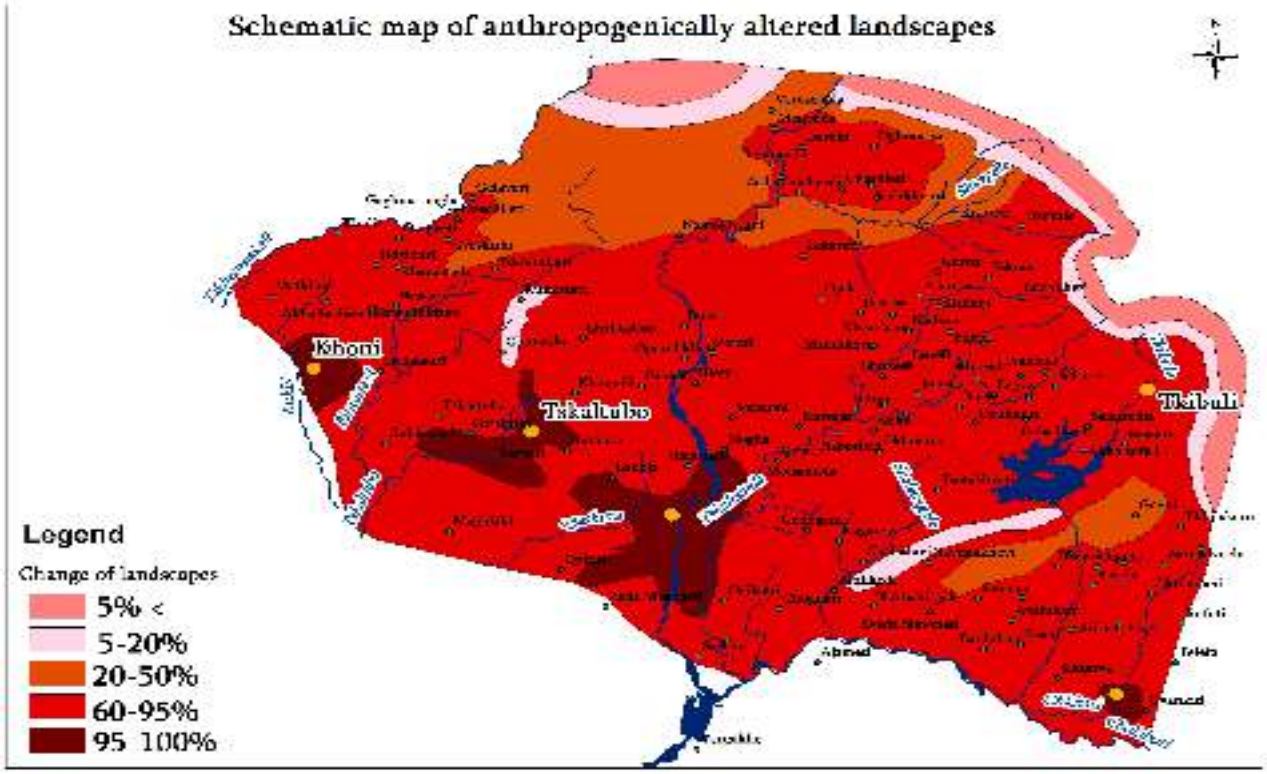


Diagram 4. Anthropogenic impact on habitat

Hundreds of species of Georgian flora are in danger of extinction / serious genetic erosion. It is necessary to take actions to save them (***ex-situ & in-situ*** conservation). The basis of these actions is to specify the areas of endangered plants and to assess the vital condition of the populations.



Map 3. Schematic map of anthopogenically altered landscapes

Chapter 8. Habitats and Species of Emerald Network, Natura 2000 and EU Nature System in Imereti Phytogeographical Region

Two habitats common in the floristic region of Imereti: 8240 Limestone pavements and Oak forests with endemic flora habitats common here are a special habitat for conservation.

Emerald Chain Code: 8240 Limestone pavements

Limestone habitats are protected by the Emerald Network and EUNIS (www.Emereladwww.eunis.eea.europa.eu)

We significantly distinguish limestone biotopes because the ecological diversity of limestone biotopes contributes to their floristic richness. Conservation of the species during changing historical-climatic conditions seems to have taken place more on limestone

ecotopes. Limestone mountains in Imereti is characterized by particularly abundant endemism, which follow the periphery of the southern slope of the Caucasus within western Georgia. This phenomenon is related to the special nature of the limestone substrate.

