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ORIGINAL ARTICLE

Study of Flora, Life form and Chorotypes of the Forest area of West Kurdistan (Iran)

F. Ahmadi[1*], F. Mansory[1], H. Maroofi[1] and K. Karimi[2]
[1] Research Center of Agriculture and Natural Resources, Kurdistan Province, Iran.
Email: ahmadi.farhad@yahoo.com,
[2]Young research club and Elites, Ghorveh branch, Islamic Azad University, Iran.
Email: Keivan_sa144@yahoo.com.

ABSTRACT
Studies show that Iran has been considered as one of the centers of rich and unusual flora in the world. Based on the literature, the numbers of accounted plant species are mostly from 8000 to 8500 species. This study aims at the life form and Chorotype flora forest area in west of the province. In order to study the forest floor in the forests of Bane and Marivan, 120, 500 -square meter plots were randomly selected respectively. Results of the study showed 37 families, 151 genera and 178 species exist in the region. Families of Asteraceae with 32 species, Poaceae with 26 species, Apiaceae with 18 species, Fabaceae, with 18 species and Lamiaceae with 13 species can be found in the region. Hemicryptophytes with 52/2 % (93 species), therophytes with 23/5 % (42 species), geophytes with 15/6 % (27 species), chamaephytes with 5 % (9 species) and phanerophytes with 3/9 % (7 species). High percentage of hemicryptophytes marks the mountainous cold climate of the region. The geographical distribution of the plants showed that the 52/2 % species (93 species) belonging to the regions of Irano- Turanian, 2/12 % species (11 species) with a wide distribution (cosmopolitan) were most important ecological groups in the region .Other species are also found in other regions other than the Irano-Turanian regions.
***Keywords**: Flora, Chorotypes*

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INTRODUCTION

Flora of Iran like the flora of the Middle East countries is one of the richest floras. Number of endemic species is one of the highest, among which regions of Irano- Turanian is very remarkable. This fact indicates that Iran the center for the formation of Irano- Turanian rich and unusual flora [1]. According to sources, the number of species is around 9500-8500 and in comparison, near to the number of all species in Europe [2].

Iran's rich and diverse flora has attracted foreign researchers for many years [3,4,5,6] and in recent years it has been studied by interested Iranian botanists [7,8]. Abundance of collected plant samples have been identified and have been introduced to the world of botany. However, there is no doubt there are still many areas of vegetation which have been less studied.

Identification of plants in an area is important for the following reasons: to have quick and easy access to a particular species in a given place and time, to determine the potential and the capability of vegetative area, to determine the possibility of increasing the number of species in terms of density, to identify the resistant species and endangered species and to help to preserve them, to identify Medicinal Plants and their proper use. Kurdistan Province with an area of over 28,000 square km is located in west of Iran. Due to the rough topography of the Highlands, it may be difficult to access. With an area of about 320 thousand hectares of forest in the West, North West and South West Province, it is one of the best habitats of oak, almond and other species in Zagros forests [9]. Despite sporadic floristic studies in some areas, it seems there is need for more research in order to achieve more reliable results. It seems that few studies in northern Iran region of Caspian [10, 11,12,13] Central [14,15,16] and southern [17,18,19] have been carried out. Therefore, it is necessary to carry out more studies in the west area.

The study area is located deep in the forests of Marivan and Bane, Kurdistan Province, Iran and the range is placed vegetative Irano-Touranian or Zagros zone. In terms of climate is placed in the range of arid and semiarid. The aim of this study was to collect and identify plants in the region, especially the flora and the forest floor and the geographical distribution of life forms of plants.

MATERIAL AND METHOD

Study area

Study sites are in the western and in southwestern Kurdistan, Bane and Marivan. Marivan city is 126 km West of Sanandaj, 46°- 10' East longitude and latitude 35° -30' north and is located at an altitude of 1315 meters above sea level. Marivan enjoys major climates including cold and wet, very wet, extra cold and mediterranean extra cold. Bane is 224 km north-west of the city of Sanandaj, the ° 45- 53' East longitude and latitude 35° -59' north, located at an altitude of 1550 meters above sea level. Bane enjoys major climates including cold and wet, extra cold and Mediterranean extra cold.