Fig. 14. Lemestone habitat (Naqerala pas, Tskrajvari)

Habitat is distinguished by the diversity of endemic species of flora. The limestones are the habitat for the spread of endemics in Imereti.

Conclusions:

1. The territory of Imereti with its historical past of vegetation, species composition of floristic complexes, systematic structure belongs to the ancient Mediterranean world, sub-Mediterranean region, Colchis or Western Evxin province, Racha-Lechkhumi and Imeretilimestone areas, Colchis lowlands and foothills, Guria-South Imereti Districts;
2. Imereti is divided into 5 botanical-geographical regions based on the vertical vegetation belt, systematic structure of flora, peculiarities of flora complexes, quantitatively and cenotaphically leading taxa and endemic species;
- Kolkheti lowland region (eastern part of Kolkheti lowland);
- Khvaml-Racha ridge and Askhi massif district (southern slope of Khvaml-Racha ridge and south-eastern part of Askha massif);
- Okriba district (foothills of northern Imereti);
- Upper Imereti Plateau and Likhi ridge district (western slopes of Upper Imereti plateau and Likha ridge);

- Meskheti ridge district (sections of Guria-Imereti, Adjara-Imereti, Akhaltsikhe-Imereti ridges).

3. The number of endemic flora species in Imereti is 15.7% of the total floristic composition of Imereti. The flora of Imereti counts up to 900 species;

4. Among the most prominent genera, the abundance of Mediterranean-Caucasian geneara is noteworthy;

5. From the botanical-geographical regions of Imereti, the Khvaml-Racha ridge and the Askhi massif (southern slope of the Khvaml-Racha ridge and the south-eastern part of the Askhi massif) are distinguished by the abundance of endemic species with 71 species, which is 50% of the total number of endemics;

6. The prevalence of local endemics in Imereti is expressed in II and IV districts, which are mainly related to high hypsometric heights and limestone habitats;

7. The main biotopes of Imereti endemic flora species are:

Mixed deciduous forest-8; Shrubland, middle mountain zone forests (on roadsides, rocky areas) -12; Stony ecotopes, lower mountain zone (polluted places) -6; Subalpine meadow, mid-mountain zone to alpine-28; Upper and alpine forest zone, rock crevices, gravel meadows -12; Rocky places; In the alpine zone-6; River valleys, wetlands, middle and upper mountain zone-9; Limestone rock, in the upper part of the middle zone of the mountain-18;

8.Most endemic species are associated with limestone floristic complexes found in almost every landscape unit and vertical zone;

9.The vegetation of Imereti is of the Colchian type with vertical zones and is represented by: forest, subalpine and slightly alpine zones. There are several sub- zones in the forest zones:

The analysis of the distribution of endemics of different geographical origins reveals the following regulation: Most of the endemic species of the Caucasus are found in the subalpine, broadleaf and coniferous zone, in the smallest-mixed Kolkheti deciduous forest;

10.Endemic medicinal plants of the Caucasus and Georgia spread in Imereti are represented by 26 families, 58 species. Of these, 41 species are endemic to the Caucasus, 17 to Georgia, which is as follows: Caucasus -71%, Georgia -29%;

11.During the ethno-botanical field trips, some of the remedies obtained from plant and animal sources were discovered and identified. A number of them have not been published before;

12.For the first time, comprehensive material on endemic flora of Imereti region was collected and studied, inventory, as well as collection of materials for ethno-botanical purposes and documenting traditional knowledge, making recommendations for the conservation of endemic species.

Recommendation. *in-situ* conservation of emerald network limestone habitat and oak forests is necessary.

List of Publication:

1. Matchutadze I., Goradze R., Goradze I., Tetemadze N., Tsinaridze M., Cheishvili T., Memarne Q. 2020, Unique Habitats of Kolkheti (West Georgia): Threats, Conservation and Wise Use The 6th International EcoSummit Congress - EcoSummit 2021 – Building a sustainable and desirable future: Adapting to a changing land and sea-scape, will take place at The Gold Coast Convention Centre, Gold Coast, Australia, from 14th – 18th June 2021. https://www.journals.elsevier.com/water-research/conferences/6th-international-ecosummit-congress-ecosummit-2020
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