With reference to topographic maps, aerial photos, access and initial field visit, the study area was determined (Fig. 1). In order to study the forest floor in forests and Marivan Bane, 120, 500-square meter plots were randomly selected. In each plot 5 five micro plots were placed, four micro-plots at each one of the four corners and one plot were selected at the center. Micro plot area dimension was 4 × 4m^2 based on a minimal area. Plants collected within the micro plot after drying and preparation, the plants were identified in the herbarium in agricultural and natural resources research center of Kurdistan. Distributions of species were verified using Flora Iranica [20], Flora of Iran [21], Flora of Turkey [22], and Flora of Iraq [23]. In determining the area of life forms, classification was made based on the classification made by Raunkiaer [24]. This classification has been built based on vegetative buds position after spending the season unfavorable. The distribution of plant species was determined using the above flora. Geographical distribution of species was determined based on vegetative areas classified by Zohary [25,26] and Takhtajan [27].

RESULTS

The results of this study are summarized in Table 1. 178 species belong to 37 families and 150 genera were collected from the area and are kept in the herbarium of agriculture and natural resources research center of Kurdistan Province. The families of Alliaceae Amaryllidaceae, Poaceae, Liliaceae, Cyperaceae, Iridaceae, Araceae, Orchidaceae are Monocotyledons and others are Dicotyledons. Asteraceae, with 32 species, Poaceae with 26 species, Apiaceae with 18 species, Fabaceae with 18 species and Lamiaceae with 13 species, respectively form the maximum species. Frequency graph of each plant species belonging to each family is shown in Figure 2. The Largest numbers of species are Bromus with five species, Trifolium with 3 species and Astragalus with 3 species. Spectrum of life forms showed that Hemicryptophytes with **5**2/2 percent (93 species) as the largest group of plants and after, respectively, Therophytes with 23/5 percent (42 species), Geophytes with 15/6 percent (27 species), Chamaephytes with 5 percent (9 species) and Phanerophytes with 9/3 percent (7 species) in the category ratings are next **(**Fig. 3). The results of the geographical distribution of plants also shows that 59/8 percent of species belong to the region of Iran - Turanian, /8 percent to the area of Iran - Mediterranean, 12/2 percent of species show a wide distribution (cosmopolitanism), 10/7 percent to the Iran-Turanian species - Europe to Siberia and 5/6 percent to the Iran- Turanian and Mediterranean region and Europe to Siberia (Fig. 4).

Table 1. List of family, species, life form and chorotype of Kurdistan forest region

Taxon	Life forms	Chorotypes
Acanthaceae		
Acanthus dioscoridis L.	He	IT
Aceraceae		
Acer monspessulanum L. subsp. *cenerascens* (Boiss.) yaltrik	Ph	IT
Alliaceae		
Allium atroviolaceum Boiss.	Geo	IT,M
Allium spp.	Geo	
Ixioliriaceae		
Ixiolirion tataricum (Pall.)Herb.	Geo	IT,M
Araceae		
Arum conophalloides K. ex Schott	Geo	IT,M
Apiaceae		
Astrodaucus orientalis (L.) Drude	He	IT,ES
Bunium elegans (Fenzl) Freyn	He	IT
Chaerophyllum macropodum Boiss.	He	IT
Chaerophyllum macrospermum (Spreng.) Fisch. & C. A. Mey .	He	IT
Eryngium billardieri F. Delaroche	He	IT,M,ES
Eryngium thyrsoideum Boiss.	He	IT
Ferula haussknechtii Wollf ex Rech.	He	IT,M
Ferulago stellata Boiss.	He	IT,M
Grammosciadium platycarpum Boiss. & Hausskn.	He	IT
Lisaea heterocarpa (DC.) Boiss.	He	IT,M,ES
Pimpinella affinis Ledeb.	He	IT,ES
Pimpinella tragium Vill.	He	IT,M,ES
Prangos acaulis (DC.) Bornm.	He	IT

Prangos ferulacea (L.) Lindl.	He	IT,ES
Rhabdosciadium petiolare Boiss. & Hausskn. ex Boiss.	He	IT
Scandix iberica M. B.	Tr	IT,M
Smyrnium cordifolium Boiss.	He	IT
Torilis leptophylla (L.) Reichenb	He	IT,ES
Asteraceae		
Achillea millefolium L.	He	IT, ES
Achillea wilhelmsii C. Koch	He	IT,ES
Anthemis hyalina DC.	Tr	IT,M
Anthemis tinctoria L.	He	IT
Artemisia vulgaris L.	He	IT,M,ES
Carduus arabicus jacq. Ex Murray	Tr	IT,M
Carthamus oxyacantha M. B.	Tr	IT
Centaurea aggregata Fisch & C. A. Mey. Ex DC.	He	IT
Chardinia orientalis (L.) Kuntze	Tr	IT
Cichorium intybus L.	He	Cosm
Chondrilla juncea L.	Tr	IT,M
Cousinia millefontana Rech.f.	He	IT
Crepis sancta L.	Tr	IT
Crupina crupinastrum (Moris) Vis.	He	IT,M
Echinops ritrodes Bunge	He	IT
Gundelia Tournefortii L.	Geo	IT
Helichrysum armenium DC.	He	IT,ES
Inula helenium L.	He	IT,ES
Jurinea leptoloba DC.	He	IT
Lactuca scarioloides Boiss.	Tr	IT
Onopordon heteracanthum C. A. Mey.	He	IT,ES
Picnomon acarna (L.) Cass	Tr	IT
Scariola orientalis (Boiss.) Sojak	He	IT
Scorzonera laciniata L.	Geo	IT,M,ES
Senecio vernalis Waldst. & Kit.	Tr	IT,M,ES
Serratula grandifolia P. H. Davis	He	IT
Taraxacum montanum (C. A. Mey.) DC.	He	IT
Tragopogon buphthalmoides (Dc.) Boiss.	Geo	IT
Tragopogon Bornmuelleri M. Ownbey & Rech. f.	He	IT
Tripleurospermum decipiens (Fisch. & C. A. Mey.) Bornm.	He	IT
Xeranthemum inapertum (L.) Miller	Tr	IT,M
Zoegea leptaurea L.	Tr	IT
Boraginaceae		
Anchusa italica Retz.var. italica	He	IT,M
Cerinthe minor L.	He	IT,ES
Lappula barbata (M. B.) Gurk	He	IT
Nonea pulla (L.) DC.	He	IT,M,ES
Onosma microcarpum Steven ex DC.	He	IT,M
Symphytum kurdicum Boiss. & Hausskn.	He	IT
Brassicaceae		
Alyssum linifolium Steph. ex Willd.	Tr	IT,M,ES
Arabis caucasica Wild	He	IT
Brossardia papyracea Boiss.	He	IT
Capsella bursa – pastoris (L.)Medicus	Tr	Cosm
Cardaria draba (L.) Desv.	He	IT, ES
Descurainia sophia (L.) Webb & Berth.	He	Cosm
Fibigia macrocarpa (Boiss.) Boiss	He	IT
Hesperis kurdica Dvorak et Hadac	He	IT
Isatis cappadocica Desv.	He	IT
Sisymbrium officinale L.	Tr	Cosm
Campanulaceae		
Campanula cecilii Rech. f. & Schiman-Czeika	Tr	IT,M
Campanula involucrata Auch. ex DC.	He	IT
Caprifoliaceae		
Lonicera lummularifolia jaub. & Spach	Ph	IT,M
Caryophyllaceae		
Acanthophyllum microcephalum Boiss.	Ch	IT
Dianthus crinitus Sm.	Ch	IT
Dianthus orientalis Adams	He	IT
Gypsophila bicolor (Freyn & Slint.) Grossh.	He	IT
Silene ampullata Boiss.	He	IT
Chenopodiaceae		
Noaea mucronata (Forsk.) Asch. & Schweinf	Ch	IT
Cistaceae		
Helianthemum ledifolium (L.) Miller	Tr	IT,M
Cucrbitaceae		
Bryonia aspera Stev. ex Ledeb.	Tr	IT
Cyperaceae		

Carex stenophylla Wahlenb.	Geo	IT
Cyperus longus L.	He	IT
Dipsacaceae		
Cephalaria syriaca (L.) Schard.	Tr	IT
Euphorbiaceae		
Euphorbia macroclada Boiss.	He	IT
Fabaceae		
Astragalus carduchorum Boiss. & Hausskn.	Ch	IT
Astragalus curvirostris Boiss.	He	IT
Astragalus michauxianus Boiss.	He	IT
Coronilla varia L.	He	IT,ES
Hedysarum criniferum Boiss.	Ch	IT
Lathyrus cicera L.	Tr	IT
Lathyrus vinealis Boiss. & Noe in Boiss.	Tr	IT
Lens orientalis (Boiss.) Hand- Mzt.	Tr	IT,M
Lotus corniculatus L.	He	Cosm
Lotus gebelia Vent.	He	IT
Medicago rigidula (L.)All.	Ch	IT
Medicago sativa L.	He	IT
Onobrychis major (Boiss.) Hand. – Mazz.	He	IT
Trifolium pilulare Boiss.	Tr(Geo)	IT
Trifolium pratensis L.	He	IT
Trifolium arvense L. var. arvense	Tr	IT,ES
Trigonella monantha C. A. Meyer	Tr	IT
Vicia variabilis Freyn & Sint.	Tr	IT,ES
Geraniaceae		
Geranium tuberosum L.	Geo	IT
Hypericaceae		
Hypericum scabrum L.	He	IT
Iridaceae		
Crocus cancellatus Herb. subsp. damascenus (Herb) Mathew	Geo	IT
Iris reticulata M. B.	Geo	IT
Lamiaceae		
Eremostachys laevigata Bunge.	He	IT
Lamium album L.	He	IT,ES
Marrubium cuneatum Russell	He	IT,ES
Melissa officinalis L.	He	IT,M
Nepeta heliotropifolia Lam.	He	IT
Phlomis Olivieri Benth.	He	IT
Phlomis persica Boiss.	He	IT
Salvia verticillata L.	He	IT,ES
Scutellaria pinnatifida A. Hamilt.	He	IT
Stachys kurdica Boiss. & Hohen.	He	IT,M
Teucrium polium L. var. *tonsum* Stapf	He	IT
Thymus fallax Fisch. & Mey.	He	IT
Ziziphora capitata L.	Tr	IT
Liliaceae	Geo	IT
Colchicum kotschyi Boiss.	Geo	IT
Eremurus spectabilis M. B. subsp. *spectabilis*	Geo	IT
Fritillaria crassifilia Boiss. & Huet	Geo	IT
Gagea reticulata (Pallas) Schultes & Schultes	Geo	IT
Muscari neglectum Guss.	Geo	IT
Tulipa biflora Pall.	Geo	IT,ES
Malvaceae		
Alcea kurdica (Schlecht.) Alef.	He	IT
Orchidaceae		
Comperia comperiana (Stev.) Ascherson & Graebner	Geo	IT
Orchis palustris Jacq.	Geo	IT,ES
Papaveraceae		
Papaver bracteatum Lindl.	He	IT
Plataginaceae		
Plantago lanceolata L.	He	Cosm
Plumbaginaceae		
Acantholimon wendelboi Rech. f. & Schiman-Czeika	Ch	IT
Poaceae		
Aegilpos triuncialis L.	Tr	IT
Agropyron panormitanum Parl.	Ch	IT,M
Agropyron trichophorum (Link) Richter	Ch	IT,M
Alopecurus apiatus Ovcz.	He	IT
Arrhenatherum elatius (L.) P. Beauv. Ex J. & C. Presl.	Geo	IT
Avena fatua L. var. *fatua*	Tr	IT
Boissiera squarrosa (Banks & Soland.) Nevski.	Tr	IT
Bromus danthoniae Trin.	Tr	IT
Bromus scoparius L.	Tr	IT,M

Bromus sterilis L.	Tr	IT
Bromus tectorum L.	Tr	IT,M
Bromus tomentellus Boiss.	He	IT
Dactylis glomerata L.	He	IT,M
Digitaria sanguinalis (L.) Scop.	Tr	Cosm
Eremopoa persica (Trin.) Roshev. var. *persica*	Tr	IT
Festuca ovina L.	He	Cosm
Heteranthelium piliferum (Banks & Soland.) Hochst.	Tr	IT
Hordeum bulbosum L.	Geo	IT,M
Hordeum leporinum Link	Geo	IT
Melica persica Kunth.	He	IT
Oryzopsis molinioides (Boiss.) Hack. ex Paulsen	He	IT
Phalaris arundinacea L.	He	Cosm
Poa pratensis L.	Geo	Cosm
Poa bulbosa L.	Geo	IT,M
Secale cereale L. subsp. *cereale*	Tr	IT
Taeniatherum crinitum (Schreb.) Nevski	Tr	IT
Polygonaceae		
Polygonum alpestre C. A. Mey.	He	IT
Rheum ribes L.	He	IT
Ranunculaceae		
Adonis aestivalis L.	Tr	IT,M
Ficaria kochii (Ledeb.) Iranshahr & Rech. F.	Geo	IT
Ranunculus arvensis L.	Tr	IT
Ranunculus oxypermus Willd.	Geo	IT,M
Rosaceae		
Amygdalus lyscioides Spach	Ph	IT
Cerasus microcarpa (C. A. Mey.) Boiss.	Ph	IT
Crataegus meyeri Pojark.	Ph	IT,M
Rosa canina L.	Ph	IT
Sanguisorba minor Scop.	He	IT,M,ES
Rubiaceae		
Cruciata taurica (Pall. ex Willd) Ehrend	He	IT
Galium verum L. subsp. *glabrescens* Ehrend.	He	IT,M,ES
Scrophulariaceae		
Scrophularia pruinosa Boiss.	He	IT
Verbascum agrimoniifolium (C. Koch) Hub- Mor	He	IT, M
Veronica persica Poir.	Tr	Cosm
Thymelaceae		
Daphne mucronata Royle	Ph	IT,ES
Valerianaceae		
Valerianella vesicaria (L.) Moench	Tr	IT

Life form; He: Hemicrytophyte, Th: therophyte, Geo: geophytes, Ph: Phanerophyte, Ch: Chamaephyte.
Chorotypes; IT: Iran-Turanian, M: Mediterranean, ES: Europe to Siberia, Cosm: Cosmopolitanism.

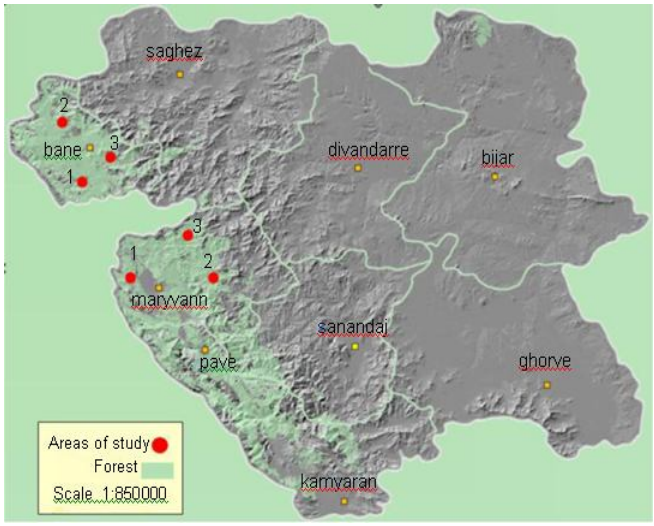

Fig.1. The study area situation in cities marivan and baneh and stations main collect plants

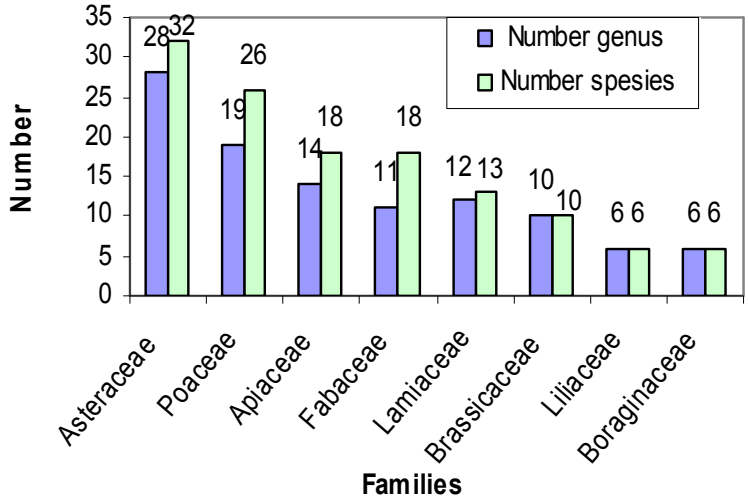

Fig. 2. Frequency graph of number genus and species belong to main families

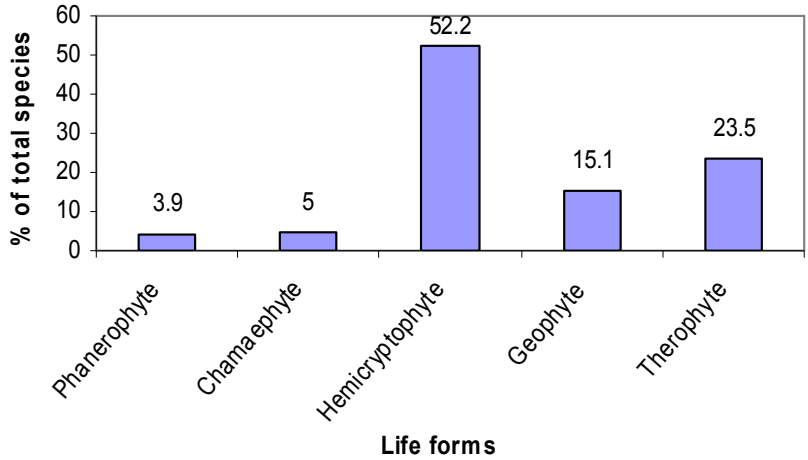

Fig. 3. Life form spectrum of plants in Kurdistan forest region

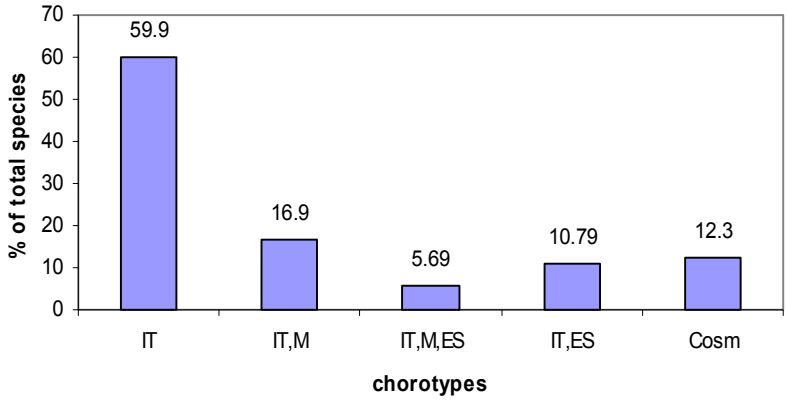

Fig.4. Chorological type's spectrum in flora in Kurdistan forest region

DISCUSSION

Places of human settlement and livestock in the area have caused the destruction of vegetation. Since grazing damage vegetation, loss of biodiversity and the dominance of annual, thorny plants causing Asteraceae family to prevail. Since the annual species of Bromus has the largest number, it can be alarming for the destruction of vegetation and the loss of main species. Life forms of plants in this region

are hemicryptophytes, therophytes, cryptophytes, chamaephytes and phanerophytes, respectively .This is consistent with the biological spectrum and moderate cold climates. The relationship between climate and plant life forms shows a close relationship. According to Dumarton, a cold climate and mountainous climate is prevalent at the area. Therefore high species richness and palpable predominance of Hemicryptophytes probably resulted from mountain and cold climate encompassing the area [27]. Hemicryptophytes vegetative buds are lying in the soil surface in winter and this feature causes a high resistance to cold temperature conditions. High percentage of species therophytes (23/2) represents a period of growth completion from seed to seed during a short time, rainfall and humidity conditions (April to June).The presence of this species in other months of the year is less and sometimes their remains are seen. Several factors resulted in the abundance of therophytes. For example, the human intervention in vegetation leading to decrease in vegetation and consequently the amount of water those plants absorb from the soil and therefore annual plants increases. The geographic distribution of plant species in an area is reflected in its effectiveness in the area or various areas of vegetation. According to the results, more than half of the species (8/59 percent) of the region - are Irano-Turanian, It can be concluded that the region belongs to Irano-Turanian area. The low percentage of growth in other parts of the region is due to the absence of other growing areas. The mountain flora of neighboring countries like Turkey, Pakistan, and Afghanistan has the highest percentage of vegetative therophytes and hemicryptophytes. Phytogeography of Iranian – Turanian elements also accounted for a large percentage. This indicates that uniform conditions prevail vegetation of the mountains of Iran - Turanian area [28,29,30].

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